

### ENERGY STAR COMPLIANT 13 SEER SINGLE PACKAGE ELECTRIC COOLING R-410A ROOFTOP 3 – 5 TONS 575V

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

- One-piece, high efficiency electric cooling, 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
- Single-stage cooling capacity control
- Scroll compressors with internal line-break overload protection
- 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
- 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 any application
- 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 or thru-the-curb electrical routing
- Single point electric connections

#### WARRANTY

- 5 Year compressor limited warranty
- 1 Year parts limited warranty



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

#### UNIT PERFORMANCE DATA

UNIT	Nominal Tons	COOLING			Unit Dimensions H x W x L	Unit Weight lbs (kg)
		Net Cap. (Btuh)	SEER	EER		
RAS036S0AA0AAA	3	34,600	13.0	11.0	33-3/8" x 44" x 74-3/8"	438 (199)
RAS048S0AA0AAA	4	45,000	13.0	11.0	33-3/8" x 44" x 74-3/8"	494 (224)
RAS060S0AA0AAA	5	59,000	13.0	10.8	33-3/8" x 44" x 74-3/8"	524 (238)

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## MODEL NOMENCLATURE

MODEL SERIES	R	A	S	0	6	0	S	0	A	B	0	A	A	A
Position Number	1	2	3	4	5	6	7	0	9	10	11	12	13	14
R = Rooftop														
A = Air Conditioning (Cooling Only) G = Gas/Electric	Type													
S = Standard ASHRAE 90.1-2010 Efficiency	Efficiency													
036 = 36,000 = 3 Tons 048 = 48,000 = 4 Tons 060 = 60,000 = 5 Tons	NOMINAL COOLING CAPACITY													
S = 575-3-60	VOLTAGE													
0 = No Heat	Heating Capacity													
A = Standard Motor B = High Static Motor	Motor Option													
A = None B = Economizer w/Bara-relief, OA Temp sensor	Outdoor Air Options / Control (See spec sheet for details)													
OA = No Options	Factory Installed Options													
A = Aluminum / Copper Cond & Evap Coil	Condenser / Evaporator Coil Configuration													
A = Sales Digit														

**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>Controls</b>	Time Guard II compressor delay control circuit		X
	Phase Monitor		X
	Filter status switch <sup>1</sup>		X
	Fan status switch <sup>1</sup>		X
<b>Economizer &amp; Outdoor Air Dampers</b>	Economizer	X	X
	Motorized 2 position outdoor-air damper		X
	Manual outdoor-air damper		X
	Barometric relief <sup>2</sup>		X
	Power exhaust		X
<b>Economizer Sensors &amp; IAQ Devices</b>	Single dry bulb temperature sensors <sup>3</sup>		X
	Single enthalpy sensors <sup>3</sup>		X
	Differential enthalpy sensors <sup>3</sup>		X
	CO <sub>2</sub> sensor (wall, duct, or unit mounted) <sup>3</sup>		X
<b>Indoor Motor &amp; Drive</b>	Multiple motor and drive packages	X	
<b>Low Ambient Control</b>	Winter start kit <sup>4</sup>		X
	Motormaster head pressure controller <sup>4</sup>		X
<b>Roof Curbs</b>	Roof curb 14"		X
	Roof curb 24"		X

**NOTES:**

1. Use in conjunction with specialized thermostat or control device.
2. Included with economizer.
3. Sensors used to optimize economizer performance.
4. 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 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 dry–bulb temperature inputs. Additional sensors are available as accessories to optimize the economizers.

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

Improves productivity and saves money by working 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 as an accessory.

### **Louvered Hail Guards**

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

### **Barometric Relief (included with economizer)**

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

### **Power Exhaust with Barometric Relief.**

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 your 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**

Use these accessory differential pressure switches to 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 your 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. Regardless of the case, your unit has a factory installed combination to meet your application. 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 either an accessory or as a factory option, 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.

## ACCESSORIES – RAS036–060

<b>FLAT ROOF CURBS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
CRRFCURB001A01	14" High Roof Curb	036 – 060
CRRFCURB002A01	24" High Roof Curb	036 – 060
<b>ECONOMIZERS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
DNECOMZR020A02	Vertical Fully Modulating – with W7212 controller	036 – 060
DNECOMZR024A02	Horizontal Fully Modulating – with W7212 controller	036 – 060
<b>POWER EXHAUST</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
DNPWREXH030A01	Vertical Power Exhaust 208/230 volt	036 – 060
DNPWREXH028A01	Horizontal Power Exhaust 208/230 & 575 volt	036 – 060
<b>575V TRANSFORMER</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
HT01AH859	Transformer for conversion from 575v to 208/230v power exhaust applications.	036 – 060
<b>MANUAL OUTDOOR AIR DAMPERS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
CRMANDPR001A03	25% Open Manual Fresh Air Damper	036 – 060
CRMANDPR001A02	50% Open Manual Fresh Air Damper	036 – 060
<b>MOTORIZED OUTDOOR AIR DAMPERS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
CRTWOPOS010A00	Motorized 2 position outdoor air damper (25–100% Outdoor Air)	036 – 060
<b>LOW AMBIENT CONTROLS</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
32LT900611	–20° Low Ambient Control 575–3–60	036 – 060
HC40GE463	Low Ambient Control compatible w/ Condenser Fan Motor 575–3–60	036 – 060
<b>THROUGH-THE-BOTTOM/CURB POWER CONNECTION</b>		
<b>Model Number</b>	<b>Description</b>	<b>Use With Model Size</b>
CRBTMPWR001A01	Thru-the-bottom electrical and thru-the-curb gas	036 – 060
CRBTMPWR003A01	Thru-the-bottom electrical and gas	036 – 060
<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 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>
CRSTATUS001A00	Fan/Filter Status Switch	036 – 060
NRTIMEGD001A00	Time Guard II (Anti cycle timer)	036 – 060
KA99ZT003	Remote keyed attenuator / test / reset station	036 – 060
DNPBASE3001A01	Phase Monitor Control	036 – 060

**Table 2 – ARI COOLING RATING TABLE**

UNIT RAS	NOM. CAPACITY (TONS)	NET COOLING CAPACITY (MBH)	TOTAL POWER (KW)	SEER	EER	IPLV	IEER
036	3	34.6	3.1	13.0	11.0	–	–
048	4	45.0	4.0	13.0	11.0	–	–
060	5	59.0	5.5	13.0	10.8	–	–

**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

**NOTES:**

1. Rated and certified under ARI Standard 210/240–06 or 340/360–04, as appropriate.
2. Ratings are based on:
  - Cooling Standard:** 80°F (27°C) db, 67°F (19°C) wb indoor air temp and 95°F (35°C) db outdoor air temp.
  - IPLV Standard:** 80°F (27°C) db, 67°F (19°C) wb indoor air temp and 80°F (27°C) db outdoor air temp.
  - IEER Standard:** Procedure described in ARI Standard 340/360.
3. All RAS units comply with ASHRAE 90.1 2001, 2004 Energy Standard for minimum SEER and EER requirements.
4. RAS units comply with US Energy Policy Act (2005). To evaluate code compliance requirements, refer to state and local codes or visit the following website: <http://bcap-energy.org>.



ARI Standard  
210/240 UAC



ARI Standard  
340/360



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

**Table 3 – MINIMUM – MAXIMUM AIRFLOWS**

UNIT	COOLING	
	Minimum	Maximum
036	900	1500
048	1200	2000
060	1500	2500

**Table 4 – SOUND PERFORMANCE TABLE**

UNIT	OUTDOOR SOUND (dB)								
	A-Weighted	63	125	250	500	1000	2000	4000	8000
036	80	90.6	80.9	80.2	76.0	74.6	71.3	68.5	63.9
048	81	90.9	84.6	79.5	77.9	76.5	71.1	66.9	62.5
060	78	84.0	82.2	76.3	74.8	72.5	68.8	65.6	61.8

**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 5 – PHYSICAL DATA (COOLING) 3 – 5 TONS**

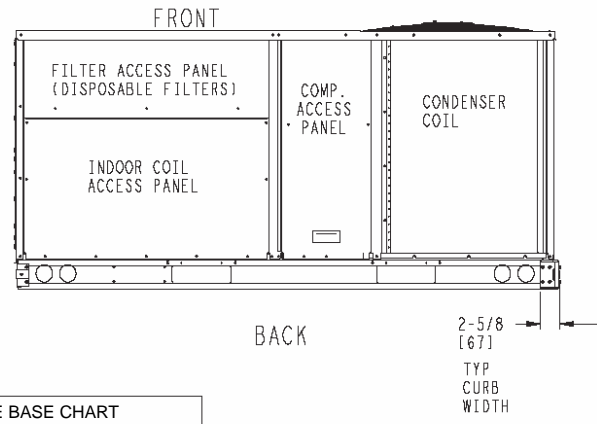
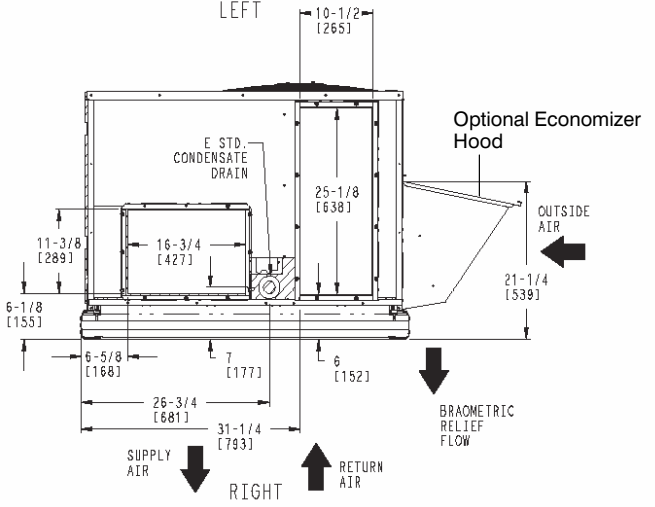
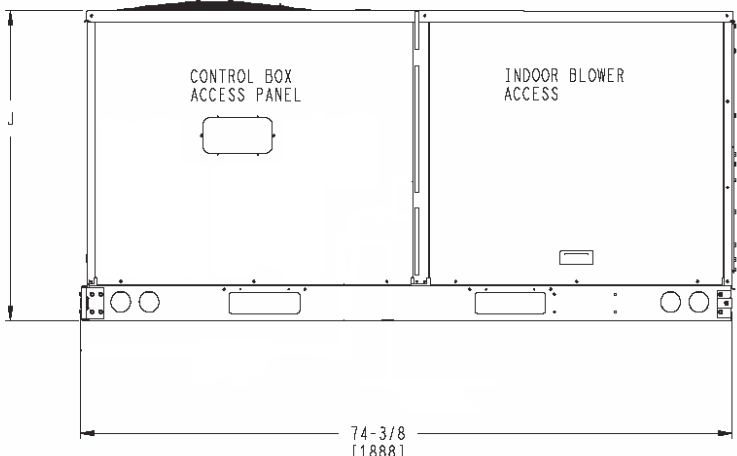
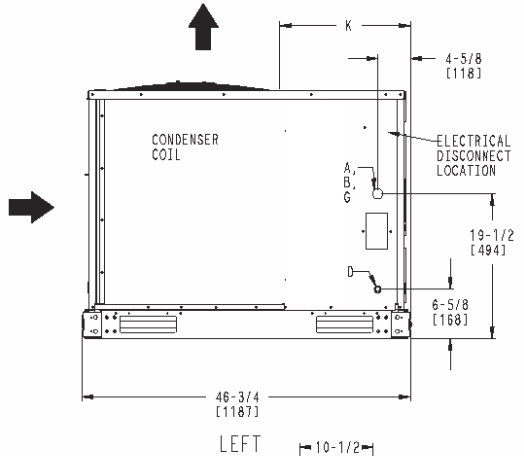
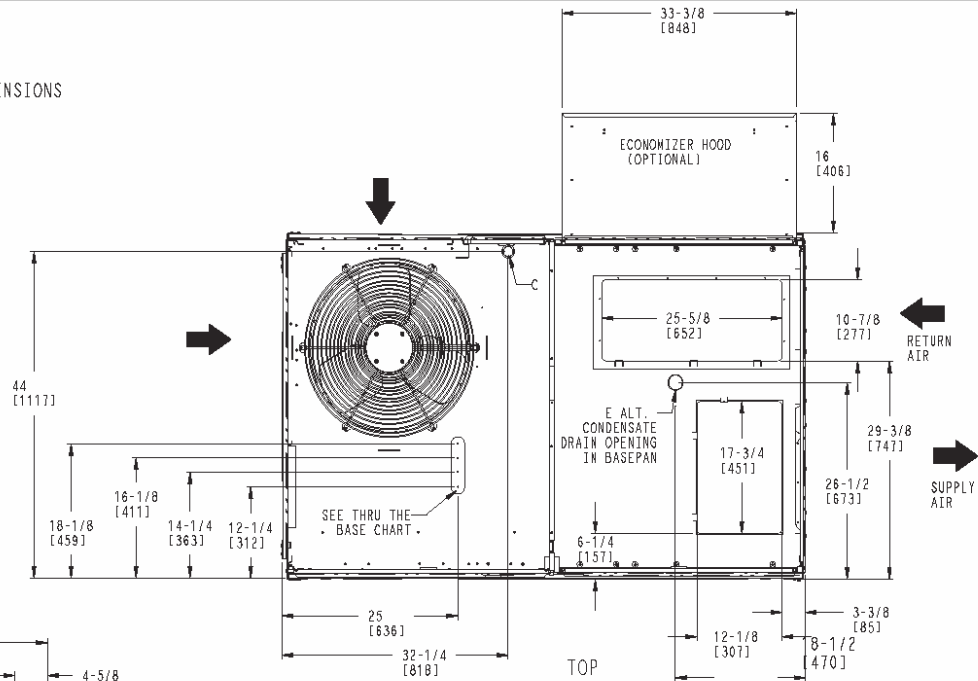
		<b>RAS036S</b>	<b>RAS048S</b>	<b>RAS060S</b>
<b>Refrigeration System</b>				
# Circuits / # Comp. / Type		1 / 1 / Scroll	1 / 1 / Scroll	1 / 1 / Scroll
R-410A charge (lbs)		5.6	8.5	10.7
Oil (oz)		25	42	42
Metering Device		Fixed		
High–press. Trip / Reset (psig)		630 / 505	630 / 505	630 / 505
Low–press. 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		2 / 15	2 / 15	4 / 15
Total Face Area (ft <sup>2</sup> )		5.5	5.5	5.5
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	1.2	1.2	1.2
	RPM Range	560–854	560–854	770–1175
	Motor Frame Size	48	48	48
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	10 x 10	10 x 10	10 x 10
High Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	2.4	2.4	2.9
	RPM Range	1035–1466	1035–1466	1303–1687
	Motor Frame Size	56	56	56
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	10 x 10	10 x 10	10 x 10
<b>Cond. Coil</b>				
Material		Cu / Al	Cu / Al	Cu / Al
Coil type		3/8" RTPF *	3/8" RTPF *	3/8" RTPF *
Rows / FPI		1 / 17	2 / 17	2 / 17
Total Face Area (ft <sup>2</sup> )		14.6	12.6	16.5
<b>Cond. fan / motor</b>				
Qty / Motor Drive Type		1/ Direct	1/ Direct	1/ Direct
Motor HP / RPM		1/4 / 1100	1/4 / 1100	1/4 / 1100
Fan diameter (in)		22	22	22
<b>Filters</b>				
RA Filter # / Size (in)		2 / 16 x 25 x 2	2 / 16 x 25 x 2	2 / 16 x 25 x 2
OA inlet screen # / Size (in)		1 / 20 x 24 x 1	1 / 20 x 24 x 1	1 / 20 x 24 x 1

\* RTPF = Round tube plate fin coil design.

# BASE UNIT DIMENSIONS – RAS036–060

**NOTES:**

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



CONNECTION SIZES		
A	1 3/8" DIA [35]	FIELD POWER SUPPLY HOLE
B	2 1/2" [64]	DIA POWER SUPPLY KNOCKOUT
C	1 3/4" DIA [51]	GAUGE ACCESS PLUG
D	7/8" DIA [22]	FIELD CONTROL WIRING HOLE
E	3/4"-14 NPT	CONDENSATE DRAIN
G	2" DIA [51]	POWER SUPPLY KNOCK-OUT

THRU THE BASE CHART THESE HOLES REQ'S FOR USE CRBTMPWR001A01, 003A01		
THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
1/2"	ACC.	7/8" (22.2)
1/2"	24V	7/8" (22.2)
3/4" (001,003)	POWER*	1 1/8" (28.4)

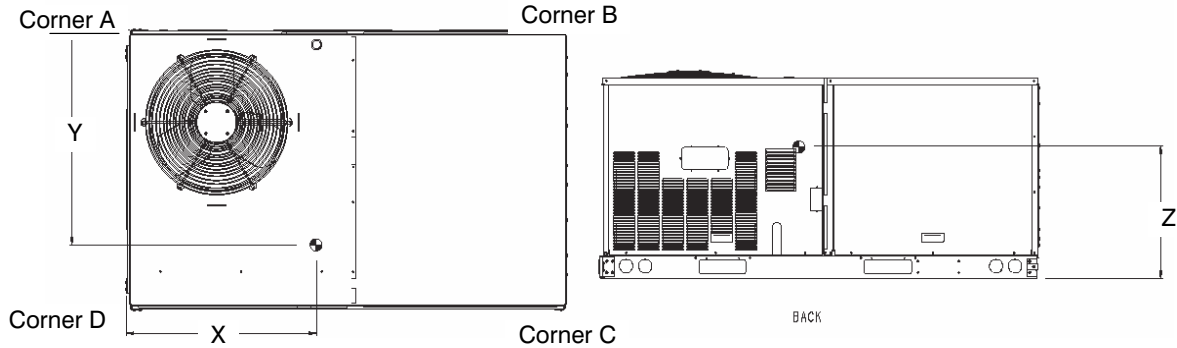
\* SELECT EITHER 3/4" OR 1 1/4" FOR POWER, DEPENDING ON WIRE SIZE

UNIT	J	K
036	33 3/8 [847]	18 5/8 [472]
048	33 3/8 [847]	14 7/8 [377]
060	33 3/8 [847]	14 7/8 [377]



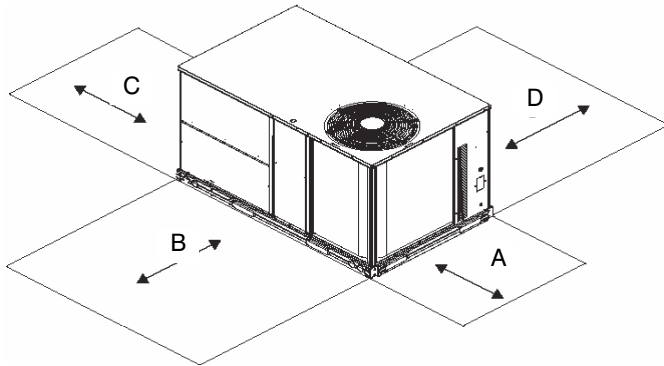
## WEIGHTS & DIMENSIONS – RAS036–060

UNIT	BASE UNIT WEIGHT		Corner Weight A		Corner Weight B		Corner Weight C		Corner Weight D		Center of Gravity In [mm]		Height In [mm]
	LBS	KG	LBS	KG	LBS	KG	LBS	KG	LBS	KG	X	Y	Z
RAS036	438	199	108	49	115	52	110	50	104	47	38 [965]	22 [559]	17–1/4 [438]
RAS048	494	224	122	55	130	59	125	57	117	53	38 [965]	22 [559]	17–1/2 [445]
RAS060	524	238	130	59	138	63	132	60	124	56	38 [965]	22 [559]	17–3/4 [451]



### UNIT CLEARANCES

LOC	DIMENSION	CONDITION
A	48" (1219 mm) 18" (457 mm) 18" (457 mm) 12" (305 mm)	Unit disconnect is mounted on panel No disconnect, convenience outlet Recommended service clearance Minimum clearance
B	42" (1067 mm) 36" (914 mm) Special	Surface behind servicer is grounded (e.g., metal, masonry wall) Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass) 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	42" (1067 mm) 36" (914 mm)	Surface behind servicer is grounded (e.g., metal, masonry wall, another unit) Surface behind servicer is electrically non-conductive (e.g., wood, fiberglass)



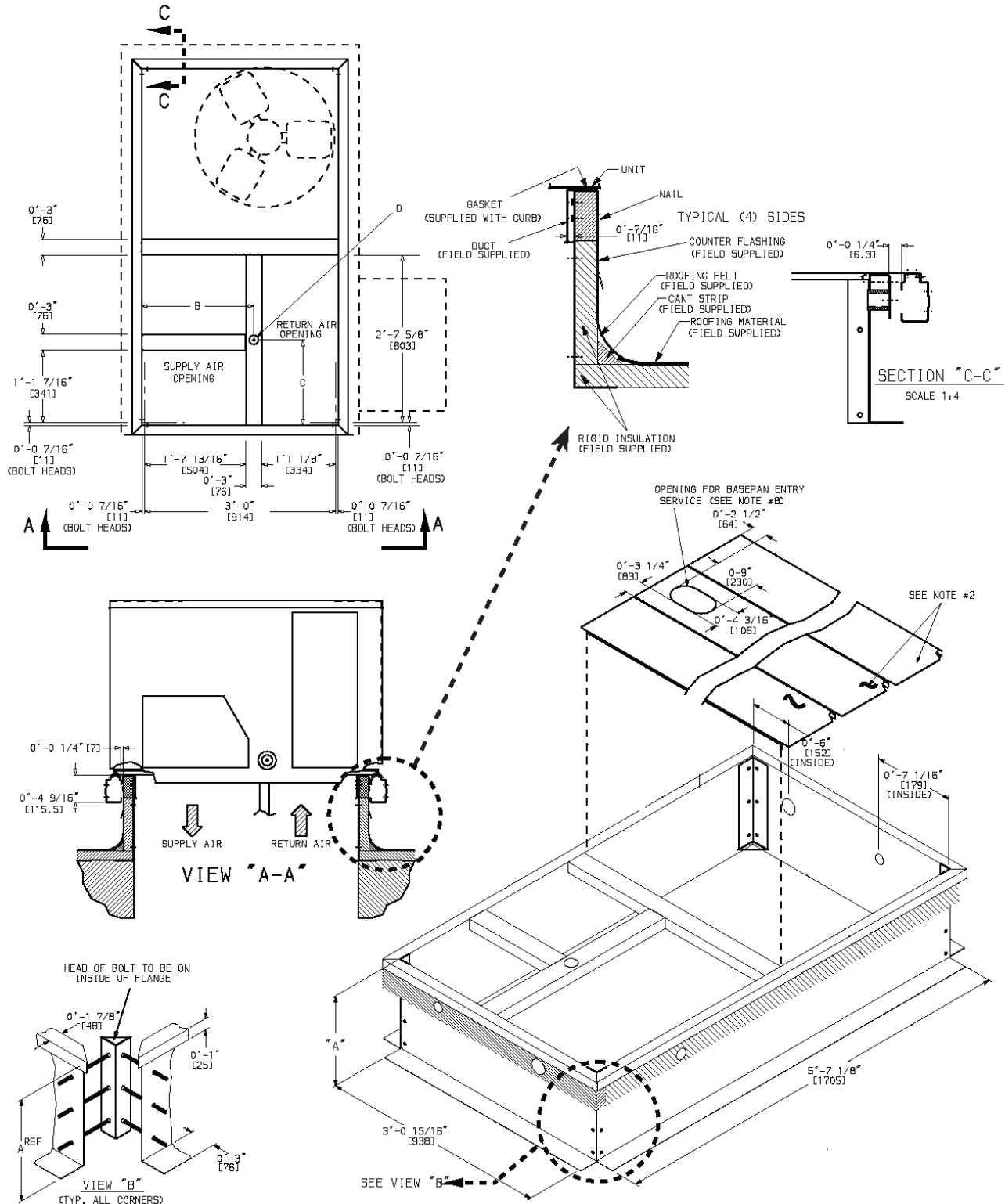
# ROOF CURB DETAILS – RAS036–060

RoofCurb Accessory	A	Unit Size
CRRFCURB001A01	1' 2" [356]	RAS036–060
CRRFCURB002A01	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. CRBTMPWR001A01 is for thru–the–curb connections. Pkg. CRBTMPWR003A01 is for thru–the–bottom connections.

Connector Pkg. Acc.	B	C	D Alt. Drain Hole	Power	Control	Accessory Power
CRBTMPWR001A01	1' 89–11/16" [551]	1' 4" [406]	11–3/4" [44.5]	3/4" [19] NPT	1/2" [12.7] NPT	1/2" [12.7] NPT
CRBTMPWR003A01				11–1/4" [31.7] NPT		



## APPLICATION DATA

### Min operating ambient temp (cooling):

In mechanical cooling mode, your 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 minimum 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.

### 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 5, 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

Bigger isn't necessarily better. 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 6 – COOLING CAPACITIES 3 TONS**

RAS036				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
900 Cfm	EAT (wb)	58	TC	28.1	28.1	31.7	26.3	26.3	29.8	24.5	24.5	27.7	22.6	22.6	25.5
			SHC	24.4	28.1	31.7	22.9	26.3	29.8	21.3	24.5	27.7	19.6	22.6	25.5
		62	TC	30.3	30.3	31.0	27.8	27.8	29.8	25.1	25.1	28.4	22.6	22.6	26.5
			SHC	22.6	26.8	31.0	21.5	25.7	29.8	20.2	24.3	28.4	18.7	22.6	26.5
		67	TC	35.5	35.5	35.5	33.1	33.1	33.1	30.5	30.5	30.5	27.5	27.5	27.5
			SHC	19.5	23.7	27.9	18.5	22.7	26.9	17.4	21.6	25.8	16.2	20.4	24.6
		72	TC	39.0	39.0	39.0	37.1	37.1	37.1	35.1	35.1	35.1	32.7	32.7	32.7
			SHC	15.3	19.5	23.7	14.5	18.8	23.0	13.7	17.9	22.2	12.9	17.1	21.3
		76	TC	-	41.4	41.4	-	39.6	39.6	-	37.6	37.6	-	35.4	35.4
			SHC	-	16.0	21.0	-	15.4	20.2	-	14.6	19.3	-	13.8	18.3
1050 Cfm	EAT (wb)	58	TC	30.2	30.2	34.2	28.4	28.4	32.2	26.5	26.5	30.0	24.5	24.5	27.7
			SHC	26.3	30.2	34.2	24.7	28.4	32.2	23.1	26.5	30.0	21.3	24.5	27.7
		62	TC	31.9	31.9	34.2	29.4	29.4	32.8	26.7	26.7	31.2	24.5	24.5	28.8
			SHC	24.6	29.4	34.2	23.4	28.1	32.8	22.0	26.6	31.2	20.3	24.5	28.8
		67	TC	36.7	36.7	36.7	34.8	34.8	34.8	32.2	32.2	32.2	29.1	29.1	29.1
			SHC	20.6	25.4	30.2	19.8	24.6	29.4	18.8	23.6	28.4	17.6	22.4	27.2
		72	TC	40.1	40.1	40.1	38.2	38.2	38.2	36.1	36.1	36.1	33.7	33.7	33.7
			SHC	15.7	20.5	25.3	15.0	19.8	24.6	14.2	19.0	23.8	13.4	18.2	23.0
		76	TC	-	42.4	42.4	-	40.6	40.6	-	38.5	38.5	-	36.2	36.2
			SHC	-	16.6	22.2	-	15.9	21.3	-	15.2	20.4	-	14.4	19.5
1200 Cfm	EAT (wb)	58	TC	32.2	32.2	36.4	30.4	30.4	34.3	28.4	28.4	32.1	26.3	26.3	29.7
			SHC	28.0	32.2	36.4	26.4	30.4	34.3	24.7	28.4	32.1	22.8	26.3	29.7
		62	TC	33.3	33.3	37.0	30.8	30.8	35.5	28.4	28.4	33.4	26.3	26.3	30.9
			SHC	26.4	31.7	37.0	25.1	30.3	35.5	23.4	28.4	33.4	21.7	26.3	30.9
		67	TC	37.7	37.7	37.7	35.6	35.6	35.6	33.4	33.4	33.4	30.4	30.4	30.4
			SHC	21.7	27.0	32.4	20.9	26.3	31.6	20.0	25.4	30.8	18.8	24.2	29.6
		72	TC	40.9	40.9	40.9	39.0	39.0	39.0	36.9	36.9	36.9	34.4	34.4	34.4
			SHC	16.1	21.5	26.8	15.4	20.8	26.1	14.7	20.0	25.4	13.8	19.2	24.5
		76	TC	-	43.1	43.1	-	41.3	41.3	-	39.1	39.1	-	36.8	36.8
			SHC	-	17.1	23.1	-	16.4	22.3	-	15.7	21.4	-	14.9	20.5
1350 Cfm	EAT (wb)	58	TC	-	-	-	32.1	32.1	36.3	30.0	30.0	34.0	27.9	27.9	31.5
			SHC	-	-	-	27.9	32.1	36.3	26.1	30.0	34.0	24.2	27.9	31.5
		62	TC	28.4	28.4	30.5	32.2	32.2	37.8	30.1	30.1	35.3	27.9	27.9	32.8
			SHC	17.6	24.1	30.5	26.6	32.2	37.8	24.8	30.1	35.3	23.0	27.9	32.8
		67	TC	33.2	33.2	33.2	36.4	36.4	36.4	34.1	34.1	34.1	31.5	31.5	32.0
			SHC	15.0	21.4	27.9	21.9	27.8	33.7	21.0	26.9	32.9	20.0	26.0	32.0
		72	TC	37.5	37.5	37.5	39.7	39.7	39.7	37.5	37.5	37.5	35.0	35.0	35.0
			SHC	11.8	18.3	24.8	15.8	21.7	27.5	15.0	20.9	26.8	14.2	20.1	26.0
		76	TC	-	40.1	40.1	-	41.8	41.8	-	39.6	39.6	-	37.3	37.3
			SHC	-	15.3	22.7	-	16.8	23.2	-	16.1	22.3	-	15.3	21.5
1500 Cfm	EAT (wb)	58	TC	28.1	28.1	34.2	33.7	33.7	38.1	31.6	31.6	35.7	29.3	29.3	33.2
			SHC	21.9	28.1	34.2	29.3	33.7	38.1	27.4	31.6	35.7	25.5	29.3	33.2
		62	TC	30.3	30.3	33.8	33.7	33.7	39.6	31.6	31.6	37.1	29.4	29.4	34.5
			SHC	19.8	26.8	33.8	27.8	33.7	39.6	26.1	31.6	37.1	24.2	29.4	34.5
		67	TC	35.5	35.5	35.5	36.9	36.9	36.9	34.6	34.6	34.9	32.0	32.0	34.0
			SHC	16.7	23.7	30.7	22.8	29.2	35.7	21.9	28.4	34.9	21.0	27.5	34.0
		72	TC	39.0	39.0	39.0	40.2	40.2	40.2	38.0	38.0	38.0	35.5	35.5	35.5
			SHC	12.4	19.5	26.6	16.1	22.5	28.8	15.4	21.7	28.1	14.6	21.0	27.4
		76	TC	-	41.4	41.4	-	42.2	42.2	-	40.0	40.0	-	-	-
			SHC	-	16.0	24.3	-	17.2	24.0	-	16.5	23.2	-	-	-

**LEGEND:**

- Do not operate
- 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 7 – COOLING CAPACITIES 4 TONS**

RAS048				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
1200 Cfm	EAT (wb)	58	TC	-	-	-	-	-	-	36.1	36.1	40.7	34.3	34.3	38.6
			SHC	-	-	-	-	-	-	31.5	36.1	40.7	29.9	34.3	38.6
		62	TC	43.1	43.1	43.1	40.8	40.8	40.8	38.4	38.4	39.4	35.9	35.9	38.2
			SHC	31.2	36.4	41.7	30.1	35.3	40.6	28.9	34.1	39.4	27.8	33.0	38.2
		67	TC	47.4	47.4	47.4	45.2	45.2	45.2	42.9	42.9	42.9	40.3	40.3	40.3
			SHC	25.9	31.2	36.4	25.0	30.2	35.5	23.9	29.2	34.4	22.9	28.2	33.4
		72	TC	51.1	51.1	51.1	49.1	49.1	49.1	46.8	46.8	46.8	43.9	43.9	43.9
			SHC	20.1	25.5	30.9	19.4	24.7	30.1	18.4	23.7	29.0	17.4	22.7	28.0
		76	TC	-	53.3	53.3	-	51.5	51.5	-	49.2	49.2	-	45.9	45.9
			SHC	-	20.8	27.4	-	20.2	26.8	-	19.3	25.7	-	18.3	24.6
1400 cfm	EAT (wb)	58	TC	41.9	41.9	47.3	40.1	40.1	45.3	38.2	38.2	43.2	36.3	36.3	41.0
			SHC	36.6	41.9	47.3	35.0	40.1	45.3	33.3	38.2	43.2	31.7	36.3	41.0
		62	TC	44.6	44.6	45.4	42.3	42.3	44.2	39.8	39.8	42.9	37.3	37.3	41.6
			SHC	33.4	39.4	45.4	32.3	38.3	44.2	31.0	37.0	42.9	29.8	35.7	41.6
		67	TC	48.7	48.7	48.7	46.6	46.6	46.6	44.2	44.2	44.2	41.4	41.4	41.4
			SHC	27.3	33.2	39.2	26.4	32.3	38.3	25.3	31.3	37.3	24.2	30.2	36.2
		72	TC	52.2	52.2	52.2	50.3	50.3	50.3	47.8	47.8	47.8	44.8	44.8	44.8
			SHC	20.6	26.7	32.7	19.9	25.9	32.0	18.9	24.9	30.9	17.9	23.8	29.7
		76	TC	-	54.1	54.1	-	52.3	52.3	-	49.9	49.9	-	46.4	46.4
			SHC	-	21.5	29.0	-	20.8	28.0	-	19.9	26.9	-	18.8	25.7
1600 Cfm	EAT (wb)	58	TC	44.0	44.0	49.6	42.1	42.1	47.4	40.1	40.1	45.2	38.1	38.1	43.0
			SHC	38.3	44.0	49.6	36.7	42.1	47.4	34.9	40.1	45.2	33.2	38.1	43.0
		62	TC	45.7	45.7	48.6	43.5	43.5	47.5	41.0	41.0	46.0	38.5	38.5	44.4
			SHC	35.3	42.0	48.6	34.2	40.8	47.5	32.9	39.4	46.0	31.6	38.0	44.4
		67	TC	49.8	49.8	49.8	47.6	47.6	47.6	45.1	45.1	45.1	42.3	42.3	42.3
			SHC	28.4	35.0	41.6	27.6	34.2	40.9	26.5	33.2	39.9	25.4	32.1	38.7
		72	TC	53.0	53.0	53.0	51.1	51.1	51.1	48.6	48.6	48.6	45.4	45.4	45.4
			SHC	21.0	27.6	34.3	20.3	27.0	33.6	19.4	26.0	32.6	18.3	24.8	31.3
		76	TC	-	54.6	54.6	-	52.8	52.8	-	50.4	50.4	-	46.8	46.8
			SHC	-	22.0	29.9	-	21.3	29.0	-	20.3	27.9	-	19.2	26.6
1800 Cfm	EAT (wb)	58	TC	44.0	44.0	50.3	42.1	42.1	48.1	40.1	40.1	45.9	38.0	38.0	43.5
			SHC	37.6	44.0	50.3	36.0	42.1	48.1	34.3	40.1	45.9	32.6	38.0	43.5
		62	TC	45.7	45.7	49.5	43.5	43.5	48.3	41.0	41.0	46.8	38.4	38.4	45.2
			SHC	34.5	42.0	49.5	33.4	40.8	48.3	32.1	39.4	46.8	30.8	38.0	45.2
		67	TC	49.8	49.8	49.8	47.6	47.6	47.6	45.1	45.1	45.1	42.3	42.3	42.3
			SHC	27.6	35.0	42.5	26.8	34.2	41.7	25.7	33.2	40.7	24.6	32.1	39.5
		72	TC	53.0	53.0	53.0	51.1	51.1	51.1	48.6	48.6	48.6	45.4	45.4	45.4
			SHC	20.2	27.6	35.1	19.5	27.0	34.4	18.5	26.0	33.4	17.5	24.8	32.1
		76	TC	-	54.6	54.6	-	52.8	52.8	-	50.4	50.4	-	46.8	46.8
			SHC	-	22.0	30.9	-	21.3	30.0	-	20.3	28.9	-	19.2	27.5
2000 Cfm	EAT (wb)	58	TC	46.9	46.9	52.9	45.0	45.0	50.8	42.9	42.9	48.4	40.7	40.7	45.9
			SHC	40.9	46.9	52.9	39.3	45.0	50.8	37.4	42.9	48.4	35.5	40.7	45.9
		62	TC	47.5	47.5	54.0	45.3	45.3	52.5	43.0	43.0	50.3	40.7	40.7	47.7
			SHC	38.5	46.3	54.0	37.3	44.9	52.5	35.6	43.0	50.3	33.8	40.7	47.7
		67	TC	51.2	51.2	51.2	49.1	49.1	49.1	46.5	46.5	46.5	43.5	43.5	43.5
			SHC	30.5	38.3	46.0	29.8	37.6	45.5	28.7	36.6	44.5	27.5	35.4	43.2
		72	TC	54.0	54.0	54.0	52.1	52.1	52.1	49.7	49.7	49.7	46.2	46.2	46.2
			SHC	21.7	29.2	36.8	21.1	28.7	36.4	20.1	27.8	35.4	18.9	26.4	33.9
		76	TC	-	55.2	55.2	-	53.5	53.5	-	51.0	51.0	-	47.3	47.3
			SHC	-	22.7	31.4	-	22.0	30.6	-	21.1	29.6	-	19.9	28.1

**LEGEND:**

- Do not operate
- 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 5 TONS**

RAS060				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
1500 Cfm	EAT (wb)	58	TC	52.9	52.9	60.0	49.9	49.9	56.6	46.6	46.6	52.9	43.1	43.1	48.9
			SHC	45.8	52.9	60.0	43.2	49.9	56.6	40.4	46.6	52.9	37.3	43.1	48.9
		62	TC	56.2	56.2	57.6	52.2	52.2	55.7	47.8	47.8	53.5	43.2	43.2	51.0
			SHC	41.8	49.7	57.6	39.9	47.8	55.7	37.8	45.6	53.5	35.5	43.2	51.0
		67	TC	62.4	62.4	62.4	58.8	58.8	58.8	54.4	54.4	54.4	49.5	49.5	49.5
			SHC	34.8	42.8	50.7	33.2	41.2	49.1	31.4	39.3	47.3	29.4	37.3	45.3
		72	TC	68.2	68.2	68.2	64.8	64.8	64.8	60.8	60.8	60.8	56.2	56.2	56.2
			SHC	27.2	35.2	43.2	25.9	33.9	41.9	24.4	32.4	40.4	22.6	30.6	38.6
		76	TC	-	71.1	71.1	-	69.0	69.0	-	65.4	65.4	-	60.9	60.9
			SHC	-	28.4	36.6	-	27.6	35.9	-	26.3	34.6	-	24.8	33.0
1750 Cfm	EAT (wb)	58	TC	56.5	56.5	64.0	53.3	53.3	60.4	49.8	49.8	56.5	46.1	46.1	52.3
			SHC	48.9	56.5	64.0	46.1	53.3	60.4	43.1	49.8	56.5	39.9	46.1	52.3
		62	TC	58.5	58.5	63.4	54.4	54.4	61.3	49.9	49.9	58.9	46.1	46.1	54.4
			SHC	45.2	54.3	63.4	43.2	52.2	61.3	41.0	49.9	58.9	37.9	46.1	54.4
		67	TC	64.3	64.3	64.3	60.5	60.5	60.5	56.2	56.2	56.2	51.3	51.3	51.3
			SHC	36.9	46.1	55.2	35.3	44.5	53.7	33.6	42.8	51.9	31.6	40.8	49.9
		72	TC	69.5	69.5	69.5	66.5	66.5	66.5	62.4	62.4	62.4	57.7	57.7	57.7
			SHC	27.8	36.9	45.9	26.7	35.9	45.1	25.2	34.5	43.7	23.5	32.8	42.0
		76	TC	-	72.2	72.2	-	70.1	70.1	-	66.6	66.6	-	-	-
			SHC	-	29.3	38.9	-	28.6	38.2	-	27.4	36.8	-	-	-
2000 Cfm	EAT (wb)	58	TC	59.3	59.3	67.3	56.1	56.1	63.6	52.5	52.5	59.5	48.6	48.6	55.1
			SHC	51.4	59.3	67.3	48.6	56.1	63.6	45.4	52.5	59.5	42.1	48.6	55.1
		62	TC	60.1	60.1	68.5	56.2	56.2	66.3	52.5	52.5	62.0	48.7	48.7	57.4
			SHC	48.1	58.3	68.5	46.2	56.2	66.3	43.1	52.5	62.0	39.9	48.7	57.4
		67	TC	65.7	65.7	65.7	61.9	61.9	61.9	57.5	57.5	57.5	52.6	52.6	54.4
			SHC	38.8	49.1	59.5	37.3	47.7	58.1	35.6	46.0	56.4	33.6	44.0	54.4
		72	TC	70.1	70.1	70.1	67.6	67.6	67.6	63.6	63.6	63.6	58.9	58.9	58.9
			SHC	28.3	38.1	48.0	27.4	37.7	48.0	26.0	36.4	46.7	24.3	34.7	45.2
		76	TC	-	72.9	72.9	-	70.8	70.8	-	67.4	67.4	-	-	-
			SHC	-	30.1	40.7	-	29.3	39.9	-	28.2	38.7	-	-	-
2250 Cfm	EAT (wb)	58	TC	61.5	61.5	69.8	58.4	58.4	66.2	54.8	54.8	62.1	50.8	50.8	57.6
			SHC	53.2	61.5	69.8	50.5	58.4	66.2	47.4	54.8	62.1	43.9	50.8	57.6
		62	TC	61.6	61.6	72.6	58.4	58.4	68.9	54.8	54.8	64.6	50.8	50.8	59.9
			SHC	50.6	61.6	72.6	47.9	58.4	68.9	45.0	54.8	64.6	41.7	50.8	59.9
		67	TC	66.8	66.8	66.8	63.0	63.0	63.0	58.5	58.5	60.6	53.6	53.6	58.6
			SHC	40.5	52.0	63.4	39.1	50.7	62.3	37.4	49.0	60.6	35.5	47.0	58.6
		72	TC	70.8	70.8	70.8	68.5	68.5	68.5	64.5	64.5	64.5	59.8	59.8	59.8
			SHC	28.7	39.5	50.2	28.0	39.3	50.5	26.7	38.1	49.6	25.0	36.6	48.1
		76	TC	-	73.4	73.4	-	71.2	71.2	-	67.9	67.9	-	-	-
			SHC	-	30.7	42.1	-	30.0	41.4	-	28.9	40.4	-	-	-
2500 Cfm	EAT (wb)	58	TC	63.3	63.3	71.8	60.1	60.1	68.2	56.5	56.5	64.1	52.6	52.6	59.6
			SHC	54.8	63.3	71.8	52.1	60.1	68.2	49.0	56.5	64.1	45.5	52.6	59.6
		62	TC	63.4	63.4	74.7	60.2	60.2	71.0	56.6	56.6	66.7	52.6	52.6	62.1
			SHC	52.0	63.4	74.7	49.4	60.2	71.0	46.5	56.6	66.7	43.2	52.6	62.1
		67	TC	67.6	67.6	67.6	63.8	63.8	66.2	59.3	59.3	64.6	54.4	54.4	62.5
			SHC	42.1	54.6	67.1	40.9	53.5	66.2	39.2	51.9	64.6	37.2	49.8	62.5
		72	TC	71.3	71.3	71.3	69.0	69.0	69.0	65.1	65.1	65.1	60.4	60.4	60.4
			SHC	29.1	40.7	52.2	28.5	40.7	52.9	27.3	39.7	52.2	25.7	38.3	50.9
		76	TC	-	73.8	73.8	-	71.4	71.4	-	68.3	68.3	-	-	-
			SHC	-	31.2	43.3	-	30.5	42.6	-	29.6	41.9	-	-	-

**LEGEND:**

- Do not operate
- 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 – STATIC PRESSURE ADDERS  
(Factory Options and/or Accessories)**

**Economizer**

3 – 5 TONS											
CFM	600	800	1000	1250	1500	1750	2000	2250	2500	2750	3000
Vertical Economizer	0.01	0.02	0.04	0.05	0.07	0.09	0.12	0.15	0.18	0.22	0.26
Horizontal Economizer*	0.02	0.03	0.04	0.06	0.08	0.10	0.13	0.15	0.18	0.23	0.28

\* Available as field installed accessories only.

**GENERAL FAN 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 9. 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

Table 10 – RAS036, 3 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>				<b>High Static Option – Field Supplied Drive<sup>2</sup></b>			
900	<b>554</b>	<b>0.14</b>	681	0.22	783	0.32	870	0.42	947	0.53
975	575	0.16	701	0.25	801	0.35	888	0.45	965	0.57
1050	597	0.18	721	0.28	821	0.38	906	0.49	983	0.61
1125	620	0.21	741	0.31	840	0.42	925	0.54	1001	0.66
1200	643	0.23	762	0.35	860	0.46	944	0.58	1020	0.71
1275	666	0.27	784	0.38	880	0.50	964	0.63	1039	0.76
1350	690	0.30	805	0.42	900	0.55	983	0.68	1058	0.82
1425	714	0.34	827	0.47	921	0.60	1003	0.74	1077	0.88
1500	738	0.38	849	0.52	942	0.66	1024	0.80	1097	0.95

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 – Field Supplied Drive<sup>2</sup></b>					<b>High Static Option</b>				
900	1017	0.64	1082	0.76	1143	0.88	1200	1.01	1254	1.14
975	1035	0.68	1100	0.81	1160	0.93	1217	1.07	1271	1.20
1050	1053	0.73	1117	0.86	1177	0.99	1234	1.13	1288	1.27
1125	1071	0.78	1135	0.92	1195	1.05	1251	1.19	1305	1.34
1200	1089	0.84	1153	0.98	1212	1.12	1269	1.26	1322	1.41
1275	1107	0.90	1171	1.04	1230	1.19	1286	1.33	1340	1.49
1350	1126	0.96	1189	1.11	1249	1.26	1304	1.41	1357	1.57
1425	1145	1.03	1208	1.18	1267	1.33	1323	1.49	1375	1.66
1500	1164	1.10	1227	1.25	1285	1.41	1341	1.58	1394	1.75

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

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

1. Recommend using field-supplied blower pulley (part number KR11AG006) and belt (part number KR30AE039)
2. Recommend using field-supplied motor pulley (part number KR11HY150 - 575V) and belt (part number KR29AF035)

Table 11 – RAS036, 3 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>				<b>High Static Option – Field Supplied Drive<sup>2</sup></b>			
900	<b>566</b>	<b>0.14</b>	690	0.23	791	0.32	879	0.42	957	0.52
975	590	0.17	711	0.26	811	0.36	897	0.46	975	0.57
1050	615	0.19	733	0.29	831	0.39	916	0.50	993	0.62
1125	640	0.22	755	0.33	851	0.43	936	0.55	1012	0.67
1200	666	0.25	778	0.36	873	0.48	956	0.60	1031	0.72
1275	692	0.29	802	0.41	894	0.53	976	0.65	1051	0.78
1350	719	0.33	825	0.45	916	0.58	997	0.71	1071	0.84
1425	746	0.37	850	0.50	939	0.63	1019	0.77	1091	0.91
1500	774	0.42	875	0.55	962	0.69	1041	0.83	1112	0.98

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 – Field Supplied Drive<sup>2</sup></b>					<b>High Static Option</b>				
900	1029	0.63	1095	0.75	1157	0.86	1216	0.99	1272	1.11
975	1046	0.68	1112	0.80	1174	0.92	1232	1.05	1287	1.18
1050	1064	0.73	1129	0.86	1190	0.98	1248	1.11	1304	1.25
1125	1082	0.79	1147	0.92	1208	1.05	1265	1.18	1320	1.32
1200	1100	0.85	1165	0.98	1225	1.12	1282	1.26	1337	1.40
1275	1119	0.91	1183	1.05	1243	1.19	1300	1.34	1354	1.49
1350	1139	0.98	1202	1.12	1262	1.27	1318	1.42	1372	1.57
1425	1159	1.05	1221	1.20	1280	1.35	1336	1.51	1390	1.66
1500	1179	1.13	1241	1.28	1300	1.44	1355	1.60	1408	1.76

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

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

1. Recommend using field-supplied blower pulley (part number KR11AG006) and belt (part number KR30AE039)
2. Recommend using field-supplied motor pulley (part number KR11HY150 - 575V) and belt (part number KR29AF035)



## FAN PERFORMANCE (cont.)

### Table 12 – RAS048, 4 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>Standard Static Option</b>					<b>High Static Option – Field Supplied Drive<sup>2</sup></b>				
1200	643	0.23	762	0.35	860	0.46	944	0.58	1020	0.71
1300	674	0.28	791	0.40	887	0.52	970	0.65	1045	0.78
1400	706	0.33	820	0.45	914	0.59	997	0.72	1071	0.86
1500	738	0.38	849	0.52	942	0.66	1024	0.80	1097	0.95
1600	771	0.44	879	0.59	971	0.74	1051	0.89	1124	1.04
1700	804	0.51	910	0.66	1000	0.82	1079	0.98	1151	1.14
1800	837	0.59	941	0.75	1029	0.91	1107	1.08	1178	1.25
1900	871	0.67	972	0.84	1059	1.02	1136	1.19	1206	1.37
2000	906	0.76	1004	0.94	1089	1.12	1165	1.31	1234	1.49

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 – Field Supplied Drive<sup>2</sup></b>					<b>High Static Option</b>				
1200	1089	0.84	1153	0.98	1212	1.12	1269	1.26	1322	1.41
1300	1114	0.92	1177	1.06	1236	1.21	1292	1.36	1346	1.52
1400	1139	1.01	1202	1.15	1261	1.31	1316	1.47	1369	1.63
1500	1164	1.10	1227	1.25	1285	1.41	1341	1.58	1394	1.75
1600	1190	1.20	1252	1.36	1311	1.53	1366	1.70	1418	1.87
1700	1217	1.31	1278	1.48	1336	1.65	1391	1.83	1443	2.01
1800	1244	1.42	1305	1.60	1362	1.78	1416	1.97	1468	2.15
1900	1271	1.55	1331	1.73	1388	1.92	1442	2.11	<b>1494</b>	<b>2.31</b>
2000	1298	1.68	1358	1.87	1415	2.07	1468	2.27	–	–

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

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

1. Recommend using field-supplied blower pulley (part no. KR11AZ506), motor pulley (part no. KR11HY181) and belt (part no. KR30AE041).
2. Recommend using field-supplied motor pulley (part number KR11HY150 – 575V) and belt (part number KR29AF035).

### Table 13 – RAS048, 4 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</b>					<b>High Static Option – Field Supplied Drive<sup>2</sup></b>				
1200	666	0.25	778	0.36	873	0.48	956	0.60	1031	0.72
1300	701	0.30	809	0.42	902	0.54	983	0.67	1057	0.80
1400	737	0.36	842	0.48	932	0.61	1012	0.75	1085	0.89
1500	774	0.42	875	0.55	962	0.69	1041	0.83	1112	0.98
1600	811	0.49	909	0.63	994	0.78	1071	0.93	1141	1.08
1700	849	0.57	943	0.72	1026	0.87	1101	1.03	1170	1.19
1800	887	0.65	978	0.81	1059	0.98	1133	1.14	1200	1.31
1900	926	0.75	1014	0.92	1092	1.09	1164	1.26	1231	1.44
2000	965	0.86	1050	1.03	1127	1.21	1197	1.39	1262	1.58

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 – Field Supplied Drive<sup>2</sup></b>					<b>High Static Option</b>				
1200	1100	0.85	1165	0.98	1225	1.12	1282	1.26	1337	1.40
1300	1126	0.94	1189	1.07	1249	1.22	1306	1.36	1360	1.51
1400	1152	1.03	1215	1.17	1274	1.32	1330	1.48	1384	1.63
1500	1179	1.13	1241	1.28	1300	1.44	1355	1.60	1408	1.76
1600	1206	1.24	1268	1.40	1326	1.56	1381	1.73	1433	1.90
1700	1235	1.36	1295	1.52	1352	1.69	1407	1.87	1459	2.04
1800	1264	1.48	1323	1.66	1380	1.84	1434	2.02	<b>1485</b>	<b>2.20</b>
1900	1293	1.62	1352	1.80	1408	1.99	1461	2.17	<b>1512</b>	<b>2.37</b>
2000	1324	1.77	1381	1.96	1436	2.15	<b>1489</b>	<b>2.34</b>	–	–

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

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

1. Recommend using field-supplied blower pulley (part no. KR11AZ506), motor pulley (part no. KR11HY181) and belt (part no. KR30AE041).
2. Recommend using field-supplied motor pulley (part number KR11HY150 – 575V) and belt (part number KR29AF035).

## FAN PERFORMANCE (cont.)

### Table 14 – RAS060, 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></b>				<b>Standard Static Option</b>					
1500	<b>724</b>	<b>0.33</b>	837	0.45	937	0.59	1028	0.74	1111	0.91
1625	<b>765</b>	<b>0.40</b>	873	0.53	969	0.67	1056	0.83	1137	1.00
1750	806	0.48	909	0.61	1002	0.76	1087	0.92	<b>1165</b>	<b>1.10</b>
1875	849	0.57	947	0.71	1036	0.86	1118	1.03	1195	1.21
2000	892	0.67	986	0.82	1072	0.98	1151	1.15	1226	1.33
2125	935	0.79	1025	0.94	1108	1.11	1185	1.29	1258	1.47
2250	980	0.92	1066	1.08	1146	1.25	1220	1.43	1291	1.63
2375	1024	1.06	1107	1.23	1184	1.41	1256	1.60	1325	1.79
2500	1069	1.22	1149	1.39	1223	1.58	1293	1.77	1360	1.98

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 – Field Supplied Drive<sup>2</sup></b>						<b>High Static Option</b>			
1500	1188	1.09	1261	1.29	1330	1.49	1395	1.71	1457	1.95
1625	1213	1.18	1284	1.38	1352	1.59	1416	1.81	1478	2.04
1750	1239	1.28	1309	1.49	1375	1.70	1439	1.92	1499	2.16
1875	1267	1.40	1335	1.60	1400	1.82	1462	2.04	1522	2.28
2000	1296	1.53	1363	1.74	1427	1.95	1488	2.18	1546	2.42
2125	1326	1.67	1392	1.88	1454	2.11	1514	2.34	1571	2.58
2250	1358	1.83	1421	2.05	1483	2.27	1541	2.51	1598	2.75
2375	1390	2.00	1452	2.22	1512	2.45	1570	2.69	1625	2.94
2500	1424	2.19	1484	2.42	1543	2.65	1599	2.89	1654	3.15

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

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

Shaded area is High Static

1. Recommend using field-supplied fan pulley (part number KR11AZ606) and belt (part number KR30AE037).

2. Recommend using field-supplied motor pulley (part number KR11HY161) blower pulley (part no. KR11AZ406), and belt (part number KR29AF038)

### Table 15 – RAS060, 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</b>									
1500	790	0.40	897	0.53	991	0.68	1075	0.83	1152	1.00
1625	837	0.48	940	0.62	1030	0.77	1112	0.94	<b>1187</b>	<b>1.11</b>
1750	885	0.58	983	0.73	1070	0.89	1150	1.06	1223	1.24
1875	934	0.69	1027	0.85	1112	1.01	<b>1189</b>	<b>1.19</b>	1260	1.38
2000	983	0.81	1073	0.98	1154	1.16	1229	1.34	1299	1.53
2125	1033	0.95	1119	1.13	1198	1.31	1270	1.50	1338	1.71
2250	1084	1.11	1166	1.29	1242	1.49	1312	1.69	1379	1.89
2375	1134	1.28	1214	1.48	1287	1.68	1355	1.89	1420	2.10
2500	1185	1.48	1262	1.68	1333	1.89	1399	2.10	1462	2.33

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 – Field Supplied Drive<sup>1</sup></b>						<b>High Static Option</b>			
1500	1224	1.18	1291	1.36	1354	1.56	1414	1.77	1472	1.98
1625	1257	1.30	1323	1.49	1385	1.69	1445	1.90	1501	2.12
1750	1292	1.43	1356	1.63	1418	1.83	1476	2.05	1532	2.27
1875	1327	1.57	1391	1.78	1451	1.99	1509	2.21	1564	2.44
2000	1364	1.74	1427	1.95	1486	2.17	1542	2.39	1596	2.63
2125	1402	1.92	1463	2.13	1521	2.36	1577	2.59	1630	2.83
2250	1441	2.11	1501	2.34	1558	2.57	1612	2.81	–	–
2375	1481	2.33	1539	2.56	1595	2.80	–	–	–	–
2500	1522	2.56	1579	2.80	–	–	–	–	–	–

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

Shaded area is High Static

1. Recommend using field-supplied motor pulley (part number KR11HY161) blower pulley (part no. KR11AZ406), and belt (part number KR29AF038)

## FAN PERFORMANCE (cont.)

**Table 16 – 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
RAS036	3 phase	Standard Static	854	825	795	766	736	707	678	648	619	589	560
		High Static	1466	1423	1380	1337	1294	1251	1207	1164	1121	1078	1035
RAS048	3 phase	Standard Static	854	825	795	766	736	707	678	648	619	589	560
		High Static	1466	1423	1380	1337	1294	1251	1207	1164	1121	1078	1035
RAS060	3 phase	Standard Static	1175	1135	1094	1054	1013	973	932	892	851	811	770
		High Static	1687	1649	1610	1572	1533	1495	1457	1418	1380	1341	1303

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

■ – Factory settings

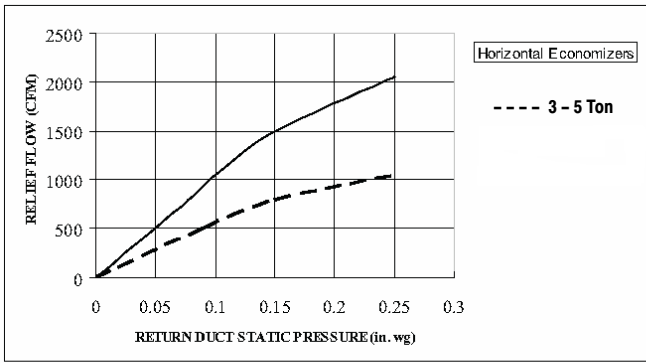
**Table 17 – 3–5 Ton R–410A Rooftop Indoor Fan System Standard, Optional High Static and Field Installed Medium Static Drive Options**

UNIT MODEL NUMBER	RAS036S		RAS048S		RAS060S	
UNIT TONNAGE	3		4		5	
<b>INDOOR FAN (Standard static)</b>						
<b>ID Fan Motor (Standard Static)</b>	Voltage-Ph					
Indoor Motor Part No.	575-3		HC52EE575		HC52EE575	
Indoor Motor Max Continuous BHP	575-3		1		1	
<b>ID Fan Wheel, Shaft, Bearings, Drive (Belt Drive Standard Static)</b>						
Motor Pulley Pitch Diameter A min (in.)	575-3		1.9		1.9	
Motor Pulley Pitch Diameter A max (in.)	575-3		2.9		2.9	
<b>ID Fan Motor (Medium Static) **</b>						
Indoor Motor Part No.	575-3		HC52EE575		HD56FE575	
Indoor Motor Capacitor	575-3		HC91CL015		-	
Indoor Motor Max Continuous BHP	575-3		1		2.4	
<b>ID Fan Wheel, Shaft, Bearings, Drive (Medium Static)</b>						
Motor Pulley Pitch Diameter A min (in)	575-3		1.9		1.9	
Motor Pulley Pitch Diameter A max (in)	575-3		2.9		2.9	
Same all voltages						

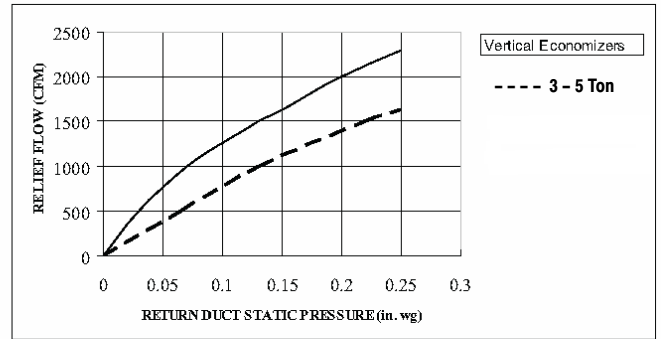
\*\* Medium static motor and drives available from FAST parts

<b>ID Fan Motor (High Static)</b>						
Indoor Motor Max Continuous BHP	575-3		2.4		3.7	
<b>ID Fan Wheel, Shaft, Bearings, Drive (High Static)</b>						
Motor Pulley Part No.	Same all voltages		KR11HY161		KR11HY184	
Motor Pulley Type			Variable		Variable	
Motor Pulley Pitch Diameter A min (in.)			2.4		3.4	
Motor Pulley Pitch Diameter A max (in.)			3.4		4.4	
Blower Pulley Part No.			KR11AZ406		KR11AD516	
Blower Pulley Type			Fixed		Fixed	
Blower Pulley Pitch Diameter A (in.)			4		4.5	
Belt Part No.			KR29AF038		KR29AF038	

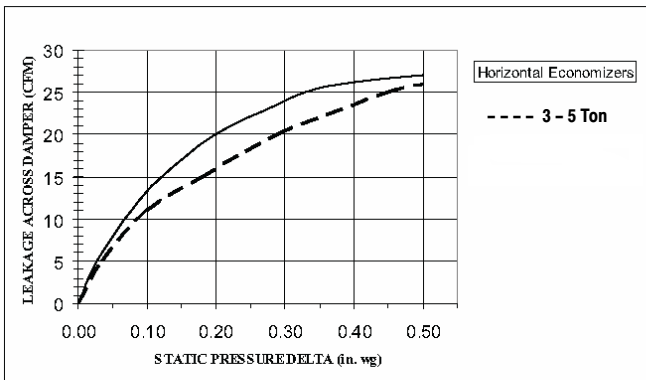
# ECONOMIZER, BAROMETRIC RELIEF, AND PERFORMANCE



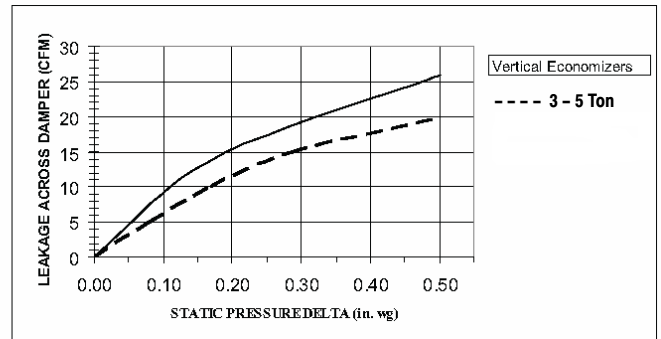
**Fig. 1 - Barometric Relief Flow Capacity**



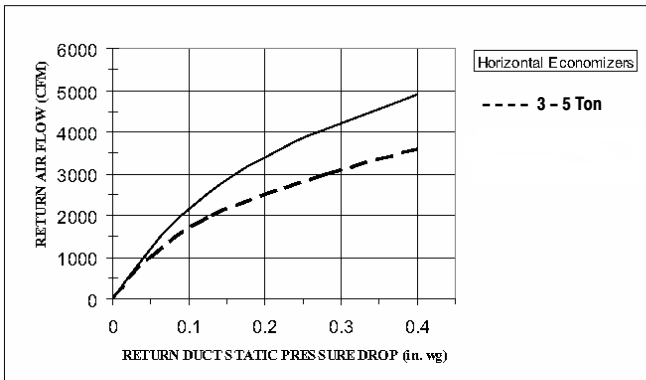
**Fig. 4 - Barometric Relief Flow Capacity**



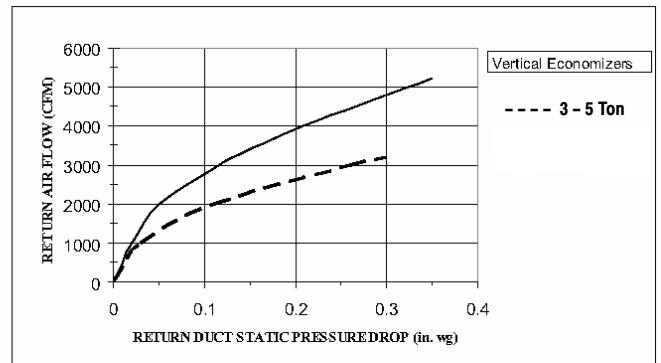
**Fig. 2 - Outdoor Air Damper Leakage**



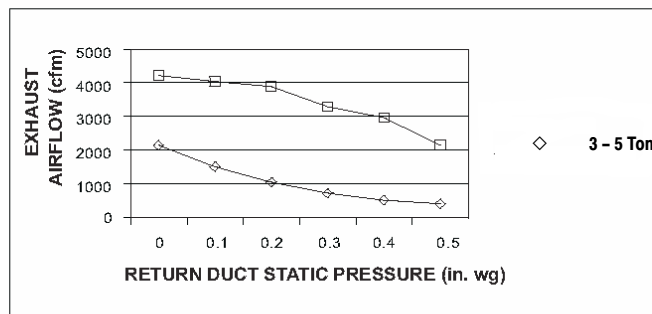
**Fig. 5 - Outdoor Air Damper Leakage**



**Fig. 3 - Return Air Pressure Drop**



**Fig. 6 - Return Air Pressure Drop**



**Fig. 7 - Power Exhaust Performance**

# ELECTRICAL INFORMATION

## Table 18 – RAS036, 3 TONS

V-Ph-Hz	VOLTAGE RANGE		COMP (ea)		OFM (ea)		IFM				
	MIN	MAX	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
575-3-60	518	633	3.8	37	325	0.6	Std Static	1000	2.0	71%	1.9
							High Static	2120	2.1	80%	2.0

## Table 19 – RAS048, 4 TONS

V-Ph-Hz	VOLTAGE RANGE		COMP (ea)		OFM (ea)		IFM				
	MIN	MAX	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
575-3-60	518	633	4.8	37	325	0.6	Std Static	1000	2.0	71%	1.9
							High Static	2120	2.1	80%	2.0

## Table 20 – RAS060, 5 TONS

V-Ph-Hz	VOLTAGE RANGE		COMP (ea)		OFM (ea)		IFM				
	MIN	MAX	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
575-3-60	518	633	5.8	39	325	0.6	Std Static	1000	2.0	71%	1.9
							High Static	3775	2.9	81%	2.8

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

Unit	NOM. V-PH-HZ	IFM TYPE	NO C.O. or UNPWRD C.O.							
			NO PE.				w/ PE. (pwrd fr/unit)			
			MCA	MOCP	DISC. SIZE		MCA	MOCP	DISC. SIZE	
					FLA	LRA			FLA	LRA
RAS036	575-3-60	STD	7.3	15	7	44	9.2	15	9	46
		MED	7.3	15	7	44	9.2	15	9	46
		HIGH	7.4	15	7	50	9.3	15	10	52
RAS048	575-3-60	STD	8.5	15	8	44	10.4	15	11	46
		MED	8.5	15	8	44	10.4	15	11	46
		HIGH	8.6	15	9	50	10.5	15	11	52
RAS060	575-3-60	STD	9.8	15	10	46	11.7	15	12	48
		MED**	9.9	15	10	52	11.8	15	12	54
		HIGH	10.7	15	11	63	12.6	15	13	65

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

\*\* Available from Fast Parts.

See Legend and calculations.

<sup>1</sup>Fuse or breaker

**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



Example: Supply voltage is 230-3-60



AB = 224 v  
BC = 231 v  
AC = 226 v

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

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.

$$\% \text{ Voltage Imbalance} = 100 \times \frac{4}{227} = 1.76\%$$

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.

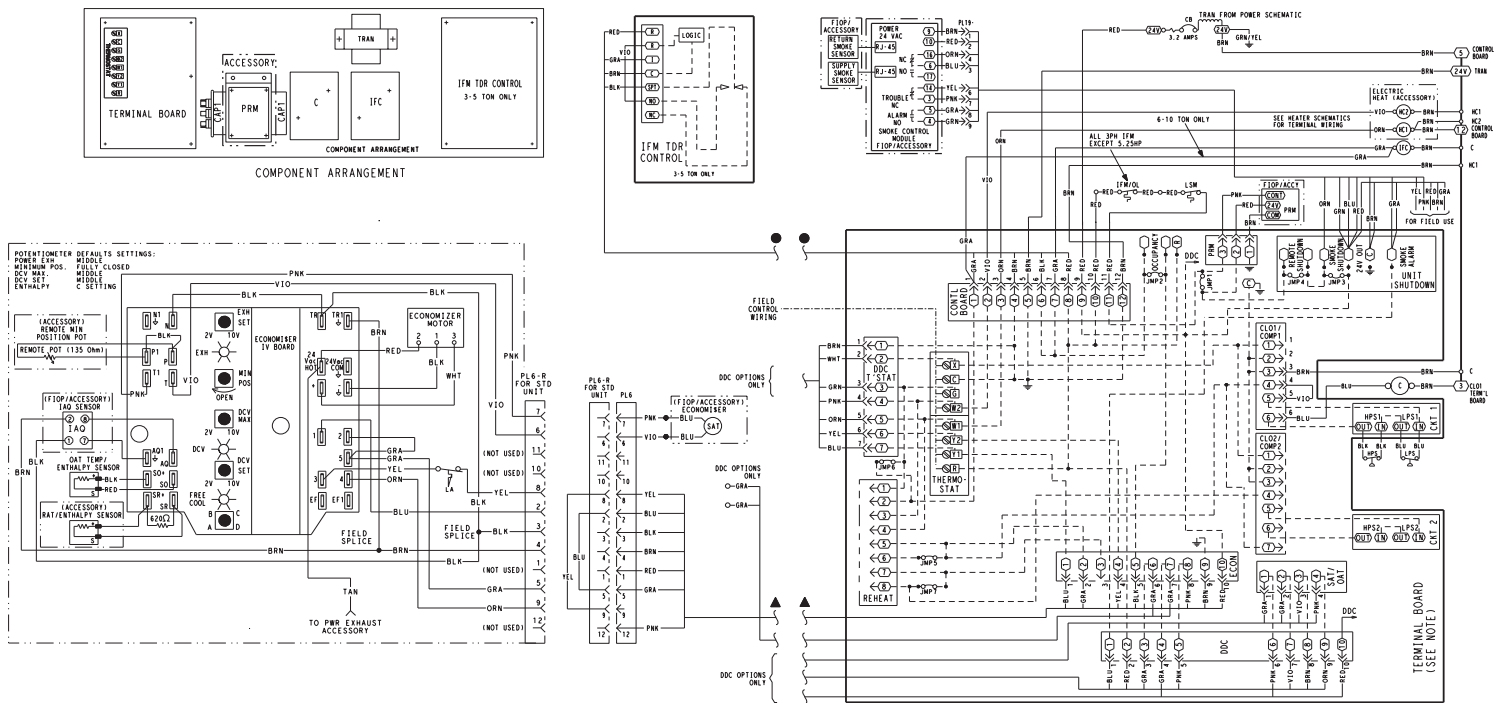
**NOTES:**

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.

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



**Fig. 9 Typical Power Diagram**

**NOTES:**

Terminal board schematic layout does not match actual terminal board to simplify circuit traces. Ensure designated jumpers on terminal board are cut when adding smoke detectors, phase loss relay and remote shutdown.

**ECONOMIZER NOTES:**

1.620 ohm, 1 watt, 5% resistor should be removed only when using differential enthalpy or dry bulb.

- 2.If a separate field-supplied 24V transformer is used for the IAQ sensor power supply, it cannot have the secondary of the transformer grounded.
- 3.For field-installed remote minimum position POT, remove black wire jumper between P and P1 and set control minimum position POT to the minimum 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 in this sequence. 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-an motor (IFM), compressor #1, and outdoor fan to start. The outdoor-an motor runs continuously while unit is cooling.

**Heating**

**NOTE:** The RAS is sold as cooling only.

**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 (7°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 CO2 sensors are connected to the economizer control, a demand controlled ventilation strategy will begin to operate. As the CO2 level in the zone increases above the CO2 set point, the minimum position of the damper will be increased proportionally. As the CO2 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 set point 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 set point. The economizer damper will be open at maximum position. economizer operation is limited to a single compressor.

# GUIDE SPECIFICATIONS – RAS036–060

## HVAC GUIDE SPECIFICATIONS

Size Range: 3 to 5 Nominal Tons



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



### **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 fiberglass 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. have capability to energize 2 different stages of cooling.
  - b. must 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 fuse on the 24-v transformer side (3 – 5 ton units have a resettable circuit breaker).
2. Shall utilize color-coded wiring.
3. Unit shall include self-contained low-voltage control circuit protected by a fuse on the 24-v transformer side with a resettable circuit breaker.
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. Low pressure switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service person to correctly wire and or troubleshoot the rooftop unit.
3. High-pressure switch.
  - a. High pressure switch shall use different color wire than the low pressure switch. The purpose is to assist the installer and service person 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 shall

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. Filter face velocity shall not exceed 365 fpm at nominal airflows.
4. 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 (RAS036-060)**

#### 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 ARI Standards 210 and 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 either shipping top panel or spreader bars.
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 ambient outdoor temperature, meeting maximum load criteria of ARI Standard 210/240 or 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 from 40°F (4°C) to 20°F (-7°C) below 20°F (-7°C) an accessory Motormaster low ambient control is required and the outdoor fan motor needs to be changed to a ball-bearing speed control motor design.
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 (.076mm) minimum, gloss (per ASTM D523, 60°F (16°C)): 60, Hardness: H-2H Pencil hardness.
3. Evaporator fan compartment interior cabinet insulation shall conform to ARI Standards 210 or 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 gas 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.
8. -
9. Electrical Connections
  - a. All unit power wiring shall enter unit cabinet at a single, factory-prepared, knockout location.
  - b. Thru-the-base capability
    - i. Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit basepan.
    - ii. Optional, factory-approved, water-tight connection method must be used for thru-the-base electrical connections.
    - iii. No basepan penetration, other than those authorized by the manufacturer, is permitted.
10. 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. -

23 81 19.13.J. Coils

1. Standard Aluminum/Copper Coils:

- a. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
- b. Evaporator and condenser coils shall be leak tested to 150 psig, pressure tested to 400 psig, and qualified to UL 1995 burst test at 2,200 psi.

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 (036-060 only).

- 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. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
- c. Compressors shall be internally protected from high discharge temperature conditions using a Thermal Overload Disk (TOD) installed at the muffler plate on 036-060 sizes.
- d. Compressors shall be protected from an over-temperature and over-ampereage conditions by an internal, motor overload device.
- e. Compressor shall be factory mounted on rubber grommets.
- f. Compressor motors shall have internal line break thermal and current overload protection.
- g. Crankcase heaters shall not be required for normal operating range.

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. Filter face velocity shall not exceed 320 fpm at nominal airflows.
5. Filters shall be standard, commercially available sizes.
6. 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.
- 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. Shaft-up designs including those with "rain-slinger devices" shall not be allowed.
2. Condenser Fans shall:
    - 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 (Optional)
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 set point shall be adjustable and shall range from 40 to 100°F. 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 set point.
    - m. Dampers shall be completely closed when the unit is in the unoccupied mode.
    - n. Economizer controller shall accept a 2-10Vdc CO2 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.
    - r. Economizer uses a mixed air thermister (MAT) located on indoor fan housing to modulate outdoor air dampers and return air dampers to control to a 55°F (13°C) discharge air temperature
  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 economizer 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. Design shall incorporate inherent barometric relief capabilities for barometric relief of rooftop unit return air.
    - h. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.
    - i. Outside air hood shall include aluminum water entrainment filter
  3. Manual damper
    - a. Manual damper field installed accessory 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 and 110°F at outdoor ambient temperatures down to -20°F.
  5. Condenser Coil Hail Guard Assembly
    - a. Shall protect against damage from hail.

- b. Shall be either hood style or louvered.
- 6. Thru-the-Base Connectors:
  - a. Kits shall provide connectors to permit gas and electrical connections to be brought to the unit through the unit basepan.
  - b. Minimum of four connection locations per unit.
- 7. Fan/Filter Status Switch:
  - a. Switch shall provide status of indoor evaporator fan (ON/OFF) or filter (CLEAN/DIRTY).
  - b. Status shall be displayed with an indicator light at the thermostat.
- 8. 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.
- 9. Roof Curbs (Vertical):
  - a. Full perimeter roof curb with exhaust capability providing separate airstreams 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.
- 10. Head Pressure Control Package:
  - a. Consists 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) by condenser-fan speed modulation or condenser-fan cycling and wind baffles.
- 11. Condenser Coil Hail Guard Assembly:
  - a. Hail guard shall protect against damage from hail and flying debris.
  - b. Shall be accessible from outside the unit.
- 12. High-Static Indoor Fan Motor(s) and Drive(s) (048–060):
  - a. High-static motor(s) and drive(s) shall be factory-installed to provide additional performance range.
- 13. Condenser Coil Grille:
  - a. The grille protects the condenser coil from damage by large objects without increasing unit clearances.
- 14. Thru-the-Bottom Utility Connectors:
  - a. Accessory kit shall provide connectors to permit gas and electrical connections to be brought to the unit through the basepan.
- 15. 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.
- 16. 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.
- 17. 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.
- 18. Indoor Air Quality (CO2) Sensor:
  - a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.
  - b. The IAQ sensor shall be available in duct mount. The set point shall have adjustment capability.
- 19. Winter start kit
  - a. Shall contain a bypass device around the low pressure switch.
  - b. Shall be required when mechanical cooling below an outdoor ambient of 40°F (4°C) to 25°F (–4°C).
  - c. Shall not be required to operate an equipped economizer when below an outdoor ambient of 40°F.
- 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. 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.