Arcoaire®
Air Conditioning & Heating

RAS

Product Specifications

ENERGY STAR COMPLIANT PACKAGE ELECTRIC COOLING, R−410A SINGLE PACKAGE ROOFTOP 3 − 5 TONS (3−Phase)

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
- Single-stage cooling capacity control
- Single Scroll compressor 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
- Indoor and outdoor coils constructed of aluminum fins mechanically bonded to seamless copper tubes
- 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 compressor.
- “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

RAS036−060

ASHRAE 90.1 COMPLIANT

ARI PERFORMANCE CERTIFIED
ARI Standard 340/360

ENERGY STAR

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

UNIT PERFORMANCE DATA

High Static Model	Nominal Tons	COOLING Net Cap. (Btuh)	SEER	EER	Unit Dimensions H x W x L	Unit Weight lb. [kg]
RAS036*0BA0AAA	3	34,600	13.0	11.0	33-3/8” x 44” x 74-3/8”	483 [219]
RAS048*0BA0AAA	4	45,000	13.0	11.0	33-3/8” x 44” x 74-3/8”	537 [244]
RAS060*0BA0AAA	5	59,000	13.0	10.8	33-3/8” x 44” x 74-3/8”	569 [258]

* Indicates Unit voltage: H = 208/230−3−60, L = 460−3−60

TABLE OF CONTENTS

MODEL NOMENCLATURE

MODEL SERIES	R	A	S	0	6	0	H	0	B	A	0	A	A	A
Position Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
R = Rooftop														
A = Air Conditioning (Cooling Only) H = Heat Pump 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**								
H = 208/230-3-60 L = 460-3-60							**Voltage**							
0 = No Heat								**Heating Capacity**						
B = High Static Motor									**Motor Option**					
A = None										**Outdoor Air Options / Control**				
0A = No Options											**Factory Installed Options**			
A = Aluminum / Copper Cond & Evap Coil												**Condenser / Evaporator Coil Configuration**		
A = Sales Digit														

ACCESSORIES

Economizer (dry−bulb or enthalpy)

Economizers save money. They bring in fresh, outside air for ventilation; and provide cool, outside air to cool your building. This is the preferred method of low−ambient cooling. When coupled to CO_2 sensors, Economizers can provide even more savings by coupling the ventilation air to only that amount required based on occupancy.

Economizers are available as an accessory, with either enthalpy or dry−bulb temperature inputs. There are also models for electromechanical as well as direct digital controllers. Additional sensors are available as accessories to optimize the economizers.

CO_2 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 your building, the CO_2 sensor detects their presence through increasing CO_2 levels, and opens the economizer appropriately.

When the occupants leave, the CO_2 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.

Louvered Hail Guards

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

Barometric Relief

Gravity controlled, barometric relief equalizes building pressure and ambient air pressures. This can be a cost effective solution to prevent building pressurization.

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 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

2−position, motorized outdoor air damper admits up to 100% outside air. Using reliable, gear−driven technology, the 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.

Thru−the−Base Connections

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

Electric Heaters

RAS units offer a full−line of accessory heaters. The heaters are very easy to use / install and are pre−engineered and certified.

ACCESSORIES − RAS036 − 060

FLAT ROOF CURBS		
Model Number	**Description**	**Use With Model Size**
CRRFCURB001A01	14” High Roof Curb	036 − 060
CRRFCURB002A01	24” High Roof Curb	036 − 060

ECONOMIZERS		
Model Number	**Description**	**Use With Model Size**
DNECOMZR020A02	Vertical Fully Modulating − with W7212 controller	036 − 060
DNECOMZR024A02	Horizontal Fully Modulating − with W7212 controller	036 − 060

POWER EXHAUST		
Model Number	**Description**	**Use With Model Size**
DNPWREXH030A01	Vertical Power Exhaust 208/230 volt	036 − 060
DNPWREXH021A01	Vertical Power Exhaust 460 volt	036 − 060
DNPWREXH028A01	Horizontal Power Exhaust 208/230	036 − 060
DNPWREXH029A01	Horizontal Power Exhaust 460 volt	036 − 060

MANUAL OUTDOOR AIR DAMPERS		
Model Number	**Description**	**Use With Model Size**
DNMANDPR001A03	25% Open Manual Fresh Air Damper	036 − 060
CRMANDPR001A02	50% Open Manual Fresh Air Damper	036 − 060

MOTORIZED OUTDOOR AIR DAMPERS		
Model Number	**Description**	**Use With Model Size**
CRTWOPOS010A00	Motorized 2 position outdoor air damper (25−100% Outdoor Air)	036 − 060

LOW AMBIENT CONTROLS *		
Model Number	**Description**	**Use With Model Size**
32LT900301[1A]	Motormaster I −20°F Low Ambient Control 208/203−3−60	036 − 060
32LT900611[1B]	Motormaster I −20°F Low Ambient Control 460−3−60	036 − 060
CPLOWAMB001A00	Motormaster® II 0°F Low Ambient Control 208/230−3, 460−3−60	036 − 060
1171974 [2]	Motormaster I Compatible Condenser Fan Motor 208/203−3−60	036 − 060
1171975 [2]	Motormaster I Compatible Condenser Fan Motor 460−3−60	036 − 060
1171108 [2]	10 Micro Farad Run Capacitor 208/230−3	036 − 060

THROUGH−THE−BOTTOM/CURB POWER CONNECTION		
Model Number	**Description**	**Use With Model Size**
CRBTMPWR001A01	Thru−the−bottom electrical	036 − 060
CRBTMPWR003A01	Thru−the−bottom electrical (AXB035PKA)	036 − 060

WINTER START KIT		
Model Number	**Description**	**Use With Model Size**
DNWINSTR001A00	Electronic phase monitor breaks “R” control signal if trouble is detected. (Allows operation down to 25°F from standard 40°F.)	036 − 060

*See usage tables in kit instructions.
[1A] Requires motor change out. Requires FAST # 1171974 and 1171108
[1B] Requires motor change out. Requires FAST # 1171975 and 1171108
[2] Available from FAST Parts.

PART NUMBERS FOR APPROVED MEDIUM STATIC CONVERSIONS			
Unit Size	**Motor Pulley**	**Blower Pulley**	**Belt**
3 Ton	1175849	N/A	1178179
4 Ton	1175849	N/A	1178179
5 Ton	1175832	1175830	1178200

ACCESSORIES − RAS036 − 060 (cont.)

ECONOMIZER SENSORS		
Model Number	**Description**	**Use With Model Size**
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

CONTROL UPGRADE KITS		
Model Number	**Description**	**Use With Model Size**
DNSTATUS001A00	Fan/Filter Status Switch	036 − 060
NRTIMEGD001A00	Time Guard II	036 − 060
1178184 [2]	Remote keyed attenuator / test / reset station	036 − 060
DNPHASE3001A02	Phase Monitor Control	036 − 060
HAIL GUARDS		
Model Number	**Description**	**Use With Model Size**
DNLVHLGD011A00	Louvered Condenser Coil Hail Guard	036
DNLVHLGD012A00	Louvered Condenser Coil Hail Guard	048 − 060

[2] Available from FAST Parts.

Table 1 – 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 PERFORMANCE CERTIFIED ARI Standard 210/240 UAC

c UL us

ENERGY STAR PARTNER

ARI PERFORMANCE CERTIFIED ARI Standard 340/360

ASHRAE 90.1 COMPLIANT

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.**

Table 2 – MINIMUM − MAXIMUM AIRFLOWS ELECTRIC HEAT

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

Table 3 – 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 4 – PHYSICAL DATA (COOLING) 3 − 5 TONS

		RAS036	RAS048	RAS060
Refrigeration System				
	# Circuits / # Comp. / Type	1 / 1 / Scroll	1 / 1 / Scroll	1 / 1 / Scroll
	R−410A charge (lbs−oz.)	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
Evap. Coil				
	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^2)	5.5	5.5	5.5
	Condensate Drain Conn. Size	3/4”	3/4”	3/4”
Evap. Fan and Motor				
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
Cond. Coil				
	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^2)	14.6	12.6	16.5
Cond. fan / motor				
	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
Filters				
	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

Table 5 – ELECTRIC HEAT − ELECTRICAL DATA, 3 − 5 TONS

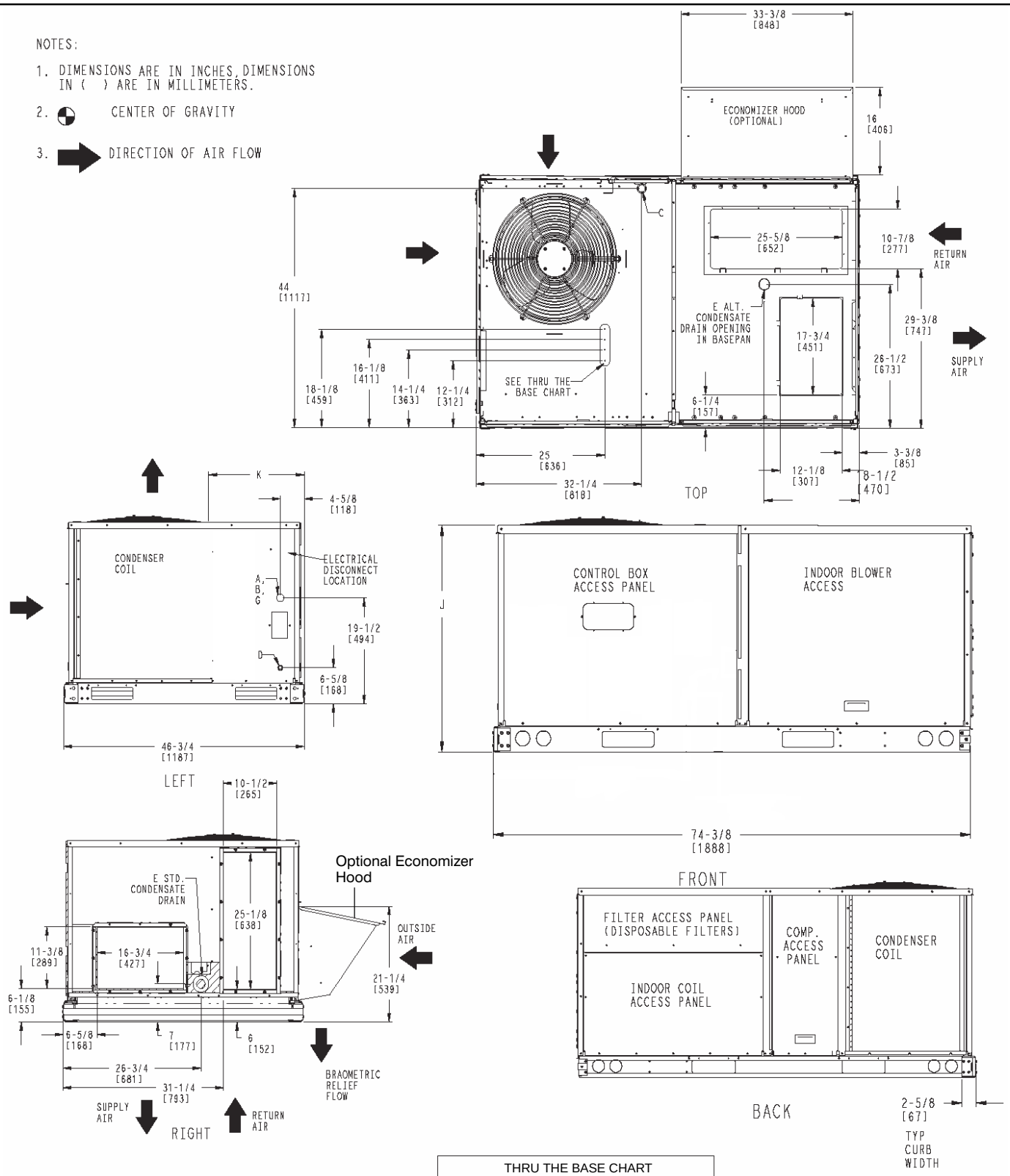
UNIT	Volt−Ph.−Hz	IFM TYPE	ELECTRIC HEATER PART NUMBER CRHEATERXXXXXX	NOM PWR (kW) 240v or 480v	Application PWR (kW) 203/230V or 460V	SINGLE POINT KIT PART NUMBER CRSINGLEXXXXXX	
						NO C.O or UNPWRD C.O	
						NO P.E.	w/P.E. (pwrd fr/unit)
RAS036	208/230−3−60	MEDIUM	101A00	4.4	3.3/4.0	−	−
			102A00	6.5	4.9/6.0	−	−
			103B00	8.7	6.5/8.0	−	−
			104B00	10.5	7.9/9.6	−	−
			105A00	16	12.0/14.7	−	−
		HIGH	101A00	4.4	3.3/4.0	−	−
			102A00	6.5	4.9/6.0	−	−
			103B00	8.7	6.5/8.0	−	−
			104B00	10.5	7.9/9.6	−	−
			105A00	16	12.0/14.7	−	−
	460−3−60	MEDIUM	106A00	6	5.5	−	−
			107A00	8.8	8.1	−	−
			108A00	11.5	10.6	−	−
			109A00	14	12.9	−	−
		HIGH	106A00	6	5.5	−	−
			107A00	8.8	8.1	−	−
			108A00	11.5	10.6	−	−
			109A00	14	12.9	−	−
RAS048	208/230−3−60	MEDIUM	102A00	6.5	4.9/6.0	−	−
			103B00	8.7	6.5/8.0	−	−
			105A00	16	12.0/14.7	−	−
			104B00,104B00	21	15.8/19.3	038A00	038A00
		HIGH	102A00	6.5	4.9/6.0	−	−
			103B00	8.7	6.5/8.0	−	−
			105A00	16	12.0/14.7	−	−
			104B00,104B00	21	15.8/19.3	038A00	038A00
	460−3−60	MEDIUM	106A00	6	5.5	−	−
			108A00	11.5	10.6	−	−
			109A00	14	12.9	−	−
			108A00,108A00	23	21.1	−	−
		HIGH	106A00	6	5.5	−	−
			108A00	11.5	10.6	−	−
			109A00	14	12.9	−	−
			108A00,108A00	23	21.1	−	−
RAS060	208/230−3−60	MEDIUM	102A00	6.5	4.9/6.0	−	−
			104B00	10.5	7.9/9.6	−	−
			105A00	16	12.0/14.7	−	−
			104B00,104B00	21	15.8/19.3	038A00	038A00
			104B00,105A00	26.5	19.9/24.3	038A00	038A00
		HIGH	102A00	6.5	4.9/6.0	−	−
			104B00	10.5	7.9/9.6	−	−
			105A00	16	12.0/14.7	−	−
			104B00,104B00	21	15.8/19.3	038A00	038A00
			104B00,105A00	26.5	19.9/24.3	038A00	038A00
	460−3−60	MEDIUM	106A00	6	5.5	−	−
			108A00	11.5	10.6	−	−
			109A00	14	12.9	−	−
			108A00,108A00	23	21.1	−	−
			108A00,109A00	25.5	23.4	−	−
		HIGH	106A00	6	5.5	−	−
			108A00	11.5	10.6	−	−
			109A00	14	12.9	−	−
			108A00,108A00	23	21.1	−	−
			108A00,109A00	25.5	23.4	−	−

LEGEND
CO − Convenient outlet
FLA − Full load amps
IFM − Indoor fan motor
P.E. − Power exhaust
UNPWRD − Unpowered convenient outlet

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

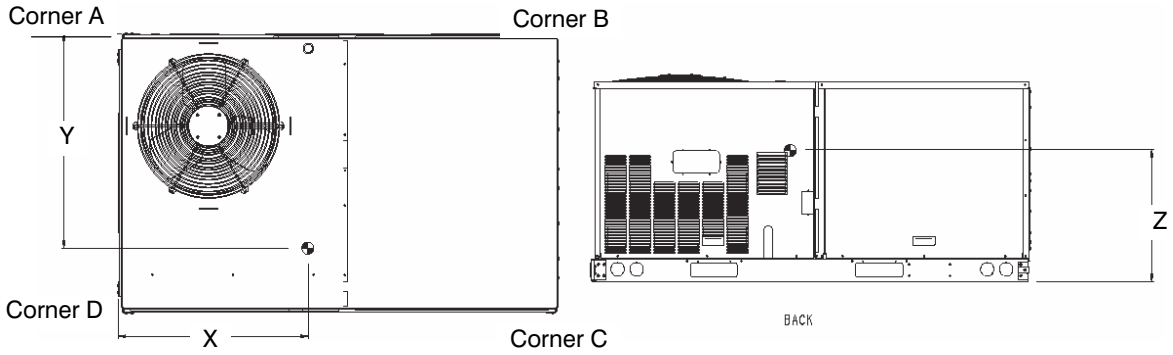
THREADED CONDUIT SIZE	WIRE USE	REQ'D HOLE SIZES (MAX.)
1/2"	ACC.	7/8" (22.2)
1/2"	24V	7/8" (22.2)
3/4" (001,003)	POWER*	1 1/8" (28.4)

* 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]

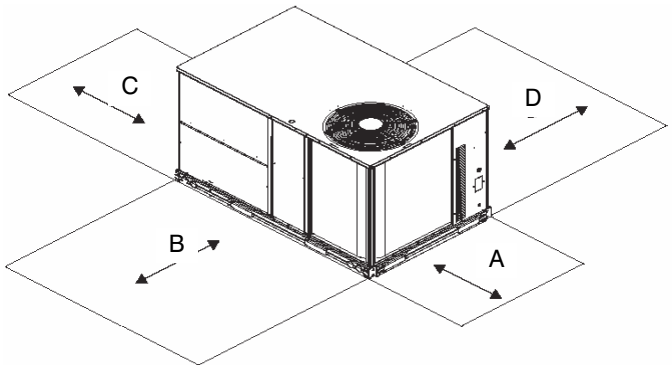
WEIGHT & CLEARANCE DIMENSIONS − RAS036−060 (cont.)

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

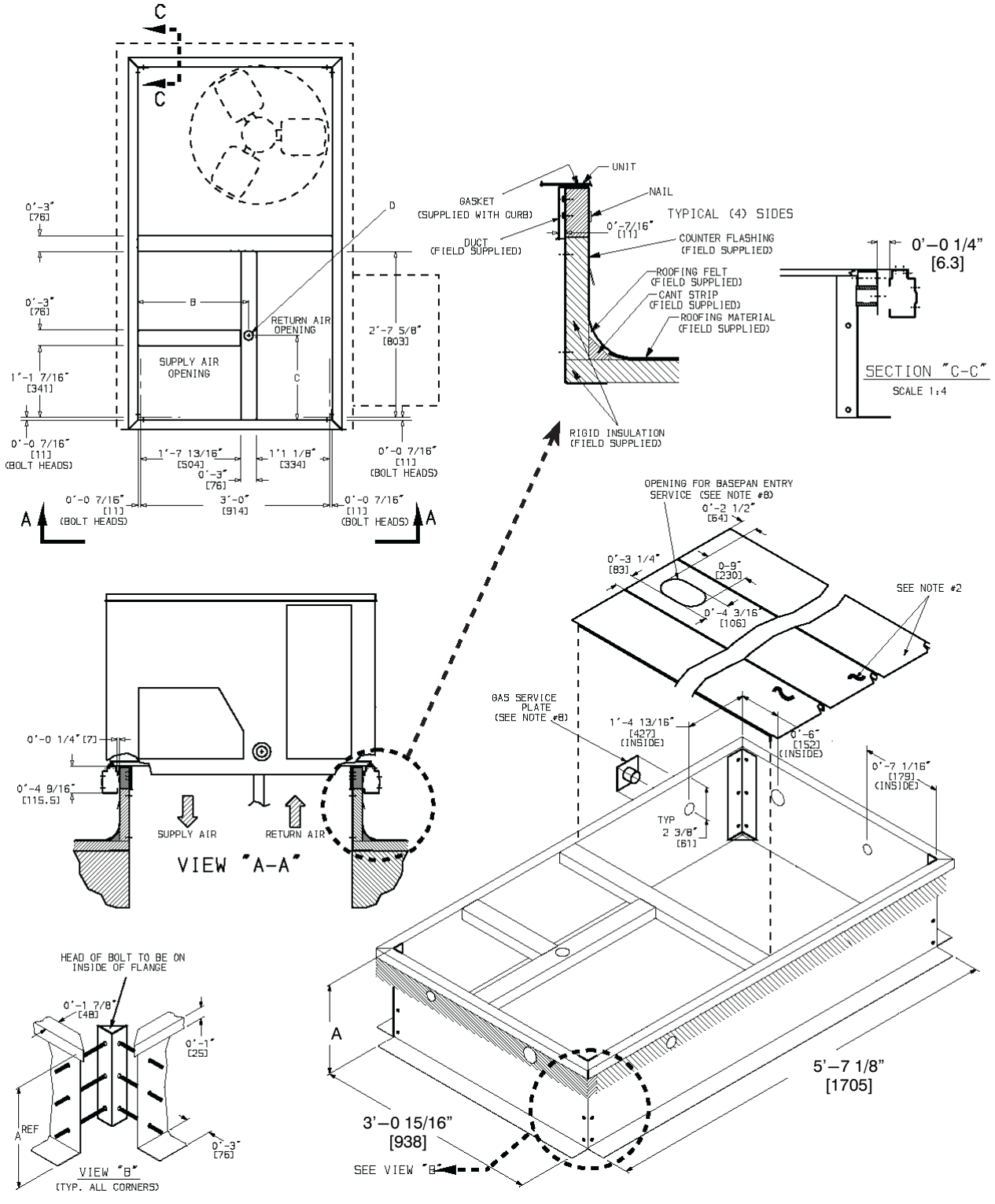


ROOF CURB DETAILS − RAS036−060

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' 9−11/16" [551]	1' 4" [406]	1−3/4" [44.5]	3/4" [19] NPT	1/2" [12.7] NPT	1/2" [12.7] NPT
CRBTMPWR003A01						



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 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 during cooling mode. 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−though 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, 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 winter start kit extends the low ambient limit of your rooftop to 25_F. 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

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 a field installed accessory.

Electric Heaters*

3 – 5 TONS										
CFM	600	900	1200	1400	1600	1800	2000	2200	2400	2600
1 Electric Heater Module	0.03	0.05	0.07	0.09	0.09	0.10	0.11	0.11	0.12	0.13
2 Electric Heater Modules	0.13	0.15	0.16	0.16	0.16	0.17	0.17	0.17	0.18	0.18

Available as a field installed accessory.

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 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.
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 10 – RAS036, 3 PHASE, 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
							Medium Static (Field Supplied Parts Required)[1]			
900							870	0.42	947	0.53
975							888	0.45	965	0.57
1050							906	0.49	983	0.61
1125							925	0.54	1001	0.66
1200					860	0.46	944	0.58	1020	0.71
1275					880	0.50	964	0.63	1039	0.76
1350					900	0.55	983	0.68	1058	0.82
1425					921	0.60	1003	0.74	1077	0.88
1500					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
	Medium Static (Field Supplied Parts Required)[1]						High Static (Standard)			
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 on page 16.

1. Achieve medium static by using field-supplied motor pulley (part number 1175849 -208/230 & 460V) and belt (part number 1178179)

Table 11 – RAS036, 3 PHASE, 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
							Medium Static (Field Supplied Parts Required)[1]			
900							879	0.42	957	0.52
975							897	0.46	975	0.57
1050							916	0.50	993	0.62
1125							936	0.55	1012	0.67
1200					873	0.48	956	0.60	1031	0.72
1275					894	0.53	976	0.65	1051	0.78
1350					916	0.58	997	0.71	1071	0.84
1425					939	0.63	1019	0.77	1091	0.91
1500					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
	Medium Static (Field Supplied Parts Required)[1]						High Static (Standard)			
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 on page 16.

1. Achieve medium static by using field-supplied motor pulley (part number 1175849 -208/230 & 460V) and belt (part number 1178179)

FAN PERFORMANCE (cont.)

Table 12 – RAS048, 3 PHASE, 4 TON HORIZONTAL SUPPLY

	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
CFM	Medium Static (Field Supplied Parts Required)[1]									
1200					860	0.46	944	0.58	1020	0.71
1300					887	0.52	970	0.65	1045	0.78
1400					914	0.59	997	0.72	1071	0.86
1500					942	0.66	1024	0.80	1097	0.95
1600			879	0.59	971	0.74	1051	0.89	1124	1.04
1700			910	0.66	1000	0.82	1079	0.98	1151	1.14
1800			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

	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
CFM	Medium Static (Field Supplied Parts Required)[1]				High Static (Standard)					
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		
2000	1298	1.68	1358	1.87	1415	2.07	1468	2.27		

NOTE: For more information, see General Fan Performance Notes on page 16.

1. Achieve medium static by using field-supplied motor pulley (part number 1175849 -208/230 & 460V) and belt (part number 1178179).

Table 13 – RAS048, 3 PHASE, 4 TON VERTICAL SUPPLY

	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
CFM	Medium Static (Field Supplied Parts Required)[1]									
1200					873	0.48	956	0.60	1031	0.72
1300					902	0.54	983	0.67	1057	0.80
1400			842	0.48	932	0.61	1012	0.75	1085	0.89
1500			875	0.55	962	0.69	1041	0.83	1112	0.98
1600			909	0.63	994	0.78	1071	0.93	1141	1.08
1700			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

	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
CFM	Medium Static (Field Supplied Parts Required)[1]		High Static (Standard)							
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		
1900	1293	1.62	1352	1.80	1408	1.99	1461	2.17		
2000	1324	1.77	1381	1.96	1436	2.15				

NOTE: For more information, see General Fan Performance Notes on page 16.

1. Achieve medium static by using field-supplied motor pulley (part number 1175849 -208/230 & 460V) and belt (part number 1178179).

FAN PERFORMANCE (cont.)

Table 14 – RAS060, 3 PHASE, 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
1500										
1625										
1750									1165	1.10
1875									1195	1.21
2000									1226	1.33
2125							1185	1.29	1258	1.47
2250					1146	1.25	1220	1.43	1291	1.63
2375			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
	Medium Static (Field Supplied Parts Required)[1]								High Static(Standard)	
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 on page 16.

1. Achieve medium static by using field-supplied motor pulley (part number 1175832) blower pulley (part no. 1175830), and belt (part number 1178200)

Table 15 – RAS060, 3 PHASE, 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
1500										
1625									1187	1.11
1750									1223	1.24
1875							1189	1.19	1260	1.38
2000							1229	1.34	1299	1.53
2125					1198	1.31	1270	1.50	1338	1.71
2250			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
	Medium Static (Field Supplied Parts Required)[1]								High Static (Standard)	
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 on page 16.

1. Achieve medium static by using field-supplied motor pulley (part number 1175832) blower pulley (part no. 1175830), and belt (part number 1178200)

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	Medium Static	1175	1135	1094	1054	1013	973	932	892	851	811	770
		High Static	1466	1423	1380	1337	1294	1251	1207	1164	1121	1078	1035
RAS048	3 phase	Medium Static	1175	1135	1094	1054	1013	973	932	892	851	811	770
		High Static	1466	1423	1380	1337	1294	1251	1207	1164	1121	1078	1035
RAS060	3 phase	Medium Static	1466	1423	1380	1337	1294	1251	1207	1164	1121	1078	1035
		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

ECONOMIZER, BAROMETRIC RELIEF, AND PERFORMANCE

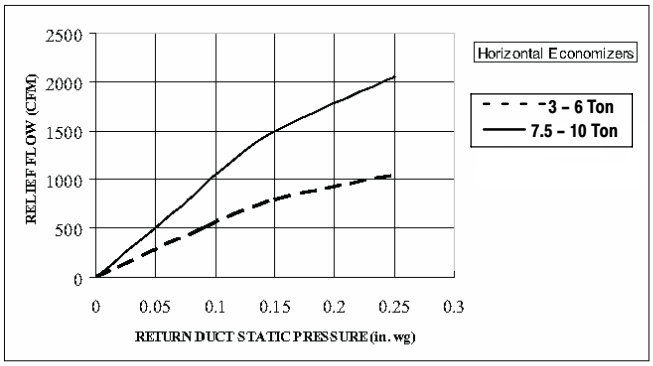


Fig. 1 – Barometric Relief Flow Capacity

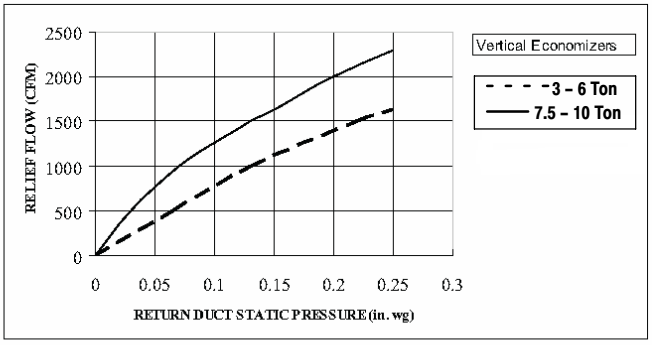


Fig. 4 – Barometric Relief Flow Capacity

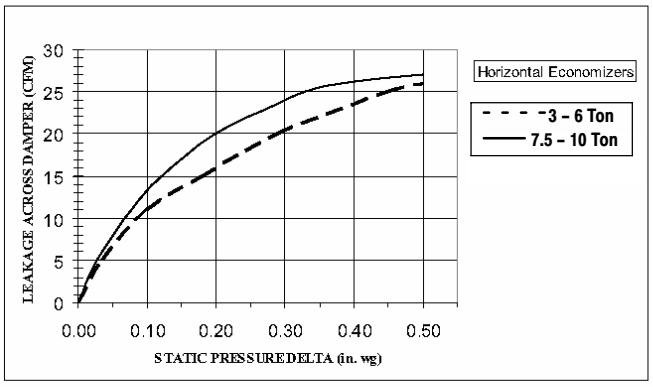


Fig. 2 – Outdoor Air Damper Leakage

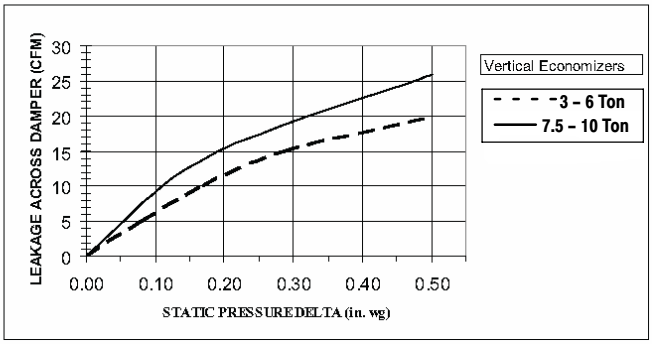


Fig. 5 – Outdoor Air Damper Leakage

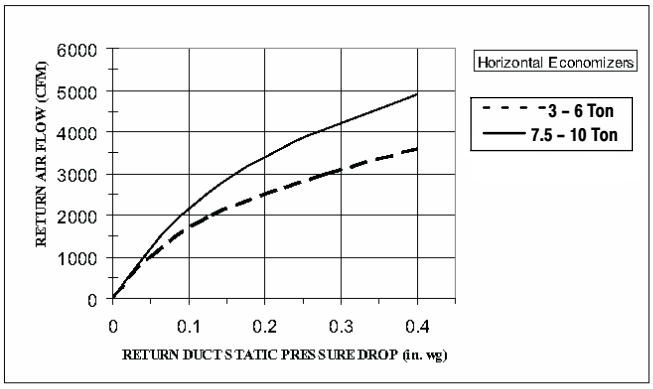


Fig. 3 – Return Air Pressure Drop

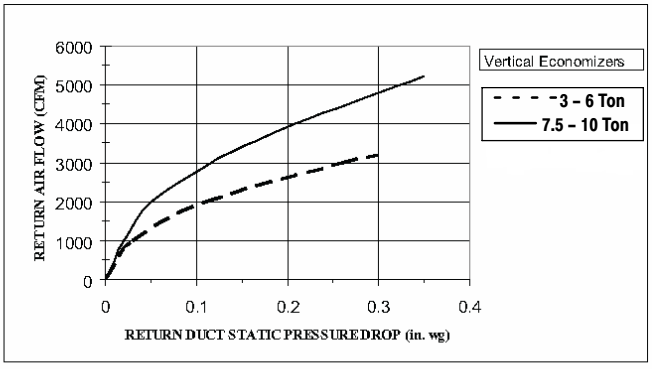


Fig. 6 – Return Air Pressure Drop

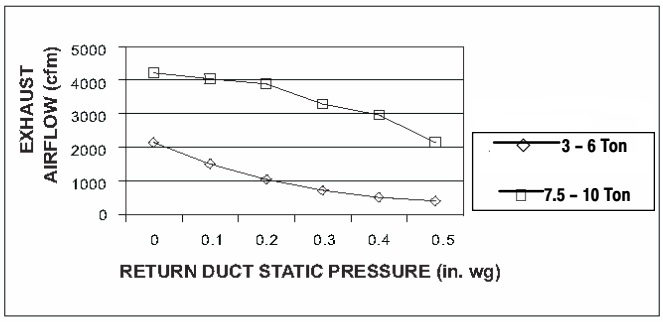


Fig. 7 – Power Exhaust Performance

ELECTRICAL INFORMATION

Table 17 – RAS036, 3 TONS

	VOLTAGE RANGE		COMP (ea)		OFM (ea)		IFM				
V–Ph–Hz	MIN	MAX	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
208–3–60	187	253	10.4	73	325	1.5	Medium Static	1000	5.1	70%	4.9
							High Static	2120	5.5	80%	5.2
230–3–60	187	253	10.4	73	325	1.5	Medium Static	1000	5.1	70%	4.9
							High Static	2120	5.5	80%	5.2
460–3–60	414	506	5.8	38	325	0.8	Medium Static	1000	2.2	70%	2.1
							High Static	2120	2.7	80%	2.6

Table 18 – RAS048, 4 TONS

	VOLTAGE RANGE		COMP (ea)		OFM (ea)		IFM				
V–Ph–Hz	MIN	MAX	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
208–3–60	187	253	13.7	83	325	1.5	Medium Static	1000	5.1	70%	4.9
							High Static	2120	5.5	80%	5.2
230–3–60	187	253	13.7	83	325	1.5	Medium Static	1000	5.1	70%	4.9
							High Static	2120	5.5	80%	5.2
460–3–60	414	506	6.2	41	325	0.8	Medium Static	1000	2.2	70%	2.1
							High Static	2120	2.7	80%	2.6

Table 19 – RAS060, 5 TONS

	VOLTAGE RANGE		COMP (ea)		OFM (ea)		IFM				
V–Ph–Hz	MIN	MAX	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
208–3–60	187	253	15.6	110	325	1.5	Medium Static	1000	5.1	70%	4.9
							High Static	2615	7.9	81%	7.5
230–3–60	187	253	15.6	110	325	1.5	Medium Static	1000	5.1	70%	4.9
							High Static	2615	7.9	81%	7.5
460–3–60	414	506	7.7	52	325	0.8	Medium Static	1000	2.2	70%	2.1
							High Static	2615	3.6	81%	3.4

Table 20 – MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.

Unit	Volt–Ph–Hz	IFM TYPE	ELECTRIC HEATER		NO C.O. or UNPWR C.O.							
					NO P.E.				w/ P.E. (pwrd fr/unit)			
							DISC. SIZE				DISC. SIZE	
			Nom* (kW)	FLA	MCA	MOCP	FLA	LRA	MCA	MOCP	FLA	LRA
RAS036	208/230–3–60	MED**	None	None	19.4	25	19	89	21.3	30	22	91
			3.3/4.4	9.2/10.6	19.4/19.4	25/25	19/19	89/89	21.3/21.8	30/30	22/22	91/91
			4.9/6.5	13.6/15.6	23.1/25.6	25/30	21/24	89/89	25.5/28.0	30/30	23/26	91/91
			6.5/8.7	18.1/20.9	28.8/32.3	30/35	26/30	89/89	31.1/34.6	35/35	29/32	91/91
			7.9/10.5	21.9/25.3	33.5/37.8	35/40	31/35	89/89	35.9/40.1	40/45	33/37	91/91
			12.0/16.0	33.4/38.5	47.9/54.3	50/60	44/50	89/89	50.3/56.6	60/60	46/52	91/91
		HIGH	None	None	19.7	30	20	107	21.6	30	22	109
			3.3/4.4	9.2/10.6	19.7/19.8	30/30	20/20	107/107	21.6/22.1	30/30	22/22	109/109
			4.9/6.5	13.6/15.6	23.5/26.0	30/30	22/24	107/107	25.9/28.4	30/30	24/26	109/109
			6.5/8.7	18.1/20.9	29.1/32.6	30/35	27/30	107/107	31.5/35.0	35/40	29/32	109/109
			7.9/10.5	21.9/25.3	33.9/38.1	35/40	31/35	107/107	36.3/40.5	40/45	33/37	109/109
			12.0/16.0	33.4/38.5	48.3/54.6	50/60	44/50	107/107	50.6/57.0	60/60	47/52	109/109
	460–3–60	MED**	None	None	10.2	15	10	46	11.2	15	11	47
			6.0	7.2	11.6	15	11	46	12.9	15	12	47
			8.8	10.6	15.9	20	15	46	17.1	20	16	47
			11.5	13.8	19.9	20	18	46	21.1	25	19	47
			14.0	16.8	23.6	25	22	46	24.9	25	23	47
		HIGH	None	None	10.7	15	11	55	11.7	15	12	56
			6.0	7.2	12.3	15	11	55	13.5	15	12	56
			8.8	10.6	16.5	20	15	55	17.8	20	16	56
			11.5	13.8	20.5	25	19	55	21.8	25	20	56
			14.0	16.8	24.3	25	22	55	25.5	30	23	56
RAS048	208/230–3–60	MED**	None	None	23.5	30	23	99	25.4	30	25	101
			4.9/6.5	13.6/15.6	23.5/25.6	30/30	23/24	99/99	25.5/28.0	30/30	25/26	101/101
			6.5/8.7	18.1/20.9	28.8/32.3	30/35	26/30	99/99	31.1/34.6	35/35	29/32	101/101
			12.0/16.0	33.4/38.5	47.9/54.3	50/60	44/50	99/99	50.3/56.6	60/60	46/52	101/101
			15.8/21.0	43.8/50.5	60.9/69.3	70/70	56/64	99/99	63.3/71.6	70/80	58/66	101/101
		HIGH	None	None	23.8	30	23	117	25.7	30	26	119
			4.9/6.5	13.6/15.6	23.8/26.0	30/30	23/24	117/117	25.9/28.4	30/30	26/26	119/119
			6.5/8.7	18.1/20.9	29.1/32.6	30/35	27/30	117/117	31.5/35.0	35/40	29/32	119/119
			12.0/16.0	33.4/38.5	48.3/54.6	50/60	44/50	117/117	50.6/57.0	60/60	47/52	119/119
			15.8/21.0	43.8/50.5	61.3/69.6	70/70	56/64	117/117	63.6/72.0	70/80	59/66	119/119
	460–3–60	MED**	None	None	10.7	15	10	49	11.7	15	12	50
			6.0	7.2	11.6	15	11	49	12.9	15	12	50
			11.5	13.8	19.9	20	18	49	21.1	25	19	50
			14.0	16.8	23.6	25	22	49	24.9	25	23	50
			23.0	27.7	37.3	40	34	49	38.5	40	35	50
		HIGH	None	None	11.2	15	11	58	12.2	15	12	59
			6.0	7.2	12.3	15	11	58	13.5	15	12	59
			11.5	13.8	20.5	25	19	58	21.8	25	20	59
			14.0	16.8	24.3	25	22	58	25.5	30	23	59
			23.0	27.7	37.9	40	35	58	39.1	40	36	59
RAS060	208/230–3–60	MED**	None	None	26.2	40	26	144	28.1	40	28	146
			4.9/6.5	13.6/15.6	26.2/26.2	40/40	26/26	144/144	28.1/28.4	40/40	28/28	146/146
			7.9/10.5	21.9/25.3	33.9/38.1	40/40	31/35	144/144	36.3/40.5	40/45	33/37	146/146
			12.0/16.0	33.4/38.5	48.3/54.6	50/60	44/50	144/144	50.6/57.0	60/60	47/52	146/146
			15.8/21.0	43.8/50.5	61.3/69.6	70/70	56/64	144/144	63.6/72.0	70/80	59/66	146/146
			19.9/26.5	55.2/63.8	75.5/86.3	80/90	69/79	144/144	77.9/88.6	80/90	72/82	146/146
		HIGH	None	None	28.5	40	28	170	30.4	45	30	172
			4.9/6.5	13.6/15.6	28.5/28.9	40/40	28/28	170/170	30.4/31.3	45/45	30/30	172/172
			7.9/10.5	21.9/25.3	36.8/41.0	40/45	34/38	170/170	39.1/43.4	45/45	36/40	172/172
			12.0/16.0	33.4/38.5	51.1/57.5	60/60	47/53	170/170	53.5/59.9	60/60	49/55	172/172
			15.8/21.0	43.8/50.5	64.1/72.5	70/80	59/67	170/170	66.5/74.9	70/80	61/69	172/172
			19.9/26.5	55.2/63.8	78.4/89.1	80/90	72/82	170/170	80.8/91.5	90/100	74/84	172/172
	460–3–60	MED**	None	None	13	20	13	69	14	20	14	70
			6.0	7.2	13.0	20	13	69	14.0	20	14	70
			11.5	13.8	20.5	25	19	69	21.8	25	20	70
			14.0	16.8	24.3	25	22	69	25.5	30	23	70
			23.0	27.7	37.9	40	35	69	39.1	40	36	70
			25.5	30.7	41.6	45	38	69	42.9	45	39	70
		HIGH	None	None	13.8	20	14	82	14.8	20	15	83
			6.0	7.2	13.8	20	14	82	14.8	20	15	83
			11.5	13.8	21.5	25	20	82	22.8	25	21	83
			14.0	16.8	25.3	30	23	82	26.5	30	24	83
			23.0	27.7	38.9	40	36	82	40.1	45	37	83
			25.5	30.7	42.6	45	39	82	43.9	45	40	83

* Nominal values, listed as 208/240v or 460v as appropriate.

** Available from FAST Parts

See Legend and calculations on next page.

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

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

$$= 227$$

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.

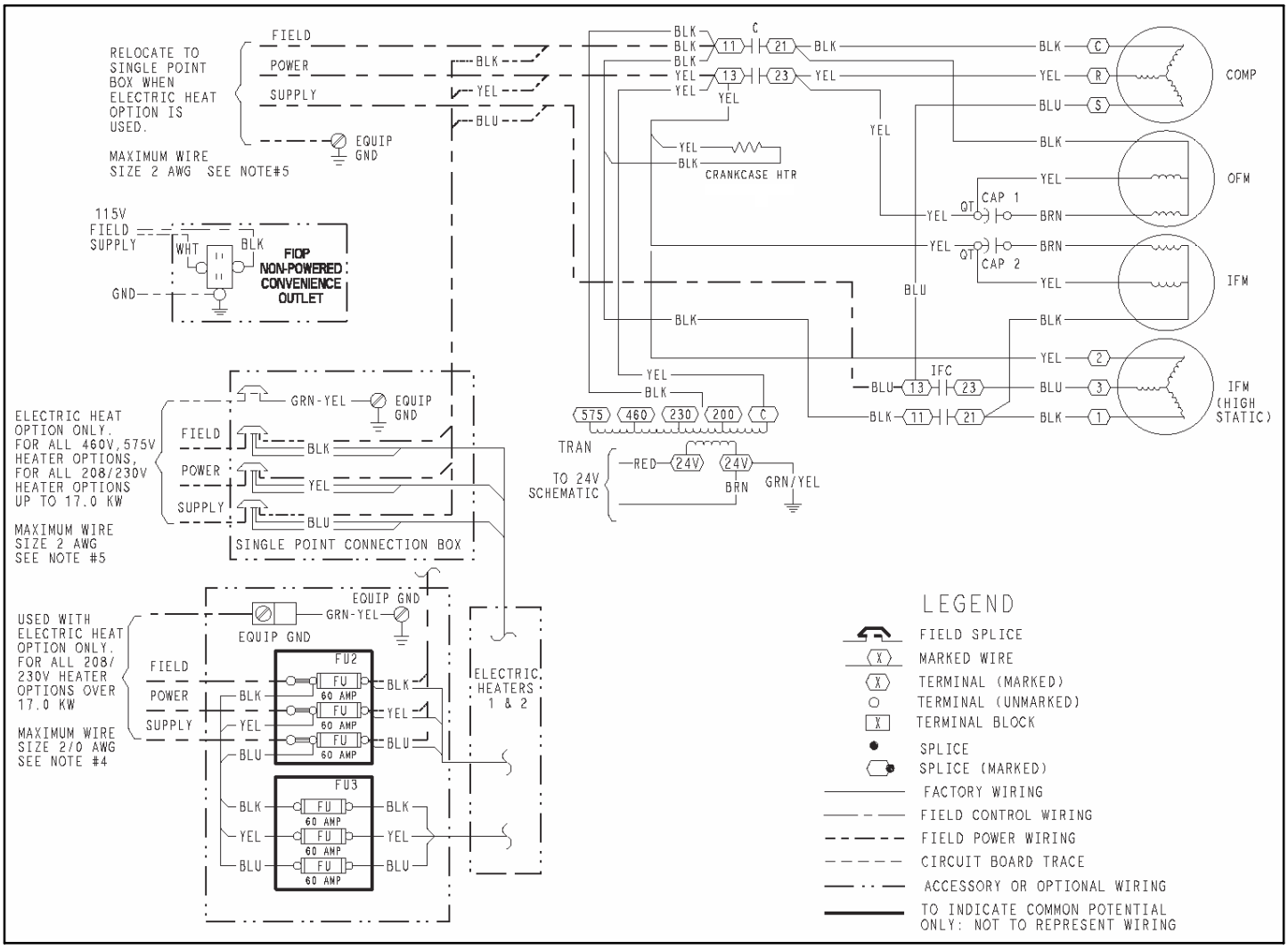


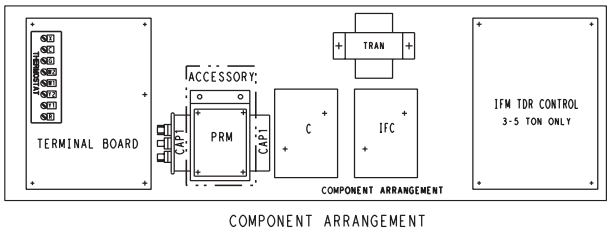
Fig. 8 Typical Power Diagram

LEGEND

C	–	Contactor, compressor
CAP	–	Capacitor
CB	–	Circuit breaker
COMP	–	Compressor motor
DDC	–	Direct digital control
FU	–	Fuse
GND	–	Ground
HPS	–	High pressure switch
IAQ	–	Indoor air quality sensors
IFC	–	Indoor fan contactor
IFM	–	Indoor fan motor
LA	–	Low ambient lockout
LPS	–	Low pressure switch
LPS	–	Low pressure switch
LS	–	Limit switch
MGV	–	Main gas valve
OAT	–	Outdoor air temp sensor
OFM	–	Outdoor fan motor
OLR	–	Overload relay
PL	–	Plug assembly
POT	–	Potentiometer
PRM	–	Phase relay monitor
QT	–	Quadruple terminal
R	–	Relay
RAT	–	Return air temp sensor
RS	–	Rollout switch
SAT	–	Supply air temp sensor
TB	–	Terminal block
TRAN	–	Transformer

NOTES:

1. If any of the original wire furnished must be replaced, it must be replaced with type 90 C wire or its equivalent.
2. Compressor and fan motors are thermally protected against primary single phasing conditions.
3. 208/230V unit transformer is wired for 230V unit. If unit is to be run with 208V power supply, disconnect black wire from 230V tap and connect to 200V tap.
4. Use copper, copper clad, aluminum or aluminum connectors.
5. Use copper conductor only.



COMPONENT ARRANGEMENT

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% resister 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. 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−fan motor runs continuously while unit is cooling.

Heating

NOTE: The RAS is 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 (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.

Heating

The sequence of operation for the heating is the same as an 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.

Note about this specification:

GAS HEAT PACKAGED ROOFTOP

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. energize both “W” and “G” when calling for heat.
   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 be 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 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−amperage 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

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.

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. Unit−Mounted, Non−Fused Disconnect Switch:
   a. Switch shall be 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.
   e. Shall be internally mounted, NEC and UL approved non−fused switch shall provide unit power shutoff.
   f. Shall be accessible from outside the unit and shall provide power off lockout capability. (80 amp maximum).
7. Convenience Outlet:
   a. Non−Powered convenience outlet.
   b. Outlet shall be powered from a separate 115−120v power source.
   c. A transformer shall not be included.
   d. Outlet shall be internally mounted with easily accessible 115−v female receptacle.
   e. Outlet shall include 15 amp GFI receptacles with independent fuse protection.
   f. Outlet shall be accessible from outside the unit.
8. 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.
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 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 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.
12. 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.
13. 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.
14. High−Static Indoor Fan Motor(s) and Drive(s) (036 − 060):
    a. High−static motor(s) and drive(s) shall be factory−installed to provide additional performance range.
15. Condenser Coil Grille:
    a. The grille protects the condenser coil from damage by large objects without increasing unit clearances.
16. 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.
17. 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.
18. 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.

19. 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.
20. 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.
21. Smoke detector (field supplied):
    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:
        i. One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel
        ii. Two Form−C auxiliary alarm relays for interface with rooftop unit or other equipment
        iii. One Form−C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station
        iv. Capable of direct connection to two individual detector modules
        v. Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications
22. 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.
23. Barometric relief
    a. Shall include damper, seals, hard−ware, and hoods to relieve excess building pressure.
    b. Damper shall gravity−close upon unit shutdown.
24. 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.
25. 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.