HEATING & COOLING PRODUCTS

RHS

Product Specifications

ENERGY STAR COMPLIANT PACKAGE HEAT PUMP UNIT R−410A SINGLE PACKAGE ROOFTOP 3 − 5 TONS (3−Phase)

BUILT TO LAST, EASY TO INSTALL AND SERVICE

- One−piece, high efficiency electric heating and 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
- Scroll compressors with internal line−break overload protection
- Single stage cooling
- 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
- Precision sized suction line accumulator to provide high reliability
- 4−way reversing valve rapidly changes the flow of refrigerant to quickly changeover from cooling to heating and heating to cooling
- Belt drive evaporator−fan motor and pulley combinations available to meet any application
- Crankcase heaters on all models but the 3 ton
- 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
- 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 accessory 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

RHS036−060

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.

WARRANTY

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

UNIT PERFORMANCE DATA

High Static Model	Nominal Tons	COOLING Net Cap. (Btuh)	COOLING SEER	COOLING EER	HEATING High Cap. (Btuh)	HEATING HSPF	HEATING COP	Unit Dimensions H x W x L	Unit Weight lbs (kg)
RHS036*0BA0AAA	3	37,000	13.4	11.00	35,600	7.7	N/A	33-3/8” x 46-3/4” x 74-3/8”	505 (229)
RHS048*0BA0AAA	4	47,000	13.1	11.20	45,500	7.7	N/A	33-3/8” x 46-3/4” x 74-3/8”	510 (231)
RHS060*0BA0AAA	5	61,500	13.2	11.15	58,000	7.7	N/A	41-3/8” x 46-3/4” x 74-3/8”	590 (268)

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

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11/9/09

TABLE OF CONTENTS

MODEL NOMENCLATURE

MODEL SERIES	R	H	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 (included with economizer)

Gravity controlled, barometric relief equalizes building pressure and ambient air pressures. This can be a cast 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

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.

Thru−the−Base Connections

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

Electric Heaters

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

ACCESSORIES − RHS036−060

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 3−Position −− with W7212 controller	036 − 060
DNECOMZR024A02	Horizontal 3−Position −− 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 volt	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	036 − 060

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

*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.

ACCESSORIES − RHS036−060 (cont.)

CONTROL UPGRADE KITS		
Model Number	**Description**	**Use With Model Size**
DNSTATUS001A00	Fan/Filter Status Switch	036 − 060
NRTIMEGD001A00	Time Guard II	036 − 060
11781842 [2]	Remote keyed attenuator / test / reset station	036 − 060
DNPHASE3001A01	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
DNLVHLGD023A00	Louvered Condenser Coil Hail Guard	060

[2] Available from Fast parts.

Table 1 – ARI COOLING RATING TABLE

UNIT RHS	NOM. CAPACITY (TONS)	NET COOLING CAPACITY (BTUH)	TOTAL POWER (KW)	SEER	EER	IPLV
036	3	37,000	3.3	13.4*	11.00	N/A
048	4	47,000	4.1	13.1*	11.20	N/A
060	5	61,500	5.5	13.2*	11.15	N/A

NOTE:

All AHRI ratings are based on 230, 460 and 575 volt.

* Electric Drive (direct drive) X13 5 speed/torque motor. SEER rating is 13.0 for belt drive.

NA Not applicable

Table 2 − ARI HEATING TABLE

UNIT RHS	HSPF	HEATING LOW		HEATING HIGH	
		CAPACITY (BTUH)	COP	CAPACITY (BTUH)	COP
036	7.7	18,200	N/A	35,600	N/A
048	7.7	23,600	N/A	45,500	N/A
060	7.7	31,200	N/A	58,000	N/A

LEGEND

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

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.

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.
3. All RHS units comply with ASHRAE 90.1 2001, 2004 Energy Standard for minimum SEER and EER requirements.
4. RHS 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 .

Table 2 – MINIMUM − MAXIMUM AIRFLOWS ELECTRIC HEAT

UNIT RHS	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 RHS	OUTDOOR SOUND (dB)								
	A−Weighted	63	125	250	500	1000	2000	4000	8000
036	77	78.9	81.7	74.9	72.5	70.3	65.6	65.6	62.6
048	80	90.4	84.6	77.6	77.5	74.8	70.6	68.0	64.2
060	80	92.7	84.9	79	76.7	73.8	69.6	66.4	62.8

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

	RHS036	RHS048	RHS060
Refrigeration System			
# Circuits / # Comp. / Type	1 / 1 / Scroll	1 / 1 / Scroll	1 / 1 / Scroll
R−410A charge per circuit (lbs−oz)	9 – 8	10 –3	12 – 13
Oil (oz)	42	42	42
Metering Device		Fixed Orifice	
High−pressure Trip / Reset (psig)	630 / 505	630 / 505	630 / 505
Loss of Charge Pressure Trip / Reset (psig)	27 / 44	27 / 44	27 / 44
Evap. Coil			
Material	Cu / Al	Cu / Al	Cu / Al
Coil type	3/8” RTPF	3/8” RTPF	3/8” RTPF
Rows / FPI	3 / 15	3 / 15	4/ 15
Total Face Area (ft^2)	5.5	5.5	7.3
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	2	2.9
RPM Range	1035−1466	1035−1466	1208−1639
Motor Frame Size	56	56	56
Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
Fan Diameter x Length (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	2 / 17	2 / 17	2 / 17
Total Face Area (ft^2)	10.7	12.7118055	15
Cond. fan / motor			
Qty / Motor Drive Type	1 / direct	1 / direct	1 / direct
Motor HP / RPM	1/8 / 825	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	4 / 16 x 16 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	Nominal Volt−Ph−Hz	IFM TYPE	ELECTRIC HEATER PART NUMBER CRHEATERXXXXXX	NOM PWR (kW)	APP PWR (kW)	SINGLE POINT KIT PART NUMBER CRSINGLEXXXXXX	
						WITHOUT C.O. or UNPWRD C.O.	
						WITHOUT P.E.	WITH P.E.
RHS036	208/230−3−60	MED	101A00	4.4	3.3/4.0	–	–
			102A00	6.5	4.9/6.0	–	–
			103B00	8.7	6.5/8.0	–	037A00
			104B00	10.5	7.9/9.6	037A00	037A00
			105A00	16.0	12.0/14.7	038A00	038A00
		HIGH	101A00	4.4	3.3/4.0	–	–
			102A00	6.5	4.9/6.0	–	–
			103B00	8.7	6.5/8.0	–	037A00
			104B00	10.5	7.9/9.6	037A00	037A00
			105A00	16.0	12.0/14.7	038A00	038A00
	460−3−60	MED	106A00	6.0	5.5	–	–
			107A00	8.8	8.1	–	–
			108A00	11.5	10.6	–	–
			109A00	14.0	12.9	–	–
		HIGH	106A00	6.0	5.5	–	–
			107A00	8.8	8.1	–	–
			108A00	11.5	10.6	–	–
			109A00	14.0	12.9	–	–
RHS048	208/230−3−60	STD DD	102A00	6.5	4.9/6.0	–	–
			103B00	8.7	6.5/8.0	037A00	037A00
			105A00	16.0	12.0/14.7	038A00	038A00
			104B00,104B00	21.0	15.8/19.3	039A00	039A00
		MED	102A00	6.5	4.9/6.0	–	–
			103B00	8.7	6.5/8.0	–	037A00
			105A00	16.0	12.0/14.7	038A00	038A00
			104B00,104B00	21.0	15.8/19.3	039A00	039A00
		HIGH	102A00	6.5	4.9/6.0	–	–
			103B00	8.7	6.5/8.0	–	037A00
			105A00	16.0	12.0/14.7	038A00	038A00
			104B00,104B00	21.0	15.8/19.3	039A00	039A00
	460−3−60	MED	106A00	6.0	5.5	–	–
			108A00	11.5	10.6	–	–
			109A00	14.0	12.9	–	–
			108A00,108A00	23.0	21.1	037A00	037A00
		HIGH	106A00	6.0	5.5	–	–
			108A00	11.5	10.6	–	–
			109A00	14.0	12.9	–	–
			108A00,108A00	23.0	21.1	037A00	037A00

– No Single Point Kit required

LEGEND

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

Table 6 − (cont.) ELECTRIC HEAT − ELECTRIC DATA 3 − 5 TONS

Unit	Nominal Volt−Ph−Hz	IFM TYPE	ELECTRIC HEATER PART NUMBER CRHEATERXXXXXX	NOM PWR (kW)	APP PWR (kW)	SINGLE POINT KIT PART NUMBER CRSINGLEXXXXXX	
						WITHOUT C.O. or UNPWRD C.O.	
						WITHOUT P.E.	WITH P.E.
RHS060	208/230−3−60	MED	102A00	6.5	4.9/6.0	−	−
			104B00	10.5	7.9/9.6	037A00	037A00
			105A00	16.0	12.0/14.7	038A00	038A00
			104B00,104B00	21.0	15.8/19.3	039A00	039A00
			104B00,105A00	26.5	19.9/24.3	039A00	039A00
		HIGH	102A00	6.5	4.9/6.0	−	−
			104B00	10.5	7.9/9.6	038A00	038A00
			105A00	16.0	12.0/14.7	038A00	038A00
			104B00,104B00	21.0	15.8/19.3	039A00	039A00
			104B00,105A00	26.5	19.9/24.3	039A00	039A00
	460−3−60	MED	106A00	6.0	5.5	−	−
			108A00	11.5	10.6	−	−
			109A00	14.0	12.9	−	−
			108A00,108A00	23.0	21.1	037A00	037A00
			108A00,109A00	25.5	23.4	037A00	037A00
		HIGH	106A00	6.0	5.5	−	−
			108A00	11.5	10.6	−	−
			109A00	14.0	12.9	−	−
			108A00,108A00	23.0	21.1	037A00	037A00
			108A00,109A00	25.5	23.4	037A00	037A00

− No Single Point Kit required

LEGEND

APP PWR − 208 / 230V / 460V
C.O. − Convenient outlet
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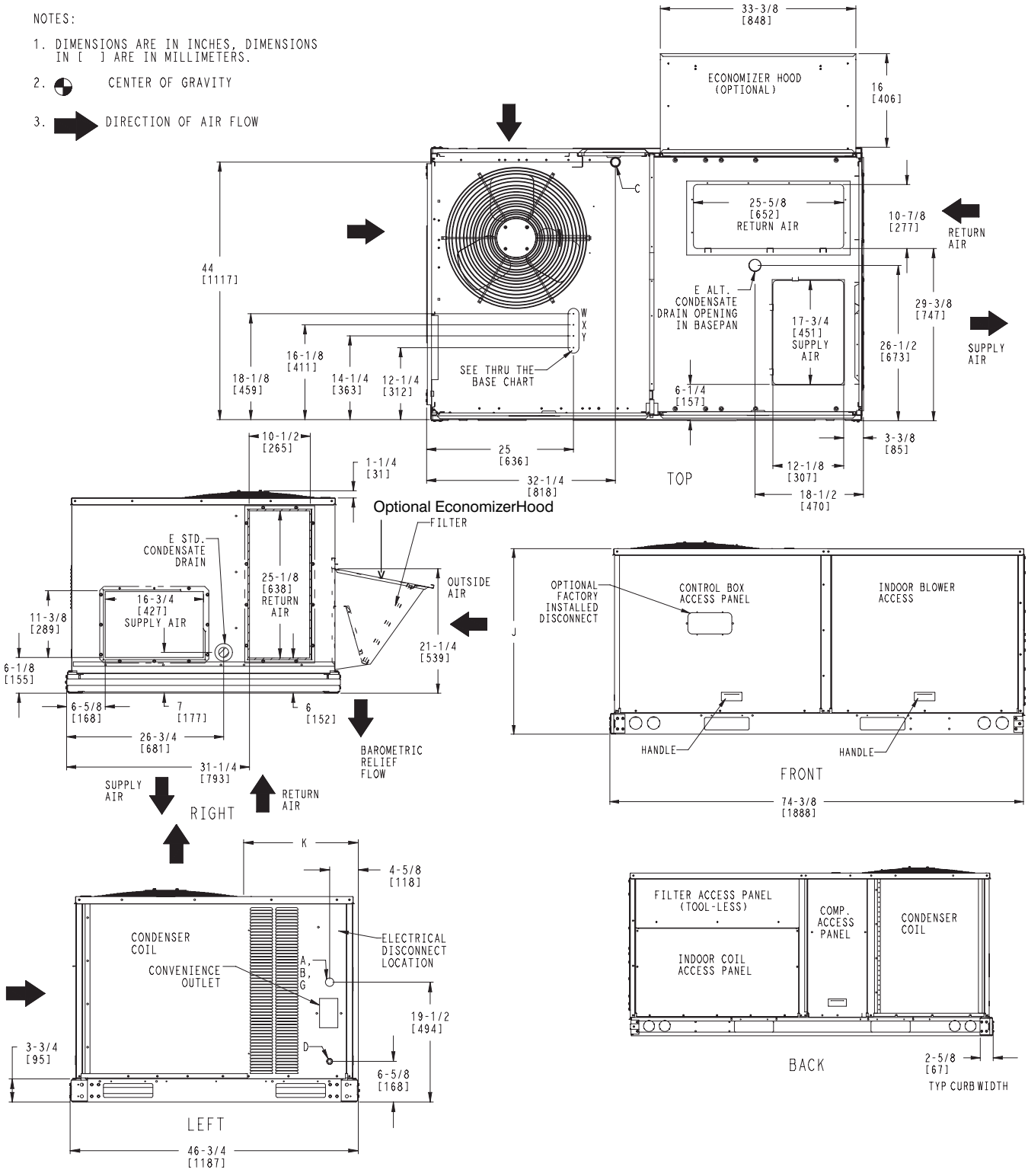
IFM − Indoor fan motor
NOM PWR − 240V / 480V / 600V
P.E. − Power exhaust
UNPWRD − Unpowered convenient outlet

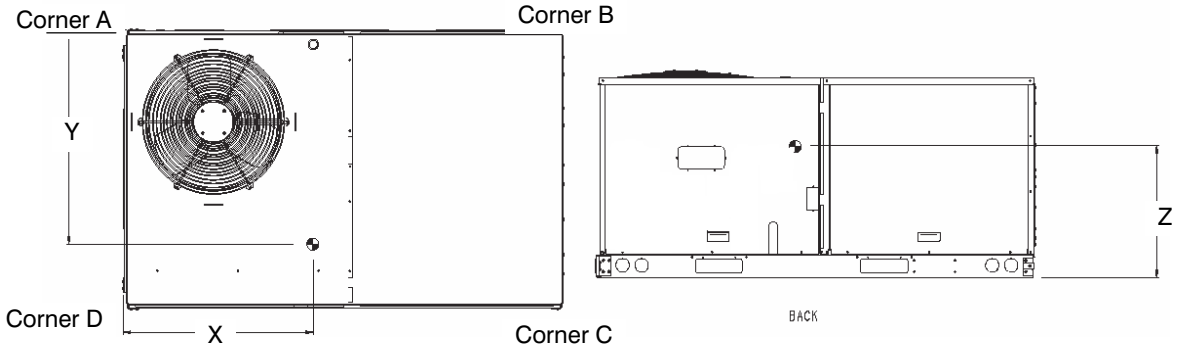
BASE UNIT DIMENSIONS − RHS036−060



	Connection Sizes	Thru the Base Chart These Holes Req'd For Use CRBTMPWR001A01				Unit	J	K
			Threaded Conduit Size	Wire Use	Req'd Hole Sizes (Max.)			
A	1-3/8" [35] DIA Field Power Supply Hole	W	1/2"	Acc.	7/8" [22.2]	036	33-3/8 [847]	18-5/8 [472]
B	2" [51] DIA Power Supply Knockout	X	1/2"	24V	7/8" [22.2]	048	33-3/8 [847]	14-7/8 [377]
C	1-3/4" [44] DIA Gauge Access Plug	Y*	3/4" (001)	Power*	1-1/8" [28.4]	060	41-3/8 [1051]	14-7/8 [377]
D	7/8" [22] DIA Field Control Wiring Hole	* Select either 3/4" or 1-1/4" for power, depending on wire size.						
E	3/4" 14 NPT Condensate Drain							
G	2" [51] DIA Power Supply Knockout							

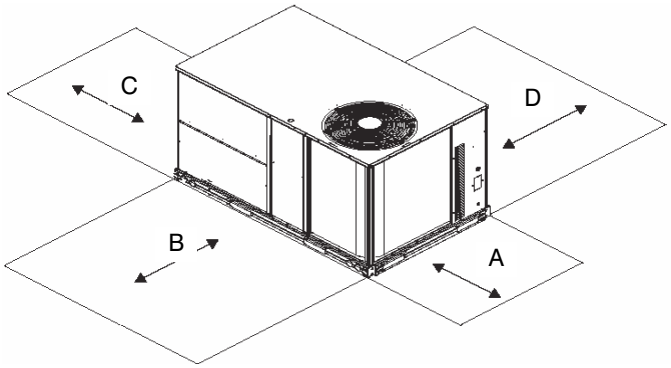
WEIGHTS & DIMENSIONS − RHS036−060 (cont.)

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
RHS036	505	229	136	62	130	59	117	53	123	56	36−1/4 [921]	22−1/8 [562]	16−3/8 [416]
RHS048	510	231	138	63	131	59	118	54	124	56	36−1/4 [921]	22−1/8 [562]	16−1/2 [419]
RHS060	590	268	159	72	146	66	137	62	149	68	35−5/8 [905]	22−1/8 [562]	20−1/8 [511]



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	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)

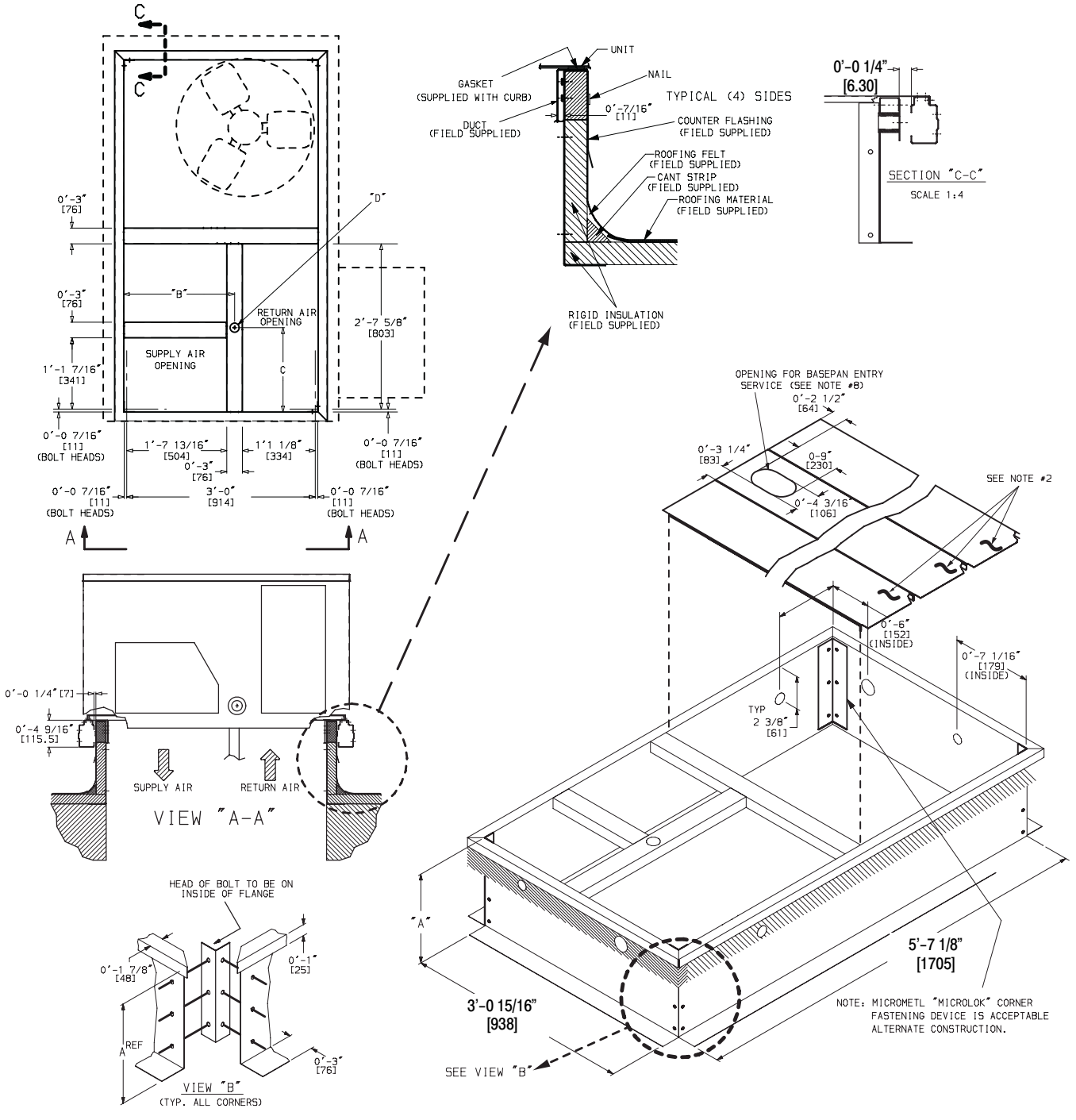


ROOF CURB DETAILS − RHS036−060

RoofCurb Accessory	A	Unit Size
CRRFCURB001A01	1’ 2 “ [356]	RHS036−060
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 18 ga steel on 14” curb, 16 ga steel on 24” curb.
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	2’−8 7/16” [827]	1’−10 15/16” [583]	1−3/4” [44.5]	3/4” [19] NPT	1/2” [12.7] NPT	1/2” [12.7] NPT
CRBTMPWR003A01				3/4” [19] 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−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 in Table 4, 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 1−Stage Cooling 3 TONS

RHS036				AMBIENT TEMPERATURE											
				85			95			105			115		
				EA (dB)			EA (dB)			EA (dB)			EA (dB)		
				75	80	85	75	80	85	75	80	85	75	80	85
900 Cfm	EAT (wb)	58	TC	31.4	31.4	35.7	29.6	29.6	33.6	27.6	27.6	31.5	25.6	25.6	29.1
			SHC	27.1	31.4	35.7	25.5	29.6	33.6	23.8	27.6	31.5	22.0	25.6	29.1
		62	TC	33.5	33.5	34.4	30.9	30.9	33.2	28.3	28.3	31.9	25.7	25.7	30.4
			SHC	24.8	29.6	34.4	23.6	28.4	33.2	22.3	27.1	31.9	20.9	25.7	30.4
		67	TC	38.0	38.0	38.0	35.3	35.3	35.3	32.4	32.4	32.4	29.4	29.4	29.4
			SHC	21.0	25.8	30.7	19.8	24.6	29.5	18.6	23.4	28.2	17.3	22.2	27.0
		72	TC	42.1	42.1	42.1	39.7	39.7	39.7	37.1	37.1	37.1	34.0	34.0	34.0
			SHC	16.7	21.6	26.4	15.8	20.6	25.5	14.7	19.6	24.4	13.6	18.4	23.2
		76	TC	–	44.9	44.9	–	43.0	43.0	–	40.5	40.5	–	37.5	37.5
			SHC	–	17.8	22.7	–	17.1	22.0	–	16.2	21.1	–	15.2	20.1
1050 Cfm	EAT (wb)	58	TC	33.7	33.7	38.3	31.7	31.7	36.0	29.6	29.6	33.6	27.4	27.4	31.2
			SHC	29.1	33.7	38.3	27.3	31.7	36.0	25.5	29.6	33.6	23.6	27.4	31.2
		62	TC	35.0	35.0	38.1	32.3	32.3	36.7	29.7	29.7	35.1	27.4	27.4	32.5
			SHC	26.9	32.5	38.1	25.6	31.2	36.7	24.2	29.7	35.1	22.4	27.4	32.5
		67	TC	39.4	39.4	39.4	36.7	36.7	36.7	33.7	33.7	33.7	30.5	30.5	30.5
			SHC	22.4	28	33.6	21.2	26.8	32.4	20.0	25.6	31.2	18.7	24.3	29.9
		72	TC	43.3	43.3	43.3	41.0	41.0	41.0	38.3	38.3	38.3	35.2	35.2	35.2
			SHC	17.2	22.8	28.4	16.4	22.0	27.7	15.3	21.0	26.6	14.2	19.8	25.4
		76	TC	–	45.8	45.8	–	44.0	44.0	–	41.6	41.6	–	38.6	38.6
			SHC	–	18.4	24.2	–	17.8	23.5	–	16.9	22.7	–	15.9	21.6
1200 Cfm	EAT (wb)	58	TC	35.7	35.7	40.5	33.5	33.5	38.1	31.3	31.3	35.6	28.9	28.9	32.9
			SHC	30.8	35.7	40.5	28.9	33.5	38.1	27.0	31.3	35.6	24.9	28.9	32.9
		62	TC	36.3	36.3	41.5	33.6	33.6	39.7	31.3	31.3	37.1	29.0	29.0	34.3
			SHC	28.9	35.2	41.5	27.4	33.6	39.7	25.6	31.3	37.1	23.6	29.0	34.3
		67	TC	40.4	40.4	40.4	37.8	37.8	37.8	34.7	34.7	34.7	31.4	31.4	32.6
			SHC	23.6	30.0	36.4	22.5	28.9	35.3	21.3	27.6	34.0	19.9	26.3	32.6
		72	TC	44.1	44.1	44.1	42.0	42.0	42.0	39.2	39.2	39.2	36.0	36.0	36.0
			SHC	17.7	23.9	30.2	16.9	23.3	29.6	15.9	22.3	28.6	14.7	21.1	27.5
		76	TC	–	46.6	46.6	–	44.4	44.4	–	42.3	42.3	–	39.4	39.4
			SHC	–	19.0	25.5	–	18.3	24.7	–	17.6	24.0	–	16.6	23.1
1350 Cfm	EAT (wb)	58	TC	37.5	37.5	42.6	35.1	35.1	40.0	32.8	32.8	37.3	30.3	30.3	34.5
			SHC	32.4	37.5	42.6	30.3	35.1	40.0	28.3	32.8	37.3	26.1	30.3	34.5
		62	TC	37.6	37.6	44.4	35.2	35.2	41.6	32.8	32.8	38.8	30.3	30.3	35.9
			SHC	30.7	37.6	44.4	28.8	35.2	41.6	26.8	32.8	38.8	24.8	30.3	35.9
		67	TC	41.2	41.2	41.2	38.6	38.6	38.6	35.6	35.6	36.7	32.2	32.2	35.3
			SHC	24.8	31.9	39	23.7	30.8	38.0	22.5	29.6	36.7	21.1	28.2	35.3
		72	TC	44.7	44.7	44.7	42.7	42.7	42.7	39.9	39.9	39.9	36.7	36.7	36.7
			SHC	18.0	24.9	31.8	17.3	24.4	31.5	16.3	23.5	30.6	15.2	22.3	29.5
		76	TC	–	47.2	47.2	–	44.9	44.9	–	42.9	42.9	–	39.9	39.9
			SHC	–	19.5	26.6	–	18.7	25.7	–	18.1	25.2	–	17.2	24.4
1500 Cfm	EAT (wb)	58	TC	38.8	38.8	44.1	36.6	36.6	41.6	34.1	34.1	38.8	31.5	31.5	35.8
			SHC	33.5	38.8	44.1	31.6	36.6	41.6	29.4	34.1	38.8	27.2	31.5	35.8
		62	TC	38.8	38.8	45.9	36.6	36.6	43.3	34.1	34.1	40.4	31.6	31.6	37.3
			SHC	31.7	38.8	45.9	29.9	36.6	43.3	27.9	34.1	40.4	25.8	31.6	37.3
		67	TC	41.8	41.8	41.8	39.2	39.2	40.6	36.3	36.3	39.3	32.8	32.8	37.9
			SHC	25.8	33.6	41.4	24.9	32.7	40.6	23.7	31.5	39.3	22.3	30.1	37.9
		72	TC	45.2	45.2	45.2	43.2	43.2	43.2	40.5	40.5	40.5	37.2	37.2	37.2
			SHC	18.4	25.8	33.3	17.7	25.4	33.2	16.8	24.6	32.5	15.6	23.5	31.4
		76	TC	–	47.6	47.6	–	45.2	45.2	–	43.2	43.2	–	40.3	40.3
			SHC	–	19.9	27.5	–	19.1	26.7	–	18.6	26.3	–	17.7	25.6

= Indicates standard rating point

LEGEND:

– = Do not operate in this region (Points are outside SST and SDT permissible operating range)
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 1−Stage Cooling 4 TONS

RHS048				AMBIENT TEMPERATURE											
				85			95			105			115		
				EA (dB)			EA (dB)			EA (dB)			EA (dB)		
				75	80	85	75	80	85	75	80	85	75	80	85
1200 Cfm	EAT (wb)	58	TC	41.7	41.7	46.9	39.9	39.9	45.1	37.8	37.8	43.1	35.6	35.6	41.0
			SHC	36.5	41.7	46.9	34.7	39.9	45.1	32.5	37.8	43.1	30.3	35.6	41.0
		62	TC	44.1	44.1	44.1	42.0	42.0	43.1	39.4	39.4	41.9	36.7	36.7	40.6
			SHC	33.7	38.9	44.1	32.6	37.8	43.1	31.3	36.6	41.9	29.8	35.2	40.6
		67	TC	48.8	48.8	48.8	46.4	46.4	46.4	43.7	43.7	43.7	40.9	40.9	40.9
			SHC	28.2	33.4	38.6	27.1	32.4	37.6	25.9	31.3	36.6	24.6	30.0	35.4
		72	TC	53.2	53.2	53.2	50.7	50.7	50.7	48.1	48.1	48.1	45.2	45.2	45.2
			SHC	22.3	27.5	32.7	21.3	26.5	31.8	20.2	25.5	30.8	18.9	24.4	29.8
		76	TC	–	56.2	56.2	–	53.8	53.8	–	51.1	51.1	–	48.0	48.0
			SHC	–	22.5	27.7	–	21.7	27.0	–	20.8	26.1	–	19.7	25.1
1400 cfm	EAT (wb)	58	TC	44.1	44.1	50.2	42.2	42.2	48.3	40.2	40.2	46.4	38.0	38.0	44.3
			SHC	38.1	44.1	50.2	36.1	42.2	48.3	34.0	40.2	46.4	31.7	38.0	44.3
		62	TC	45.8	45.8	48.3	43.3	43.3	47.1	40.8	40.8	45.8	38.0	38.0	44.3
			SHC	36.2	42.3	48.3	34.9	41.0	47.1	33.4	39.6	45.8	31.7	38.0	44.3
		67	TC	50.2	50.2	50.2	47.7	47.7	47.7	44.9	44.9	44.9	42.0	42.0	42.0
			SHC	29.7	35.8	41.9	28.7	34.8	40.9	27.5	33.7	39.9	26.2	32.5	38.8
		72	TC	54.4	54.4	54.4	52.0	52.0	52.0	49.2	49.2	49.2	46.2	46.2	46.2
			SHC	22.9	28.9	35.0	21.9	28.0	34.1	20.8	27.0	33.2	19.5	25.8	32.2
		76	TC	–	57.1	57.1	–	54.8	54.8	–	52.0	52.0	–	48.7	48.7
			SHC	–	23.3	29.4	–	22.5	28.6	–	21.5	27.7	–	20.3	26.7
1600 Cfm	EAT (wb)	58	TC	46.1	46.1	53.1	44.0	44.0	51.0	41.9	41.9	48.9	39.6	39.6	46.8
			SHC	39.2	46.1	53.1	37.1	44.0	51.0	34.8	41.9	48.9	32.4	39.6	46.8
		62	TC	46.9	46.9	52.1	44.6	44.6	50.5	42.0	42.0	49.0	39.6	39.6	46.8
			SHC	38.2	45.2	52.1	36.5	43.5	50.5	34.9	42.0	49.0	32.4	39.6	46.8
		67	TC	51.2	51.2	51.2	48.7	48.7	48.7	45.9	45.9	45.9	42.8	42.8	42.8
			SHC	31.1	38.0	45.0	30.1	37.1	44.0	28.9	35.9	43.0	27.5	34.7	42.0
		72	TC	55.3	55.3	55.3	52.9	52.9	52.9	50.0	50.0	50.0	46.9	46.9	46.9
			SHC	23.2	30.1	37.1	22.3	29.3	36.3	21.2	28.3	35.4	19.9	27.1	34.4
		76	TC	–	57.8	57.8	–	55.4	55.4	–	52.6	52.6	–	49.3	49.3
			SHC	–	23.9	30.8	–	23.1	30.1	–	22.1	29.2	–	20.9	28.2
1800 Cfm	EAT (wb)	58	TC	47.7	47.7	55.5	45.6	45.6	53.5	43.4	43.4	51.3	41.0	41.0	49.1
			SHC	39.9	47.7	55.5	37.8	45.6	53.5	35.4	43.4	51.3	32.8	41.0	49.1
		62	TC	47.9	47.9	55.7	45.7	45.7	53.5	43.4	43.4	51.4	41.0	41.0	49.1
			SHC	40.1	47.9	55.7	37.8	45.7	53.5	35.5	43.4	51.4	32.9	41.0	49.1
		67	TC	52.0	52.0	52.0	49.4	49.4	49.4	46.6	46.6	46.6	43.5	43.5	45.0
			SHC	32.3	40.1	47.9	31.3	39.2	47.1	30.1	38.1	46.0	28.7	36.9	45.0
		72	TC	55.9	55.9	55.9	53.5	53.5	53.5	50.6	50.6	50.6	47.4	47.4	47.4
			SHC	23.4	31.3	39.1	22.6	30.5	38.3	21.5	29.5	37.4	20.1	28.3	36.4
		76	TC	–	58.3	58.3	–	55.9	55.9	–	53.1	53.1	–	49.6	49.6
			SHC	–	24.4	32.2	–	23.6	31.5	–	22.6	30.6	–	21.4	29.6
2000 Cfm	EAT (wb)	58	TC	49.1	49.1	57.7	46.9	46.9	55.7	44.6	44.6	53.5	42.1	42.1	51.1
			SHC	40.4	49.1	57.7	38.2	46.9	55.7	35.8	44.6	53.5	33.1	42.1	51.1
		62	TC	49.1	49.1	57.7	47.0	47.0	55.7	44.7	44.7	53.5	42.2	42.2	51.2
			SHC	40.4	49.1	57.7	38.2	47.0	55.7	35.8	44.7	53.5	33.1	42.2	51.2
		67	TC	52.6	52.6	52.6	50.0	50.0	50.0	47.1	47.1	49.0	44.0	44.0	47.9
			SHC	33.4	42.0	50.7	32.5	41.2	49.9	31.2	40.1	49.0	29.8	38.8	47.9
		72	TC	56.4	56.4	56.4	53.9	53.9	53.9	51.1	51.1	51.1	47.8	47.8	47.8
			SHC	23.6	32.2	40.9	22.8	31.5	40.3	21.7	30.6	39.4	20.3	29.3	38.4
		76	TC	–	58.6	58.6	–	56.3	56.3	–	53.4	53.4	–	49.9	49.9
			SHC	–	24.8	33.5	–	24.0	32.8	–	23.1	32.0	–	21.8	30.9

// = Indicates standard rating point

LEGEND:

– = Do not operate in this region (Points are outside SST and SDT permissible operating range)
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 1−Stage Cooling 5 TONS

RHS060				AMBIENT TEMPERATURE											
				85			95			105			115		
				EA (dB)			EA (dB)			EA (dB)			EA (dB)		
				75	80	85	75	80	85	75	80	85	75	80	85
1500 Cfm	EAT (wb)	58	TC	52.7	52.7	59.2	49.9	49.9	56.5	46.9	46.9	53.6	43.6	43.6	50.4
			SHC	46.2	52.7	59.2	43.4	49.9	56.5	40.3	46.9	53.6	36.8	43.6	50.4
		62	TC	55.5	55.5	55.8	52.1	52.1	54.3	48.1	48.1	52.4	43.7	43.7	50.3
			SHC	42.8	49.3	55.8	41.1	47.7	54.3	39.2	45.8	52.4	36.7	43.5	50.3
		67	TC	61.7	61.7	61.7	58.1	58.1	58.1	54.1	54.1	54.1	49.6	49.6	49.6
			SHC	35.6	42.1	48.6	34.0	40.5	47.1	32.2	38.8	45.5	30.2	37.0	43.8
		72	TC	68.0	68.0	68.0	64.3	64.3	64.3	60.1	60.1	60.1	55.5	55.5	55.5
			SHC	27.9	34.4	40.9	26.4	33.0	39.6	24.7	31.4	38.1	22.8	29.7	36.5
		76	TC	–	72.9	72.9	–	69.0	69.0	–	64.5	64.5	–	59.5	59.5
			SHC	–	28.0	34.5	–	26.6	33.2	–	25.1	31.8	–	23.4	30.2
1750 Cfm	EAT (wb)	58	TC	56.0	56.0	63.6	53.0	53.0	60.7	49.9	49.9	57.7	46.5	46.5	54.5
			SHC	48.4	56.0	63.6	45.4	53.0	60.7	42.2	49.9	57.7	38.6	46.5	54.5
		62	TC	57.6	57.6	61.6	54.1	54.1	59.9	50.1	50.1	57.6	46.6	46.6	54.5
			SHC	46.4	54.0	61.6	44.6	52.2	59.9	42.1	49.8	57.6	38.7	46.6	54.5
		67	TC	63.6	63.6	63.6	59.9	59.9	59.9	55.7	55.7	55.7	51.1	51.1	51.1
			SHC	38.0	45.6	53.2	36.4	44.0	51.7	34.5	42.3	50.1	32.5	40.5	48.4
		72	TC	69.9	69.9	69.9	66.0	66.0	66.0	61.7	61.7	61.7	56.9	56.9	56.9
			SHC	29.0	36.6	44.2	27.5	35.2	42.8	25.7	33.5	41.3	23.7	31.7	39.7
		76	TC	–	74.6	74.6	–	70.6	70.6	–	65.8	65.8	–	60.5	60.5
			SHC	–	29.2	36.8	–	27.8	35.5	–	26.1	34.0	–	24.3	32.3
2000 Cfm	EAT (wb)	58	TC	58.8	58.8	67.4	55.8	55.8	64.5	52.5	52.5	61.4	48.8	48.8	57.9
			SHC	50.1	58.8	67.4	47.0	55.8	64.5	43.6	52.5	61.4	39.7	48.8	57.9
		62	TC	59.3	59.3	66.9	55.9	55.9	64.6	52.5	52.5	61.4	48.8	48.8	57.9
			SHC	49.5	58.2	66.9	47.1	55.9	64.6	43.6	52.5	61.4	39.8	48.8	57.9
		67	TC	65.1	65.1	65.1	61.3	61.3	61.3	56.9	56.9	56.9	52.2	52.2	52.8
			SHC	40.2	48.9	57.6	38.6	47.3	56.1	36.7	45.6	54.5	34.6	43.7	52.8
		72	TC	71.3	71.3	71.3	67.3	67.3	67.3	62.8	62.8	62.8	57.8	57.8	57.8
			SHC	29.9	38.6	47.3	28.3	37.1	45.9	26.5	35.5	44.4	24.5	33.6	42.7
		76	TC	–	75.9	75.9	–	71.7	71.7	–	66.6	66.6	–	61.2	61.2
			SHC	–	30.2	38.9	–	28.7	37.6	–	27.0	36.0	–	25.1	34.3
2250 Cfm	EAT (wb)	58	TC	61.0	61.0	70.8	57.9	57.9	67.8	54.5	54.5	64.5	50.7	50.7	60.9
			SHC	51.3	61.0	70.8	48.1	57.9	67.8	44.5	54.5	64.5	40.5	50.7	60.9
		62	TC	61.1	61.1	70.8	58.0	58.0	67.8	54.6	54.6	64.6	50.7	50.7	61.0
			SHC	51.3	61.1	70.8	48.1	58.0	67.8	44.6	54.6	64.6	40.5	50.7	61.0
		67	TC	66.2	66.2	66.2	62.3	62.3	62.3	57.9	57.9	58.8	53.1	53.1	57.0
			SHC	42.3	52.0	61.8	40.6	50.5	60.4	38.7	48.7	58.8	36.6	46.8	57.0
		72	TC	72.3	72.3	72.3	68.3	68.3	68.3	63.7	63.7	63.7	58.5	58.5	58.5
			SHC	30.6	40.4	50.2	29.1	39.0	48.9	27.2	37.3	47.3	25.0	35.3	45.5
		76	TC	–	76.9	76.9	–	72.5	72.5	–	67.4	67.4	–	61.8	61.8
			SHC	–	31.1	40.9	–	29.6	39.5	–	27.9	37.9	–	25.9	36.2
2500 Cfm	EAT (wb)	58	TC	63.0	63.0	73.8	59.8	59.8	70.7	56.2	56.2	67.3	52.3	52.3	63.7
			SHC	52.1	63.0	73.8	48.8	59.8	70.7	45.1	56.2	67.3	41.0	52.3	63.7
		62	TC	63.0	63.0	73.9	59.8	59.8	70.8	56.3	56.3	67.4	52.4	52.4	63.7
			SHC	52.2	63.0	73.9	48.9	59.8	70.8	45.2	56.3	67.4	41.0	52.4	63.7
		67	TC	67.2	67.2	67.2	63.1	63.1	64.5	58.7	58.7	62.8	53.8	53.8	61.0
			SHC	44.2	55.0	65.9	42.5	53.5	64.5	40.6	51.7	62.8	38.3	49.6	61.0
		72	TC	73.2	73.2	73.2	69.0	69.0	69.0	64.3	64.3	64.3	59.0	59.0	59.0
			SHC	31.3	42.2	53.1	29.7	40.7	51.7	27.8	38.9	50.1	25.5	36.9	48.3
		76	TC	–	77.7	77.7	–	73.1	73.1	–	67.9	67.9	–	62.2	62.2
			SHC	–	32.0	42.9	–	30.5	41.5	–	28.6	39.8	–	26.6	38.0

⁄⁄ = Indicates standard rating point

LEGEND:

– = Do not operate in this region (Points are outside SST and SDT permissible operating range)
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 – HEATING CAPACITIES 3 TONS

RETURN AIR (°F db)	CFM (STANDARD AIR)		TEMPERATURE AIR ENTERING OUTDOOR COIL (°F db at 70% rh)								
			–10	0	10	17	30	40	47	50	60
55	900	Capacity	11.6	15.1	18.9	21.7	27.6	32.7	36.0	37.1	41.8
		Int. Cap.	10.7	13.9	17.4	19.8	24.2	32.7	36.0	37.1	41.8
	1200	Capacity	12.0	15.5	19.4	22.3	28.4	33.5	36.7	37.8	42.7
		Int. Cap.	11.1	14.3	17.8	20.3	24.9	33.5	36.7	37.8	42.7
	1500	Capacity	12.6	16.3	20.2	23.1	29.5	34.2	37.5	38.6	43.5
		Int. Cap.	11.6	15.0	18.5	21.1	25.8	34.2	37.5	38.6	43.5
70	900	Capacity	9.8	13.3	17.2	20.0	25.6	30.4	34.5	35.5	40.2
		Int. Cap.	9.0	12.3	15.7	18.2	22.5	30.4	34.5	35.5	40.2
	1200	Capacity	10.1	13.8	17.7	20.7	26.6	31.7	35.4	36.5	41.2
		Int. Cap.	9.3	12.7	16.3	18.8	23.3	31.7	35.4	36.5	41.2
	1500	Capacity	10.8	14.6	18.6	21.5	27.7	33.0	36.4	37.4	42.0
		Int. Cap.	10.0	13.4	17.1	19.6	24.3	33.0	36.4	37.4	42.0
80	900	Capacity	8.3	11.9	15.7	18.6	24.1	29.0	32.7	34.1	39.0
		Int. Cap.	7.7	10.9	14.4	16.9	21.2	29.0	32.7	34.1	39.0
	1200	Capacity	8.6	12.4	16.3	19.3	25.1	30.2	34.3	35.4	40.1
		Int. Cap.	8.0	11.4	15.0	17.6	22.0	30.2	34.3	35.4	40.1
	1500	Capacity	9.3	13.2	17.2	20.2	26.2	31.4	35.5	36.5	41.1
		Int. Cap.	8.6	12.1	15.8	18.4	23.0	31.4	35.5	36.5	41.1

Table 10 – HEATING CAPACITIES 4 TONS

RETURN AIR (°F db)	CFM (STANDARD AIR)		TEMPERATURE AIR ENTERING OUTDOOR COIL (°F db at 70% rh)								
			–10	0	10	17	30	40	47	50	60
55	1200	Capacity	17.5	22.0	26.6	30.0	36.8	42.6	47.1	48.9	55.3
		Int. Cap.	16.2	20.2	24.4	27.3	32.2	42.6	47.1	48.9	55.3
	1600	Capacity	17.5	22.1	26.7	30.2	37.3	43.5	47.9	49.8	56.1
		Int. Cap.	16.2	20.3	24.5	27.5	32.7	43.5	47.9	49.8	56.1
	2000	Capacity	18.5	23.1	27.8	31.3	38.7	44.9	49.1	50.9	57.1
		Int. Cap.	17.1	21.3	25.5	28.6	33.9	44.9	49.1	50.9	57.1
70	1200	Capacity	15.8	20.3	25.0	28.3	35.0	40.5	44.7	46.7	53.0
		Int. Cap.	14.6	18.7	22.9	25.8	30.6	40.5	44.7	46.7	53.0
	1600	Capacity	15.9	20.5	25.3	28.7	35.6	41.3	45.8	47.8	53.9
		Int. Cap.	14.7	18.9	23.2	26.1	31.2	41.3	45.8	47.8	53.9
	2000	Capacity	17.0	21.7	26.5	29.9	36.9	42.9	47.3	49.1	55.2
		Int. Cap.	15.7	20.0	24.3	27.3	32.4	42.9	47.3	49.1	55.2
80	1200	Capacity	14.2	18.8	23.5	26.9	33.6	39.0	43.2	45.1	51.4
		Int. Cap.	13.1	17.3	21.6	24.6	29.4	39.0	43.2	45.1	51.4
	1600	Capacity	14.4	19.1	23.9	27.4	34.2	39.8	44.2	46.1	52.4
		Int. Cap.	13.3	17.6	22.0	25.0	30.0	39.8	44.2	46.1	52.4
	2000	Capacity	15.5	20.3	25.2	28.7	35.6	41.4	45.9	47.8	53.8
		Int. Cap.	14.3	18.7	23.1	26.1	31.2	41.4	45.9	47.8	53.8

////// = Indicates standard rating point

▨ – Indicates operation not permissible

LEGEND

Capacity – Instantaneous Capacity (1000 Btuh) includes indoor fan motor heat @ARI static conditions

Int. Cap. – Integrated Capacity is Instantaneous Capacity minus the effects of frost on the outdoor coil and the heat required to defrost

rh – Relative Humidity

db – Dry Bulb

Table 11 – HEATING CAPACITIES 5 TONS

RETURN AIR (°F DB)	CFM (STANDARD AIR)		TEMPERATURE AIR ENTERING OUTDOOR COIL (°F DB AT 70% RH)								
			–10	0	10	17	30	40	47	50	60
55	1500	Capacity	22.7	28.3	34.2	38.6	47.4	54.3	60.0	62.6	70.3
		Int. Cap.	21.0	26.1	31.4	35.2	41.5	54.3	60.0	62.6	70.3
	2000	Capacity	22.8	28.5	34.4	38.9	47.9	55.3	60.9	63.1	70.9
		Int. Cap.	21.1	26.2	31.6	35.4	42.0	55.3	60.9	63.1	70.9
	2500	Capacity	24.2	30.0	35.9	40.4	49.6	56.9	62.3	64.4	72.0
		Int. Cap.	22.4	27.6	33.0	36.8	43.5	56.9	62.3	64.4	72.0
70	1500	Capacity	19.9	25.8	31.9	36.3	45.2	51.7	57.6	60.0	67.9
		Int. Cap.	18.4	23.7	29.3	33.1	39.6	51.7	57.6	60.0	67.9
	2000	Capacity	20.1	26.1	32.3	36.7	45.8	52.9	58.4	61.0	68.8
		Int. Cap.	18.6	24.0	29.6	33.5	40.1	52.9	58.4	61.0	68.8
	2500	Capacity	21.5	27.6	33.8	38.3	47.5	54.7	60.4	62.7	70.2
		Int. Cap.	19.9	25.4	31.1	35.0	41.6	54.7	60.4	62.7	70.2
80	1500	Capacity	17.6	23.7	30.0	34.6	43.5	50.2	55.7	58.2	66.1
		Int. Cap.	16.3	21.9	27.6	31.5	38.1	50.2	55.7	58.2	66.1
	2000	Capacity	17.8	24.1	30.5	35.1	44.3	51.2	56.6	59.4	67.2
		Int. Cap.	16.5	22.2	28.0	32.0	38.8	51.2	56.6	59.4	67.2
	2500	Capacity	19.3	25.6	32.1	36.8	46.0	53.1	58.8	61.1	68.8
		Int. Cap.	17.8	23.6	29.4	33.5	40.3	53.1	58.8	61.1	68.8

= Indicates standard rating point — = Indicates operation not permissible

LEGEND

Capacity – Instantaneous Capacity (1000 Btuh) includes indoor fan motor heat @ARI static conditions

Int. Cap. – Integrated Capacity is Instantaneous Capacity minus the effects of frost on the outdoor coil and the heat required to defrost

rh – Relative Humidity

db – Dry Bulb

Table 12 – STATIC PRESSURE ADDERS

Economizer *

3 − 5 TONS											
CFM (in. wg)	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.

Electric Heaters *

3 − 5 TONS										
CFM (in. wg)	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 field installed accessories only.

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 12.
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 13 – RHS036, 3 TON HORIZONTAL SUPPLY, 3 PHASE BELT DRIVE

	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]			
900							913	0.47	999	0.61
975					835	0.37	929	0.50	1015	0.64
1050					853	0.40	946	0.53	1030	0.68
1125					872	0.43	964	0.57	1047	0.72
1200					892	0.47	982	0.61	1064	0.76
1275					912	0.51	1001	0.65	1082	0.81
1350			835	0.42	933	0.55	1020	0.70	1100	0.86
1425			859	0.46	955	0.60	1040	0.75	1119	0.91
1500			883	0.51	977	0.65	1061	0.80	1138	0.97

	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)			
900	1078	0.77	1151	0.93	1220	1.11	1284	1.30	1346	1.49
975	1093	0.80	1165	0.97	1233	1.15	1297	1.33	1358	1.53
1050	1108	0.84	1180	1.01	1247	1.19	1311	1.38	1371	1.58
1125	1123	0.88	1195	1.05	1261	1.23	1325	1.42	1385	1.62
1200	1140	0.92	1210	1.10	1276	1.28	1339	1.47	1399	1.68
1275	1157	0.97	1226	1.15	1292	1.33	1354	1.53	1414	1.73
1350	1174	1.02	1243	1.20	1308	1.39	1370	1.59	1429	1.80
1425	1192	1.08	1260	1.26	1325	1.45	1386	1.65	1444	1.86
1500	1210	1.14	1278	1.33	1342	1.52	1403	1.72	1461	1.93

NOTE: For more information, see General Fan Performance Notes on page 21.

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

Table 14 – RHS036, 3 TON VERTICAL SUPPLY, 3 PHASE BELT DRIVE

	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]					
900					867	0.37	981	0.52	1084	0.68
975					881	0.40	991	0.55	1092	0.71
1050					896	0.43	1003	0.58	1102	0.75
1125					912	0.47	1017	0.62	1113	0.79
1200					930	0.51	1032	0.66	1126	0.83
1275			841	0.41	949	0.55	1048	0.71	1140	0.88
1350			864	0.46	968	0.60	1065	0.76	1155	0.93
1425			888	0.50	989	0.65	1083	0.81	1171	0.99
1500			913	0.56	1011	0.71	1103	0.87	1188	1.05

	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)						High Static (Field Supplied Parts Required)	
900	1180	0.86	1269	1.05	1354	1.25	1434	1.47	**1511**	**1.70**
975	1186	0.89	1275	1.08	1358	1.29	1437	1.51	**1513**	**1.74**
1050	1194	0.92	1281	1.12	1363	1.32	1441	1.54	**1516**	**1.78**
1125	1204	0.97	1289	1.16	1370	1.37	1447	1.59	**1520**	**1.82**
1200	1215	1.01	1298	1.21	1378	1.42	1454	1.64	**1526**	**1.87**
1275	1227	1.06	1309	1.26	1387	1.47	1462	1.69	**1533**	**1.92**
1350	1240	1.12	1321	1.32	1397	1.53	**1471**	**1.75**	**1541**	**1.99**
1425	1254	1.18	1333	1.38	1409	1.59	**1481**	**1.82**	–	–
1500	1270	1.24	1347	1.45	1421	1.66	**1492**	**1.89**	–	–

NOTE: For more information, see General Fan Performance Notes on page 21.

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

BOLD FACE – Use field–supplied fan pulley (1178447), motor pulley (1170551) and belt (1178179)

FAN PERFORMANCE (cont.)

Table 15 – RHS048, 4 TON HORIZONTAL SUPPLY, 3 PHASE BELT DRIVE

	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					892	0.47	982	0.61	1064	0.76
1300					919	0.52	1007	0.67	1088	0.82
1400					947	0.58	1034	0.73	1113	0.89
1500			883	0.51	977	0.65	1061	0.80	1138	0.97
1600			916	0.58	1007	0.73	1089	0.89	1165	1.05
1700			949	0.66	1038	0.81	1118	0.97	1192	1.15
1800	888	0.60	984	0.75	1069	0.90	1148	1.07	1221	1.25
1900	927	0.69	1019	0.84	1102	1.00	1179	1.18	1250	1.36
2000	965	0.78	1054	0.94	1135	1.11	1210	1.29	1280	1.48

	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	1140	0.92	1210	1.10	1276	1.28	1339	1.47	1399	1.68
1300	1162	0.99	1232	1.16	1297	1.35	1360	1.55	1419	1.75
1400	1186	1.06	1254	1.24	1319	1.43	1381	1.63	1439	1.84
1500	1210	1.14	1278	1.33	1342	1.52	1403	1.72	1461	1.93
1600	1236	1.23	1302	1.42	1365	1.62	1425	1.82	**1483**	**2.04**
1700	1262	1.33	1328	1.52	1390	1.72	1449	1.93	**1505**	**2.15**
1800	1289	1.44	1354	1.63	1415	1.84	**1473**	**2.05**	**1529**	**2.27**
1900	1317	1.55	1380	1.75	1441	1.96	**1498**	**2.18**	–	–
2000	1345	1.68	1408	1.88	**1467**	**2.10**	**1524**	**2.32**	–	–

NOTE: For more information, see General Fan Performance Notes on page 21.

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

BOLD FACE - Use field-supplied fan pulley (1178447), motor pulley (1170551) and belt (1178179)

Table 16 – RHS048, 4 TON VERTICAL SUPPLY, 3 PHASE BELT DRIVE

	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					930	0.51	1032	0.66	1126	0.83
1300					955	0.57	1053	0.72	1145	0.89
1400			880	0.49	982	0.63	1077	0.79	1166	0.97
1500			913	0.56	1011	0.71	1103	0.87	1188	1.05
1600			948	0.63	1042	0.79	1130	0.96	1213	1.14
1700	887	0.57	983	0.72	1073	0.88	1158	1.06	1239	1.24
1800	928	0.66	1020	0.82	1106	0.98	1188	1.16	1266	1.35
1900	969	0.76	1057	0.92	1140	1.09	1219	1.28	1295	1.48
2000	1010	0.87	1095	1.04	1175	1.21	1251	1.41	1325	1.61

	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)				High Static (Field Supplied Parts Required)	
1200	1215	1.01	1298	1.21	1378	1.42	1454	1.64	**1526**	**1.87**
1300	1231	1.08	1313	1.28	1390	1.49	1465	1.71	**1538**	**1.94**
1400	1249	1.16	1329	1.36	1405	1.57	**1478**	**1.79**	–	–
1500	1270	1.24	1347	1.45	1421	1.66	**1492**	**1.89**	–	–
1600	1292	1.34	1367	1.54	1440	1.76	**1509**	**1.99**	–	–
1700	1315	1.44	1389	1.65	1459	1.88	**1527**	**2.11**	–	–
1800	1341	1.56	1412	1.77	**1481**	**2.00**	–	–	–	–
1900	1367	1.68	1437	1.90	**1504**	**2.13**	–	–	–	–
2000	1395	1.82	**1483**	**2.04**	**1528**	**2.28**	–	–	–	–

NOTE: For more information, see General Fan Performance Notes on page 21.

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

BOLD FACE - Use field-supplied fan pulley (1178447), motor pulley (1170551) and belt (1178179)

FAN PERFORMANCE (cont.)

Table 17 – RHS060, 5 TON HORIZONTAL SUPPLY, 3 PHASE BELT DRIVE

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
CFM									Medium Static (Field Supplied Parts Required)[1]	
1500									1101	0.90
1625									1131	1.00
1750							1087	0.94	1162	1.11
1875							1120	1.05	1194	1.23
2000					1075	1.00	1154	1.18	1226	1.36
2125					1112	1.13	1189	1.31	1260	1.50
2250			1067	1.08	1149	1.27	1224	1.46	1294	1.66
2375			1107	1.23	1187	1.43	1261	1.63	1329	1.84
2500			1148	1.39	1226	1.59	1297	1.81	1364	2.02

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
CFM	Medium Static (Field Supplied Parts Required)[1]								High Static(Standard)	
1500	1172	1.06	1239	1.23	1302	1.40	1361	1.58	1418	1.77
1625	1201	1.16	1267	1.34	1329	1.52	1388	1.71	1444	1.90
1750	1231	1.28	1296	1.46	1358	1.65	1416	1.84	1472	2.04
1875	1262	1.41	1326	1.60	1387	1.79	1445	1.99	1499	2.20
2000	1294	1.55	1357	1.74	1417	1.95	1474	2.15	1528	2.36
2125	1326	1.70	1388	1.90	1447	2.11	1504	2.33	1557	2.55
2250	1359	1.87	1420	2.08	1479	2.29	1534	2.51	1587	2.74
2375	1393	2.05	1453	2.27	1511	2.49	1566	2.72		
2500	1427	2.24	1487	2.47	1543	2.70	1597	2.94		

NOTE: For more information, see General Fan Performance Notes on page 21.

1. Achieve medium static by using field-supplied motor pulley (TBD), blower pulley TBD and belt (TBD)

Table 18 – RHS060, 5 TON VERTICAL SUPPLY, 3 PHASE BELT DRIVE

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
CFM							Medium Static (Field Supplied Parts Required)[1]			
1500							1074	0.85	1147	1.00
1625							1113	0.96	1185	1.13
1750					1075	0.92	1153	1.09	1223	1.26
1875					1117	1.05	1193	1.23	1263	1.41
2000			1078	1.00	1160	1.19	1235	1.39	1303	1.58
2125			1124	1.15	1204	1.35	1277	1.56	1343	1.76
2250	1083	1.11	1170	1.32	1248	1.53	1319	1.74	1385	1.96
2375	1133	1.28	1217	1.50	1293	1.72	1363	1.95	1427	2.17
2500	1183	1.47	1265	1.70	1339	1.93	1406	2.17	1470	2.41

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
CFM	Medium Static (Field Supplied Parts Required)[1]						High Static (Standard)			
1500	1214	1.16	1277	1.33	1336	1.50	1392	1.67	1445	1.85
1625	1251	1.30	1313	1.47	1371	1.65	1427	1.83	1479	2.02
1750	1289	1.44	1350	1.63	1407	1.81	1462	2.01	1514	2.20
1875	1327	1.60	1387	1.80	1444	1.99	1498	2.19	1550	2.40
2000	1366	1.78	1426	1.98	1482	2.19	1535	2.40	1586	2.61
2125	1406	1.97	1464	2.18	1520	2.40	1573	2.62	1623	2.84
2250	1446	2.18	1504	2.40	1559	2.62	1611	2.85		
2375	1487	2.40	1544	2.63	1598	2.87				
2500	1529	2.64	1585	2.89						

NOTE: For more information, see General Fan Performance Notes on page 21.

1. Achieve medium static by using field-supplied motor pulley (TBD), blower pulley TBD and belt (TBD)

FAN PERFORMANCE (cont.)

Table 19 – PULLEY ADJUSTMENT

UNIT RHS	PHASE	MOTOR/DRIVE COMBO	MOTOR PULLEY TURNS OPEN										
			0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
036	3	Medium Static	1251	1208	1165	1121	1078	1035	992	949	905	862	819
		High Static	1466	1423	1380	1337	1294	1251	1207	1164	1121	1078	1035
048	3	Medium Static	1303	1265	1226	1188	1150	1112	1073	1035	997	958	920
		High Static	1466	1423	1380	1337	1294	1251	1207	1164	1121	1078	1035
060	3	Medium Static	1380	1349	1317	1286	1254	1223	1192	1160	1129	1097	1066
		High Static	1639	1596	1553	1510	1467	1424	1380	1337	1294	1251	1208

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

– Factory settings

ECONOMIZER, BAROMETRIC RELIEF, AND PERFORMANCE

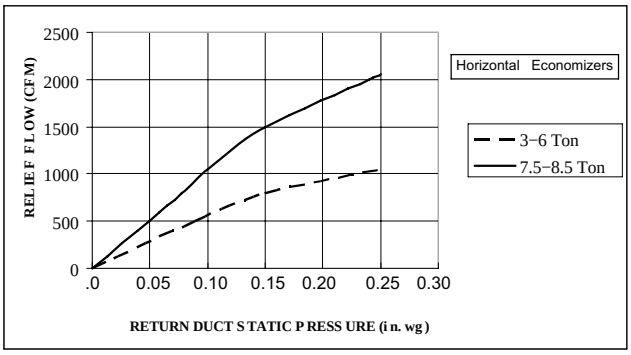


Fig 1 − Barometric Relief Flow Capacity

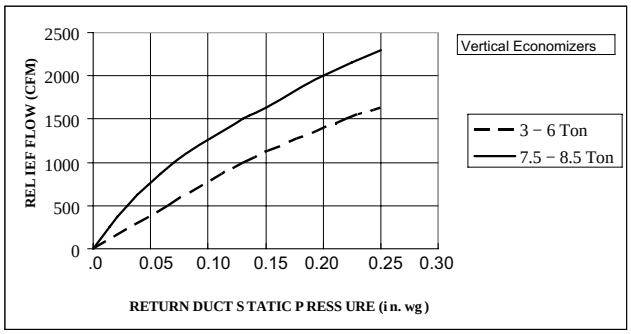


Fig 2 − Barometric Relief Flow Capacity

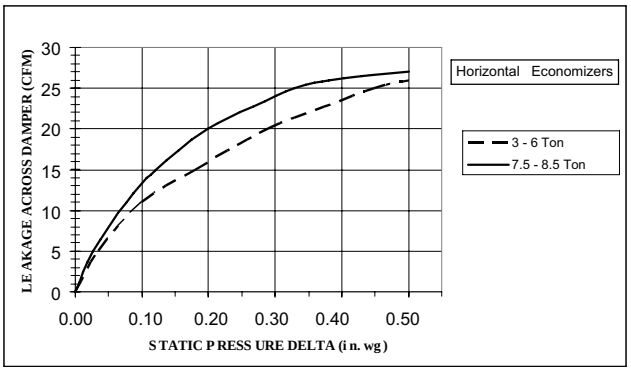


Fig 3 − Outdoor Air Damper Leakage

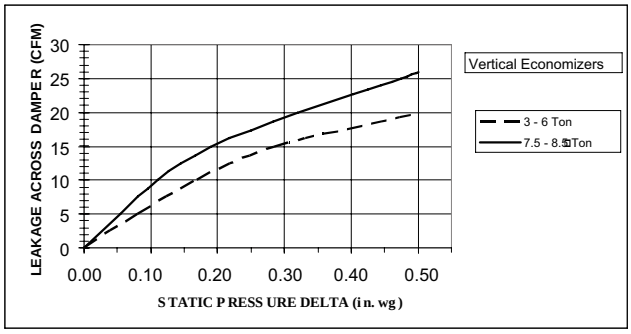


Fig 4 − Outdoor Air Damper Leakage

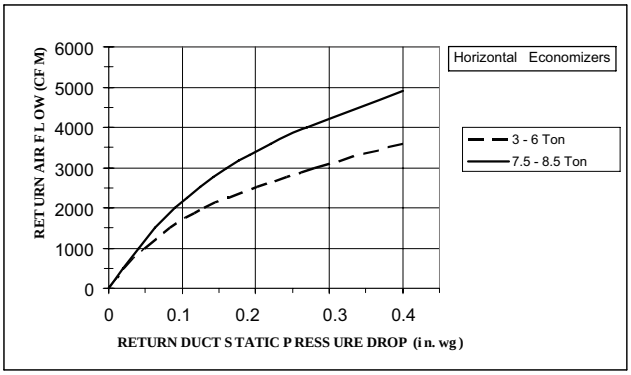


Fig 5 − Return Air Pressure Drop

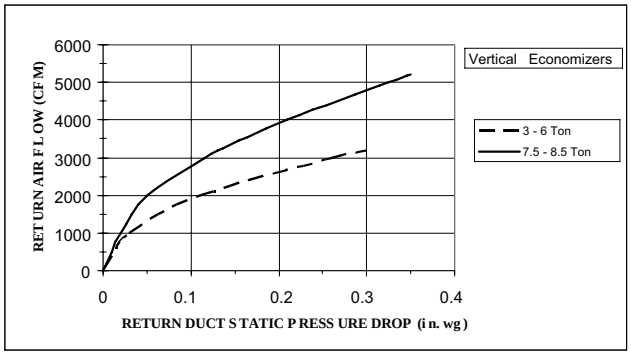


Fig 6 − Return Air Pressure Drop

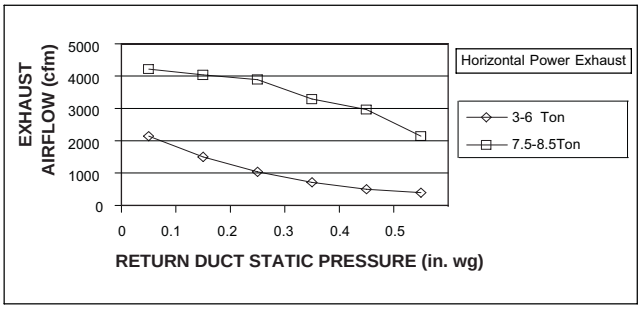


Fig 7 − Horizontal Power Exhaust Performance

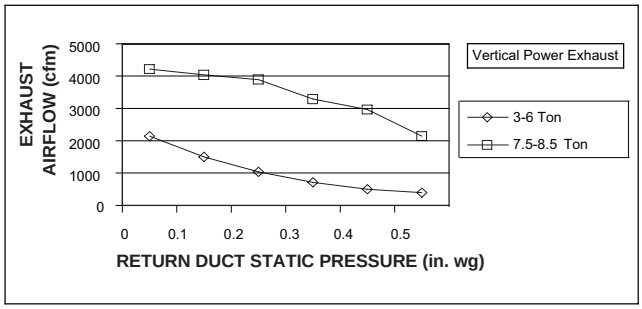


Fig 8 − Vertical Power Exhaust Performance

ELECTRICAL INFORMATION

Table 20 – RHS036, 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	13.2	88	190	0.9	HIGH	2000	5.5	80%	5.2
230−3−60	187	253	13.2	88	190	0.9	HIGH	2000	5.5	80%	5.2
460−3−60	414	506	6.0	44	190	0.5	HIGH	2000	2.7	80%	2.6

Table 21 – RHS048, 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	HIGH	2000	5.5	80%	5.2
230−3−60	187	253	13.7	83	325	1.5	HIGH	2000	5.5	80%	5.2
460−3−60	414	506	6.2	41	325	0.8	HIGH	2000	2.7	80%	2.6

Table 22 – RHS060, 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	HIGH	2770	7.9	81%	7.5
230−3−60	187	253	15.6	110	325	1.5	HIGH	2770	7.9	81%	7.5
460−3−60	414	506	7.7	52	325	0.8	HIGH	2770	3.6	81%	3.4

Table 23 – MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.

Unit RHS	V–Ph–Hz*	IFM TYPE	ELEC. HTR		WITHOUT C.O. or UNPWR C.O.							
					WITHOUT P.E.				WITH P.E.			
							DISC. SIZE				DISC. SIZE	
			Nom (kW)	FLA	MCA	MOCP	FLA	LRA	MCA	MOCP	FLA	LRA
036	208/230–3–60	MED**	–	–	22.6	30	22	109	24.5	30	24	111
			3.3/4.4	9.2/10.6	34.1/35.9	45/45	33/34	118/120	36.0/37.8	45/45	35/37	120/122
			4.9/6.5	13.6/15.6	39.6/42.1	45/50	38/40	123/125	41.5/44.0	50/50	40/42	125/127
			6.5/8.7	18.1/20.9	45.2/48.7	50/50	43/46	127/130	47.1/50.6	50/60	45/48	129/132
			7.9/10.5	21.9/25.3	50.0/54.2	50/60	47/51	131/134	51.9/56.1	60/60	50/53	133/136
			12.0/16.0	33.4/38.5	64.4/70.7	70/80	61/66	142/148	66.3/72.6	70/80	63/69	144/150
		HIGH	–	–	22.6	30	22	120	24.5	30	24	122
			3.3/4.4	9.2/10.6	34.1/35.9	45/45	33/34	129/131	36.0/37.8	45/45	35/37	131/133
			4.9/6.5	13.6/15.6	39.6/42.1	45/50	38/40	134/136	41.5/44.0	50/50	40/42	136/138
			6.5/8.7	18.1/20.9	45.2/48.7	50/50	43/46	138/141	47.1/50.6	50/60	45/48	140/143
			7.9/10.5	21.9/25.3	50.0/54.2	50/60	47/51	142/145	51.9/56.1	60/60	50/53	144/147
			12.0/16.0	33.4/38.5	64.4/70.7	70/80	61/66	153/159	66.3/72.6	70/80	63/69	155/161
	460–3–60	MED**	–	–	10.6	15	10	54	11.6	15	12	55
			6.0	7.2	19.6	20	19	61	20.6	25	20	62
			8.8	10.6	23.9	25	23	65	24.9	25	24	66
			11.5	13.8	27.9	30	26	68	28.9	30	27	69
			14.0	16.8	31.6	35	30	71	32.6	35	31	72
		HIGH	–	–	10.6	15	10	60	11.6	15	12	61
			6.0	7.2	19.6	20	19	67	20.6	25	20	68
			8.8	10.6	23.9	25	23	71	24.9	25	24	72
			11.5	13.8	27.9	30	26	74	28.9	30	27	75
			14.0	16.8	31.6	35	30	77	32.6	35	31	78
048	208/230–3–60	MED**	–	–	23.8	30	23	106	25.7	30	26	108
			4.9/6.5	13.6/15.6	40.8/43.3	50/50	39/41	120/122	42.7/45.2	50/50	41/44	122/124
			6.5/8.7	18.1/20.9	46.5/50.0	50/50	44/47	124/127	48.4/51.9	50/60	46/50	126/129
			12.0/16.0	33.4/38.5	65.6/72.0	70/80	62/68	139/145	67.5/73.9	70/80	64/70	141/147
			15.8/21.0	43.8/50.5	78.6/87.0	80/90	74/82	194/207	80.5/88.9	90/90	76/84	196/209
		HIGH	–	–	23.8	30	23	117	25.7	30	26	119
			4.9/6.5	13.6/15.6	40.8/43.3	50/50	39/41	131/133	42.7/45.2	50/50	41/44	133/135
			6.5/8.7	18.1/20.9	46.5/50.0	50/50	44/47	135/138	48.4/51.9	50/60	46/50	137/140
			12.0/16.0	33.4/38.5	65.6/72.0	70/80	62/68	150/156	67.5/73.9	70/80	64/70	152/158
			15.8/21.0	43.8/50.5	78.6/87.0	80/90	74/82	205/218	80.5/88.9	90/90	76/84	207/220
	460–3–60	MED**	–	–	11.2	15	11	52	12.2	15	12	53
			6.0	7.2	20.2	25	19	59	21.2	25	20	60
			11.5	13.8	28.4	30	27	66	29.4	30	28	67
			14.0	16.8	32.2	35	30	69	33.2	35	32	70
			23.0	27.7	45.8	50	43	107	46.8	50	44	108
		HIGH	–	–	11.2	15	11	58	12.2	15	12	59
			6.0	7.2	20.2	25	19	65	21.2	25	20	66
			11.5	13.8	28.4	30	27	72	29.4	30	28	73
			14.0	16.8	32.2	35	30	75	33.2	35	32	76
			23.0	27.7	45.8	50	43	113	46.8	50	44	114
060	208/230–3–60	MED**	–	–	26.2	40	26	144	28.1	40	28	146
			4.9/6.5	13.6/15.6	43.2/45.7	50/50	41/44	158/160	45.1/47.6	50/50	43/46	160/162
			7.9/10.5	21.9/25.3	53.6/57.8	60/60	51/55	166/169	55.5/59.7	60/60	53/57	168/171
			12.0/16.0	33.4/38.5	68.0/74.3	70/80	64/70	177/183	69.9/76.2	70/80	66/72	179/185
			15.8/21.0	43.8/50.5	81.0/89.3	90/90	76/84	232/245	82.9/91.2	90/100	78/86	234/247
			19.9/26.5	55.2/63.8	95.2/106.0	100/110	89/99	254/272	97.1/107.9	100/110	91/101	256/274
		HIGH	–	–	28.5	40	28	170	30.4	45	30	172
			4.9/6.5	13.6/15.6	45.5/48.0	50/50	44/46	184/186	47.4/49.9	50/60	46/48	186/188
			7.9/10.5	21.9/25.3	55.9/60.1	60/70	53/57	192/195	57.8/62.0	60/70	56/60	194/197
			12.0/16.0	33.4/38.5	70.3/76.6	80/80	67/73	203/209	72.2/78.5	80/80	69/75	205/211
			15.8/21.0	43.8/50.5	83.3/91.6	90/100	79/86	258/271	85.2/93.5	90/100	81/89	260/273
			19.9/26.5	55.2/63.8	97.5/108.3	100/110	92/102	280/298	99.4/110.2	100/125	94/104	282/300
	460–3–60	MED**	–	–	13.0	20	13	69	14.0	20	14	70
			6.0	7.2	22.0	25	21	76	23.0	25	22	77
			11.5	13.8	30.3	35	29	83	31.3	35	30	84
			14.0	16.8	34.0	35	32	86	35.0	40	33	87
			23.0	27.7	47.7	50	45	124	48.7	50	46	125
			25.5	30.7	51.4	60	48	130	52.4	60	49	131
		HIGH	–	–	13.8	20	14	82	14.8	20	15	83
			6.0	7.2	22.8	25	22	89	23.8	25	23	90
			11.5	13.8	31.1	35	30	96	32.1	35	31	97
			14.0	16.8	34.8	35	33	99	35.8	40	34	100
			23.0	27.7	48.5	50	46	137	49.5	50	47	138
			25.5	30.7	52.2	60	49	143	53.2	60	50	144

*Nominal values, listed as 208/240V, 480V or 600V as appropriate.
** Field supplied belts and pulleys required to achieve medium static.
See Legend and calculations on following page.

Table 24 (cont.) MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.

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

** Available from Fast Parts.

See Legend and calculations on page 30.

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.

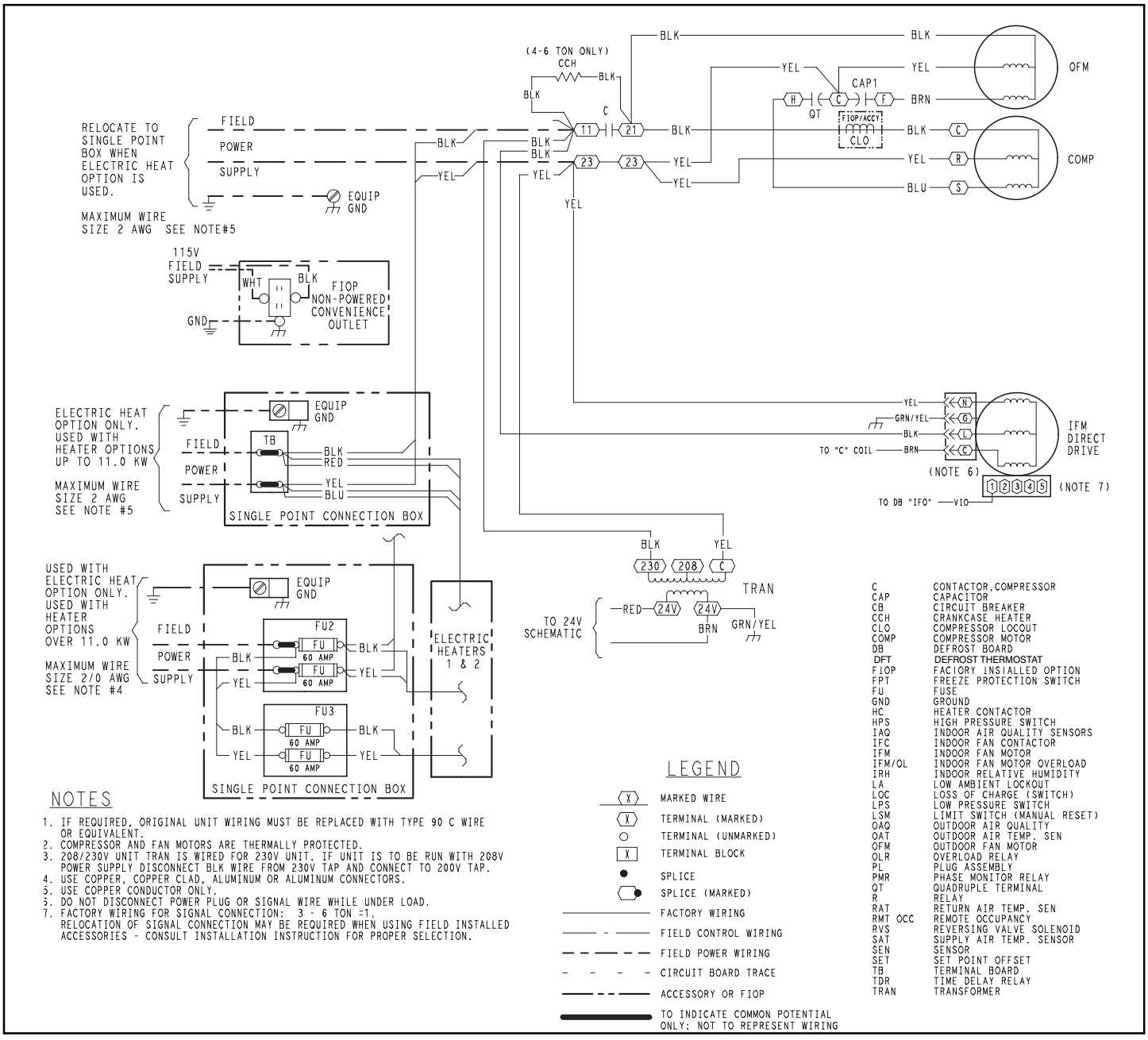


Fig. 9 Typical Power Diagram

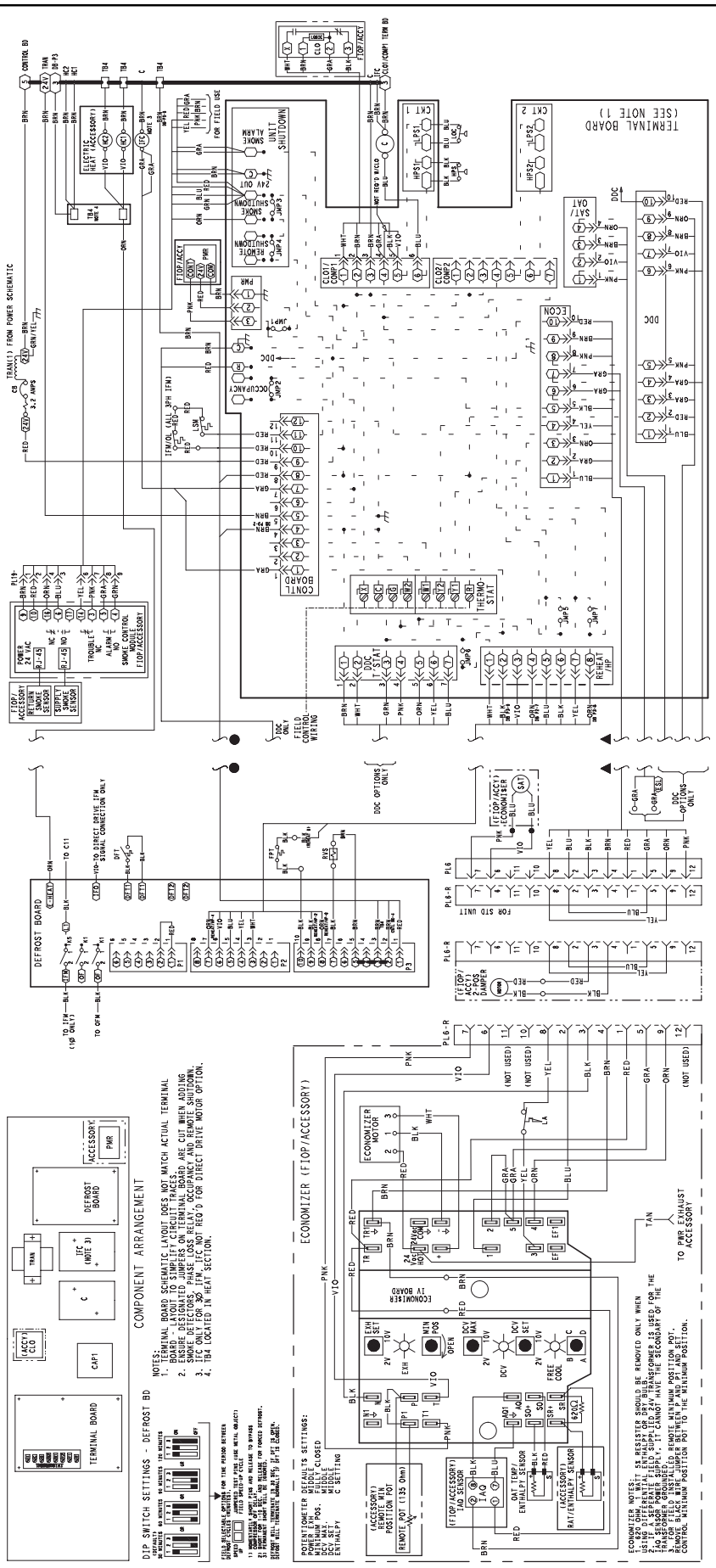


Fig. 11, 1 − Stage Typical Wiring Diagram

SEQUENCE OF OPERATION

Cooling, unit without economizer

When the field supplied commercial thermostat calls for cooling, terminals G and Y1 are energized. The indoor-fan contactor (IFC), reversing valve solenoid (RVS) and compressor contactor are energized and indoor-fan motor, compressor, and outdoor fan starts. The outdoor fan motor runs continuously while unit is cooling.

Heating, unit without economizer

Upon a request for heating from the space thermostat, terminal W1 will be energized with 24V. The IFC, outdoor-fan contactor (OFC), C1, and C2 will be energized. The indoor fan, outdoor fans, and compressor no. 1, and compressor no. 2 are energized and reversing valves are deenergized and switch position.

If the space temperature continues to fall while W1 is energized, W2 will be energized with 24V, and the heater contactor(s) (HC) will be energized, which will energize the electric heater(s).

When the space thermostat is satisfied, W2 will be deenergized first, and the electric heater(s) will be deenergized.

Upon a further rise in space temperature, W1 will be deenergized.

Cooling, unit with economizer

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 to 55°F (10° to 13°C) mixed-air temperature into the zone. As the mixed-air temperature fluctuates above 55 or below 50°F (13° to 10°C), the 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).

If optional power exhaust is installed, as the outdoor-air damper opens and closes, the power exhaust fans will be energized and deenergized.

If field-installed accessory CO_2 sensors are connected to the economizer control, a demand controlled ventilation strategy will begin to operate. As the CO_2 level in the zone increases above the CO_2 setpoint, the minimum position of the damper will be increased proportionally. As the CO_2 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. Any change in damper position will take up to 30 seconds to initiate. Damper movement from full closed to full open (or vice versa) will take between $1^1/_2$ and $2^1/_2$ minutes.

If free cooling can be used as determined from the appropriate changeover command (switch, dry bulb, enthalpy curve, differential dry bulb, or differential enthalpy), then the control will modulate the dampers open to maintain the mixed-air temperature setpoint at 50° to 55°F (10° to 13°C).

If there is a further demand for cooling (cooling second stage — Y2 is energized), then the control will bring on compressor stage 1 to maintain the mixed-air temperature setpoint. The economizer damper will be open at maximum position. economizer operation is limited to a single compressor.

Heating, unit with economizer

When the room temperature calls for heat through terminal W1, the indoor (evaporator) fan contactor (IFC) and heater contactor no. 1 (HC1) are energized and the reversing valve(s) deenergize and switches position. On units equipped for 2 stages of heat, when additional heat is needed, heater contactor no. 2 is energized through W2. The economizer damper moves to the minimum position. When the thermostat is satisfied, the damper moves to the fully closed position.

Defrost

When the temperature of the outdoor coil drops below 28°F (−2°C) as sensed by the defrost thermostat (DFT2) and the defrost timer is at the end of a timed period (adjustable at 30, 60, 90 or 120 minutes), reversing valve solenoids (RVS1 and RVS2) are energized and the OFC is deenergized. This switches the position of the reversing valves and shuts off the outdoor fan. The electric heaters (if installed) will be energized.

The unit continues to defrost until the coil temperature as measured by DFT2 reaches 65°F (18°C), or the duration of defrost cycle completes a 10-minute period.

During the Defrost mode, if circuit 1 defrosts first, RVS1 will oscillate between Heating and Cooling modes until the Defrost mode is complete.

At the end of the defrost cycle, the electric heaters (if installed) will be deenergized; the reversing valves switch and the outdoor-fan motor will be energized. The unit will now operate in the Heating mode.

If the space thermostat is satisfied during a defrost cycle, the unit will continue in the Defrost mode until the time or temperature constraints are satisfied.

Automatic changeover

When the system selection switch is set at AUTO. position, unit automatically changes from heating operation to cooling operation when the temperature of the conditioned space rises to the cooling level setting. When the temperature of the conditioned space falls to the heating level setting, unit automatically changes from cooling to heating operation (with a 3°F deadband in between).

Continuous air circulation

Turn unit power on. Set system control (field supplied commercial thermostat) at OFF position. Set fan switch at ON position. The indoor-fan contactor is energized through the thermostat switch and the indoor fan runs continuously.

Cycle-LOC™ protection

If unit operation is interrupted by an open high-pressure switch, low-pressure switch, indoor coil freeze stat, or by compressor internal line-break device (overcurrent or overtemperature), and compressor is calling for either cooling or heating, Cycle-LOC protection device simultaneously locks out unit and lights a warning light on the thermostat. Restart the unit by manually turning thermostat to OFF and then to ON position. If any of the protective devices opens again, the unit continues to lock out until corrective action is taken.

NOTE: If the unit fails to operate due to compressor over-current condition, restart by manually resetting circuit breakers at the unit. Restart cannot be accomplished at the room thermostat.

Emergency heat

If compressor is inoperative due to a tripped safety device (high or low pressure, indoor coil freeze stat, overcurrent, or overtemperature), the Cycle-LOC device locks out the compressor and lights a warning light on the room thermostat (if light opton is included). When the switch is on (thermostat is set to the EM HT position), compressor circuit and outdoor thermostats are bypassed, and the second stage of thermostat energizes the indoor blower and the electric resistance heaters.

Rooftop Packaged Heat Pump

HVAC Guide Specifications

Size Range: **3 to 5 Nominal Tons**

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

Section **Description**

23 06 80 Schedules for Decentralized HVAC Equipment

23 06 80.13 Decentralized Unitary HVAC Equipment Schedule

23 06 80.13.A. Rooftop unit schedule

1. Schedule is per the project specification requirements.

23 07 16 HVAC Equipment Insulation

23 07 16.13 Decentralized, Rooftop Units:

23 07 16.13.A. Evaporator fan compartment:

1. Interior cabinet surfaces shall be insulated with a minimum 1/2−in. thick, minimum 1 1/2 lb density, flexible 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. include capability for occupancy scheduling.

23 09 23 Direct−digital Control system for HVAC

23 09 23.13

23 09 23.13.A.

23 09 23.13.B.

23 09 33 Electric and Electronic Control System for HVAC

23 09 33.13 Decentralized, Rooftop Units:

23 09 33.13.A. General:

1. Shall be complete with self−contained low−voltage control circuit protected by a resettable circuit breaker on the 24−v transformer side. Transformer shall have 75VA capability.
2. Shall utilize color−coded wiring.
3. Shall include a central control terminal board to conveniently and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, loss of charge, freeze switch, high pressure switches.
4. Unit shall include a minimum of one 8−pin screw terminal connection board for connection of control wiring.
5. Shall include integrated defrost system to prevent excessive frost accumulation during heating duty, and shall be controlled as follows:
   a. Defrost shall be initiated on the basis of time and coil temperature.
   b. A 30,60,90,120 minute timer shall activate the defrost cycle only if the coil temperature is low enough to indicate a heavy frost condition.
   c. Defrost cycle shall terminate when defrost thermostat are satisfied and shall have a positive termination time of 10 minutes.
6. Defrost system shall also include:
   a. Defrost Cycle Indicator LED.

b. Dip switch selectable defrost time between 30,60,90 and 120 minutes. Factory set at 30 minutes.

c. Molded plug connection to insure proper connection.

23 09 33.23.B. Safeties:

1. Compressor over−temperature, over current.
2. Loss of charge switch.
   a. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross−wiring of the safety switches between circuits 1 and 2.
   b. Loss of charge switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
3. High−pressure switch.
   c. High pressure switch shall use different color wire than the low pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.
4. Freeze protection thermostat, evaporator coil (one per refrigerant circuit).
5. Automatic reset, motor thermal overload protector.

23 09 93 Sequence of Operations for HVAC Controls

23 09 93.13 Decentralized, Rooftop Units:

23 09 93.13 INSERT SEQUENCE OF OPERATION

23 40 13 Panel Air Filters

23 40 13.13 Decentralized, Rooftop Units:

23 40 13.13.A. Standard filter section

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

23 81 19 Self−Contained Air Conditioners

23 81 19.13 Small−Capacity Self−Contained Air Conditioners (RHS036−060)

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 heat pump for heating duty.
2. Factory assembled, single−piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field start−up.
3. Unit shall use environmentally safe, R−410A refrigerant.
4. Unit shall be installed in accordance with the manufacturer’s instructions.
5. Unit must be selected and installed in compliance with local, state, and federal codes.

23 81 19.13.B. Quality Assurance

1. Unit meets ASHRAE 90.1−2004 minimum efficiency requirements.
2. 3−phase units are Energy Star qualified.
3. Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.
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 (46°C) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at ± 10% voltage.
2. Compressor with standard controls shall be capable of operation from 25°F (−4°C), ambient outdoor temperatures. Accessory winter start kit is necessary if mechanically cooling at ambient temperatures below 25°F (−4°C).
3. Unit shall be capable of simultaneous heating duty and defrost cycle operation when using accessory electric heaters.
4. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
5. Unit shall be factory configured for vertical supply & return configurations.
6. Unit shall be field convertible from vertical to horizontal configuration
7. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.

23 81 19.13.G. Electrical Requirements

1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.

23 81 19.13.H. Unit Cabinet

1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre−painted baked enamel finish on all externally exposed surfaces.
2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F): 60, Hardness: H−2H Pencil hardness.
3. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2−in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil−faced fiberglass insulation shall be used in the heat compartment.
4. Base of unit shall have a minimum of three locations for thru−the−base electrical connections (field installed), standard.
5. Base Rail
   a. Unit shall have base rails on a minimum of 2 sides.
   b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
   c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
   d. Base rail shall be a minimum of 16 gauge thickness.
6. Condensate pan and connections:
   a. Shall be a sloped condensate drain pan made of a non−corrosive material.
   b. Shall comply with ASHRAE Standard 62.
   c. Shall use a 3/4” −14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer’s recommendations.
7. Top panel:
   a. Shall be a single piece top panel on 036 thru 060 sizes.
8. Electrical Connections
   a. All unit power wiring shall enter unit cabinet at a single, factory−prepared, knockout location.
   b. Thru−the−base capability
   (1.) Standard unit shall have a thru−the−base electrical location(s) using a raised, embossed portion of the unit basepan.
   (2.) Optional, factory−approved, water−tight connection method must be used for thru−the−base electrical connections.
   (3.) No basepan penetration, other than those authorized by the manufacturer, is permitted.
9. Component access panels (standard)
   a. Cabinet panels shall be easily removable for servicing.
   b. Unit shall have one factory installed, tool−less, removable, filter access panel.
   c. Panels covering control box, indoor fan, indoor fan motor, and compressors shall have molded composite handles.
   d. Handles shall be UV modified, composite. permanently attached, and recessed into the panel.
   e. Screws on the vertical portion of all removable access panel shall engage into heat resistant, molded composite collars.
   f. Collars shall be removable and easily replaceable using manufacturer recommended parts.

23 81 19.13.I. N/A

23 81 19.13.J. Coils

1. Standard Aluminum/Copper Coils: on all models.
   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 coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
   c. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

23 81 19.13.K. Refrigerant Components

1. Refrigerant circuit shall include the following control, safety, and maintenance features:
   a. Fixed orifice metering system shall prevent mal−distribution of two−phase refrigerant by including multiple fixed orifice devices in each refrigeration circuit. Each orifice is to be optimized to the coil circuit it serves.

b. Refrigerant filter drier.
c. Service gauge connections on suction and discharge lines.
d. Pressure gauge access through a specially designed access port in the top panel of the unit.
e. Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching.

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

3. Compressors
a. Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.
b. Models shall be available with single compressor designs.
c. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
d. Compressors shall be internally protected from high discharge temperature conditions.
e. Compressors shall be protected from an over−temperature and over−amperage conditions by an internal, motor overload device.
f. Compressor shall be factory mounted on rubber grommets.
g. Compressor motors shall have internal line break thermal, current overload and high pressure differential protection.
h. Crankcase heaters shall be utilized on all models (except 036 size) to protect compressor with specific refrigerant charge.

23 81 19.13.L. Filter Section

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

23 81 19.13.M. Evaporator Fan and Motor

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

2. Belt−driven Evaporator Fan:
a. Belt drive shall include an adjustable−pitch motor pulley.
b. Shall use sealed, permanently lubricated ball−bearing type.
c. Blower fan shall be double−inlet type with forward−curved blades.
d. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
e. Standard on all 036−060 3−phase models.

23 81 19.13.N. Condenser Fans and Motors

1. Condenser fan motors:
a. Shall be a totally enclosed motor.
b. Shall use permanently lubricated bearings.
c. Shall have inherent thermal overload protection with an automatic reset feature.
d. Shall use a shaft−down design on 036 to 060 models.

2. Condenser Fans:
a. Shall be a direct−driven propeller type fan.
b. Shall have aluminum blades riveted to corrosion−resistant steel spiders and shall be dynamically balanced.

23 81 19.13.O. Special Features, Options (factory installed) and Accessories (field installed)

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 setpoint shall be adjustable and shall range from 40 to 100°F / 4 to 38°C. Additional sensor options shall be available as accessories.
k. The economizer controller shall also provide control of an accessory power exhaust unit function. Factory set at 100%, with a range of 0% to 100%.
l. The economizer shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy. A remote potentiometer may be used to override the damper setpoint.
m. Dampers shall be completely closed when the unit is in the unoccupied mode.
n. Economizer controller shall accept a 2−10Vdc CO_2 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 closes at 50°F (10°C).
p. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
q. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.

2. Two−Position Motorized Damper
   a. Damper shall be a Two−Position Motorized Damper. Damper travel shall be from the full closed position to the field adjustable %−open setpoint.
   b. Damper shall include adjustable damper travel from 25% to 100% (full open).
   c. Damper shall include single or dual blade, gear driven dampers and actuator motor.
   d. Actuator shall be direct coupled to damper gear. No linkage arms or control rods shall be acceptable.
   e. Damper will admit up to 100% outdoor air for applicable rooftop units.
   f. Damper shall close upon indoor (evaporator) fan shutoff and/or loss of power.
   g. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.
   h. Outside air hood shall include aluminum water entrainment filter
3. Manual damper
   a. Manual damper package shall consist of damper, air inlet screen, and rain hood which can be preset to admit up to 50% outdoor air for year round ventilation.
4. Head Pressure (low ambient operation) Control Package
   a. Controller shall control coil head pressure by condenser−fan speed modulation or condenser−fan cycling and wind baffles.
   b. Shall consist of solid−state control and condenser−coil temperature sensor to maintain condensing temperature between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to −20°F (−29°C).
5. Condenser Coil Hail Guard Assembly
   a. Shall protect against damage from hail.
   b. Shall be louvered design.
6. Unit−Mounted, Non−Fused Disconnect Switch (80 amp max.):
   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.
7. Convenience Outlet:
   a. Non−Powered convenience outlet.
      (1.) Outlet shall be powered from a separate 115−120v power source.
      (2.) A transformer shall not be included.
      (3.) Outlet shall be internally mounted with easily accessible 115−v female receptacle.
      (4.) Outlet shall include 15 amp GFI receptacles.
      (5.) Outlet shall be accessible from outside the unit.
8. Thru−the−Base Connectors:
   a. Kits shall provide connectors to permit electrical connections to be brought to the unit through the unit basepan.
   b. Minimum of three connection locations per unit.
9. Fan/Filter Status Switch:
   a. Switch shall provide status of indoor evaporator fan (ON/OFF) or filter (CLEAN/DIRTY).
   b. Status shall be displayed either over communication bus (when used with direct digital controls) or with an indicator light at the thermostat.
10. Propeller Power Exhaust:
    a. Power exhaust shall be used in conjunction with an integrated economizer.
    b. Independent modules for vertical or horizontal return configurations shall be available.
    c. Horizontal power exhaust shall be mounted in return ductwork.

d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0−100% adjustable setpoint on the economizer control.

11. Roof Curbs (Vertical):
    a. Full perimeter roof curb with exhaust capability providing separate air streams for energy recovery from the exhaust air without supply air contamination.
    b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
    c. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
12. High−Static Indoor Fan Motor(s) and Drive(s) (036−060):
    a. High−static motor(s) and drive(s) shall be factory−installed to provide additional performance range.
13. Thru−the−Bottom Utility Connectors:
    a. Kit shall provide connectors to permit electrical connections to be brought to the unit through the basepan.
14. Fan/Filter Status Switch:
    a. Provides status of indoor (evaporator) fan (ON/ OFF) or filter (CLEAN/DIRTY). Status shall be displayed over communication bus when used with direct digital controls or with an indicator light at the thermostat.
15. Outdoor Air Enthalpy Sensor:
    a. The outdoor air enthalpy sensor shall be used to provide single enthalpy control. When used in conjunction with a return air enthalpy sensor, the unit will provide differential enthalpy control. The sensor allows the unit to determine if outside air is suitable for free cooling.
16. Return Air Enthalpy Sensor:
    a. The return air enthalpy sensor shall be used in conjunction with an outdoor air enthalpy sensor to provide differential enthalpy control.
17. Indoor Air Quality (CO_2) 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 setpoint shall have adjustment capability.
18. Smoke detectors (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:
        (1.) One set of normally open alarm initiation contacts for connection to an initiating device circuit on a fire alarm control panel.
        (2.) Two Form−C auxiliary alarm relays for interface with rooftop unit or other equipment.
        (3.) One Form−C supervision (trouble) relay to control the operation of the Trouble LED on a remote test/reset station.
        (4.) Capable of direct connection to two individual detector modules.
        (5.) Can be wired to up to 14 other duct smoke detectors for multiple fan shutdown applications.
19. 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.
20. Electric Heat:
    a. Heating Section
        (1.) Heater element open coil resistance wire, nickel−chrome alloy, 0.29 inches inside diameter, strung through ceramic insulators mounted on metal frame. Coil ends are staked and welded to terminal screw slots.
        (2.) Heater assemblies are provided with integral fusing for protection of internal heater circuits not exceeding 48 amps each. Auto reset thermo limit controls, magnetic heater contactors (24V coil) and terminal block all mounted in electric heater control box (minimum 18 ga galvanized steel) attached to end of heater assembly.