

### ENERGY STAR COMPLIANT PACKAGE ELECTRIC COOLING, R-410A SINGLE PACKAGE ROOFTOP 7.5 – 12.5 TONS

#### BUILT TO LAST, EASY TO INSTALL AND SERVICE

- One-piece, high efficiency electric cooling with a low profile, prewired, tested, and charged at the factory
  - All units are convertible from downflow to horizontal air flow; no special adapter curbs are necessary
  - Full perimeter base rail with built-in rigging adapters and fork truck slots
  - Pre-painted exterior panels and primer-coated interior panels tested to 500 hours salt spray protection
  - Fully insulated cabinet
  - Two-stage cooling on all models
  - Two scroll compressors with internal line-break overload protection on each model
  - All units have high and low pressure switches
  - Two inch disposable fiberglass type return air filters in dedicated rack with tool-less filter access door
  - Refrigerant circuits contain a liquid line filter drier to trap dirt and moisture
  - Outdoor coils constructed of aluminum fin and aluminum tube microchannel design.
  - Newly-designed indoor refrigerant header for easier maintenance and replacement
  - Exclusive non-corrosive composite condensate pan in accordance with ASHRAE 62 Standard, sloping design; side or center drain
  - Belt drive evaporator-fan motor and pulley combinations available to meet most applications
  - Access panels with easy grip handles provide quick and easy access to the blower and blower motor, control box, and compressors.
  - “No-strip” screw system has superior holding power and guides screws into position while preventing the screw from stripping the unit’s metal.
  - Newly designed terminal board facilitates simple safety circuit troubleshooting and simplified control box arrangement
  - Outdoor temperature cooling operation range up to 115°F (46°C) and down to 25°F ( -4°C ) using winter start kit
  - Fixed orifice metering devices on all models to precisely control refrigerant flow
  - Large, laminated control wiring and power wiring drawings are affixed to unit to make troubleshooting easy
  - Capable of thru-the-base line routing
  - Single point electrical connections
- WARRANTY**
- 5 Year compressor limited warranty
  - 1 Year parts limited warranty



RAS090-120  
Shown



As an Energy Star® Partner, International Comfort Products has determined that this product meets the ENERGY STAR® guidelines for energy efficiency.

UNIT PERFORMANCE DATA – Dual Compressors with Two Stage Cooling					
UNIT	Nominal Tons	COOLING		Unit Dimensions H x W x L	Unit Weight lb. [kg]
		Net Cap. (Btuh)	EER		
RAS090*0AA0AGA	7 <sup>1</sup> / <sub>2</sub>	83,000	11.2	41-3/8" x 59-1/2" x 88-1/8"	780 [354]
RAS120*0AA0AGA	10	114,000	11.3	49-3/8" x 59-1/2" x 88-1/8"	850 [385]
RAS150*0AA0AGA	12 <sup>1</sup> / <sub>2</sub>	140,000	11.0	49-3/8" x 59-1/2" x 88-1/8"	1030 [467]

\* Indicates Unit voltage: H = 208/230-3-60, L = 460-3-60, S = 575-3-60

**NOTE: BASE MODEL NUMBERS LISTED. SEE MODEL NOMENCLATURE LISTING FOR ADDITIONAL OPTIONS**

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# MODEL NOMENCLATURE

MODEL SERIES	R	A	S	0	9	0	H	D	A	B	0	A	G	A
<b>Position Number</b>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
R = Rooftop														
A = Air Conditioning (Cooling Only) G = Gas/Electric		<b>Type</b>												
S = Standard ASHRAE 90.1-2010 Efficiency			<b>Efficiency</b>											
090 = 90,000 = 7.5 Tons (Two Compressors) 120 = 120,000 = 10 Tons (Two Compressors) 150 = 150,000 = 12.5 Tons (Two Compressors)				<b>Nominal Cooling Capacity</b>										
H = 208/230-3-60 L = 460-3-60 S = 575-3-60							<b>Voltage</b>							
0 = No Heat								<b>Heating Capacity</b>						
A = Standard Motor B = High Static Motor									<b>Motor Option</b>					
A = None B = Economizer w/Bara-relief, OA Temp Sensor											<b>Outdoor Air Options / Control</b>			
0A = No Options											<b>Factory Installed Options</b>			
G = Alum / Alum Cond & Alum / Cu Evap K = E-Coated Alum / Alum Cond Coil, Std Alum / Cu Evap Coil											<b>Condenser / Evaporator Coil Configuration</b>			
A = Standard												<b>Unit Packaging</b>		

**Table 1 – FACTORY INSTALLED OPTIONS AND FIELD INSTALLED ACCESSORIES**

CATEGORY	ITEM	FACTORY INSTALLED OPTION	FIELD INSTALLED ACCESSORY
<b>Cabinet</b>	Thru-the-base electrical connections		X
<b>Condenser Protection</b>	Condenser coil hail guard (louvered design)		X
<b>Controls</b>	Thermostats, temperature sensors, and subbases		X
	Time Guard II compressor delay control circuit		X
	Phase Monitor		X
	Filter status switch		X
<b>Economizers &amp; Outdoor Air Dampers</b>	Economizer (for electro-mechanical controlled RTUs)	X	X
	Motorized 2 position outdoor-air damper		X
	Manual outdoor-air damper		X
	Barometric relief <sup>1</sup>		X
	Power exhaust		X
<b>Economizer Sensors &amp; IAQ Devices</b>	Single dry bulb temperature sensors <sup>2</sup>		X
	Single enthalpy sensors <sup>2</sup>		X
	Differential enthalpy sensors <sup>2</sup>		X
	CO <sub>2</sub> sensor (duct, or unit mounted) <sup>2</sup>		X
<b>Indoor Motor &amp; Drive</b>	Multiple motor and drive packages	X	
<b>Low Ambient Control</b>	Winter start kit <sup>3</sup>		X
	Head pressure controller <sup>3</sup>		X
<b>Power Options</b>	Convenience outlet (unpowered)		X
	Non-fused disconnect		X
<b>Roof Curbs</b>	Roof curb 14" (356mm)		X
	Roof curb 24" (610mm)		X

**NOTES:**

1. Included with economizer.
2. Sensors used to optimize economizer performance.
3. See application data for assistance.

**FACTORY OPTIONS AND/OR ACCESSORIES**

**Economizer (dry-bulb or enthalpy)**

Economizers bring in fresh, outside air for ventilation; and provide cool, outside air to cool the building. This is the preferred method of low-ambient cooling. When coupled to CO<sub>2</sub> sensors, Economizers can provide even more savings by coupling the ventilation air to only that amount required based on occupancy.

Economizers are available, installed and tested by the factory, with either enthalpy or dry-bulb temperature inputs. Additional sensors are available as accessories to optimize the economizers.

**CO<sub>2</sub> Sensor**

A CO<sub>2</sub> sensor works with the economizer to intake only the correct amount of outside air for ventilation. As occupants fill the building, the CO<sub>2</sub> sensor detects their presence through increasing CO<sub>2</sub> levels, and opens the economizer appropriately. When the occupants leave, the CO<sub>2</sub> levels decrease, and the sensor appropriately closes the economizer. This intelligent control of the ventilation air, called Demand Control Ventilation (DCV) reduces the overall load on the rooftop, saving money. CO<sub>2</sub> sensors are available with the economizer, installed and tested by the factory.

## FACTORY OPTIONS AND/OR ACCESSORIES (CONT.)

### Smoke Detectors (Supply Air)

Smoke detectors immediately shut down the rooftop unit when smoke is detected. They are available, installed by the factory for supply air.

### Louvered Hail Guards

Accessory louvered panels protect the condenser coil from hail damage, foreign objects, and incidental contact.

### Convenience Outlet (un-powered)

Provides a convenient, 15 amp, 115v GFCI receptacle.

### Non-fused Disconnect

This OSHA-compliant, factory-installed, safety switch allows a service technician to locally secure power to the rooftop.

### Barometric Relief (included with optional economizer)

Gravity controlled, barometric relief equalizes building pressure and ambient air pressures.

### Power Exhaust

Superior internal building pressure control. This field-installed accessory may eliminate the need for costly, external pressure control fans.

### Time Guard II Control Circuit

This accessory protects the compressor by preventing short-cycling in the event of some other failure, prevents the compressor from restarting for 30 seconds after stopping. Not required with authorized commercial thermostats.

### Filter or Fan Status Switches

Accessory differential pressure switches detect a filter clog or indoor fan motor failure. When used in conjunction with a compatible unit controller/thermostat, the switches will activate an alarm to warn the appropriate personnel.

### Motorized 2-Position Damper

A 2-position, motorized outdoor air damper is available factory installed and admits up to 100% outside air. Using reliable, gear-driven technology, the 2-position damper opens to allow ventilation air and closes when the rooftop stops, stopping unwanted infiltration.

### Manual OA Damper

Accessory manual outdoor air dampers are an economical way to bring in ventilation air.

### Head Pressure Controller

The motor controller is a low ambient, head pressure controller kit that is designed to maintain the unit's condenser head pressure during periods of low ambient cooling operation. This device should be used as an alternative to economizer free cooling not when economizer usage is either not appropriate or desired. The controller will either cycle the outdoor-fan motors or operate them at reduced speed to maintain the unit operation, depending on the model.

### Winter Start Kit

The accessory winter start kit extends the low ambient limit of the rooftop to 25°F (-9°C). The kit bypasses the low pressure switch, preventing nuisance tripping of the low pressure switch. Other low ambient precautions may still be prudent.

### Alternate Motors and Drives

Some applications need larger horsepower motors, some need more airflow, and some need both. A wide selection of motors and pulleys (drives) are available, factory installed, to handle nearly any application.

### Thru-the-Base Connections

Thru-the-base connections, available as an accessory, are necessary to ensure proper connection and seal when routing wire through the rooftop's basepan and curb. These couplings eliminate roof penetration and should be considered for main power lines, as well as control power.

### Electric Heaters

A full-line of field-installed accessory heaters are available. The heaters are very easy to use, install and are all pre-engineered and certified.

## ACCESSORIES – RAS090–150

FLAT ROOF CURBS		
Model Number	Description	Use With Model Size
CRRFCURB003A01	14" High Roof Curb	090 – 150
CRRFCURB004A01	24" High Roof Curb	090 – 150

ECONOMIZERS		
Model Number	Description	Use With Model Size
DNECOMZR021A02	Vertical Fully Modulating -- with W7212 controller	090 – 150
DNECOMZR025A02	Horizontal Fully Modulating -- with W7212 controller	090 – 150

POWER EXHAUST		
Model Number	Description	Use With Model Size
DNPWREXH022A01	Vertical Power Exhaust 208/230 volt (1 or 3 Phase)	090 – 150
DNPWREXH023A01	Vertical Power Exhaust 460 volt	090 – 150
DNPWREXH028A01	Horizontal Power Exhaust 208/230(1 or 3 Phase) (Mounted on return air duct only)	090–150
DNPWREXH029A01	Horizontal Power Exhaust 460 volt (Mounted on return air duct only)	090–150

MANUAL OUTDOOR AIR DAMPERS		
Model Number	Description	Use With Model Size
DNMANDPR002A03	25% Open Manual Fresh Air Damper	090 – 150
CRMANDPR002A02	50% Open Manual Fresh Air Damper	090 – 150

MOTORIZED OUTDOOR AIR DAMPERS		
Model Number	Description	Use With Model Size
CRTWOPOS011A00	Motorized 2 position outdoor air damper	090 – 150

LOW AMBIENT CONTROLS *		
Model Number	Description	Use With Model Size
32LT901247 <sup>1</sup>	Motormaster I –20° Low Ambient Control 208/230–1–60, 208/203–3–60	090–120
32LT901647 <sup>1</sup>	Motormaster I –20° Low Ambient Control 460–3–60, 575–3–60	090–120
CPLOWAMB001A00	Motormaster® II Low Ambient Control 208/230–1, 208/230–3, 460–3–60	090–120
1171974 <sup>2</sup>	Motormaster I 0° Compatible Condenser Fan Motor 208/230–1–60, 208/203–3–60	090–120
1171975 <sup>2</sup>	Motormaster I Compatible Condenser Fan Motor 460–3–60, 575–3–60	090–120
1171108 <sup>2</sup>	10 Micro Farad Run Capacitor 208/230–1, 208/230–3	090–120
CRLOWAMB030A00 <sup>2</sup>	Motormaster V –20° Low Ambient Control 208/230–3–60	150
CRLOWAMB031A00 <sup>2</sup>	Motormaster V –20° Low Ambient Control 460–3–60	150
CRLOWAMB032A00 <sup>2</sup>	Motormaster V –20° Low Ambient Control 575–3–60	150

THROUGH-THE-BOTTOM/CURB POWER CONNECTION		
Model Number	Description	Use With Model Size
CRBTMPWR002A01	Thru-the-bottom electrical + thru--the curb Gas	090 – 150
CRBTMPWR004A01	Thru-the-bottom electrical and Gas	090 – 150

\* See usage tables in kit instructions.

<sup>1</sup> Requires motor change out.

<sup>2</sup> Available from FAST Parts.

## ACCESSORIES – RAS090–150 (cont.)

<b>ECONOMIZER SENSORS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
DNTEMPSN002A00	Single (dry bulb) Control	ALL Economizers With W7212 Contoller
DNCBDIOX005A00	CO2 Sensor and aspirator box for use in return airstream.	ALL Economizers With W7212 Contoller
DNENTDIF004A00	Return Air Enthalpy Sensor	ALL Economizers With W7212 Contoller
AXB078ENT	Enthalpy Control	ALL

<b>CONTROL UPGRADE KITS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
DNSTATUS001A00	Fan/Filter Status Switch	090 – 150
NRTIMEGD001A00	Time Guard II	090 – 150
1178184 <sup>2</sup>	Remote keyed attenuator / test / reset station	090 – 150
DNPBASE3001A02	Electronic Phase Monitor	090 – 150
DNWINSTR001A00	Electronic phase monitor breaks “R” control signal if trouble is detected. (Allows operation down to 25°F from standard 40°F)	090 – 150

<b>575V TRANSFORMER</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
1171494 <sup>2</sup>	Transformer for conversion from 575v to 208/230v power exhaust applications.	090 – 150

<b>HAIL GUARDS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
DNLVHLGD020A00	Louvered Condenser Coil Hail Guard	090 (2 Compressors)
DNLVHLGD021A00	Louvered Condenser Coil Hail Guard	120 (2 Compressors)
DNLVHLGD022A00	Louvered Condenser Coil Hail Guard	150 (2 Compressors)

<sup>2</sup> Available from FAST Parts.

**Table 2 – ARI COOLING RATING TABLE**

Unit RAS Dual Compressors	NOM. CAPACITY (TONS)	NET COOLING CAPACITY (MBH)	TOTAL POWER (KW)	IPLV	EER
090	7.5	83.0	7.4	12.0	11.2
120	10	114.0	101	12.6	11.3
150	12.5	140.0	12.7	11.7	11.0

**LEGEND**

- ARI – Air-Conditioning & Refrigeration Institute
- ASHRAE – American Society of Heating, Refrigerating and Air Conditioning, Inc.
- EER – Energy Efficiency Ratio
- IEER – Integrated Energy Efficiency Ratio
- SEER – Seasonal Energy Efficiency Ratio
- IPLV – Integrated Part Load Value



**Table 3 – SOUND PERFORMANCE TABLE**

UNIT RAS Dual Compressors	OUTDOOR SOUND (dB)									
	Cooling Stages	A-Weighted	63	125	250	500	1000	2000	4000	8000
090	2	82	85.8	84.3	80.5	78.7	76.4	72.7	68.3	65.1
120	2	82	89.0	83.1	80.5	78.5	75.5	71.6	69.6	69.3
150	2	87	87.0	85.2	84.6	84.9	82.2	78.4	75.3	72.9

**LEGEND**

dB – Decibel

**NOTES:**

1. Outdoor sound data is measure in accordance with ARI standard 270-95.
2. Measurements are expressed in terms of sound power. Do not compare these values to sound pressure values because sound pressure depends on specific environmental factors which normally do not match individual applications. Sound power values are independent of the environment and therefore more accurate.
3. A-weighted sound ratings filter out very high and very low frequencies, to better approximate the response of "average" human ear. A-weighted measurements are taken in accordance with ARI standard 270-95.

**Table 4 – MINIMUM – MAXIMUM AIRFLOWS ELECTRIC HEAT**

UNIT	COOLING		ELECTRIC HEATERS	
	Minimum	Maximum	Minimum	Maximum
RAS090	2250	3750	2250*	3750
RAS120	3000	5000	3000*	5000
RAS150	3600	6000	3000*	6000

**\* Minimum electric heat CFM exceptions :**

UNIT	UNIT VOLTAGE	HEATER KW	UNIT CONFIGURATION	REQUIRED MINIMUM CFM
RAS120 RAS150	208/230	42.4	Horizontal	3200
RAS120 RAS150	208/230	50.0	Horizontal	3200
RAS120 RAS150	460	50.0	Horizontal or Vertical	3200
RAS090 RAS120 RAS150	575	17.0	Horizontal or Vertical	2800
		34.0		2350



**Table 5 – PHYSICAL DATA (COOLING) 7.5 – 12.5 TONS**

		<b>RAS090</b>	<b>RAS120</b>	<b>RAS150</b>
<b>Refrigeration System</b>				
# Circuits / # Comp. / Type		2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll
R-410A (lbs-oz.) per circuit		4-6, 4-6	6-0, 6-0	7-6, 8-0
Oil (oz) per circuit		42, 42	42, 42	56, 56
Metering Device			Fixed Metering Device	
High-press. Trip / Reset (psig)		630 / 505	630 / 505	630 / 505
Low-press. Trip / Reset (psig)		54 / 117	54 / 117	54 / 117
<b>Evap. Coil</b>				
Material		Cu / Al	Cu / Al	Cu / Al
Coil type		3/8" RTPF *	3/8" RTPF *	3/8" RTPF *
Rows / FPI		3 / 15	4 / 15	4 / 15
Total Face Area (ft <sup>2</sup> )		8.9	11.1	11.1
Condensate Drain Conn. Size		3/4"	3/4"	3/4"
<b>Evap. Fan and Motor</b>				
Standard Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	1.7	2.4	2.9
	RPM Range	489-747	591-838	652-843
	Motor Frame Size	56	56	56
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	15 x 15	15 x 15	15 x 15
High Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	4.70	4.7	4.7
	RPM Range	909-1102	1022-1240	1022-1240
	Motor Frame Size	145TY	145TY	145TY
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	15 x 15	15 x 15	15 x 15
<b>Cond. Coil</b>				
Material		Al / Al		
		Micro-channel aluminum multi port-flat tube design with aluminum fins		
Rows / FPI		1 / 20	1 / 20	1 / 20
Total Face Area (ft <sup>2</sup> )		20.5	25.1	25.1
<b>Cond. fan / motor</b>				
Qty / Motor Drive Type		2 / Direct	2 / Direct	1 / Direct
Motor HP / RPM		1/4 / 1100	1/4 / 1100	1 / 1175
Fan diameter (in)		22	22	30
<b>Filters</b>				
RA Filter # / Size (in)		4 / 16x20x2	4 / 20x20x2	4 / 20x20x2
OA inlet screen # / Size (in)		1 / 20x24x1	1 / 20x24x1	1 / 20x24x1

\* RTPF – Round Tube Plate Fin Coil Design

**Table 6 – ELECTRIC HEAT – ELECTRICAL DATA, 7.5 TONS**

UNIT	NOM. V–PH–HZ	IMF TYPE	ELECTRIC HEATER PART NUMBER CRHEATERXXXXXX	NOM PWR (kW)	APP PWR (kW)	SINGLE POINT KIT PART NUMBER CRSINGLEXXXXXX	
						NO C.O. or UNPWRD C.O.	
						NO P.E.	w/P.E. (pwrd fr/unit)
RAS090	208/230–3–60	STD	117A00	10.4	7.8/9.6	042A00	042A00
			110A00	16.0	12.0/14.7	042A00	042A00
			111A00	24.8	18.6/22.8	043A00	043A00
			112A00	32.0	24.0/29.4	043A00	043A00
			112A00,117A00	42.4	31.8/38.9	045A00	045A00
		MED*	117A00	10.4	7.8/9.6	042A00	042A00
			110A00	16.0	12.0/14.7	042A00	043A00
			111A00	24.8	18.6/22.8	043A00	043A00
			112A00	32.0	24.0/29.4	043A00	043A00
			112A00,117A00	42.4	31.8/38.9	045A00	045A00
		HIGH	117A00	10.4	7.8/9.6	042A00	042A00
			110A00	16.0	12.0/14.7	043A00	043A00
	111A00		24.8	18.6/22.8	043A00	043A00	
	112A00		32.0	24.0/29.4	043A00	043A00	
	112A00,117A00		42.4	31.8/38.9	045A00	045A00	
	460–3–60	STD	116A00	13.9	12.8	042A00	042A00
			113A00	16.5	15.2	042A00	042A00
			114A00	27.8	25.5	042A00	042A00
			115A00	33.0	30.3	042A00	042A00
			114A00,116A00	41.7	38.3	044A00	044A00
		MED*	116A00	13.9	12.8	042A00	042A00
			113A00	16.5	15.2	042A00	042A00
			114A00	27.8	25.5	042A00	042A00
			115A00	33.0	30.3	042A00	042A00
114A00,116A00			41.7	38.3	044A00	044A00	
HIGH		116A00	13.9	12.8	042A00	042A00	
		113A00	16.5	15.2	042A00	042A00	
	114A00	27.8	25.5	042A00	042A00		
	115A00	33.0	30.3	042A00	044A00		
	114A00,116A00	41.7	38.3	044A00	044A00		
575–3–60	STD	118A00	17.0	17.0	042A00	042A00	
		119A00	34.0	34.0	042A00	042A00	
	MED*	118A00	17.0	17.0	042A00	042A00	
		119A00	34.0	34.0	042A00	042A00	
	HIGH	118A00	17.0	17.0	042A00	042A00	
		119A00	34.0	34.0	042A00	044A00	

\*Medium static drive components available from FAST PARTS.

**LEGEND**

- APP PWR – 208 / 230V / 460V / 575V
- C.O. – Convenient outlet
- FLA – Full load amps
- IMF – Indoor fan motor
- NOM PWR – 240V / 480V / 600V
- P.E. – Power exhaust
- PWRD – Powered convenient outlet
- UNPWRD – Unpowered convenient outlet

**TABLE 6: ELECTRIC HEAT – ELECTRICAL DATA, 10 TONS**

UNIT	NOMINAL V–PH–HZ	IFM TYPE	ELECTRIC HEATER PART NUMBER CRHEATERXXXXXX	NOM PWR (kW)	APP PWR (kW)	SINGLE POINT KIT PART NUMBER CRSINGLEXXXXXX	
						NO C.O. or UNPWRD C.O.	
						NO P.E.	w/P.E. (pwrd fr/unit)
RAS120	208/230–3–60	STD	117A00	10.4	7.8/9.6	047A00	047A00
			110A00	16.0	12.0/14.7	047A00	047A00
			112A00	32.0	24.0/29.4	049A00	049A00
			112A00,117A00	42.4	31.8/38.9	051A00	051A00
			112A00,110A00	50.0	37.6/45.9	051A00	051A00
		MED*	117A00	10.4	7.8/9.6	047A00	047A00
			110A00	16.0	12.0/14.7	049A00	049A00
			112A00	32.0	24.0/29.4	049A00	049A00
			112A00,117A00	42.4	31.8/38.9	051A00	051A00
			112A00,110A00	50.0	37.6/45.9	051A00	051A00
		HIGH	117A00	10.4	7.8/9.6	047A00	049A00
			110A00	16.0	12.0/14.7	049A00	049A00
			112A00	32.0	24.0/29.4	049A00	049A00
			112A00,117A00	42.4	31.8/38.9	051A00	051A00
			112A00,110A00	50.0	37.6/45.9	051A00	051A00
	460–3–60	STD	116A00	13.9	12.8	047A00	047A00
			113A00	16.5	15.2	047A00	047A00
			115A00	33.0	30.3	047A00	047A00
			114A00,116A00	41.7	38.3	050A00	050A00
			115A00,113A00	50.0	45.9	050A00	050A00
		MED*	116A00	13.9	12.8	047A00	047A00
			113A00	16.5	15.2	047A00	047A00
			115A00	33.0	30.3	047A00	047A00
			114A00,116A00	41.7	38.3	050A00	050A00
115A00,113A00			50.0	45.9	050A00	050A00	
HIGH		116A00	13.9	12.8	047A00	047A00	
		113A00	16.5	15.2	047A00	047A00	
		115A00	33.0	30.3	047A00	050A00	
		114A00,116A00	41.7	38.3	050A00	050A00	
		115A00,113A00	50.0	45.9	050A00	050A00	
575–3–60	STD	118A00	17.0	17.0	047A00	047A00	
		119A00	34.0	34.0	047A00	047A00	
		118A00,119A00	51.0	51.0	050A00	050A00	
	MED*	118A00	17.0	17.0	047A00	047A00	
		119A00	34.0	34.0	047A00	047A00	
		118A00,119A00	51.0	51.0	050A00	050A00	
	HIGH	118A00	17.0	17.0	047A00	047A00	
		119A00	34.0	34.0	047A00	050A00	
		118A00,119A00	51.0	51.0	050A00	050A00	

\*Medium static drive components available from FAST PARTS.

**LEGEND**

- APP PWR – 208 / 230V / 460V / 575V
- C.O. – Convenient outlet
- FLA – Full load amps
- IFM – Indoor fan motor
- NOM PWR 240V / 480V / 600V
- P.E. – Power exhaust
- PWRD – Powered convenient outlet
- UNPWRD – Unpowered convenient outlet

**TABLE 6: ELECTRIC HEAT – ELECTRICAL DATA, 12.5 TONS**

UNIT	NOMINAL V–PH–HZ	IFM TYPE	ELECTRIC HEATER PART NUMBER CRHEATERXXXXXX	NOM PWR (kW)	APP PWR (kW)	SINGLE POINT KIT PART NUMBER CRSINGLEXXXXXX	
						NO C.O. or UNPWRD C.O.	
						NO P.E.	w/PE. (pwrd fr/unit)
RAS150	208/230–3–60	STD	117A00	10.4	7.8/9.6	049A00	049A00
			110A00	16.0	12.0/14.7	049A00	049A00
			112A00	32.0	24.0/29.4	049A00	049A00
			112A00,117A00	42.4	31.8/38.9	051A00	051A00
			112A00,110A00	50.0	37.6/45.9	051A00	051A00
		MED*	117A00	10.4	7.8/9.6	049A00	049A00
			110A00	16.0	12.0/14.7	049A00	049A00
			112A00	32.0	24.0/29.4	049A00	049A00
			112A00,117A00	42.4	31.8/38.9	051A00	051A00
			112A00,110A00	50.0	37.6/45.9	051A00	051A00
		HIGH	Std Unit Without Heat	–	–	–	049A00
			117A00	10.4	7.8/9.6	049A00	049A00
			110A00	16.0	12.0/14.7	049A00	049A00
			112A00	32.0	24.0/29.4	049A00	049A00
			112A00,117A00	42.4	31.8/38.9	051A00	051A00
	460–3–60	STD	116A00	13.9	12.8	047A00	047A00
			113A00	16.5	15.2	047A00	047A00
			115A00	33.0	30.3	047A00	047A00
			114A00,116A00	41.7	38.3	050A00	050A00
			115A00,113A00	50.0	45.9	050A00	050A00
		MED*	116A00	13.9	12.8	047A00	047A00
			113A00	16.5	15.2	047A00	047A00
			115A00	33.0	30.3	047A00	047A00
			114A00,116A00	41.7	38.3	050A00	050A00
			115A00,113A00	50.0	45.9	050A00	050A00
		HIGH	116A00	13.9	12.8	047A00	047A00
			113A00	16.5	15.2	047A00	047A00
			115A00	33.0	30.3	047A00	050A00
			114A00,116A00	41.7	38.3	050A00	050A00
			115A00,113A00	50.0	45.9	050A00	050A00
575–3–60	STD	118A00	17.0	17.0	047A00	047A00	
		119A00	34.0	34.0	047A00	047A00	
		118A00,119A00	51.0	51.0	050A00	050A00	
	MED*	118A00	17.0	17.0	047A00	047A00	
		119A00	34.0	34.0	047A00	047A00	
		118A00,119A00	51.0	51.0	050A00	050A00	
	HIGH	118A00	17.0	17.0	047A00	047A00	
		119A00	34.0	34.0	047A00	050A00	
		118A00,119A00	51.0	51.0	050A00	050A00	

\*Medium static drive components available from FAST PARTS.

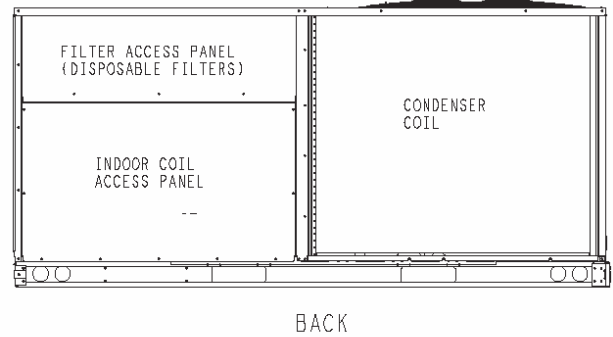
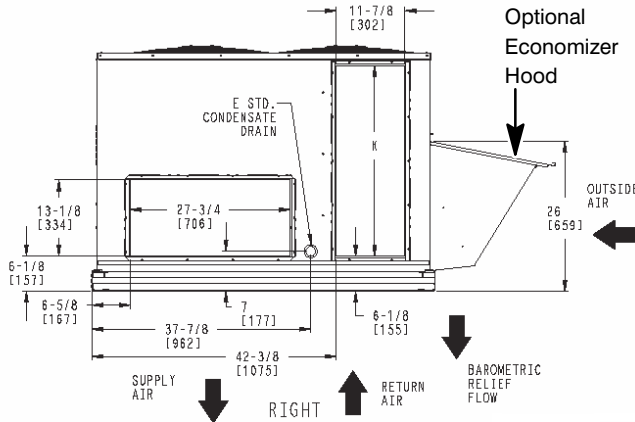
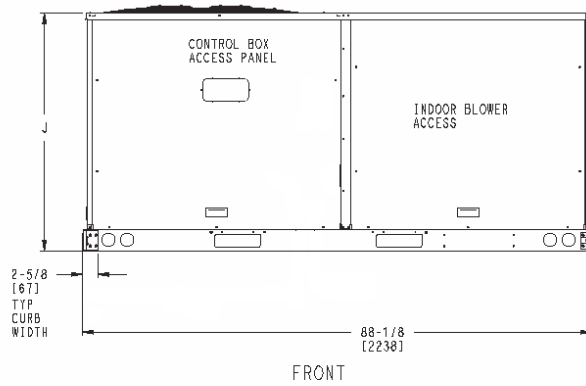
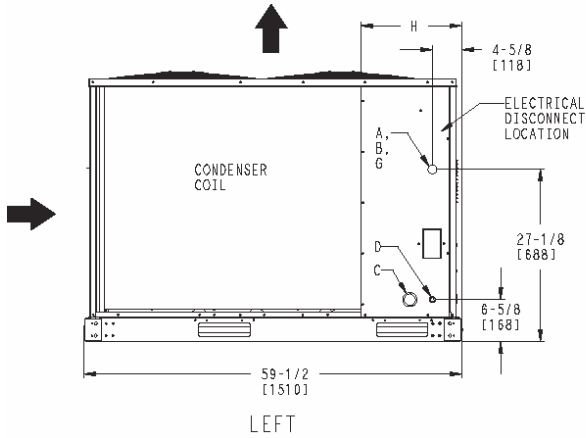
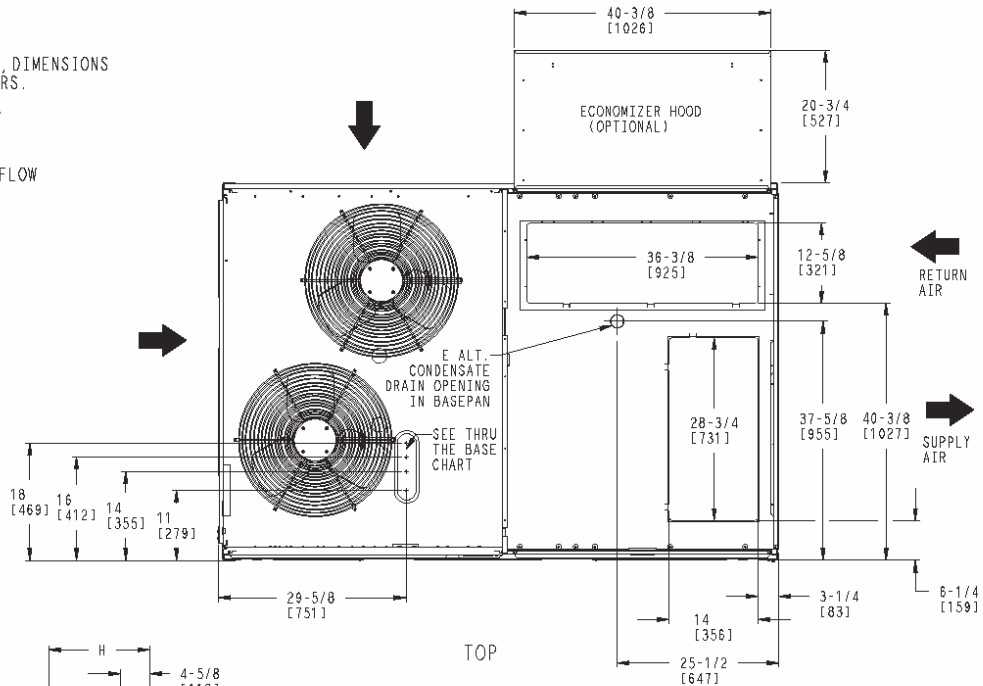
**LEGEND**

- APP PWR – 208 / 230V / 460V / 575V
- C.O. – Convenient outlet
- FLA – Full load amps
- IFM – Indoor fan motor
- NOM PWR – 240V / 480V / 600V
- P.E. – Power exhaust
- PWRD – Powered convenient outlet
- UNPWRD – Unpowered convenient outlet

# BASE UNIT DIMENSIONS – RAS090–120

**NOTES:**

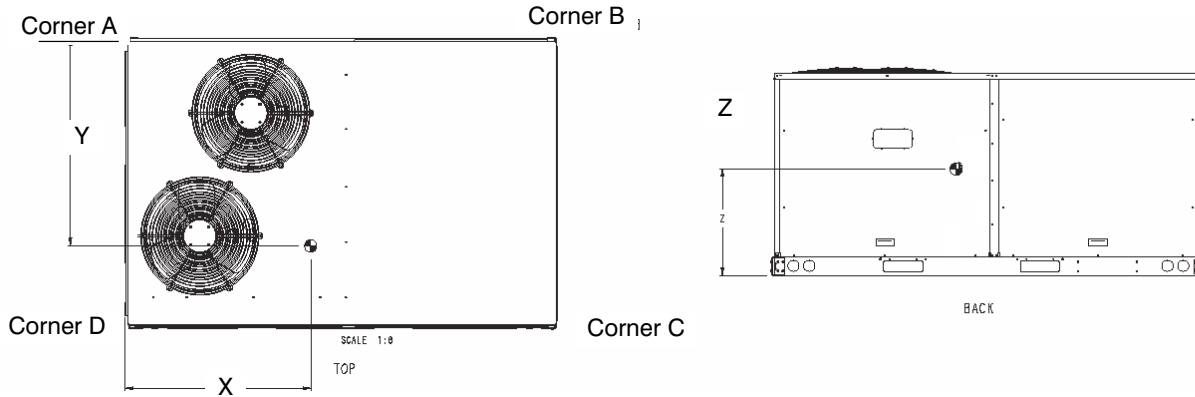
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2. CENTER OF GRAVITY
3. DIRECTION OF AIR FLOW



Connection Sizes		Thru the Base Chart These Holes Req'd For Use CRBTMPWR002A01, 004A01			Unit	J	K	H
		Threaded Conduit Size	Wire Use	Req'd Hole Sizes (Max.)				
A	1-3/8" [35] DIA Field Power Supply Hole	1/2"	Acc.	7/8" [22.2]	090	41-1/4 [1048]	33 [658]	15-7/8 [403]
B	2-1/2" [64] DIA Power Supply Knockout	1/2"	24V	7/8" [22.2]	120	49-3/8 [1253]	37-1/4 [946]	37-1/4 [946]
C	1-3/4" [51] DIA Gauge Access Plug	3/4" (001, 003)	Power*	1-1/8" [28.4]				
D	7/8" [22] DIA Field Control Wiring Hole	1-1/4" (002, 004)	Power*	1-3/4" [44.4]				
E	3/4" 14 NPT Condensate Drain							
G	2" [51] DIA Power Supply Knockout							
* Select either 3/4" or 1-1/4" for power, depending on wire size.								

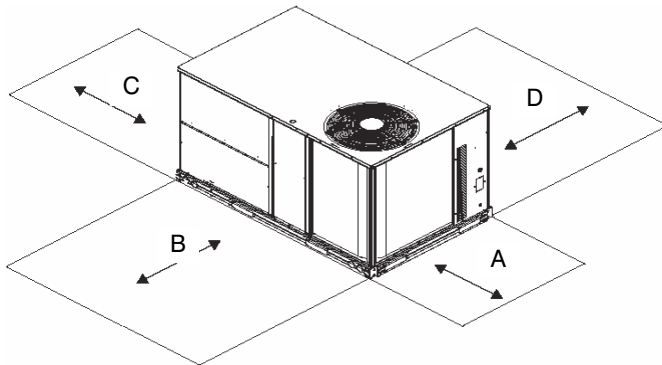
## WEIGHT & CLEARANCE DIMENSIONS – RAS090–120 (cont.)

UNIT	BASE UNIT WEIGHT		Corner Weight A		Corner Weight B		Corner Weight C		Corner Weight D		Center of Gravity In [mm]		
	LBS	KG	LBS	KG	LBS	KG	LBS	KG	LBS	KG	X	Y	Z
RAS090	780	354	147	66.8	130	59.1	234	106	265	120	41 [1041]	37-1/8 [942]	21 [534]
RAS120	850	385	192	87.1	170	77.2	229	104	258	117	41-1/8 [1019]	33-1/8 [841]	21-1/8 [535]



### UNIT CLEARANCES

LOC	DIMENSION	CONDITION
A	48" (1219 mm) 36" (914 mm) 18" (457 mm) 18" (457 mm) 12" (305 mm)	Unit disconnect is mounted on panel If dimension-B is 12" No disconnect, convenience outlet option Recommended service clearance (use electric screwdriver) Minimum clearance (use manual ratchet screwdriver)
B	36" (914 mm) 12" (305 mm) Special	Unit has economizer If dimension-A is 36" Check for sources of flue products within 10-ft of unit fresh air intake hood
C	36" (914 mm) 18" (457 mm)	Side condensate drain is used Minimum clearance
D	48" (1219 mm) 42" (1067 mm) 36" (914 mm) Special	No flue discharge accessory installed, surface is combustible material Surface behind servicer is grounded (e.g., metal, masonry wall, another unit) Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass) Check for adjacent units or building fresh air intakes within 10-ft of this unit's flue outlet



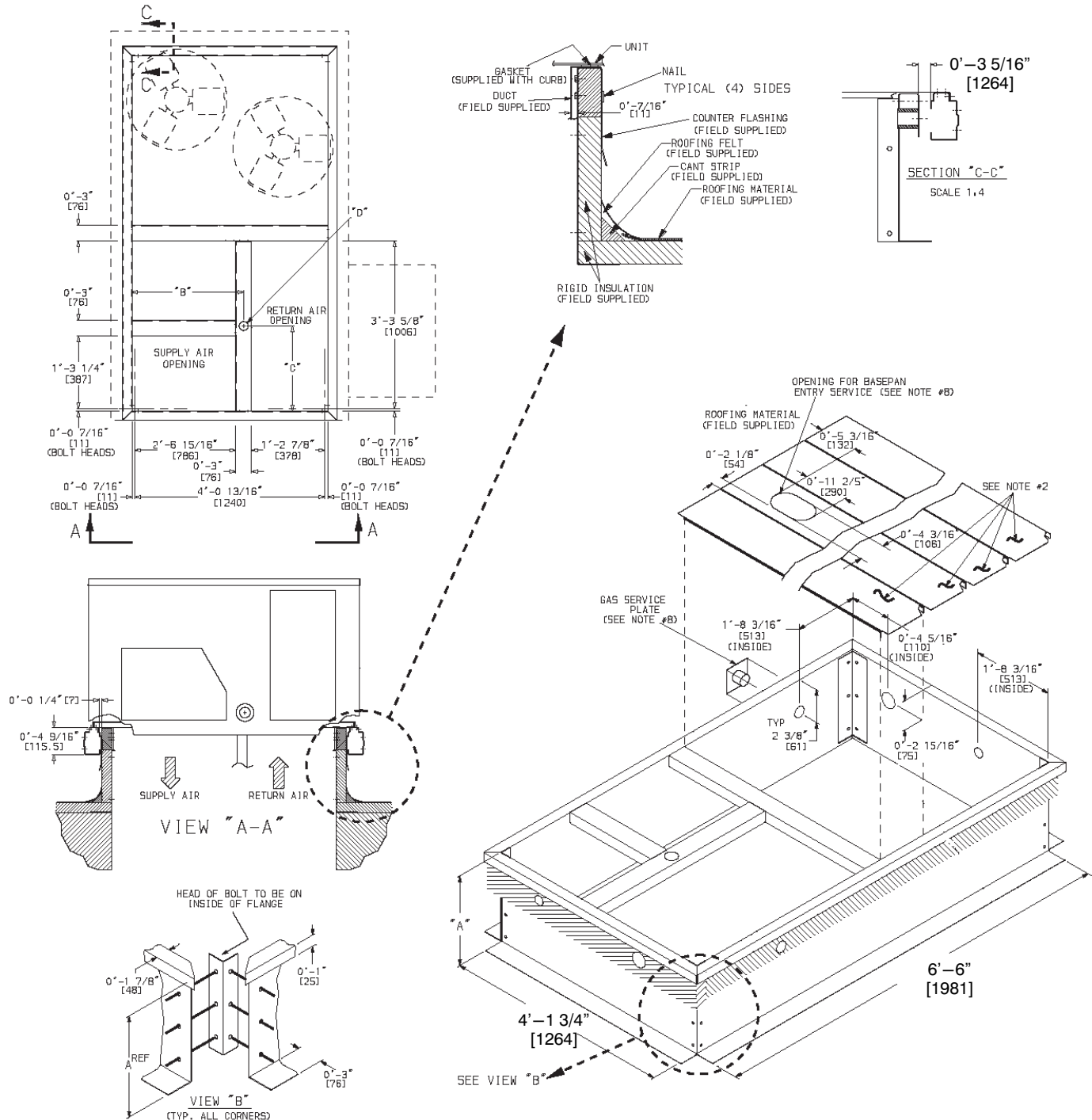
# ROOF CURB DETAILS – RAS090 – 150

RoofCurb Accessory	A	Unit Size
CRRFCURB003A01	1' 2" [356]	RAS090-150
CRRFCURB004A01	2' 0" [610]	

**NOTES:**



1. Roofcurb accessory is shipped disassembled.
2. Insulated panels, 1" thick polyurethane foam, 1-3/4# density.
3. Dimensions in. [ ] in millimeters.
4. Roofcurb 16ga steel.
5. Attach ductwork to curb (Flanges of duct rest on curb)
6. Service clearance 4' on each side.
7. ⇨ Direction of airflow.
8. Connector pkg. CRBTMPWR002A01 is for thru-the-curb connections. Pkg. CRBTMPWR004A01 is for thru-the-bottom connections.

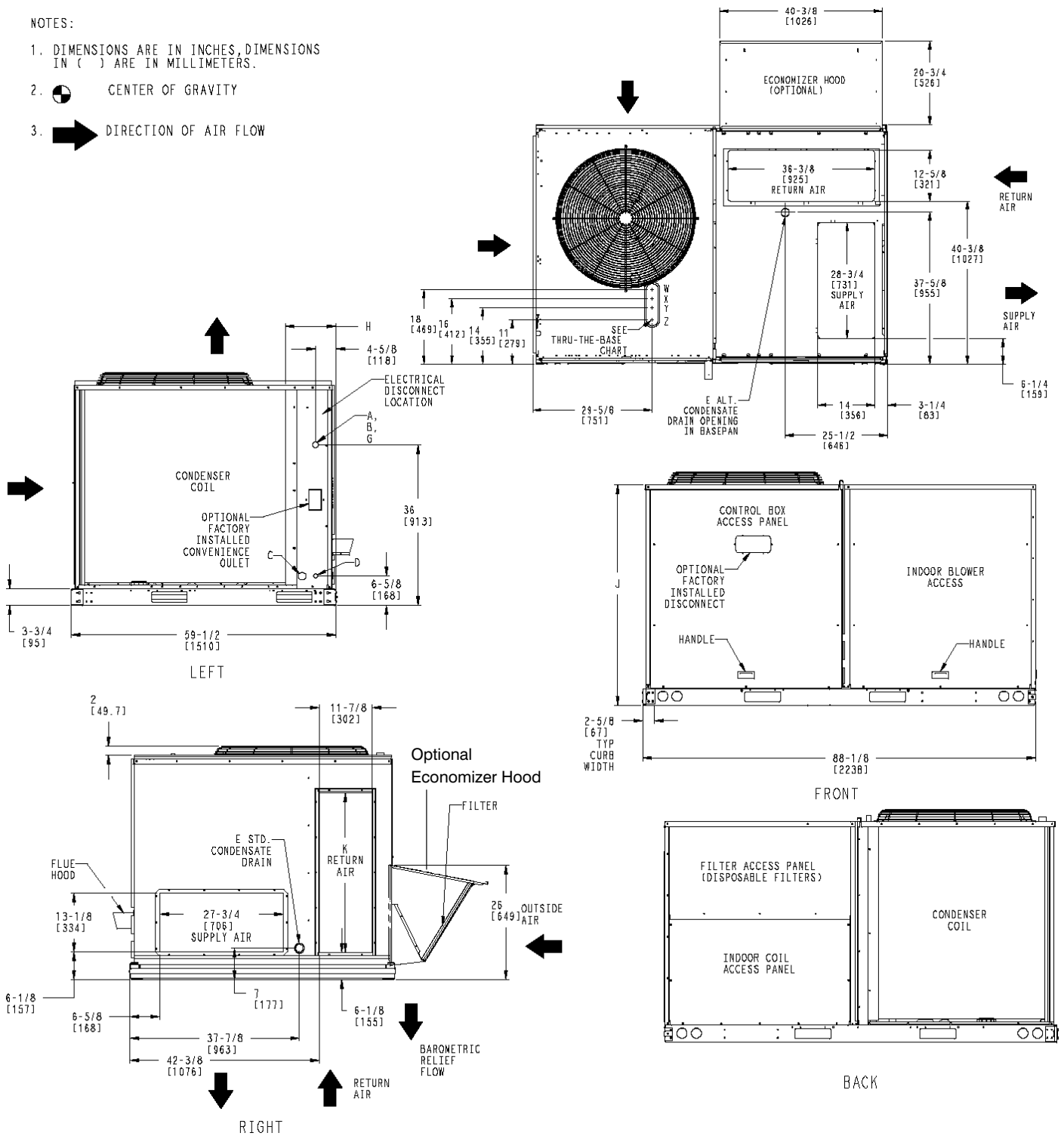
Connector Pkg. Acc.	B	C	D Alt. Drain Hole	Gas	Power	Control	Accessory Power
CRBTMPWR002A01	2' 8-7/16" [827]	1' 10-15/16" [583]	1-3/4" [44.5]	3/4" [19] NPT	1-1/4" [31.7] NPT	1/2" [12.7] NPT	1/2" [12.7] NPT
CRBTMPWR004A01							



# BASE UNIT DIMENSIONS – RAS150

**NOTES:**

1. DIMENSIONS ARE IN INCHES, DIMENSIONS IN ( ) ARE IN MILLIMETERS.
2.  CENTER OF GRAVITY
3.  DIRECTION OF AIR FLOW



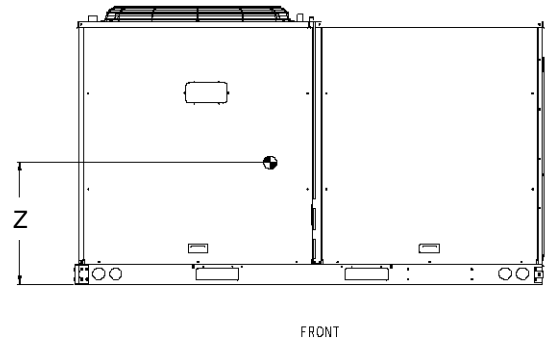
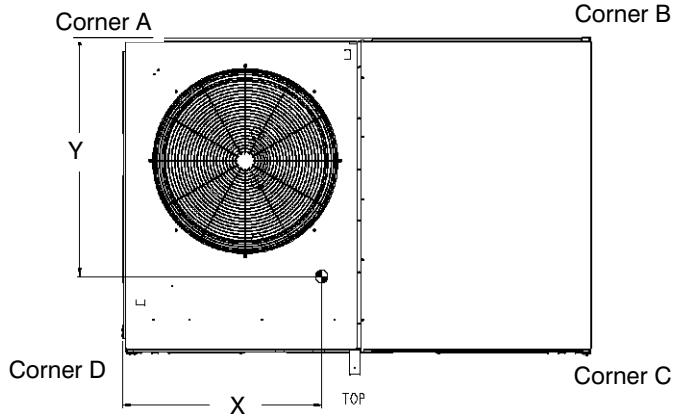
Connection Sizes		Thru the Base Chart These Holes Req'd For Use CRBTMPWR002A01, 004A01			Unit	H	J	K
		Threaded Conduit Size	Wire Use	Req'd Hole Sizes (Max.)				
A	1-3/8" [35] DIA Field Power Supply Hole	W	1/2"	Acc.	150	11-3/8 [1048]	49-3/8 [1253]	35-5/8 [905]
B	2-1/2" [64] DIA Power Supply Knockout	X	1/2"	24V				
C	1-3/4" [51] DIA Gauge Access Plug	Y	1-1/4" (002, 004)	Power*				
D	7/8" [22] DIA Field Control Wiring Hole							
E	3/4" 14 NPT Condensate Drain							
G	2" [51] DIA Power Supply Knockout							

\* Select either 3/4" or 1-1/4" for power, depending on wire size.



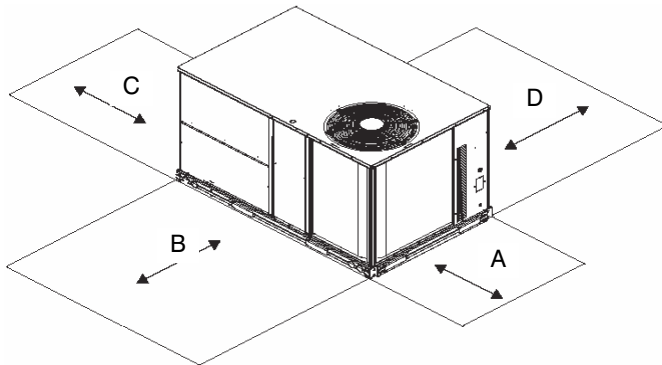
## WEIGHT & CLEARANCE DIMENSIONS – RAS150 (cont.)

UNIT	BASE UNIT WEIGHT		Corner Weight A		Corner Weight B		Corner Weight C		Corner Weight D		Center of Gravity In [mm]		
	LBS	KG	LBS	KG	LBS	KG	LBS	KG	LBS	KG	X	Y	Z
RAS150	1030	467	294	133	146	66	197	89	395	179	28-3/8 [721]	33-1/8 [841]	21-3/8 [543]



### UNIT CLEARANCES

LOC	DIMENSION	CONDITION
A	48" (1219 mm) 36" (914 mm) 18" (457 mm) 18" (457 mm) 12" (305 mm)	Unit disconnect is mounted on panel If dimension-B is 12" No disconnect, convenience outlet option Recommended service clearance (use electric screwdriver) Minimum clearance (use manual ratchet screwdriver)
B	36" (914 mm) 12" (305 mm) Special	Unit has economizer If dimension-A is 36" Check for sources of flue products within 10-ft of unit fresh air intake hood
C	36" (914 mm) 18" (457 mm)	Side condensate drain is used Minimum clearance
D	48" (1219 mm) 42" (1067 mm) 36" (914 mm) Special	No flue discharge accessory installed, surface is combustible material Surface behind servicer is grounded (e.g., metal, masonry wall, another unit) Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass) Check for adjacent units or building fresh air intakes within 10-ft of this unit's flue outlet



# APPLICATION DATA

## Min operating ambient temp (cooling):

In mechanical cooling mode, this rooftop can safely operate down to an outdoor ambient temperature of 25°F (–4°C), with an accessory winter start kit; 40°F (4°C) standard min operating temperature. It is possible to provide cooling at lower outdoor ambient temperatures by using less outside air, economizers, and/or accessory low ambient kits.

## Max operating ambient temp (cooling):

The maximum operating ambient temperature for cooling mode is 115°F (46°C). While cooling operation above 115°F (46°C) may be possible, it could cause either a reduction in performance, reliability, or a protective action by the unit's internal safety devices.

## Min and max airflow (cooling):

To maintain safe and reliable operation of your rooftop, operate within the cooling airflow limits. Operating above the max may cause blow-off, undesired airflow noise, or airflow related problems with the rooftop unit. Operating below the min may cause problems with coil freeze-up.

## Airflow:

All units are draw-through in cooling mode and blow-through in heating mode.

## Outdoor air application strategies:

Economizers reduce operating expenses and compressor run time by providing a free source of cooling and a means of ventilation to match application changing needs. In fact, they should be considered for most applications. Also, consider the various economizer control methods and their benefits, as well as sensors required to accomplish your application goals. Please contact your local sales representative for assistance.

## Motor limits, break horsepower (BHP):

Due to the internal unit design, air path, and specially designed motors, the full horsepower (maximum continuous BHP) band, as listed in Table 11 to 16, can be used with the utmost confidence. There is no need for extra safety factors, the motors are designed and rigorously tested to use the entire, listed BHP range without either nuisance tripping or premature motor failure.

## Sizing a rooftop

While an air conditioner needs to have enough capacity to meet the design loads, it doesn't need excess capacity. In fact, excess capacity typically results in very poor partload performance and humidity control.

Using higher design temperatures than ASHRAE recommends for your location, adding "safety factors" to the calculated load, are all signs of oversizing air conditioners. Oversizing the air conditioner leads to short cycling ( quick on-off cycles ) which results in poor humidity control, reduced efficiency, higher utility bills, larger indoor temperature swings, excessive noise, and increased wear and tear on the air conditioner.

Rather than oversizing an air conditioner, engineers should "right-size" or even slightly undersize air conditioners. Correctly sizing an air conditioner controls humidity better; promotes efficiency; reduces utility bills; extends equipment life, and maintains even, comfortable temperatures. Please contact your local representative for assistance.

## Low ambient applications

The optional economizer can adequately cool your space by bringing in fresh, cool outside air. In fact, when so equipped, accessory low-ambient kit may not be necessary. In low ambient conditions, unless the outdoor air is excessively humid or contaminated, economizer-based "free cooling" is the preferred less costly and energy conscious method.

In low ambient applications where outside air might not be desired (such as contaminated or excessively humid outdoor environments), your rooftop can operate to ambient temperatures down to –20°F (–29°C) using the recommended accessory Motormaster low ambient controller.

## Winter start

The accessory winter start kit extends the low ambient limit of your rooftop from 40°F (4°C) to 25°F (–4°C). The kit bypasses the low pressure switch, preventing nuisance tripping of the low pressure switch. Other low ambient precautions may still be prudent.

**Table 7 – COOLING CAPACITIES 7.5 TONS (2 Stage Cooling)**

RAS090			AMBIENT TEMPERATURE												
			85			95			105			115			
			EAT (db)			EAT (db)			EAT (db)			EA (db)			
			75	80	85	75	80	85	75	80	85	75	80	85	
2250 Cfm	EAT (wb)	58	TC	77.4	77.4	87.8	73.8	73.8	83.8	70.1	70.1	79.5	66.0	66.0	74.9
			SHC	66.9	77.4	87.8	63.9	73.8	83.8	60.6	70.1	79.5	57.1	66.0	74.9
		62	TC	82.2	82.2	83.9	77.5	77.5	81.7	72.6	72.6	79.2	67.3	67.3	76.4
			SHC	60.8	72.4	83.9	58.6	70.1	81.7	56.3	67.7	79.2	53.6	65.0	76.4
		67	TC	90.1	90.1	90.1	86.0	86.0	86.0	81.4	81.4	81.4	75.9	75.9	75.9
	SHC		50.2	61.8	73.3	48.5	60.1	71.6	46.5	58.1	69.7	44.2	55.8	67.4	
	72	TC	98.0	98.0	98.0	94.0	94.0	94.0	89.5	89.5	89.5	84.3	84.3	84.3	
		SHC	39.1	50.7	62.4	37.5	49.2	60.9	35.8	47.5	59.2	33.8	45.5	57.2	
	76	TC	-	104.3	104.3	-	100.4	100.4	-	95.9	95.9	-	90.7	90.7	
		SHC	-	41.7	54.0	-	40.3	52.7	-	38.7	51.0	-	36.8	49.0	
2625 Cfm	EAT (wb)	58	TC	82.1	82.1	93.2	78.4	78.4	89.0	74.4	74.4	84.4	70.0	70.0	79.5
			SHC	71.0	82.1	93.2	67.8	78.4	89.0	64.3	74.4	84.4	60.6	70.0	79.5
		62	TC	84.9	84.9	91.8	80.4	80.4	89.5	75.4	75.4	86.7	70.2	70.2	82.9
			SHC	65.4	78.6	91.8	63.2	76.3	89.5	60.6	73.7	86.7	57.6	70.2	82.9
		67	TC	92.5	92.5	92.5	88.3	88.3	88.3	83.6	83.6	83.6	78.3	78.3	78.3
	SHC		53.0	66.3	79.5	51.3	64.6	78.0	49.4	62.8	76.1	47.2	60.6	73.9	
	72	TC	100.4	100.4	100.4	96.4	96.4	96.4	91.7	91.7	91.7	86.4	86.4	86.4	
		SHC	40.2	53.5	66.7	38.7	52.0	65.3	36.9	50.3	63.7	35.0	48.4	61.8	
	76	TC	-	106.5	106.5	-	102.6	102.6	-	98.0	98.0	-	92.7	92.7	
		SHC	-	43.3	57.6	-	41.8	55.9	-	40.2	54.1	-	38.4	52.2	
3000 Cfm	EAT (wb)	58	TC	85.7	85.7	97.3	82.2	82.2	93.3	78.0	78.0	88.6	73.5	73.5	83.4
			SHC	74.1	85.7	97.3	71.1	82.2	93.3	67.5	78.0	88.6	63.6	73.5	83.4
		62	TC	86.9	86.9	98.7	82.8	82.8	96.4	78.2	78.2	92.3	73.6	73.6	86.9
			SHC	69.3	84.0	98.7	67.2	81.8	96.4	64.1	78.2	92.3	60.3	73.6	86.9
		67	TC	94.3	94.3	94.3	90.1	90.1	90.1	85.2	85.2	85.2	79.8	79.8	80.1
	SHC		55.6	70.5	85.4	54.0	68.9	83.9	52.1	67.1	82.2	49.9	65.0	80.1	
	72	TC	102.2	102.2	102.2	98.1	98.1	98.1	93.3	93.3	93.3	87.9	87.9	87.9	
		SHC	41.2	56.0	70.7	39.7	54.6	69.5	38.0	53.0	68.0	36.0	51.1	66.2	
	76	TC	-	108.1	108.1	-	104.2	104.2	-	99.5	99.5	-	94.2	94.2	
		SHC	-	44.5	60.2	-	43.2	58.7	-	41.6	57.0	-	39.8	55.2	
3375 Cfm	EAT (wb)	58	TC	88.5	88.5	100.4	85.0	85.0	96.4	81.0	81.0	92	76.5	76.5	86.8
			SHC	76.5	88.5	100.4	73.5	85.0	96.4	70.1	81.0	92	66.1	76.5	86.8
		62	TC	88.9	88.9	103.9	85.1	85.1	100.4	81.1	81.1	95.7	76.5	76.5	90.3
			SHC	72.3	88.1	103.9	69.7	85.1	100.4	66.5	81.1	95.7	62.7	76.5	90.3
		67	TC	95.8	95.8	95.8	91.5	91.5	91.5	86.6	86.6	87.9	81.1	81.1	85.8
	SHC		58.0	74.4	90.9	56.4	73.0	89.6	54.6	71.3	87.9	52.4	69.1	85.8	
	72	TC	103.6	103.6	103.6	99.4	99.4	99.4	94.6	94.6	94.6	89.1	89.1	89.1	
		SHC	42.0	58.3	74.5	40.6	57.0	73.4	38.9	55.5	72.0	37.0	53.7	70.3	
	76	TC	-	109.2	109.2	-	105.4	105.4	-	100.7	100.7	-	95.3	95.3	
		SHC	-	45.6	62.6	-	44.4	61.3	-	42.8	59.7	-	41.0	58.0	
3750 Cfm	EAT (wb)	58	TC	90.8	90.8	103.0	87.3	87.3	99.1	83.3	83.3	94.5	78.8	78.8	89.4
			SHC	78.5	90.8	103.0	75.5	87.3	99.1	72.0	83.3	94.5	68.2	78.8	89.4
		62	TC	90.9	90.9	107.2	87.4	87.4	103.1	83.3	83.3	98.4	78.9	78.9	93.1
			SHC	74.5	90.9	107.2	71.6	87.4	103.1	68.3	83.3	98.4	64.7	78.9	93.1
		67	TC	97.0	97.0	97.0	92.6	92.6	95.1	87.6	87.6	93.4	82.1	82.1	91.2
	SHC		60.3	78.2	96.2	58.8	76.9	95.1	56.9	75.2	93.4	54.8	73.0	91.2	
	72	TC	104.7	104.7	104.7	100.5	100.5	100.5	95.6	95.6	95.6	90.1	90.1	90.1	
		SHC	42.9	60.5	78.1	41.4	59.3	77.1	39.8	57.8	75.9	37.9	56.1	74.3	
	76	TC	-	110.2	110.2	-	106.2	106.2	-	101.6	101.6	-	96.1	96.1	
		SHC	-	46.7	64.8	-	45.4	63.6	-	44.0	62.3	-	42.2	60.6	

**LEGEND:**

- Do not operate in this region
- Cfm - Cubic feet per minute (supply air)
- EAT(db) - Entering air temperature (dry bulb)
- EAT(wb) - Entering air temperature (wet bulb)
- SHC - Sensible heat capacity
- TC - Total cooling capacity

**Table 8 – COOLING CAPACITIES 10 TONS (2 Stage Cooling)**

RAS120			AMBIENT TEMPERATURE												
			85			95			105			115			
			EAT (db)			EAT (db)			EAT (db)			EAT (db)			
			75	80	85	75	80	85	75	80	85	75	80	85	
3000 Cfm	EAT (wb)	58	TC	107.6	107.6	121.9	102.5	102.5	116.2	96.8	96.8	109.7	90.5	90.5	102.6
			SHC	93.2	107.6	121.9	88.8	102.5	116.2	83.9	96.8	109.7	78.4	90.5	102.6
		62	TC	113.6	113.6	116.5	107.1	107.1	113.4	99.7	99.7	109.8	91.8	91.8	104.9
			SHC	84.6	100.6	116.5	81.5	97.4	113.4	78.0	93.9	109.8	73.7	89.3	104.9
		67	TC	124.4	124.4	124.4	118.4	118.4	118.4	111.5	111.5	111.5	103.3	103.3	103.3
	SHC		69.7	85.7	101.7	67.1	83.2	99.2	64.3	80.3	96.3	60.8	76.8	92.8	
	72	TC	135.8	135.8	135.8	129.7	129.7	129.7	122.8	122.8	122.8	115	115	115	
		SHC	54.3	70.4	86.6	52.0	68.1	84.2	49.3	65.4	81.6	46.4	62.5	78.6	
	76	TC	-	145.3	145.3	-	139	139	-	131.9	131.9	-	124.1	124.1	
		SHC	-	57.8	74.3	-	55.6	72.1	-	53.1	69.6	-	50.4	66.9	
3500 Cfm	EAT (wb)	58	TC	114.2	114.2	129.4	108.9	108.9	123.4	102.9	102.9	116.6	96.3	96.3	109.1
			SHC	98.9	114.2	129.4	94.3	108.9	123.4	89.1	102.9	116.6	83.4	96.3	109.1
		62	TC	117.2	117.2	127.9	111.0	111.0	124.7	104.0	104.0	119.5	96.5	96.5	113.7
			SHC	91.1	109.5	127.9	88.1	106.4	124.7	83.9	101.7	119.5	79.3	96.5	113.7
		67	TC	127.8	127.8	127.8	121.7	121.7	121.7	114.5	114.5	114.5	106.6	106.6	106.6
	SHC		73.8	92.3	110.8	71.3	89.8	108.3	68.4	87.0	105.5	65.2	83.8	102.3	
	72	TC	139.4	139.4	139.4	133.0	133.0	133	125.8	125.8	125.8	117.9	117.9	117.9	
		SHC	56.0	74.6	93.1	53.7	72.2	90.8	51.0	69.6	88.2	48.1	66.7	85.4	
	76	TC	-	148.8	148.8	-	142.2	142.2	-	134.9	134.9	-	126.8	126.8	
		SHC	-	60.2	79.5	-	58.0	77.1	-	55.4	74.5	-	52.7	71.6	
4000 Cfm	EAT (wb)	58	TC	119.0	119.0	134.9	114.0	114.0	129.2	108.0	108.0	122.4	101.1	101.1	114.6
			SHC	103.1	119.0	134.9	98.7	114.0	129.2	93.6	108.0	122.4	87.6	101.1	114.6
		62	TC	120.3	120.3	137.1	114.7	114.7	132.8	108.2	108.2	127.5	101.3	101.3	119.3
			SHC	96.5	116.8	137.1	93.0	112.9	132.8	88.9	108.2	127.5	83.2	101.3	119.3
		67	TC	130.5	130.5	130.5	124.1	124.1	124.1	116.8	116.8	116.8	108.7	108.7	111.1
	SHC		77.7	98.6	119.5	75.2	96.2	117.2	72.3	93.3	114.4	69.1	90.1	111.1	
	72	TC	142.1	142.1	142.1	135.5	135.5	135.5	128.2	128.2	128.2	120.0	120.0	120.0	
		SHC	57.6	78.4	99.3	55.2	76.1	97.1	52.5	73.6	94.6	49.7	70.7	91.8	
	76	TC	-	151.4	151.4	-	144.7	144.7	-	137.1	137.1	-	-	-	
		SHC	-	62.3	83.8	-	60.0	81.4	-	57.5	78.8	-	-	-	
4500 Cfm	EAT (wb)	58	TC	123.0	123.0	139.5	117.8	117.8	133.6	111.9	111.9	126.9	105.3	105.3	119.3
			SHC	106.6	123.0	139.5	102.1	117.8	133.6	97.0	111.9	126.9	91.2	105.3	119.3
		62	TC	123.4	123.4	144.4	117.9	117.9	139.0	112.0	112.0	132.0	105.4	105.4	124.2
			SHC	100.9	122.7	144.4	96.9	117.9	139	92.1	112.0	132	86.6	105.4	124.2
		67	TC	132.6	132.6	132.6	126.0	126	126.0	118.7	118.7	122.9	110.4	110.4	119.6
	SHC		81.4	104.6	127.9	78.9	102.3	125.7	76.1	99.5	122.9	72.9	96.2	119.6	
	72	TC	144.2	144.2	144.2	137.4	137.4	137.4	129.9	129.9	129.9	121.6	121.6	121.6	
		SHC	59.0	82.1	105.2	56.6	79.8	103.1	54.0	77.3	100.7	51.1	74.5	98	
	76	TC	-	153.4	153.4	-	146.6	146.6	-	138.9	138.9	-	-	-	
		SHC	-	64.1	87.8	-	61.9	85.6	-	59.4	83	-	-	-	
5000 Cfm	EAT (wb)	58	TC	126.5	126.5	143.3	121.2	121.2	137.4	115.1	115.1	130.5	108.4	108.4	122.8
			SHC	109.6	126.5	143.3	105.0	121.2	137.4	99.8	115.1	130.5	93.9	108.4	122.8
		62	TC	126.5	126.5	149.1	121.3	121.3	142.9	115.2	115.2	135.8	108.5	108.5	127.8
			SHC	104.0	126.5	149.1	99.7	121.3	142.9	94.7	115.2	135.8	89.1	108.5	127.8
		67	TC	134.2	134.2	135.9	127.5	127.5	133.8	120.1	120.1	131.0	111.9	111.9	127.6
	SHC		84.9	110.4	135.9	82.4	108.1	133.8	79.6	105.3	131	76.4	102.0	127.6	
	72	TC	145.8	145.8	145.8	139.0	139.0	139.0	131.3	131.3	131.3	122.9	122.9	122.9	
		SHC	60.3	85.6	110.8	57.9	83.4	108.9	55.3	81.0	106.6	52.5	78.2	104	
	76	TC	-	155.1	155.1	-	148.2	148.2	-	-	-	-	-	-	
		SHC	-	65.9	91.5	-	63.7	89.5	-	-	-	-	-	-	

**LEGEND:**

- Do not operate in this region
- Cfm - Cubic feet per minute (supply air)
- EAT(db) - Entering air temperature (dry bulb)
- EAT(wb) - Entering air temperature (wet bulb)
- SHC - Sensible heat capacity
- TC - Total cooling capacity

**Table 9 – COOLING CAPACITIES 12.5 TONS (2 Stage Cooling)**

RAS150				AMBIENT TEMPERATURE											
				85			95			105			115		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85
3600 Cfm	EAT (wb)	58	TC	127.6	127.6	142.9	121.7	121.7	137.6	115.0	115.0	130	108.3	108.3	122.6
			SHC	110.3	126.6	142.9	105.8	121.7	137.6	99.9	115.0	130	94.1	108.3	122.6
		62	TC	136.1	136.1	136.1	131.1	131.1	131.1	123.8	123.8	124.5	114.9	114.9	120.3
			SHC	96.6	112.8	129.0	94.7	111.2	127.7	91.4	108.0	124.5	87.3	103.8	120.3
		67	TC	146.2	146.2	146.2	142.0	142.0	142.0	136.2	136.2	136.2	128.8	128.8	128.8
			SHC	78.5	94.4	110.3	76.9	93.1	109.2	74.7	91.0	107.3	71.7	88.1	104.6
		72	TC	155.9	155.9	155.9	152.4	152.4	152.4	147.2	147.2	147.2	140.1	140.1	140.1
			SHC	60.1	76.6	93.2	58.7	75.2	91.7	56.8	73.3	89.7	54.2	70.6	87.0
		76	TC	-	163.0	163	-	160.0	160	-	155.1	155.1	-	148.2	148.2
			SHC	-	62.0	81.8	-	61.1	80.9	-	59.5	79.3	-	57.0	76.3
4200 Cfm	EAT (wb)	58	TC	132.2	132.2	149.5	128.2	128.2	144.9	121.9	121.9	137.8	115.0	115.0	130.1
			SHC	115.0	132.2	149.5	111.5	128.2	144.9	106.0	121.9	137.8	99.9	115.0	130.1
		62	TC	139.6	139.6	139.6	134.7	134.7	138	128.0	128.0	135.6	119.1	119.1	131.2
			SHC	102.5	120.8	139	100.8	119.4	138	98.1	116.8	135.6	93.9	112.6	131.2
		67	TC	149.5	149.5	149.5	145.4	145.4	145.4	139.6	139.6	139.6	132.1	132.1	132.1
			SHC	81.8	99.6	117.4	80.6	98.7	116.8	78.5	96.9	115.2	75.7	94.3	112.8
		72	TC	159.0	159.0	159.0	155.5	155.5	155.5	150.3	150.3	150.3	143.1	143.1	143.1
			SHC	61.4	79.6	97.8	60.2	78.5	96.8	58.3	76.7	95	55.8	74.2	92.5
		76	TC	-	165.7	165.7	-	162.8	162.8	-	157.8	157.8	-	150.8	150.8
			SHC	-	64.6	87.7	-	63.5	86.3	-	61.5	83.3	-	58.9	79.9
4800 Cfm	EAT (wb)	58	TC	136.7	136.7	154.5	133.0	133.0	150.3	127.7	127.7	144.3	120.6	120.6	136.4
			SHC	118.9	136.7	154.5	115.7	133.0	150.3	111.0	127.7	144.3	104.9	120.6	136.4
		62	TC	142.2	142.2	147.8	137.4	137.4	147.1	131.0	131.0	144.7	122.8	122.8	140.3
			SHC	107.7	127.8	147.8	106.2	126.7	147.1	103.6	124.2	144.7	99.3	119.8	140.3
		67	TC	152.1	152.1	152.1	148.0	148	148	142.2	142.2	142.2	134.6	134.6	134.6
			SHC	84.8	104.3	123.7	83.8	103.8	123.7	82.0	102.3	122.6	79.4	99.9	120.4
		72	TC	161.3	161.3	161.3	157.8	157.8	157.8	152.5	152.5	152.5	145.4	145.4	145.4
			SHC	62.6	82.2	101.9	61.4	81.4	101.3	59.7	79.7	99.8	57.2	77.3	97.5
		76	TC	-	167.7	167.7	-	164.9	164.9	-	159.9	159.9	-	152.8	152.8
			SHC	-	66.4	91.4	-	65	89.2	-	63.1	86.4	-	60.5	83.1
5400 Cfm	EAT (wb)	58	TC	140.5	140.5	158.8	136.9	136.9	154.7	131.8	131.8	149	125.2	125.2	141.6
			SHC	122.2	140.5	158.8	119	136.9	154.7	114.7	131.8	149	108.9	125.2	141.6
		62	TC	144.3	144.3	155.7	139.6	139.6	155	133.5	133.5	152.4	125.8	125.8	147.8
			SHC	112.2	133.9	155.7	110.9	132.9	155	108.1	130.2	152.4	103.9	125.8	147.8
		67	TC	154.2	154.2	154.2	150.0	150.0	150.0	144.2	144.2	144.2	136.7	136.7	136.7
			SHC	87.6	108.6	129.6	86.8	108.5	130.1	85.2	107.3	129.4	82.8	105.1	127.4
		72	TC	163.1	163.1	163.1	159.7	159.7	159.7	154.3	154.3	154.3	147.1	147.1	147.1
			SHC	63.6	84.6	105.6	62.5	83.9	105.4	60.8	82.5	104.2	58.4	80.2	102
		76	TC	-	169.3	169.3	-	166.5	166.5	-	161.5	161.5	-	154.2	154.2
			SHC	-	67.6	93.7	-	66.4	91.7	-	64.5	89.2	-	61.9	86.1
6000 Cfm	EAT (wb)	58	TC	143.6	143.6	162.3	140.1	140.1	158.3	135.1	135.1	152.7	128.7	128.7	145.5
			SHC	124.9	143.6	162.3	121.8	140.1	158.3	117.5	135.1	152.7	111.9	128.7	145.5
		62	TC	146.1	146.1	162.4	141.7	141.7	161.5	135.6	135.6	159.2	128.8	128.8	151.2
			SHC	116.1	139.3	162.4	114.7	138.1	161.5	112.1	135.6	159.2	106.4	128.8	151.2
		67	TC	155.8	155.8	155.8	151.6	151.6	151.6	145.9	145.9	145.9	138.3	138.3	138.3
			SHC	90.1	112.6	135	89.6	112.8	136	88.3	112.0	135.8	85.9	110.0	134.1
		72	TC	164.5	164.5	164.5	161.2	161.2	161.2	155.8	155.8	155.8	148.5	148.5	148.5
			SHC	64.5	86.7	108.9	63.5	86.3	109.1	61.9	85.1	108.2	59.6	82.9	106.3
		76	TC	-	170.6	170.6	-	167.8	167.8	-	162.8	162.8	-	155.5	155.5
			SHC	-	68.7	95.8	-	67.5	94.1	-	65.7	91.8	-	63.3	88.8

**LEGEND:**

- Do not operate in this region
- Cfm - Cubic feet per minute (supply air)
- EAT(db) - Entering air temperature (dry bulb)
- EAT(wb) - Entering air temperature (wet bulb)
- SHC - Sensible heat capacity
- TC - Total cooling capacity

**Table 10 – STATIC PRESSURE ADDERS (Factory Options and/or Accessories)**

**Economizer**

7.5 – 12.5 TONS																
CFM	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500	5750	6000
Vertical Economizer	0.06	0.08	0.09	0.12	0.13	0.15	0.17	0.20	0.22	0.25	0.29	0.33	0.36	0.40	0.44	0.48
Horizontal Economizer*	0.08	0.10	0.13	0.15	0.18	0.21	0.25	0.28	0.30	0.34	0.39	0.43	0.47	0.51	0.56	0.60

\* Available as field installed accessories only.

**Electric Heaters**

7.5 – 12.5 TONS																
CFM (in. wg)	2250	2500	2750	3000	3250	3500	3750	4000	4250	4500	4750	5000	5250	5500	5750	6000
1 Electric Heater Module	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.15	0.16	0.18
2 Electric Heater Modules	0.04	0.05	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.15	0.16	0.17	0.19	0.20

**General fan performance notes:**

1. Interpolation is permissible. Do not extrapolate.
2. External static pressure is the static pressure difference between the return duct and the supply duct plus the static pressure caused by any FIOPs or accessories.
3. Tabular data accounts for pressure loss due to clean filters, unit casing, and wet coils. Factory options and accessories may add static pressure losses, as shown in Table 10. Selection software is available, through your salesperson, to help you select the best motor/drive combination for your application.
4. The Fan Performance tables offer motor/drive recommendations. In cases when two motor/drive combinations would work, recommend the lower horsepower option.
5. For information on the electrical properties of motors, please see the Electrical information section of this book.
6. For more information on the performance limits of motors, see the application data section of this book.

# FAN PERFORMANCE (cont.)

Table 11 – RAS090, 3 PHASE, 7.5 TON HORIZONTAL SUPPLY

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
	Field Supplied Drive <sup>1</sup>		Standard Static Option						High Static Option with Field Supplied Drive <sup>2</sup>	
2250	<b>465</b>	<b>0.43</b>	555	0.64	629	0.86	694	1.10	753	1.34
2438	<b>488</b>	<b>0.51</b>	575	0.73	648	0.97	712	1.21	769	1.47
2625	510	0.60	595	0.84	666	1.09	729	1.34	786	1.62
2813	533	0.70	616	0.95	686	1.22	<b>748</b>	<b>1.49</b>	804	1.77
3000	557	0.82	637	1.08	705	1.36	766	1.64	822	1.94
3188	581	0.94	659	1.23	726	1.51	785	1.81	840	2.12
3375	606	1.08	681	1.38	746	1.68	805	2.00	859	2.32
3563	630	1.24	703	1.55	<b>767</b>	<b>1.87</b>	825	2.20	878	2.53
3750	655	1.41	726	1.74	789	2.07	845	2.41	897	2.76

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
	High Static Option with Field Supplied Drive <sup>2</sup>					High Static Option				
2250	806	1.60	856	1.87	903	2.15	947	2.45	988	2.75
2438	822	1.74	872	2.03	918	2.32	961	2.62	1003	2.93
2625	839	1.90	887	2.19	933	2.49	977	2.81	1018	3.13
2813	856	2.06	904	2.37	949	2.68	992	3.01	1033	3.34
3000	873	2.24	921	2.56	966	2.89	1008	3.22	1049	3.56
3188	891	2.44	938	2.77	982	3.10	1025	3.45	1065	3.81
3375	909	2.65	955	2.99	1000	3.34	1041	3.70	1081	4.06
3563	927	2.88	973	3.23	1017	3.59	1059	3.96	1098	4.34
3750	946	3.12	992	3.48	1035	3.86	1076	4.24	<b>1115</b>	<b>4.63<sup>2</sup></b>

NOTE: For more information, see General Fan Performance Notes on page 22.

**Boldface** indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1178189), motor pulley (part no. 1175832) and belt (part no. 1178128).
2. Recommend using field-supplied fan pulley (part no. 1175896) and belt (part no. 1178182).

Table 12 – RAS090, 3 PHASE, 7.5 TON VERTICAL SUPPLY

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
	Standard Static Option						High Static Option with Field Supplied Drive <sup>2</sup>			
2250	511	0.53	591	0.73	660	0.95	722	1.19	779	1.44
2438	540	0.64	616	0.85	683	1.08	743	1.33	799	1.59
2625	569	0.76	642	0.99	706	1.23	765	1.49	819	1.76
2813	599	0.90	669	1.14	731	1.39	788	1.66	841	1.94
3000	630	1.06	696	1.31	756	1.58	811	1.86	863	2.15
3188	661	1.23	724	1.50	782	1.78	836	2.07	886	2.38
3375	692	1.43	753	1.71	809	2.00	861	2.31	910	2.62
3563	723	1.65	782	1.94	836	2.25	887	2.56	934	2.89
3750	755	1.89	811	2.20	864	2.52	913	2.84	959	3.18

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
	High Static Option with Field Supplied Drive <sup>2</sup>					High Static Option				
2250	832	1.71	882	1.99	928	2.29	973	2.59	1015	2.92
2438	851	1.87	899	2.16	945	2.46	989	2.78	1031	3.11
2625	870	2.04	918	2.34	963	2.66	1006	2.98	1048	3.32
2813	890	2.24	937	2.55	982	2.87	1024	3.21	1065	3.55
3000	912	2.46	958	2.78	1001	3.11	1043	3.45	1083	3.80
3188	934	2.69	979	3.02	1022	3.36	1063	3.72	1102	4.08
3375	956	2.95	1000	3.29	1042	3.64	1083	4.00	<b>1122</b>	<b>4.38</b>
3563	980	3.23	1023	3.58	1064	3.94	<b>1104</b>	<b>4.32</b>	<b>1142</b>	<b>4.70</b>
3750	1004	3.54	1046	3.90	1086	4.27	<b>1125</b>	<b>4.65</b>	–	–

NOTE: For more information, see General Fan Performance Notes on page 22.

**Boldface** indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1175896) and belt (part no. 1178182).

# FAN PERFORMANCE (cont.)

Table 13 – RAS120, 3 PHASE, 10 TON HORIZONTAL SUPPLY

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
	<b>Field-Supplied Drive<sup>1</sup></b>		<b>Standard Static Option</b>							
3000	<b>523</b>	<b>0.58</b>	592	0.73	657	0.88	718	1.05	775	1.22
3250	<b>555</b>	<b>0.71</b>	620	0.87	681	1.04	739	1.21	794	1.39
3500	<b>588</b>	<b>0.86</b>	649	1.03	707	1.21	762	1.39	815	1.58
3750	621	1.03	679	1.21	734	1.40	786	1.59	837	1.79
4000	655	1.23	709	1.42	761	1.61	812	1.82	860	2.03
4250	689	1.45	741	1.65	790	1.86	838	2.07	885	2.29
4500	723	1.69	773	1.90	820	2.12	866	2.35	910	2.57
4750	758	1.96	805	2.19	850	2.42	894	2.65	937	2.89
5000	793	2.26	838	2.50	881	2.74	923	2.98	965	3.23

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
	<b>Field Supplied Drive<sup>1</sup></b>		<b>High Static Option with Field Supplied Drive<sup>2</sup></b>							
3000	830	1.39	883	1.57	934	1.76	982	1.95	1029	2.14
3250	847	1.57	897	1.76	946	1.96	993	2.16	1039	2.36
3500	865	1.77	914	1.97	961	2.18	1007	2.38	1051	2.60
3750	885	1.99	932	2.20	978	2.42	1022	2.64	1065	2.86
4000	907	2.24	952	2.46	996	2.68	1038	2.91	1080	3.14
4250	930	2.51	973	2.74	1015	2.97	1057	3.21	1097	3.45
4500	954	2.81	996	3.05	1037	3.29	1076	3.54	1115	3.79
4750	979	3.13	1019	3.38	1059	3.63	1097	3.89	1135	4.15
5000	1005	3.49	1044	3.74	1082	4.01	1119	4.27	1156	4.55

NOTE: For more information, see General Fan Performance Notes on page 22.

**Boldface** indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1178190) and belt (part no. 1178181).

Table 14 – RAS120, 3 PHASE, 10 TON VERTICAL SUPPLY

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
	<b>Field Supplied Drive<sup>1</sup></b>		<b>Standard Static Option</b>							
3000	<b>556</b>	<b>0.65</b>	623	0.80	684	0.95	738	1.11	789	1.26
3250	<b>590</b>	<b>0.79</b>	655	0.96	713	1.13	766	1.29	815	1.46
3500	625	0.96	687	1.14	742	1.32	794	1.50	841	1.68
3750	661	1.16	719	1.35	773	1.54	822	1.73	869	1.93
4000	697	1.37	753	1.58	804	1.79	852	1.99	897	2.20
4250	733	1.62	787	1.84	836	2.06	883	2.28	926	2.49
4500	770	1.89	821	2.13	869	2.36	914	2.59	956	2.82
4750	807	2.20	856	2.45	902	2.69	945	2.94	986	3.18
5000	844	2.54	891	2.80	936	3.06	978	3.31	1018	3.57

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
	<b>High Static Option with Field Supplied Drive<sup>1</sup></b>									
3000	836	1.42	881	1.57	923	1.73	963	1.89	1001	2.05
3250	861	1.63	904	1.79	945	1.96	985	2.13	1023	2.30
3500	886	1.86	929	2.04	969	2.22	1008	2.40	1045	2.58
3750	912	2.12	954	2.31	994	2.50	1031	2.70	1068	2.89
4000	940	2.40	980	2.61	1019	2.81	1056	3.02	1092	3.22
4250	968	2.71	1007	2.93	1045	3.15	1081	3.36	1117	3.58
4500	996	3.05	1035	3.28	1072	3.51	1108	3.74	1142	3.97
4750	1026	3.42	1063	3.66	1100	3.91	1135	4.15	1168	4.39
5000	1056	3.82	1093	4.08	1128	4.34	1162	4.59	–	–

NOTE: For more information, see General Fan Performance Notes on page 22.

**Boldface** indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1178190) and belt (part no. 1178181).



## FAN PERFORMANCE (cont.)

**Table 15 – RAS150, 3 PHASE, 12.5 TON HORIZONTAL SUPPLY**

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
	<b>Field-Supplied Drive<sup>1</sup> / Standard Static Option / High Static Option with Field Supplied Drive (Between bold lines) / High Static Option (Shaded)</b>									
3438	<b>580</b>	<b>0.82</b>	642	0.99	700	1.16	756	1.34	809	1.53
3750	<b>621</b>	<b>1.03</b>	679	1.21	734	1.40	786	1.59	837	1.79
4063	663	1.28	717	1.47	769	1.67	818	1.88	866	2.09
4375	706	1.56	757	1.77	805	1.98	852	2.20	897	2.43
4688	749	1.89	797	2.11	843	2.34	887	2.57	930	2.81
5000	793	2.26	838	2.50	881	2.74	923	2.98	965	3.23
5313	837	2.69	880	2.93	921	3.19	961	3.44	<b>1000</b>	<b>3.71</b>
5625	882	3.16	922	3.42	961	3.68	<b>999</b>	<b>3.95</b>	<b>1037</b>	<b>4.23</b>
5938	926	3.68	<b>964</b>	<b>3.96</b>	<b>1001</b>	<b>4.23</b>	<b>1038</b>	<b>4.52</b>	–	–
6250	<b>971</b>	<b>4.26</b>	<b>1007</b>	<b>4.55</b>	–	–	–	–	–	–

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
	<b>High Static Option with Field Supplied Drive / High Static Option (shaded)</b>									
3438	860	1.72	910	1.92	957	2.12	1003	2.32	1048	2.54
3750	885	1.99	932	2.20	978	2.42	1022	2.64	1065	2.86
4063	912	2.31	957	2.53	1001	2.75	1043	2.98	1084	3.22
4375	941	2.66	984	2.89	1026	3.13	1066	3.37	<b>1106</b>	<b>3.62</b>
4688	972	3.05	1013	3.29	1053	3.54	<b>1092</b>	<b>3.80</b>	<b>1130</b>	<b>4.06</b>
5000	1005	3.49	<b>1044</b>	<b>3.74</b>	<b>1082</b>	<b>4.01</b>	<b>1119</b>	<b>4.27</b>	<b>1156</b>	<b>4.55</b>
5313	<b>1038</b>	<b>3.97</b>	<b>1076</b>	<b>4.24</b>	<b>1113</b>	<b>4.52</b>	–	–	–	–
5625	<b>1073</b>	<b>4.51</b>	–	–	–	–	–	–	–	–
5938	–	–	–	–	–	–	–	–	–	–
6250	–	–	–	–	–	–	–	–	–	–

**NOTE:** For more information, see General Fan Performance Notes on page 22.

**Boldface** indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1178189) and belt (part no. 1178450).
2. Recommend using field-supplied fan pulley (part no. 1175896), motor pulley (part no. 1178133) and belt (part no. 1178182).

**Table 16 – RAS150, 3 PHASE, 12.5 TON VERTICAL SUPPLY**

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
	<b>Standard Static Option / High Static Option with Field Supplied Drive (Between bold lines) / High Static Option (shaded)</b>									
3438	<b>616</b>	<b>0.92</b>	679	1.10	735	1.27	786	1.45	835	1.62
3750	661	1.16	719	1.35	773	1.54	822	1.73	869	1.93
4063	706	1.43	761	1.64	812	1.85	860	2.06	904	2.27
4375	752	1.75	804	1.98	852	2.20	898	2.43	941	2.65
4688	798	2.12	847	2.36	894	2.60	937	2.85	979	3.09
5000	844	2.54	891	2.80	936	3.06	978	3.31	1018	3.57
5313	891	3.01	936	3.28	978	3.56	<b>1019</b>	<b>3.83</b>	<b>1057</b>	<b>4.11</b>
5625	938	3.53	<b>981</b>	<b>3.83</b>	<b>1022</b>	<b>4.12</b>	<b>1060</b>	<b>4.41</b>	<b>1097</b>	<b>4.70</b>
5938	<b>986</b>	<b>4.12</b>	<b>1026</b>	<b>4.43</b>	–	–	–	–	–	–
6250	–	–	–	–	–	–	–	–	–	–

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
	<b>High Static Option with Field Supplied Drive / High Static Option (shaded)</b>									
3438	880	1.80	922	1.98	963	2.15	1002	2.33	1039	2.51
3750	912	2.12	954	2.31	994	2.50	1031	2.70	1068	2.89
4063	947	2.48	987	2.68	1025	2.89	1062	3.10	<b>1098</b>	<b>3.31</b>
4375	982	2.88	1021	3.10	1058	3.32	<b>1094</b>	<b>3.55</b>	<b>1129</b>	<b>3.77</b>
4688	1018	3.33	1056	3.57	<b>1093</b>	<b>3.81</b>	<b>1128</b>	<b>4.04</b>	<b>1162</b>	<b>4.29</b>
5000	<b>1056</b>	<b>3.82</b>	<b>1093</b>	<b>4.08</b>	<b>1128</b>	<b>4.34</b>	<b>1162</b>	<b>4.59</b>	–	–
5313	<b>1094</b>	<b>4.38</b>	<b>1130</b>	<b>4.65</b>	–	–	–	–	–	–
5625	–	–	–	–	–	–	–	–	–	–
5938	–	–	–	–	–	–	–	–	–	–
6250	–	–	–	–	–	–	–	–	–	–

**NOTE:** For more information, see General Fan Performance Notes on page 22.

**Boldface** indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1178189) and belt (part no. 1178450).
2. Recommend using field-supplied fan pulley (part no. 1175896), motor pulley (part no. 1178133) and belt (part no. 1178182).

# FAN PERFORMANCE (cont.)

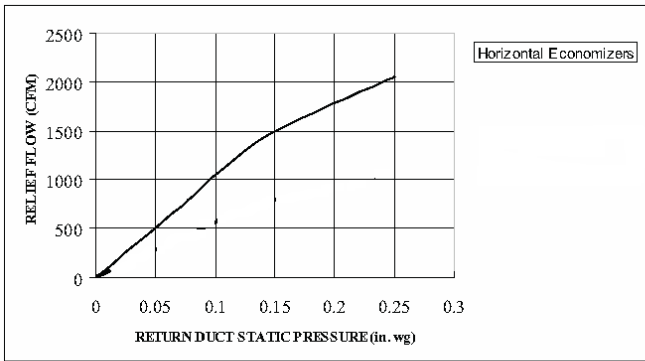
Table 17 – PULLEY ADJUSTMENT

UNIT		MOTOR/DRIVE COMBO	MOTOR PULLEY TURNS OPEN										
			0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
RAS090	3 phase	Standard Static	747	721	695	670	644	618	592	566	541	515	489
		High Static	1102	1083	1063	1044	1025	1006	986	967	948	928	909
RAS120	3 phase	Standard Static	838	813	789	764	739	715	690	665	640	616	591
		High Static	1240	1218	1196	1175	1153	1131	1109	1087	1066	1044	1022
RAS150	3 phase	Standard Static	838	813	789	764	739	715	690	665	640	616	591
		High Static	1240	1218	1196	1175	1153	1131	1109	1087	1066	1044	1022

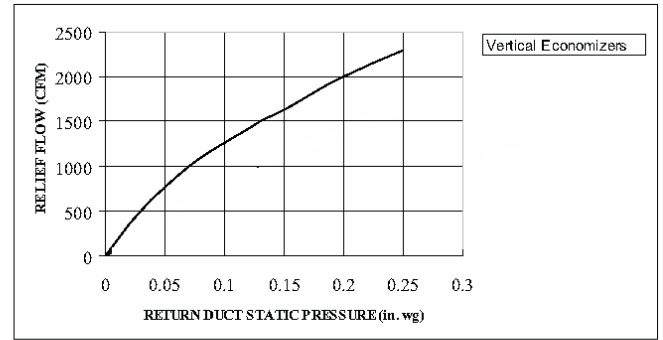
**NOTE:** Do not adjust pulley further than 5 turns open.

■ – Factory settings

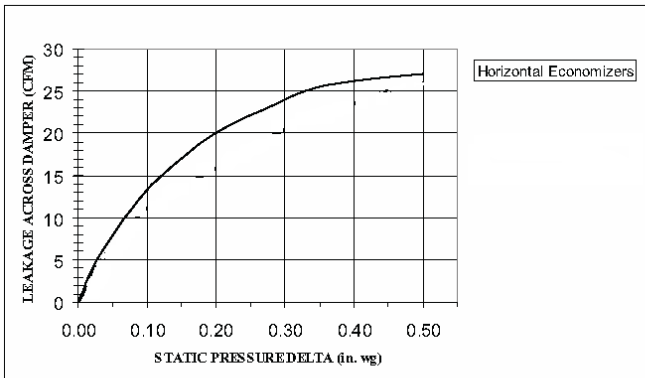
# ECONOMIZER, BAROMETRIC RELIEF, AND PERFORMANCE, 7.5 to 12.5 Ton



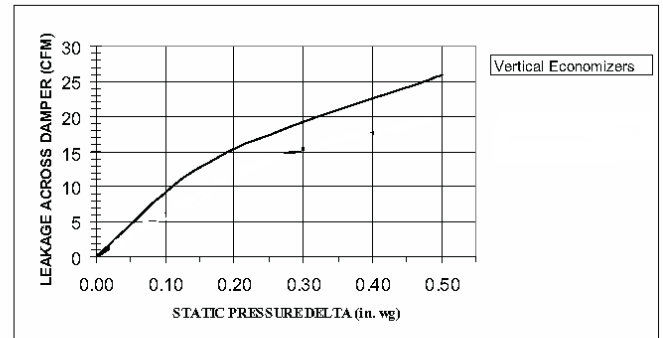
**Fig 1 – Barometric Relief Flow Capacity**



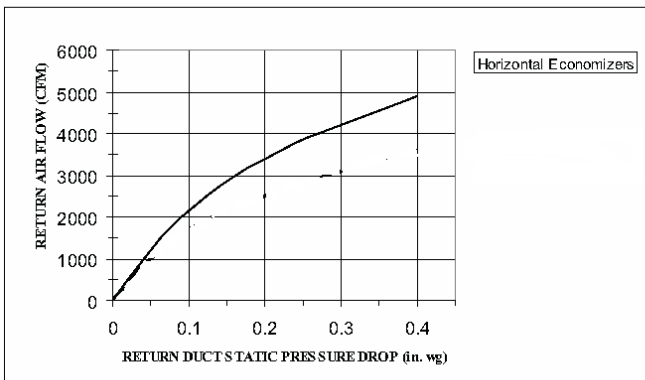
**Fig 5 – Barometric Relief Flow Capacity**



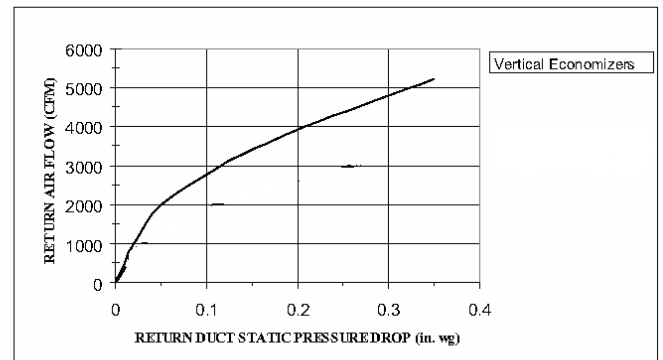
**Fig 2 – Outdoor Air Damper Leakage**



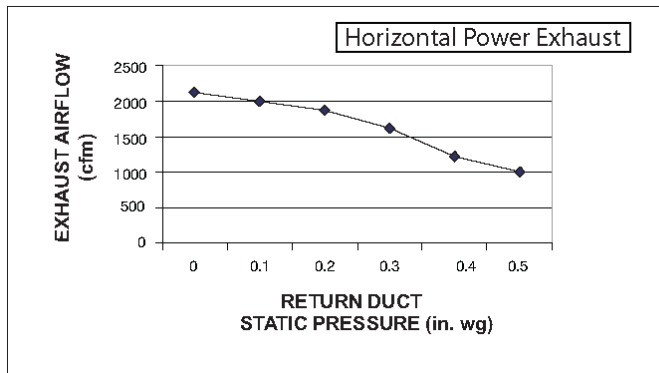
**Fig 6 – Outdoor Air Damper Leakage**



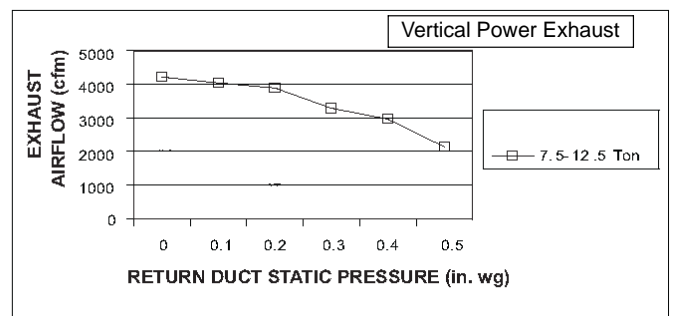
**Fig 3 – Return Air Pressure Drop**



**Fig 7 – Return Air Pressure Drop**



**Fig 4 – Horizontal Power Exhaust Performance**



**Fig 8 – Vertical Power Exhaust Performance**

# ELECTRICAL INFORMATION

**Table 18 – RAS090, 7.5 TONS (2 Stage Cooling)**

V-Ph-Hz	VOLTAGE RANGE		COMP (Cir 1)		COMP (Cir 2)		OFM (ea)		IFM				
			RLA	LRA	RLA	LRA	Watts	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
	MIN	MAX											
208-3-60	187	253	13.6	83	13.6	83	325	1.5	Std Static	1448	5.5	80%	5.2
									High Static	4400	15.0	81%	15.0
230-3-60	187	253	13.6	83	13.6	83	325	1.5	Std Static	1448	5.5	80%	5.2
									High Static	4400	15.0	81%	15.0
460-3-60	414	506	6.1	41	6.1	41	325	0.8	Std Static	1448	2.7	80%	2.6
									High Static	4400	7.4	81%	7.4
575-3-60	518	633	4.2	33	4.2	33	325	0.6	Std Static	1379	2.5	80%	2.4
									High Static	4400	5.9	81%	5.6

**Table 19 – RAS120, 10 TONS (2 Stage Cooling)**

V-Ph-Hz	VOLTAGE RANGE		COMP (Cir 1)		COMP (Cir 2)		OFM (ea)		IFM				
			RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
	MIN	MAX											
208-3-60	187	253	15.6	110	15.9	110	325	1.5	Std Static	2120	5.5	80%	5.2
									High Static	4400	15.0	81%	15.0
230-3-60	187	253	15.6	110	15.9	110	325	1.5	Std Static	2120	5.5	80%	5.2
									High Static	4400	15.0	81%	15.0
460-3-60	414	506	7.7	52	7.7	52	325	0.8	Std Static	2120	2.7	80%	2.6
									High Static	4400	7.4	81%	7.4
575-3-60	518	633	5.8	39	5.7	39	325	0.6	Std Static	1390	2.1	80%	2.0
									High Static	4400	5.9	81%	5.6

**Table 20 – RAS150, 12.5 TONS (2 Stage Cooling)**

V-Ph-Hz	VOLTAGE RANGE		COMP (Cir 1)		COMP (Cir 2)		OFM (ea)		IFM				
			RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
	MIN	MAX											
208-3-60	187	253	19.0	123	22.4	149	1288	6.2	Std Static	2615	7.9	81%	7.5
									High Static	4400	15.0	81%	15.0
230-3-60	187	253	19.0	123	22.4	149	1288	6.2	Std Static	2615	7.9	81%	7.5
									High Static	4400	15.0	81%	15.0
460-3-60	414	506	9.7	62	10.6	75	1288	3.1	Std Static	2615	3.6	81%	3.4
									High Static	4400	7.4	81%	7.4
575-3-60	518	633	7.4	50	7.7	54	1288	2.5	Std Static	3775	2.9	81%	2.8
									High Static	4400	5.9	81%	5.6

**Table 21 – MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.**

UNIT RAS	NOM. V-PH-HZ	IFM TYPE	ELECTRIC HEATER		NO C.O. or UNPWR C.O.							
			Nom* (kW)	FLA	NO P.E.				w/ P.E. (pwrd fr/unit)			
					MCA	MOCP	DISC. SIZE		MCA	MOCP	DISC. SIZE	
							FLA	LRA			FLA	LRA
090	208/230-3-60	STD	-	-	38.8	50	41	193	42.6	50	45	197
			7.8/10.4	21.7/25.0	38.8/38.8	50/50	41/41	193/193	42.6/42.6	50/50	45/45	197/197
			12.0/16.0	33.4/38.5	48.3/54.6	50/60	44/50	193/193	53.0/59.4	60/60	49/55	197/197
			18.6/24.8	51.7/59.7	71.1/81.1	80/90	65/75	193/193	75.9/85.9	80/90	70/79	197/197
			24.0/32.0	66.7/77.0	89.9/102.8	90/110	83/95	193/193	94.6/107.5	100/110	87/99	197/197
		31.8/42.4	88.4/102.0	117.0/134.0	125/150	108/123	193/193	121.8/138.8	125/150	112/128	197/197	
		MED**	-	-	41.1	50	43	230	44.9	50	48	234
			7.8/10.4	21.7/25.0	41.1/41.1	50/50	43/43	230/230	44.9/45.4	50/50	48/48	234/234
			12.0/16.0	33.4/38.5	51.1/57.5	60/60	47/53	230/230	55.9/62.3	60/70	51/57	234/234
	18.6/24.8		51.7/59.7	74.0/84.0	80/90	68/77	230/230	78.8/88.8	80/90	72/82	234/234	
	HIGH	-	-	49.0	60	52	256	52.8	60	56	260	
		7.8/10.4	21.7/25.0	49.0/50.0	60/60	52/52	256/256	52.8/54.8	60/60	56/56	260/260	
		12.0/16.0	33.4/38.5	60.5/66.9	70/70	56/62	256/256	65.3/71.6	70/80	60/66	260/260	
		18.6/24.8	51.7/59.7	83.4/93.4	90/100	77/86	256/256	88.1/98.1	90/100	81/90	260/260	
		24.0/32.0	66.7/77.0	102.1/115.0	110/125	94/106	256/256	106.9/119.8	110/125	98/110	260/260	
	31.8/42.4	88.4/102.0	129.3/146.3	150/150	119/135	256/256	134.0/151.0	150/175	123/139	260/260		
	460-3-60	STD	-	-	17.9	20	19	95	19.7	25	21	97
			13.9	16.7	24.1	25	22	95	26.4	30	24	97
			16.5	19.8	28.0	30	26	95	30.3	35	28	97
			27.8	33.4	45.0	50	41	95	47.3	50	43	97
			33.0	39.7	52.9	60	49	95	55.1	60	51	97
		41.7	50.2	66.0	70	61	95	68.3	70	63	97	
		MED**	-	-	18.7	25	20	114	20.5	25	22	116
			13.9	16.7	25.1	30	23	114	27.4	30	25	116
16.5			19.8	29.0	30	27	114	31.3	35	29	116	
27.8			33.4	46.0	50	42	114	48.3	50	44	116	
33.0			39.7	53.9	60	50	114	56.1	60	52	116	
41.7		50.2	67.0	70	62	114	69.3	70	64	116		
HIGH		-	-	23.1	30	24	127	24.9	30	26	129	
		13.9	16.7	30.1	35	28	127	32.4	35	30	129	
		16.5	19.8	34.0	35	31	127	36.3	40	33	129	
	27.8	33.4	51.0	60	47	127	53.3	60	49	129		
	33.0	39.7	58.9	60	54	127	61.1	70	56	129		
41.7	50.2	72.0	80	66	127	74.3	80	68	129			
575-3-60	STD	-	-	13.1	15	14	77	16.9	20	18	81	
		17.0	20.4	28.5	30	26	77	33.3	35	31	81	
	34.0	40.9	54.1	60	50	77	58.9	60	54	81		
	MED**	-	-	13.5	15	14	92	17.3	20	19	96	
		17.0	20.4	29.0	30	27	92	33.8	35	31	96	
	34.0	40.9	54.6	60	50	92	59.4	60	55	96		
HIGH	-	-	16.6	20	17	106	20.4	25	22	110		
	17.0	20.4	32.5	35	30	106	37.3	40	34	110		
34.0	40.9	58.1	60	53	106	62.9	70	58	110			

\* Nominal valves, listed as 208/240V, 480V or 600V as appropriate.

\*\* Available from FAST parts.

See Legend and calculations on page 32.

**Table 21 (Cont.) MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.**

UNIT RAS	NOM. V-PH-HZ	IFM TYPE	ELECTRIC HEATER		NO C.O. or UNPWR C.O.							
			Nom* (kW)	FLA	NO P.E.				w/ P.E. (pwrd fr/unit)			
					MCA	MOCP	DISC. SIZE		MCA	MOCP	DISC. SIZE	
							FLA	LRA			FLA	LRA
120	208/230-3-60	STD	-	-	43.7	50	46	258	47.5	60	50	262
			7.8/10.4	21.7/25.0	43.7/43.7	50/50	46/46	258/258	47.5/47.5	60/60	50/50	262/262
			12.0/16.0	33.4/38.5	48.3/54.6	50/60	46/50	258/258	53.0/59.4	60/60	50/55	262/262
			24.0/32.0	66.7/77.0	89.9/102.8	90/110	83/95	258/258	94.6/107.5	100/110	87/99	262/262
			31.8/42.4	88.4/102.0	117.0/134.0	125/150	108/123	258/258	121.8/138.8	125/150	112/128	262/262
		37.6/50.0	104.2/120.3	136.8/126.8	150/150	126/144	258/258	141.5/131.6	150/150	130/149	262/262	
		MED**	-	-	48.5	60	51	301	52.3	60	56	305
			7.8/10.4	21.7/25.0	48.5/48.5	60/60	51/51	301/301	52.3/52.3	60/60	56/56	305/305
			12.0/16.0	33.4/38.5	54.3/60.6	60/70	51/56	301/301	59.0/65.4	60/70	56/60	305/305
	24.0/32.0		66.7/77.0	95.9/108.8	100/110	88/100	301/301	100.6/113.5	110/125	93/104	305/305	
	31.8/42.4		88.4/102.0	123.0/140.0	125/150	113/129	301/301	127.8/144.8	150/150	118/133	305/305	
	37.6/50.0	104.2/120.3	142.8/132.8	150/150	131/150	301/301	147.5/137.6	150/150	136/154	305/305		
	HIGH	-	-	53.5	60	57	310	57.3	70	61	314	
		7.8/10.4	21.7/25.0	53.5/53.5	60/60	57/57	310/310	57.3/57.3	70/70	61/61	314/314	
		12.0/16.0	33.4/38.5	60.5/66.9	70/70	57/62	310/310	65.3/71.6	70/80	61/66	314/314	
		24.0/32.0	66.7/77.0	102.1/115.0	110/125	94/106	310/310	106.9/119.8	110/125	98/110	314/314	
		31.8/42.4	88.4/102.0	129.3/146.3	150/150	119/135	310/310	134.0/151.0	150/175	123/139	314/314	
	37.6/50.0	104.2/120.3	149.0/139.1	150/175	137/156	310/310	153.8/143.8	175/175	141/160	314/314		
	460-3-60	STD	-	-	21.5	25	23	123	23.3	30	25	125
			13.9	16.7	24.1	25	23	123	26.4	30	25	125
			16.5	19.8	28.0	30	26	123	30.3	35	28	125
			33.0	39.7	52.9	60	49	123	55.1	60	51	125
			41.7	50.2	66.0	70	61	123	68.3	70	63	125
		50.0	60.1	63.4	70	72	123	65.6	70	74	125	
MED**		-	-	23.3	30	25	145	25.1	30	27	147	
		13.9	16.7	26.4	30	25	145	28.6	30	27	147	
		16.5	19.8	30.3	35	28	145	32.5	35	30	147	
		33.0	39.7	55.1	60	51	145	57.4	60	53	147	
		41.7	50.2	68.3	70	63	145	70.5	80	65	147	
50.0		60.1	65.6	80	74	145	67.9	80	76	147		
HIGH		-	-	26.3	30	28	149	28.1	35	30	151	
		13.9	16.7	30.1	35	28	149	32.4	35	30	151	
		16.5	19.8	34.0	35	31	149	36.3	40	33	151	
	33.0	39.7	58.9	60	54	149	61.1	70	56	151		
	41.7	50.2	72.0	80	66	149	74.3	80	68	151		
50.0	60.1	69.4	80	78	149	71.6	80	80	151			
575-3-60	STD	-	-	16.2	20	17	93	20.0	25	21	97	
		17.0	20.4	28.0	30	26	93	32.8	35	30	97	
		34.0	40.9	53.6	60	49	93	58.4	60	54	97	
		51.0	61.3	63.8	70	73	93	68.6	80	77	97	
	MED**	-	-	17.0	20	18	104	20.8	25	22	108	
		17.0	20.4	29.0	30	27	104	33.8	35	31	108	
		34.0	40.9	54.6	60	50	104	59.4	60	55	108	
		51.0	61.3	64.8	70	74	104	69.6	80	78	108	
	HIGH	-	-	19.8	25	21	118	23.6	30	25	122	
		17.0	20.4	32.5	35	30	118	37.3	40	34	122	
		34.0	40.9	58.1	60	53	118	62.9	70	58	122	
		51.0	61.3	68.3	80	77	118	73.1	80	81	122	

\* Nominal valves, listed as 208/240V, 480V or 600V as appropriate.

\*\* Available from FAST parts.

See Legend and calculations on page 32.

**Table 21 (Cont.) MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.**

UNIT RAS	NOM. V-PH-HZ	IFM TYPE	ELECTRIC HEATER		NO C.O. or UNPWR C.O.							
			Nom* (kW)	FLA	NO P.E.				w/ P.E. (pwrd fr/unit)			
					MCA	MOCP	DISC. SIZE		MCA	MOCP	DISC. SIZE	
							FLA	LRA			FLA	LRA
150	208/230-3-60	STD	-	-	60.7	80	63	360	64.5	80	68	364
			7.8/10.4	21.7/25.0	60.7/60.7	80/80	63/63	360/360	64.5/64.5	80/80	68/68	364/364
			12.0/16.0	33.4/38.5	60.7/60.7	80/80	63/63	360/360	64.5/64.5	80/80	68/68	364/364
			24.0/32.0	66.7/77.0	92.8/105.6	100/110	85/97	360/360	97.5/110.4	100/125	90/102	364/364
			31.8/42.4	88.4/102.0	119.9/136.9	125/150	110/126	360/360	124.6/141.6	125/150	115/130	364/364
			37.6/50.0	104.2/120.3	139.6/129.7	150/150	128/147	360/360	144.4/134.4	150/150	133/151	364/364
		MED**	-	-	63.2	80	66	377	67.0	80	71	381
			7.8/10.4	21.7/25.0	63.2/63.2	80/80	66/66	377/377	67.0/67.0	80/80	71/71	381/381
			12.0/16.0	33.4/38.5	63.2/63.2	80/80	66/66	377/377	67.0/67.0	80/80	71/71	381/381
	24.0/32.0		66.7/77.0	95.9/108.8	100/110	88/100	377/377	100.6/113.5	110/125	93/104	381/381	
	31.8/42.4		88.4/102.0	123.0/140.0	125/150	113/129	377/377	127.8/144.8	150/150	118/133	381/381	
	37.6/50.0		104.2/120.3	142.8/132.8	150/150	131/150	377/377	147.5/137.6	150/150	136/154	381/381	
	HIGH	-	-	68.2	80	72	386	72.0	80	76	390	
		7.8/10.4	21.7/25.0	68.2/68.2	80/80	72/72	386/386	72.0/72.0	80/80	76/76	390/390	
		12.0/16.0	33.4/38.5	68.2/68.2	80/80	72/72	386/386	72.0/72.0	80/80	76/76	390/390	
		24.0/32.0	66.7/77.0	102.1/115.0	110/125	94/106	386/386	106.9/119.8	110/125	98/110	390/390	
		31.8/42.4	88.4/102.0	129.3/146.3	150/150	119/135	386/386	134.0/151.0	150/175	123/139	390/390	
		37.6/50.0	104.2/120.3	149.0/139.1	150/175	137/156	386/386	153.8/143.8	175/175	141/160	390/390	
	460-3-60	STD	-	-	29.5	40	31	181	31.3	40	33	183
			13.9	16.7	29.5	40	31	181	31.3	40	33	183
			16.5	19.8	29.5	40	31	181	31.3	40	33	183
			33.0	39.7	53.9	60	50	181	56.1	60	52	183
			41.7	50.2	67.0	70	62	181	69.3	70	64	183
			50.0	60.1	64.4	70	73	181	66.6	70	75	183
MED**		-	-	30.5	40	32	190	32.3	40	34	192	
		13.9	16.7	30.5	40	32	190	32.3	40	34	192	
		16.5	19.8	30.5	40	32	190	32.5	40	34	192	
		33.0	39.7	55.1	60	51	190	57.4	60	53	192	
		41.7	50.2	68.3	70	63	190	70.5	80	65	192	
		50.0	60.1	65.6	80	74	190	67.9	80	76	192	
HIGH		-	-	33.5	40	35	194	35.3	45	37	196	
		13.9	16.7	33.5	40	35	194	35.3	45	37	196	
		16.5	19.8	34.0	40	35	194	36.3	45	37	196	
		33.0	39.7	58.9	60	54	194	61.1	70	56	196	
		41.7	50.2	72.0	80	66	194	74.3	80	68	196	
		50.0	60.1	69.4	80	78	194	71.6	80	80	196	
575-3-60	STD	-	-	22.3	30	23	142	26.1	30	28	146	
		17.0	20.4	29.0	30	27	142	33.8	35	31	146	
		34.0	40.9	54.6	60	50	142	59.4	60	55	146	
		51.0	61.3	64.8	70	74	142	69.6	80	78	146	
	MED**	-	-	22.3	30	23	142	26.1	30	28	146	
		17.0	20.4	29.0	30	27	142	33.8	35	31	146	
		34.0	40.9	54.6	60	50	142	59.4	60	55	146	
		51.0	61.3	64.8	70	74	142	69.6	80	78	146	
	HIGH	-	-	25.1	30	27	156	28.9	35	31	160	
		17.0	20.4	32.5	35	30	156	37.3	40	34	160	
		34.0	40.9	58.1	60	53	156	62.9	70	58	160	
		51.0	61.3	68.3	80	77	156	73.1	80	81	160	

\* Nominal valves, listed as 208/240V, 480V or 600V as appropriate.

\*\* Available from FAST parts.

See Legend and calculations on page 32.

**LEGEND:**

- CO - Convenient outlet
- DISC - Disconnect
- FLA - Full load amps
- IFM - Indoor fan motor
- LRA - Locked rotor amps
- MCA - Minimum circuit amps
- MOCP - Maximum over current protection
- PE - Power exhaust
- UNPWRD CO - Unpowered convenient outlet



**NOTES:**

1. 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. Canadian units may be fuse or circuit breaker.

**2. Unbalanced 3-Phase Supply Voltage**

Never operate a motor where a phase imbalance in supply voltage is greater than 2%. Use the following formula to determine the percentage of voltage imbalance.

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

Example: Supply voltage is 230-3-60



AB = 224 v

BC = 231 v

AC = 226 v

$$\begin{aligned} \text{Average Voltage} &= \frac{(224 + 231 + 226)}{3} = \frac{681}{3} \\ &= 227 \end{aligned}$$

Determine maximum deviation from average voltage.

(AB) 227 - 224 = 3 v

(BC) 231 - 227 = 4 v

(AC) 227 - 226 = 1 v

Maximum deviation is 4 v.

Determine percent of voltage imbalance.

$$\begin{aligned} \% \text{ Voltage Imbalance} &= 100 \times \frac{4}{227} \\ &= 1.76\% \end{aligned}$$

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 your local electric utility company immediately.



**Fig. 10 Typical Power Diagram (2 Stage Cooling)**

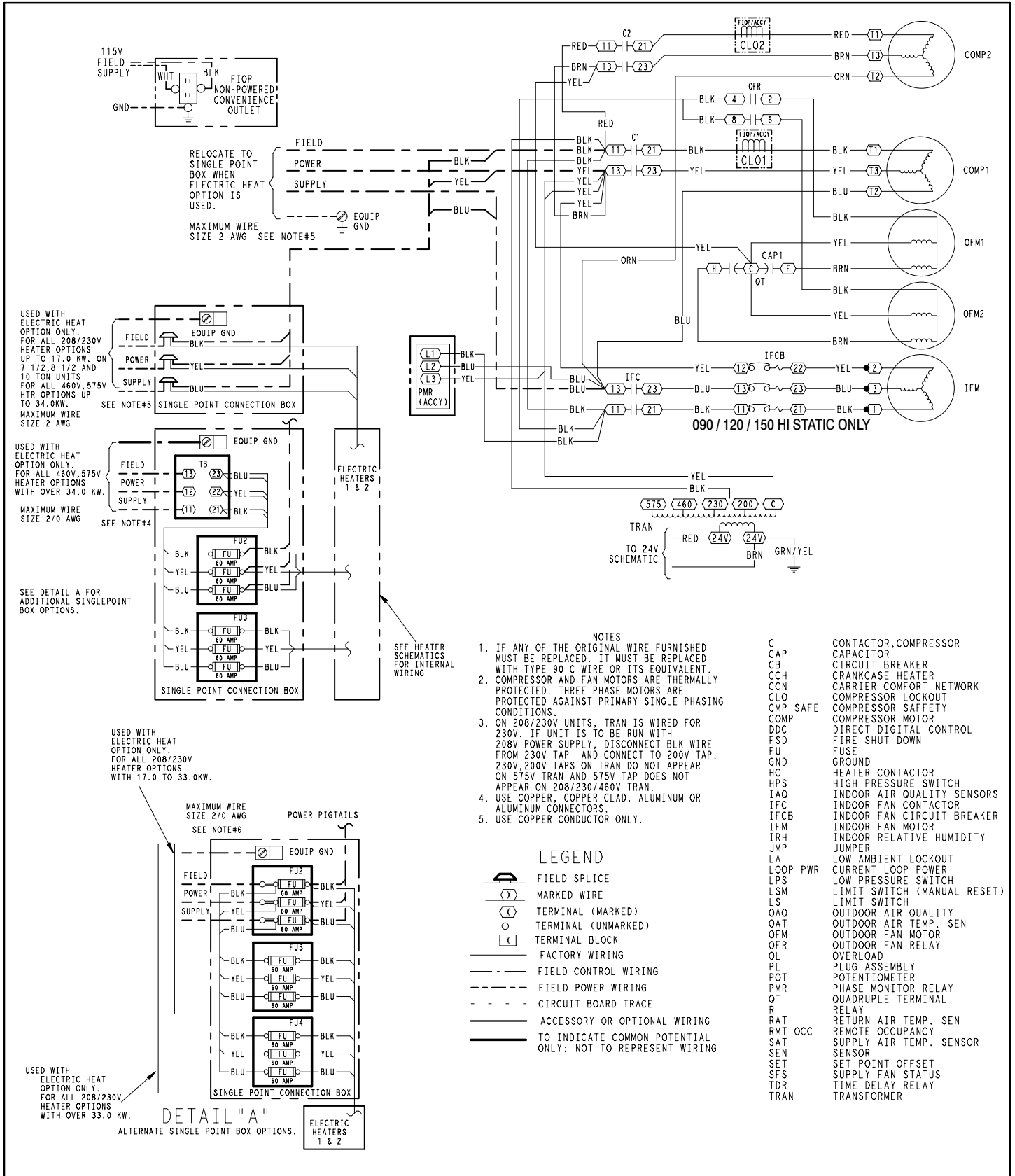
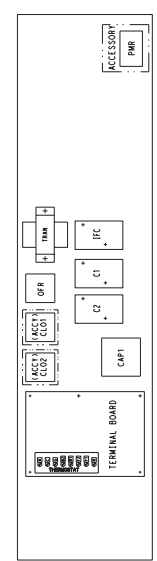
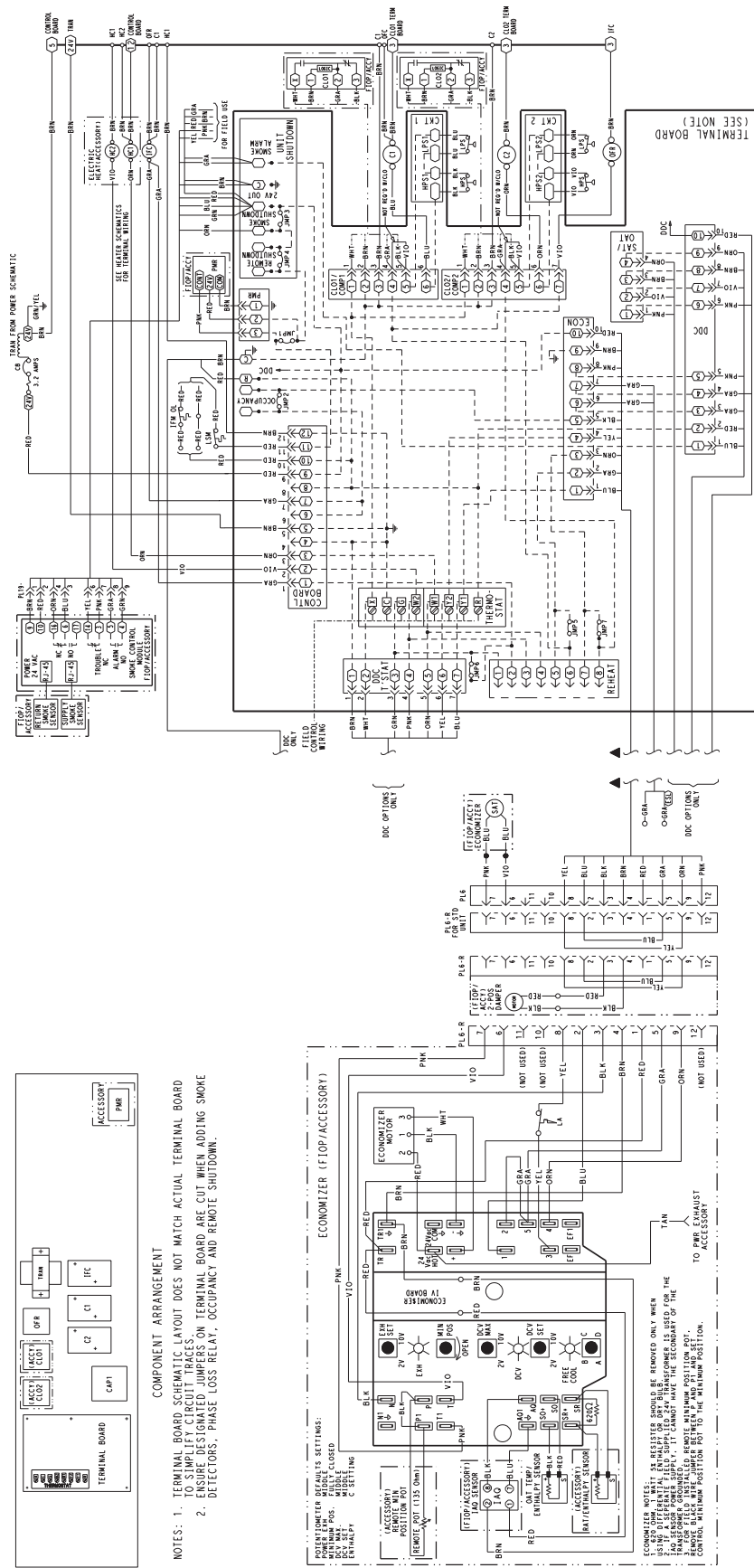
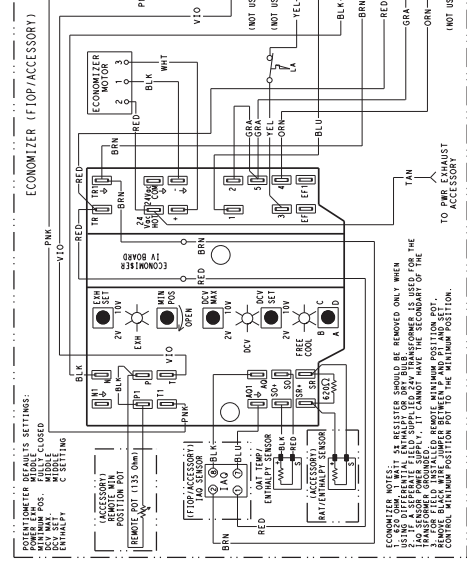


Fig. 10 Typical Power Diagram (2 Stage Cooling)



COMPONENT ARRANGEMENT

- NOTES: 1. TERMINAL BOARD SCHEMATIC LAYOUT DOES NOT MATCH ACTUAL TERMINAL BOARD TO SIMPLIFY CIRCUIT TRACES.
- 2. ENSURE DESIGNATED JUMPERS ON TERMINAL BOARD ARE CUT WHEN ADDING SMOKE DETECTORS, PHASE LOSS RELAY, OCCUPANCY AND REMOTE SHUTDOWN.



ECONOMIZER (fTOP/ACCESSORY)

POTENTIOMETER DEFAULT SETTINGS:  
 1. 250 OHM AT 10V  
 2. 250 OHM POS. FULLY CLOSED  
 3. 250 OHM POS. FULLY OPEN

REMOVAL OF 1132 OHM

ECONOMIZER NOTE: 31 REGISTER SHOULD BE REMOVED ONLY WHEN USED WITH A DIFFERENT FIELD SUPPLIER. 32W TRANSFORMER IS USED FOR THE TRANSFORMER PROVIDED PHASE LOSS RELAY. 33W TRANSFORMER IS USED FOR THE PHASE LOSS RELAY PROVIDED WITH THE UNIT POSITION.

# SEQUENCE OF OPERATION

## General

The sequence below describes the sequence of operation for an electro-mechanical unit with and without a factory installed economizer. For information regarding a direct digital controller, see the start-up, operations, and troubleshooting manual for the applicable controller.

### Units with no economizer

#### Cooling

When the thermostat calls for cooling, terminals G and Y1 are energized. As a result, the indoor-fan contactor (IFC) and the compressor contactor (C1) are energized, causing the indoor-fan motor (IFM), compressor #1, and outdoor fan to start. Since the 090, 120, and 150 models have 2 stages of cooling, the thermostat will additionally energize Y2. The Y2 signal will energize compressor contactor #2 (C2), causing compressor #2 to start. Regardless of the number of stages, the outdoor-fan motor runs continuously while unit is cooling.

#### Heating

**NOTE:** The RAS units are sold as cooling only. If electric heaters are required, use only factory-approved electric heaters. They will operate as described below.

Units have either 1 or 2 stages of electric heat. When the thermostat calls for heating, power is applied to the W1 terminal at the unit. The unit control will energize the indoor fan contactor and the first stage of electric heat. On units with two-stage heating, when additional heating is required, the second stage of electric heat (if equipped) will be energized when power is applied at the W2 terminal on the unit.

### Units with an economizer

#### Cooling

When free cooling is not available, the compressors will be controlled by the zone thermostat. When free cooling is available, the outdoor-air damper is modulated by the economizer control to provide a 50°F (10°C) to 55°F (13°C) mixed-air temperature into the zone. As the mixed air temperature fluctuates above 55°F (13°C) or below 50°F (10°C) dampers will be modulated (open or close) to bring the mixed-air temperature back within control. If mechanical cooling is utilized with free cooling, the outdoor-air damper will maintain its current position at the time the compressor is started. If the increase in cooling capacity causes the mixed-air temperature to drop below 45°F (9°C), then the outdoor-air damper position will be decreased to the minimum position. If the mixed-air temperature continues to fall, the outdoor-air damper will close. Control returns to normal once the mixed-air temperature rises above 48°F (9°C). The power exhaust fans will be energized and de-energized, if installed, as the outdoor-air damper opens and closes.

If field-installed accessory CO<sub>2</sub> sensors are connected to the economizer control, a demand controlled ventilation strategy will begin to operate. As the CO<sub>2</sub> level in the zone increases above the CO<sub>2</sub> setpoint, the minimum position of the damper will be increased proportionally. As the CO<sub>2</sub> level decreases because of the increase in fresh air, the outdoor-air damper will be proportionally closed. For economizer operation, there must be a thermostat call for the fan (G). If the unit is occupied and the fan is on, the damper will operate at minimum position. Otherwise, the damper will be closed.

When the economizer control is in the occupied mode and a call for cooling exists (Y1 on the thermostat), the control will first check for indoor fan operation. If the fan is not on, then cooling will not be activated. If the fan is on, then the control will open the economizer damper to the minimum position.

On the initial power to the economizer control, it will take the damper up to 2 1/2 minutes before it begins to position itself. After the initial power-up, further changes in damper position can take up to 30 seconds to initiate. Damper movement from full closed to full open (or vice versa) will take between 1 1/2 and 2 1/2 minutes. If free cooling can be used as determined from the appropriate changeover command (switch, dry bulb, enthalpy curve, differential dry bulb, or differential enthalpy), then the control will modulate the dampers open to maintain the mixed-air temperature setpoint at 50°F (10°C) to 55°F (13°C). If there is a further demand for cooling (cooling second stage – Y2 is energized), then the control will bring on compressor stage 1 to maintain the mixed-air temperature setpoint. The economizer damper will be open at maximum position. economizer operation is limited to a single compressor.

#### Heating

The sequence of operation for the heating is the same as an electromechanical unit with no economizer. The only difference is how the economizer acts. The economizer will stay at the Economizer Minimum Position while the evaporator fan is operating. The outdoor-air damper is closed when the indoor fan is not operating.

Cooling Only/Electric Heat Packaged Rooftop

HVAC Guide Specifications

Size Range: 3 to 12.5 Nominal Tons



This product has been designed and manufactured to meet Energy Star® criteria for energy efficiency. However, proper refrigerant charge and proper air flow are critical to achieve rated capacity and efficiency. Installation of this product should follow all manufacturer's refrigerant charging and air flow instructions. **Failure to confirm proper charge and air flow may reduce energy efficiency and shorten equipment life.**

**Section Description**

**23 06 80 Schedules for Decentralized HVAC Equipment**

- 23 06 80.13 Decentralized Unitary HVAC Equipment Schedule
- 23 06 80.13.A. Rooftop unit schedule
  1. Schedule is per the project specification requirements.

**23 07 16 HVAC Equipment Insulation**

- 23 07 16.13 Decentralized, Rooftop Units:
  - 23 07 16.13.A. Evaporator fan compartment:
    1. Interior cabinet surfaces shall be insulated with a minimum 1/2-in. thick, minimum 1 1/2 lb density, flexible fiber-glass insulation bonded with a phenolic binder, neoprene coated on the air side.
    2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
  - 23 07 16.13.B. Electric heat compartment:
    1. Aluminum foil-faced fiberglass insulation shall be used.
    2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

**23 09 13 Instrumentation and Control Devices for HVAC**

- 23 09 13.23 Sensors and Transmitters
  - 23 09 13.23.A, Thermostats
    1. Thermostat must
      - a. energize both “W” and “G” when calling for heat.
      - b. have capability to energize 2 different stages of cooling, and 2 different stages of heating.
      - c. include capability for occupancy scheduling.

**23 09 33 Electric and Electronic Control System for HVAC**

- 23 09 33.13 Decentralized, Rooftop Units:
  - 23 09 33.13.A. General:
    1. Shall be complete with self-contained low-voltage control circuit protected by a resettable circuit breaker on the 24-v transformer side. Transformer shall have 75VA capability.
    2. Shall utilize color-coded wiring.
    3. Shall include a central control terminal board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, and low and high pressure switches.
    4. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.
  - 23 09 33.23.B, Safeties:
    1. Compressor over-temperature, over current.
    2. Low-pressure switch.
      - a. Units shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.

- b. Low pressure switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
- 3. High–pressure switch.
  - a. Units shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross–wiring of the safety switches between circuits 1 and 2.
  - b. High pressure switch shall use different color wire than the low pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
- 4. Automatic reset, motor thermal overload protector.

**23 09 93 Sequence of Operations for HVAC Controls**

23 09 93.13 Decentralized, Rooftop Units:

23 09 93.13 INSERT SEQUENCE OF OPERATION

**23 40 13 Panel Air Filters**

23 40 13.13 Decentralized, Rooftop Units:

23 40 13.13.A. Standard filter section

- 1. Shall consist of factory–installed, low velocity, throwaway 2–in. thick fiberglass filters of commercially available sizes.
- 2. Unit shall use only one filter size. Multiple sizes are not acceptable.
- 3. Filters shall be accessible through an access panel with “no–tool” removal as described in the unit cabinet section of this specification (23 81 19.13.H).

**23 81 19 Self–Contained Air Conditioners**

23 81 19.13 Small–Capacity Self–Contained Air Conditioners (RAS090–150)

23 81 19.13.A. General

- 1. Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a(n) hermetic scroll compressor(s) for cooling duty and gas combustion for heating duty.
- 2. Factory assembled, single–piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start–up.
- 3. Unit shall use environmentally safe, R–410A refrigerant.
- 4. Unit shall be installed in accordance with the manufacturer’s instructions.
- 5. Unit must be selected and installed in compliance with local, state, and federal codes.

23 81 19.13.B. Quality Assurance

- 1. Unit meets ASHRAE 90.1–2004 minimum efficiency requirements.
- 2. 3 phase units are Energy Star qualified.
- 3. Unit shall be rated in accordance with AHRI Standards 360.
- 4. Unit shall be designed to conform to ASHRAE 15, 2001.
- 5. Unit shall be UL–tested and certified in accordance with ANSI Z21.47 Standards and UL–listed and certified under Canadian standards as a total package for safety requirements.
- 6. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
- 7. Unit casing shall be capable of withstanding 500–hour salt spray exposure per ASTM B117 (scribed specimen).
- 8. Unit casing shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 5000–hour salt spray.
- 9. Unit shall be designed in accordance with ISO 9001:2000, and shall be manufactured in a facility registered by ISO 9001:2000.
- 10. Roof curb shall be designed to conform to NRCA Standards.
- 11. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory, and must be available upon request.
- 12. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
- 13. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
- 14. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.

23 81 19.13.C. Delivery, Storage, and Handling

- 1. Unit shall be stored and handled per manufacturer’s recommendations.
- 2. Lifted by crane requires spreader bars to prevent top cover damage.
- 3. Unit shall only be stored or positioned in the upright position.

23 81 19.13.D. Project Conditions

1. As specified in the contract.
- 23 81 19.13.E. Project Conditions
1. As specified in the contract.
- 23 81 19.13.F. Operating Characteristics
1. Unit shall be capable of starting and running at 115°F (46°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 360 at ± 10% voltage.
  2. Compressor with standard controls shall be capable of operation down to 40°F (4°C), ambient outdoor temperatures. Accessory winter start kit is necessary if mechanically cooling at ambient temperatures to 40°F (4°C) 25°F (-4°C).
  3. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
  4. Unit shall be factory configured for vertical supply & return configurations.
  5. Unit shall be field convertible from vertical to horizontal configuration.
  6. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.
- 23 81 19.13.G. Electrical Requirements
1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.
- 23 81 19.13.H. Unit Cabinet
1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.
  2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F): 60, Hardness: H-2H Pencil hardness.
  3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment.
  4. Base of unit shall have a minimum of four locations for thru-the-base gas and electrical connections (factory installed or field installed), standard.
  5. Base Rail
    - a. Unit shall have base rails on a minimum of 2 sides.
    - b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
    - c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
    - d. Base rail shall be a minimum of 16 gauge thickness.
  6. Condensate pan and connections:
    - a. Shall be a sloped condensate drain pan made of a non-corrosive material.
    - b. Shall comply with ASHRAE Standard 62.
    - c. Shall use a 3/4" -14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer's recommendations.
  7. Top panel:
    - a. Shall be a single piece top panel on 090 and 120 sizes, two piece on 150 size.
  8. Electrical Connections
    - a. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
    - b. Thru-the-base capability
      - (1.) Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit basepan.
      - (2.) Optional, factory-approved, water-tight connection method must be used for thru-the-base electrical connections.
      - (3.) No basepan penetration, other than those authorized by the manufacturer, is permitted.
  9. Component access panels (standard)
    - a. Cabinet panels shall be easily removable for servicing.
    - b. Unit shall have one factory installed, tool-less, removable, filter access panel.
    - c. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles.
    - d. Handles shall be UV modified, composite. permanently attached, and recessed into the panel.
    - e. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.

f. Collars shall be removable and easily replaceable using manufacturer recommended parts.

23 81 19.13.I. N/A

23 81 19.13.J. Coils

10. Standard Coils: (090–150 two compressor models/two stage cooling models only)

- a. Standard evaporator coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
- b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
- c. Standard condenser coils shall have all aluminum Microchannel Heat Exchanger Technology design consisting of aluminum multi port flat tube design and aluminum fin. Coils shall be a furnace brazed design and contain epoxy lined shrink wrap on all aluminum to copper connections.
- d. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

23 81 19.13.K. Refrigerant Components

1. Refrigerant circuit shall include the following control, safety, and maintenance features:

- a. Fixed orifice metering system shall prevent mal-distribution of two-phase refrigerant by including multiple fixed orifice devices in each refrigeration circuit. Each orifice is to be optimized to the coil circuit it serves.
- b. Refrigerant filter drier.
- c. Service gauge connections on suction and discharge lines.
- d. Pressure gauge access through a specially designed access port in the top panel of the unit.

2. There shall be gauge line access port in the skin of the rooftop, covered by a black, removable plug.

- a. The plug shall be easy to remove and replace.
- b. When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.
- c. This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
- d. The plug shall be made of a leak proof, UV-resistant, composite material.

3. Compressors

- a. Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.
- b. Models shall be available with 2 compressor (stage) models from 090–150 sizes with Microchannel condenser coils.
- c. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
- d. Compressors shall be internally protected from high discharge temperature conditions.
- e. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
- f. Compressor shall be factory mounted on rubber grommets.
- g. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
- h. Crankcase heaters shall not be required for normal operating range, unless provided by the factory.

23 81 19.13.L. Filter Section

1. Filters access is specified in the unit cabinet section of this specification.
2. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
3. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
4. Filters shall be standard, commercially available sizes.
5. Only one size filter per unit is allowed.

23 81 19.13.M. Evaporator Fan and Motor

1. Evaporator fan motor:

- a. Shall have permanently lubricated bearings.
- b. Shall have inherent automatic-reset thermal overload protection or circuit breaker.
- c. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.

2. Belt-driven Evaporator Fan:

- a. Belt drive shall include an adjustable-pitch motor pulley.
- b. Shall use sealed, permanently lubricated ball-bearing type.
- c. Blower fan shall be double-inlet type with forward-curved blades.

d. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

#### 23 81 19.13.N. Condenser Fans and Motors

##### 1. Condenser fan motors:

- a. Shall be a totally enclosed motor.
- b. Shall use permanently lubricated bearings.
- c. Shall have inherent thermal overload protection with an automatic reset feature.
- d. Shall use a shaft-down design on 090 to 120 models and shaft-up design on 150 size with rain shield.

##### 2. Condenser Fans:

- a. Shall be a direct-driven propeller type fan.
- b. Shall have aluminum blades riveted to corrosion-resistant steel spiders and shall be dynamically balanced.

#### 23 81 19.13.O. Special Features, Options and Accessories

##### 1. Integrated Economizers:

- a. Integrated, gear-driven parallel modulating blade design type capable of simultaneous economizer and compressor operation.
- b. Independent modules for vertical or horizontal return configurations shall be available. Vertical return modules shall be available as a factory installed option.
- c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
- d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
- e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
- f. Shall be equipped with low-leakage dampers, not to exceed 2% leakage at 1 in. wg pressure differential.
- g. Shall be capable of introducing up to 100% outdoor air.
- h. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air.
- i. Shall be designed to close damper(s) during loss-of-power situations with spring return built into motor.
- j. Dry bulb outdoor-air temperature sensor shall be provided as standard. Outdoor air sensor setpoint shall be adjustable and shall range from 40 to 100°F / 4 to 38°C. Additional sensor options shall be available as accessories.
- k. The economizer controller shall also provide control of an accessory power exhaust unit. function. Factory set at 100%, with a range of 0% to 100%.
- l. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy. A remote potentiometer may be used to override the damper setpoint.
- m. Dampers shall be completely closed when the unit is in the unoccupied mode.
- n. Economizer controller shall accept a 2-10Vdc CO<sub>2</sub> sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor-air damper to provide ventilation based on the sensor input.
- o. Compressor lockout sensor shall open at 35°F (2°C) and close closes at 50°F (10°C).
- p. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
- q. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.

##### 2. Two-Position Damper

- a. Damper shall be a Two-Position Damper. Damper travel shall be from the full closed position to the field adjustable %-open setpoint.
- b. Damper shall include adjustable damper travel from 25% to 100% (full open).
- c. Damper shall include single or dual blade, gear driven dampers and actuator motor.
- d. Actuator shall be direct coupled to damper gear. No linkage arms or control rods shall be acceptable.
- e. Damper will admit up to 100% outdoor air for applicable rooftop units.
- f. Damper shall close upon indoor (evaporator) fan shutoff and/or loss of power.
- g. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.
- h. Outside air hood shall include aluminum water entrainment filter.

##### 3. Manual damper

- a. Manual damper package shall consist of damper, air inlet screen, and rain hood which can be preset to admit up to 50% outdoor air for year round ventilation.

##### 4. Head Pressure Control Package



- a. Controller shall control coil head pressure by condenser–fan speed modulation or condenser–fan cycling and wind baffles.
  - b. Shall consist of solid–state control and condenser–coil temperature sensor to maintain condensing temperature between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to –20°F (–29°C).
5. Condenser Coil Louvered Hail Guard Assembly
- a. Shall protect against damage from hail.
  - b. Shall be louvered design that provides coil protection from hail.
6. Unit–Mounted, Non–Fused Disconnect Switch:
- a. Switch shall be factory–installed, internally mounted.
  - b. National Electric Code (NEC) and UL approved non–fused switch shall provide unit power shutoff.
  - c. Shall be accessible from outside the unit
  - d. Shall provide local shutdown and lockout capability.
7. Convenience Outlet:
- e. Non–Powered convenience outlet.
    - (1.) Outlet shall be powered from a separate 115–120v power source.
    - (2.) A transformer shall not be included.
    - (3.) Outlet shall be factory–installed and internally mounted with easily accessible 115–v female receptacle.
    - (4.) Outlet shall include 15 amp GFI receptacles.
    - (5.) Outlet shall be accessible from outside the unit.
8. Thru–the–Base Connectors:
- a. Kits shall provide connectors to permit electrical connections to be brought to the unit through the unit basepan.
  - b. Minimum of four connection locations per unit.
9. Fan/Filter Status Switch:
- a. Switch shall provide status of indoor evaporator fan (ON/OFF) or filter (CLEAN/DIRTY).
  - b. Status shall be displayed either over communication bus (when used with direct digital controls) or with an indicator light at the thermostat.
10. Propeller Power Exhaust:
- a. Power exhaust shall be used in conjunction with an integrated economizer.
  - b. Independent modules for vertical or horizontal return configurations shall be available.
  - c. Horizontal power exhaust is shall be mounted in return ductwork.
  - d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0–100% adjustable setpoint on the economizer control.
11. Roof Curbs (Vertical):
- a. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.
  - b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
  - c. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
12. High–Static Indoor Fan Motor(s) and Drive(s) (090 – 150):
- a. High–static motor(s) and drive(s) shall be factory–installed to provide additional performance range.
13. Thru–the–Bottom Utility Connectors:
- a. Kit shall provide connectors to permit gas and electrical connections to be brought to the unit through the basepan.
14. Fan/Filter Status Switch:
- a. Provides status of indoor (evaporator) fan (ON/ OFF) or filter (CLEAN/DIRTY). Status shall be displayed over communication bus when used with direct digital controls or with an indicator light at the thermostat.
15. Outdoor Air Enthalpy Sensor:
- a. The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the unit will provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.
16. Return Air Enthalpy Sensor:
- a. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.
17. Indoor Air Quality (CO<sub>2</sub>) Sensor:
- a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.

- b. The IAQ sensor shall be available in duct mount, wall mount, or wall mount with LED display. The setpoint shall have adjustment capability.
18. Smoke detectors:
- a. Shall be a Four–Wire Controller and Detector.
  - b. Shall be environmental compensated with differential sensing for reliable, stable, and drift–free sensitivity.
  - c. Shall use magnet–activated test/reset sensor switches.
  - d. Shall have tool–less connection terminal access.
  - e. Shall have a recessed momentary switch for testing and resetting the detector.
  - f. Controller shall include:
    - (1.) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.
    - (2.) Two Form–C auxiliary alarm relays for interface with rooftop unit or other equipment.
    - (3.) One Form–C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.
    - (4.) Capable of direct connection to two individual detector modules.
    - (5.) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.
19. Winter start kit
- a. Shall contain a bypass device around the low pressure switch.
  - b. Shall be required when mechanical cooling is required down to 25°F (–4°C).
  - c. Shall not be required to operate on an economizer when below an outdoor ambient of 40°F (4°C).
20. Time Guard
- a. Shall prevent compressor short cycling by providing a 5–minute delay (±2 minutes) before restarting a compressor after shutdown for any reason.
  - b. One device shall be required per compressor.
21. Electric Heat:
- a. Heating Section
    - (1.) Heater element open coil resistance wire, nickel–chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
    - (2.) Heater assemblies are provided with integral fusing for protection of internal heater circuits not exceeding 48 amps each. Auto reset thermo limit controls, magnetic heater contactors (24 v coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.
22. Phase Monitor Control
- a. Field installed accessory that provides phase loss / phase reversal protection.
  - b. Mounts in unit control box and connects to unit main terminal board.