AIRQUEST® Heating And Cooling Products

RGS

Product Specifications

ENERGY STAR COMPLIANT PACKAGE GAS HEATING/ELECTRIC COOLING, R−410A SINGLE PACKAGE ROOFTOP 7.5 − 12.5 TONS

BUILT TO LAST, EASY TO INSTALL AND SERVICE

- One−piece, high efficiency gas 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
- Two-stage cooling on all models
- Redundant gas valve, up to two stages of heating
- Exclusive IGC solid-state control for on-board diagnostics with LED error code designation, burner control logic and energy saving indoor fan motor delay
- High efficiency, gas heat with induced draft flue exhaust design
- Two scroll compressors with internal line−break overload protection on each model
- All units have high and low pressure switches
- Two inch disposable fiberglass type return air filters in dedicated rack with tool−less filter access door
- Refrigerant circuits contain a liquid line filter drier to trap dirt and moisture
- Outdoor coils constructed of aluminum fin and aluminum tube microchannel design.
- Newly−designed indoor refrigerant header for easier maintenance and replacement
- Exclusive non−corrosive composite condensate pan in accordance with ASHRAE 62 Standard, sloping design; side or center drain
- Belt drive evaporator−fan motor and pulley combinations available to meet most applications
- Access panels with easy grip handles provide quick and easy access to the blower and blower motor, control box, and compressors.
- “No−strip” screw system has superior holding power and guides screws into position while preventing the screw from stripping the unit’s metal.
- Newly designed terminal board facilitates simple safety circuit troubleshooting and simplified control box arrangement
- Outdoor temperature cooling operation range up to 115°F (46°C) and down to 25°F (−4°C) using winter start kit
- Fixed orifice metering devices on all models to precisely control refrigerant flow
- Large, laminated control wiring and power wiring drawings are affixed to unit to make troubleshooting easy
- Capable of thru−the−base or thru−the−curb gas line routing
- Single point gas and electrical connections

RGS090−120 Shown

WARRANTY

- 10 Year heat exchanger limited warranty
- 5 Year compressor limited warranty
- 1 Year parts limited warranty

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.

UNIT PERFORMANCE DATA − Dual Compressors with Two Stage Cooling

UNIT	Nominal Tons	COOLING Net Cap. (Btuh)	COOLING EER	GAS HEATING Input Cap. (Btuh)	GAS HEATING AFUE %	Unit Dimensions H x W x L	Unit Weight lb. [kg]
RGS090*^AA0AGA	7½	83,000	11.0	125,000−224,000	80−81.0	41−3/8” x 59−1/2“ x 88−1/8”	860 [390]
RGS120*^AA0AGA	10	114,000	11.1	180,000−250,000	80−81.0	49−3/8” x 59−1/2“ x 88−1/8”	940 [426]
RGS150*^AA0AGA	12½	140,000	10.8	180,000−250,000	80−81.0	49−3/8” x 59−1/2“ x 88−1/8”	1116 [506]

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

^ See model nomenclature listing for gas heating options.

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

509 51 3505 01
07/20/09

TABLE OF CONTENTS

MODEL NOMENCLATURE

MODEL SERIES	R	G	S	0	9	0	H	D	A	B	0	A	G	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**

090 = 90,000 = 7.5 Tons (Two Compressors)
120 = 120,000 = 10 Tons (Two Compressors)
150 = 150,000 = 12.5 Tons (Two Compressors) — **Nominal Cooling Capacity**

H = 208/230-3-60
L = 460-3-60
S = 575-3-60 — **Voltage**

D = Low Heat
E = Medium Heat
F = High Heat

Heating Capacity

A = Standard Motor
B = High Static Motor — **Motor Option**

A = None
B = Economizer w/Bara-relief, OA Temp sensor

Outdoor Air Options / Control

0A = No Options

Factory Installed Options

G = Alum / Alum Cond & Alum / Cu Evap
K = E-Coated Alum / Alum Cond Coil, Std Alum / Cu Evap Coil — **Condenser / Evaporator Coil Configuration**

A = Standard — **Unit Packaging**

Table 1 – FACTORY INSTALLED OPTIONS AND FIELD INSTALLED ACCESSORIES

CATEGORY	ITEM	FACTORY INSTALLED OPTION	FIELD INSTALLED ACCESSORY
Cabinet	Thru−the−base electrical or gas−line connections		X
Condenser Protection	Condenser coil hail guard (louvered design)		X
Controls	Thermostats, temperature sensors, and subbases		X
	Time Guard II compressor delay control circuit		X
	Phase Monitor		X
	Filter status switch		X
Economizers & Outdoor Air Dampers	Economizer (for electro−mechanical controlled RTUs)	X	X
	Motorized 2 position outdoor−air damper		X
	Manual outdoor−air damper		X
	Barometric relief [1]		X
	Power exhaust		X
Economizer Sensors & IAQ Devices	Single dry bulb temperature sensors[2]		X
	Single enthalpy sensors[2]		X
	Differential enthalpy sensors[2]		X
	CO_2 sensor (duct, or unit mounted)[2]		X
Gas Heat	Liquid propane (LP) conversion kit		X
	High altitude conversion kit		X
	Flue Shield		X
	Flue Discharge Deflector		X
Indoor Motor & Drive	Multiple motor and drive packages	X	
Low Ambient Control	Winter start kit [3]		X
	Head pressure controller [3]		X
Power Options	Convenience outlet (unpowered)		X
	Non−fused disconnect		X
Roof Curbs	Roof curb 14” (356mm)		X
	Roof curb 24” (610mm)		X

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

FACTORY OPTIONS AND/OR ACCESSORIES

Economizer (dry−bulb or enthalpy)

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

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

CO_2 Sensor

A CO_2 sensor works with the economizer to intake only the correct amount of outside air for ventilation. As occupants fill the 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. CO_2 sensors are available with the economizer, installed and tested by the factory.

FACTORY OPTIONS AND/OR ACCESSORIES (CONT.)

Smoke Detectors (Supply Air)

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

Louvered Hail Guards

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

Convenience Outlet (un−powered)

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

Non−fused Disconnect

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

Barometric Relief (included with optional economizer)

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

Power Exhaust

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

Time Guard II Control Circuit

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

Filter or Fan Status Switches

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

Motorized 2−Position Damper

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

Manual OA Damper

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

Head Pressure Controller

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

Winter Start Kit

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

Liquid Propane Heating

Convert rooftop from standard natural gas operation to liquid propane using this field−installed kit.

High Altitude Heating

High altitudes have less oxygen, which means heat exchangers need less fuel. The new gas orifices in this field−installed kit make the necessary adjustment for high altitude applications. They restore the optimal fuel to air mixture and maintain healthy combustion at altitudes above 2000 ft (610m). Kits may not be required in all areas.

Flue Discharge Deflector

The flue discharge deflector is a useful accessory when flue gas recirculation is a concern. By venting the flue discharge upwards, the deflector minimizes the chance for a neighboring unit to intake the flue exhaust.

Flue Discharge Heat Shield

The flue discharge heat shield keeps people from touching the rooftop unit's potentially hot flue discharge. This is especially useful for ground level applications, where more, untrained people could have access to the unit's exterior.

Alternate Motors and Drives

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

Thru−the−Base Connections

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

ACCESSORIES − RGS090−150

FLAT ROOF CURBS		
Model Number	**Description**	**Use With Model Size**
CRRFCURB003A01	14” High Roof Curb	090 − 150
CRRFCURB004A01	24” High Roof Curb	090 − 150

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

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

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

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

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

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

* See usage tables in kit instructions.

[1] Requires motor change out.

[2] Available from FAST Parts.

ACCESSORIES − RGS090−150 (cont.)

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

LP GAS CONVERSION KITS		
Model Number	**Description**	**Use With Model Size**
CRLPELEV001A00	LP and Hi Altitude conversion kit. Contains spuds sizes 31, 32, 33, 35, and 36.	090 − 150
CRLPELEV002A00	LP and Hi Altitude conversion kit. Contains spuds sizes 37, 38, 39, 44, and 45.	090 − 150
CRLPELEV003A00	LP and Hi Altitude conversion kit. Contains spuds sizes 46, 47, 48, 49, and 50.	090 − 150
CRLPELEV004A00	LP and Hi Altitude conversion kit. Contains spuds sizes 51, 52, 53, 54, and 55.	090 − 150

HEATING UPGRADE KITS		
Model Number	**Description**	**Use With Model Size**
CRFLUEDS001A00	Flue Discharge Deflector	090 − 150
CRFLUEHD001A01	Flue Exhaust Heat Shield	090 − 150

CONTROL UPGRADE KITS		
Model Number	**Description**	**Use With Model Size**
DNSTATUS001A00	Fan/Filter Status Switch	090 − 150
NRTIMEGD001A00	Time Guard II	090 − 150
1178184[2]	Remote keyed attenuator / test / reset station	090 − 150
DNPHASE3001A02	Electronic Phase Monitor	090 − 150
DNWINSTR001A00	Winter Start Kit − Electronic phase monitor breaks “R” control signal if trouble is detected. (Allows operation down to 25°F from standard 40°F)	090 − 150

575V TRANSFORMER		
Model Number	**Description**	**Use With Model Size**
1171494[2]	Transformer for conversion from 575v to 208/230v power exhaust applications.	090 − 150

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

[2] Available from FAST Parts.

Table 2 – ARI COOLING RATING TABLE

Unit RGS Dual Compressors	NOM. CAPACITY (TONS)	NET COOLING CAPACITY (MBH)	TOTAL POWER (KW)	SEER	EER	IPLV	IEER
090	7.5	83.0	8.0	–	11.0	12.0	11.2
120	10	114.0	10.6	–	11.1	12.2	11.2
150	12.5	140.0	10.6	–	10.8	11.4	11.2

LEGEND

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

NOTES:

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

ARI Standard 210/240 UAC

ARI Standard 340/360

ENERGY STAR PARTNER

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

Table 3 – HEATING RATING TABLE − NATURAL GAS & LIQUID PROPANE

UNIT RGS Dual Compressors		Gas Heat	AL & SS Heat Exchanger		Temp Rise (deg F)	Thermal Efficiency (%)	AFUE (%)
			Input / Output Stage 1 (MBH)	Input / Output Stage 2 (MBH)			
Three Phase	090	LOW	−	125.0 / 103.0	20 − 50	82%	−
		MED	120 / 98	180.0 / 148.0	35 − 65	82%	−
		HIGH	180 / 147	224.0 / 184.0	45 − 75	82%	−
	120	LOW	120 / 98	180.0 / 148.0	35 − 65	82%	−
		MED	180 / 147	224.0 / 184.0	45 − 75	82%	−
		HIGH	200 / 160	250.0 / 205.0	40 − 70	82%	−
	150	LOW	120 / 98	180.0 / 148.0	35 − 65	82%	−
		MED	180 / 147	224.0 / 184.0	45 − 75	82%	−
		HIGH	200 / 160	250.0 / 205.0	40 − 70	82%	−

NOTE:

Heat ratings are for natural gas heat exchangers operated at or below 2000 ft. For information on LP or altitudes above 2000 ft (610m), see the Application Data section of this book. Accessory LP/High Altitude kits are also available.

Table 4 – SOUND PERFORMANCE TABLE

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

LEGEND

dB − Decibel

NOTES:

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

Table 5 – MINIMUM − MAXIMUM AIRFLOW RATINGS − NATURAL GAS & LIQUID PROPANE

UNIT RGS Dual Compressors	HEAT LEVEL	COOLING		AL and SS HX HEATING	
		Minimum	Maximum	Minimum	Maximum
090	LOW	2250	3750	1900	4750
	MED			2100	3900
	HIGH			2270	3780
120	LOW	3000	5000	2100	5470
	MED			2270	5670
	HIGH			2710	5290
150	LOW	3600	6000	2100	6830
	MED			2620	6800
	HIGH			2650	7410‘

Table 6 – PHYSICAL DATA (COOLING) 7.5 − 12.5 TONS

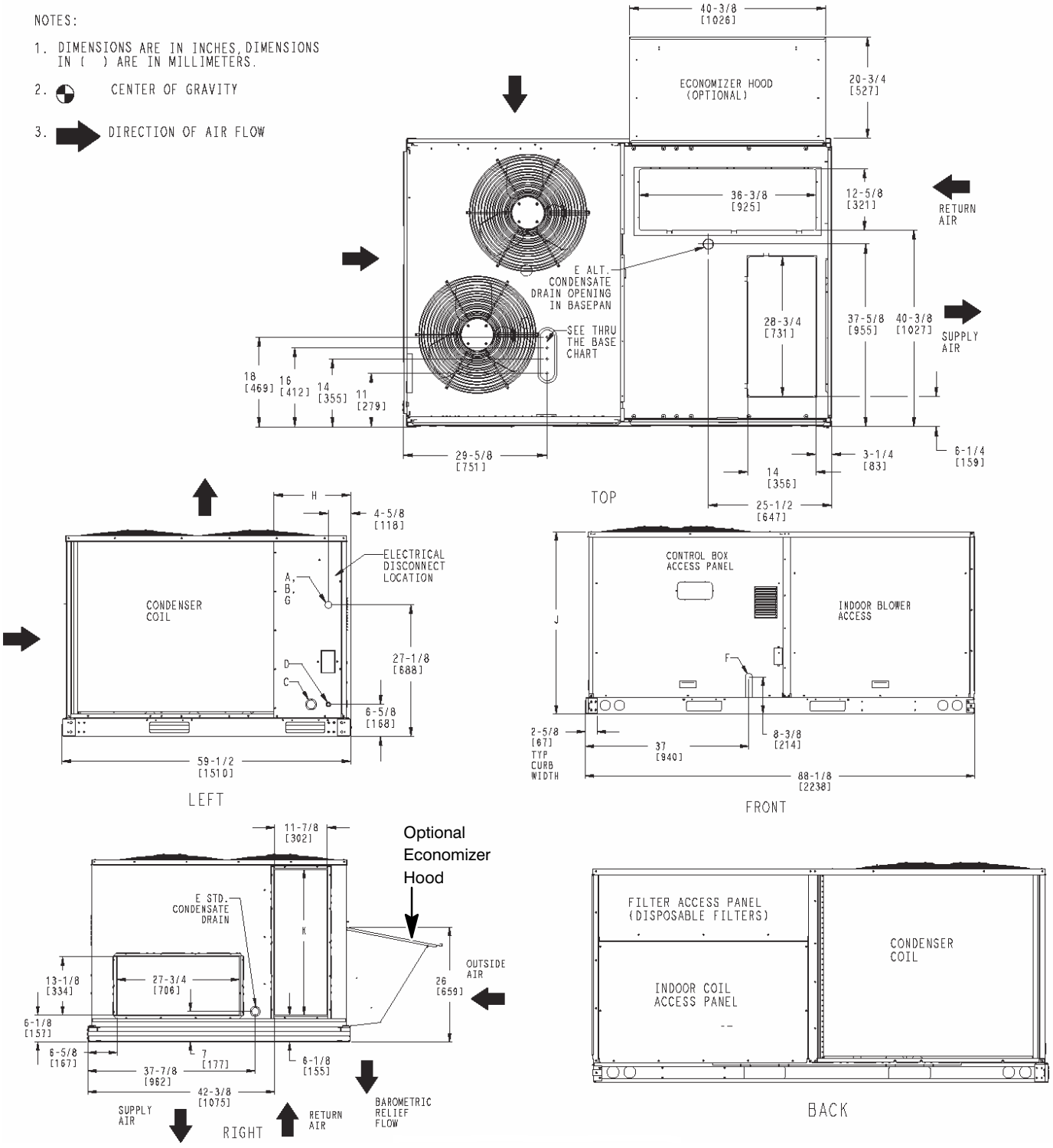
		RGS090	RGS120	RGS150
Refrigeration System				
	# Circuits / # Comp. / Type	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll
	R−410A (lbs−oz.) per circuit	4−6, 4−6	6−0, 6−0	7−6, 8−0
	Oil (oz) per circuit	42, 42	42, 42	56, 56
	Metering Device		Fixed Metering Device	
	High−press. Trip / Reset (psig)	630 / 505	630 / 505	630 / 505
	Low−press. Trip / Reset (psig)	54 / 117	54 / 117	54 / 117
Evap. Coil				
	Material	Cu / Al	Cu / Al	Cu / Al
	Coil type	3/8” RTPF *	3/8” RTPF *	3/8” RTPF *
	Rows / FPI	3 / 15	4 / 15	4 / 15
	Total Face Area (ft^2)	8.9	11.1	11.1
	Condensate Drain Conn. Size	3/4”	3/4”	3/4”
Evap. Fan and Motor				
Standard Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	1.7	2.4	2.9
	RPM Range	489−747	591−838	652−843
	Motor Frame Size	56	56	56
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	15 x 15	15 x 15	15 x 15
High Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	4.70	4.7	4.7
	RPM Range	909−1102	1022−1240	1022−1240
	Motor Frame Size	145TY	145TY	145TY
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	15 x 15	15 x 15	15 x 15
Cond. Coil				
	Material	Al / Al		
		Micro−channel aluminum multi port−flat tube design with aluminum fins		
	Rows / FPI	1 / 20	1 / 20	1 / 20
	Total Face Area (ft^2)	20.5	25.1	25.1
Cond. fan / motor				
	Qty / Motor Drive Type	2 / Direct	2 / Direct	1 / Direct
	Motor HP / RPM	1/4 / 1100	1/4 / 1100	1 / 1175
	Fan diameter (in)	22	22	30
Filters				
	RA Filter # / Size (in)	4 / 16x20x2	4 / 20x20x2	4 / 20x20x2
	OA inlet screen # / Size (in)	1 / 20x24x1	1 / 20x24x1	1 / 20x24x1

* RTPF − Round Tube Plate Fin Coil Design

Table 7 – PHYSICAL DATA (HEATING) 7.5 − 12.5 TONS

		RGS090	RGS120	RGS150
Gas Connection				
	# of Gas Valves	1	1	1
	Nat. gas supply line press (in. w.g.)/(PSIG)	4−13 / 0.18−0.47	4−13 / 0.18−0.47	4−13 / 0.18−0.47
	LP supply line press (in. w.g.)/(PSIG)	11−13 / 0.40−0.47	11−13 / 0.40−0.47	11−13 / 0.40−0.47
Heat Anticipator Setting (Amps)				
	1st stage	0.14	0.14	0.14
	2nd stage	0.14	0.14	0.14
Natural Gas, propane Heat				
LOW	Connection size	1/2” NPT	3/4” NPT	3/4” NPT
	# of stages / # of burners (total)	1 / 3	2 / 4	2 / 4
	Rollout switch opens / Closes	195 / 115	195 / 115	195 / 115
	Temperature rise (min/max)	20 / 50	25 / 65	25 / 65
MED	Connection size	3/4” NPT	3/4” NPT	3/4” NPT
	# of stages / # of burners (total)	2 / 4	2 / 5	2 / 5
	Rollout switch opens / Closes	195 / 115	195 / 115	195 / 115
	Temperature rise (min/max)	35 / 65	30 / 65	30 / 65
HIGH	Connection size	3/4” NPT	3/4” NPT	3/4” NPT
	# of stages / # of burners (total)	2 / 5	2 / 5	2 / 5
	Rollout switch opens / Closes	195 / 115	195 / 115	195 / 115
	Temperature rise (min/max)	45 / 75	35 / 70	35 / 70

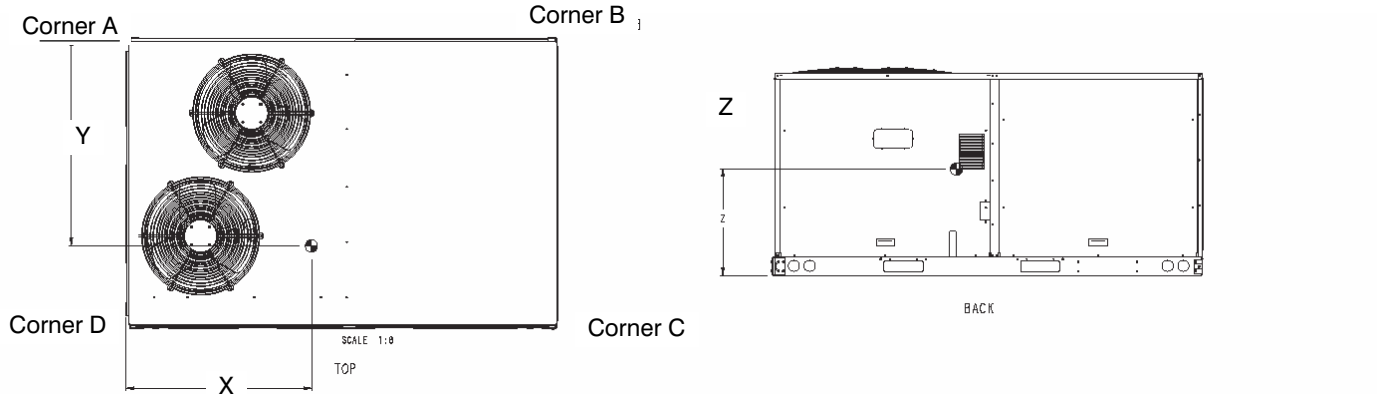
BASE UNIT DIMENSIONS − RGS090−120



	Connection Sizes	Thru the Base Chart These Holes Req'd For Use CRBTMPWR002A01, 004A01			Unit	J	K	H
		Threaded Conduit Size	Wire Use	Req'd Hole Sizes (Max.)				
A	1-3/8" [35] DIA Field Power Supply Hole	1/2"	Acc.	7/8" [22.2]	090	41-1/4 [1048]	33 [658]	15-7/8 [403]
B	2-1/2" [64] DIA Power Supply Knockout	1/2"	24V	7/8" [22.2]	120	49-3/8 [1253]	37-1/4 [946]	37-1/4 [946]
C	1-3/4" [51] DIA Gauge Access Plug	3/4" (001, 003)	Power*	1-1/8" [28.4]				
D	7/8" [22] DIA Field Control Wiring Hole	1-1/4" (002, 004)	Power*	1-3/4" [44.4]				
E	3/4" 14 NPT Condensate Drain	1/2" FTP (003)	Gas	1-1/4" [31.8]				
F	1/2" 14 NPT Gas Connection 3/4" 14 NPT Gas Connection	3/4" FTP (004)	Gas	1-5/8" [41.3]				
G	2" [51] DIA Power Supply Knockout	* Select either 3/4" or 1-1/4" for power, depending on wire size.						

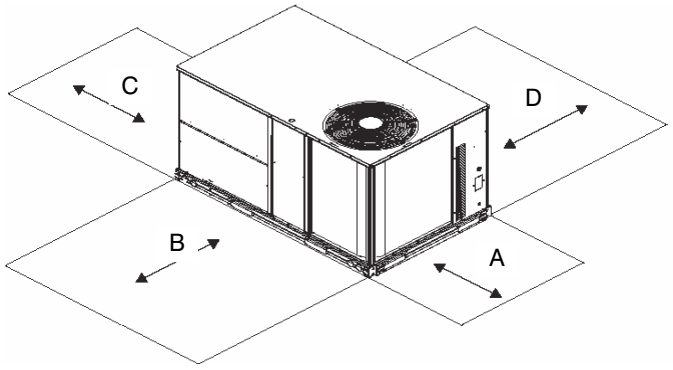
WEIGHT & CLEARANCE DIMENSIONS − RGS090−120 (cont.)

UNIT	BASE UNIT WEIGHT		Corner Weight A		Corner Weight B		Corner Weight C		Corner Weight D		Center of Gravity In [mm]		
	LBS	KG	LBS	KG	LBS	KG	LBS	KG	LBS	KG	X	Y	Z
RGS090	860	390	153	69	147	67	273	124	284	129	43 [1088]	38 [954]	20 [512]
RGS120	940	426	196	89	190	86	271	123	279	127	42 [1067]	34 [862]	20 [613]



UNIT CLEARANCES

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

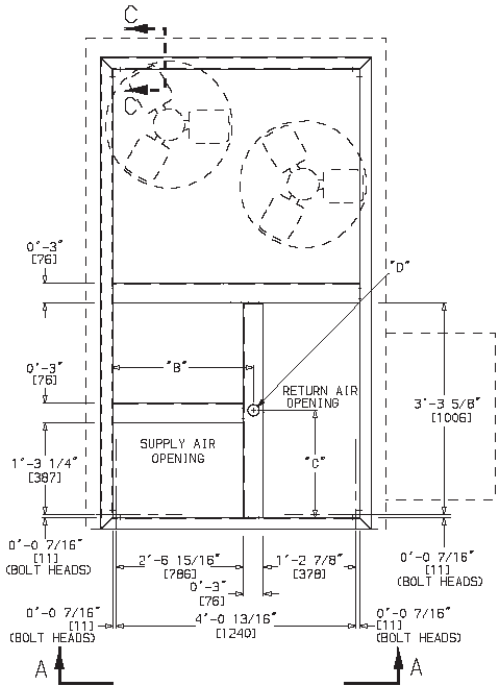


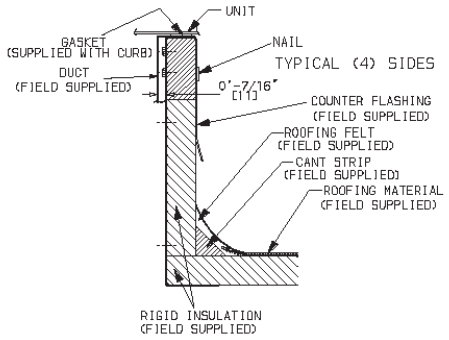
ROOF CURB DETAILS − RGS090 − 150

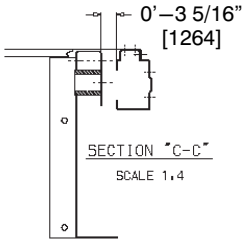
RoofCurb Accessory	A	Unit Size
CRRFCURB003A01	1’ 2 “ [356]	RGS090−150
CRRFCURB004A01	2’ 0” [610]	

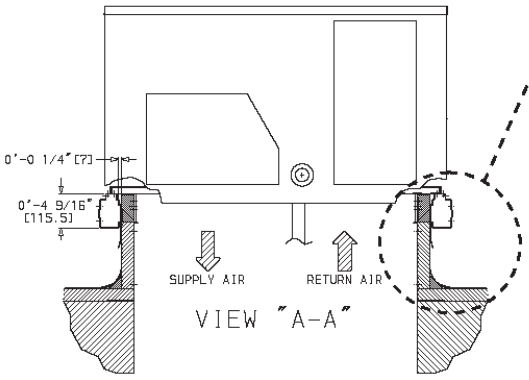
NOTES:
1. Roofcurb accessory is shipped disassembled.
2. Insulated panels, 1” thick polyurethane foam, 1−3/4# density.
3. Dimensions in. [ ] in millimeters.
4. Roofcurb 16ga steel.
5. Attach ductwork to curb (Flanges of duct rest on curb)
6. Service clearance 4’ on each side.
7. ⇨ Direction of airflow.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

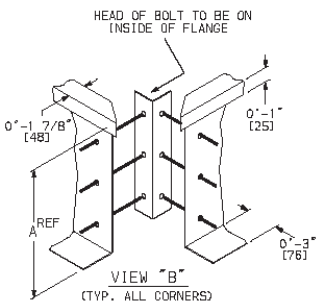
Connector Pkg. Acc.	B	C	D Alt. Drain Hole	Gas	Power	Control	Accessory Power
CRBTMPWR002A01	2’ 8−7/16” [827]	1’ 10−15/16” [583]	1−3/4” [44.5]	3/4” [19] NPT	1−1/4” [31.7] NPT	1/2” [12.7] NPT	1/2” [12.7] NPT
CRBTMPWR004A01							

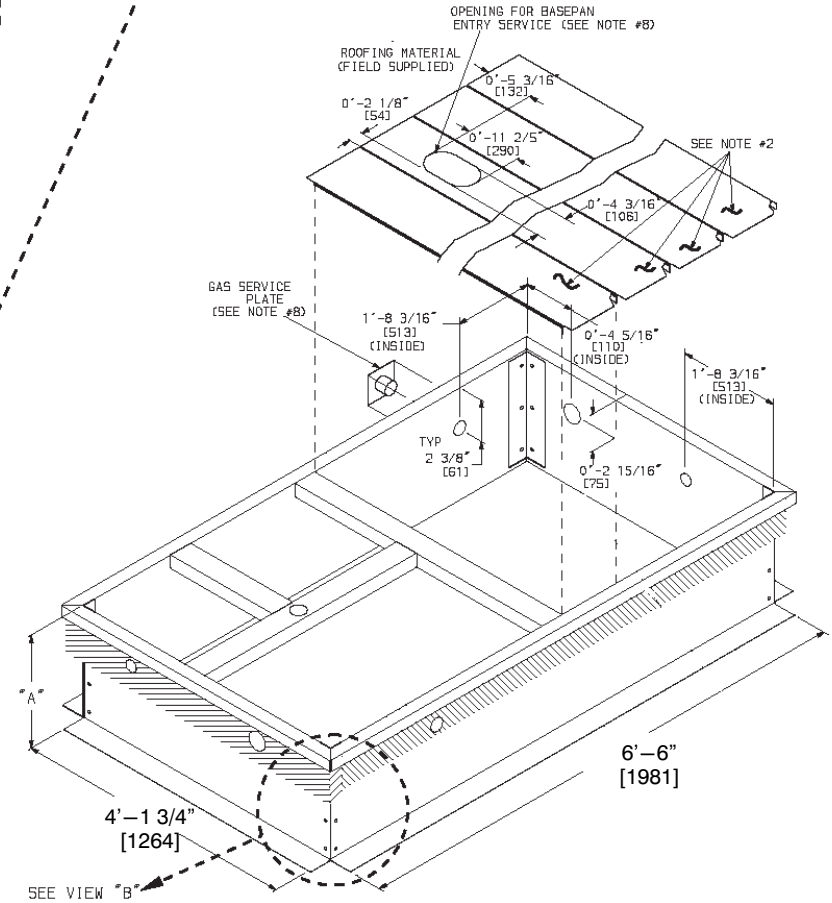




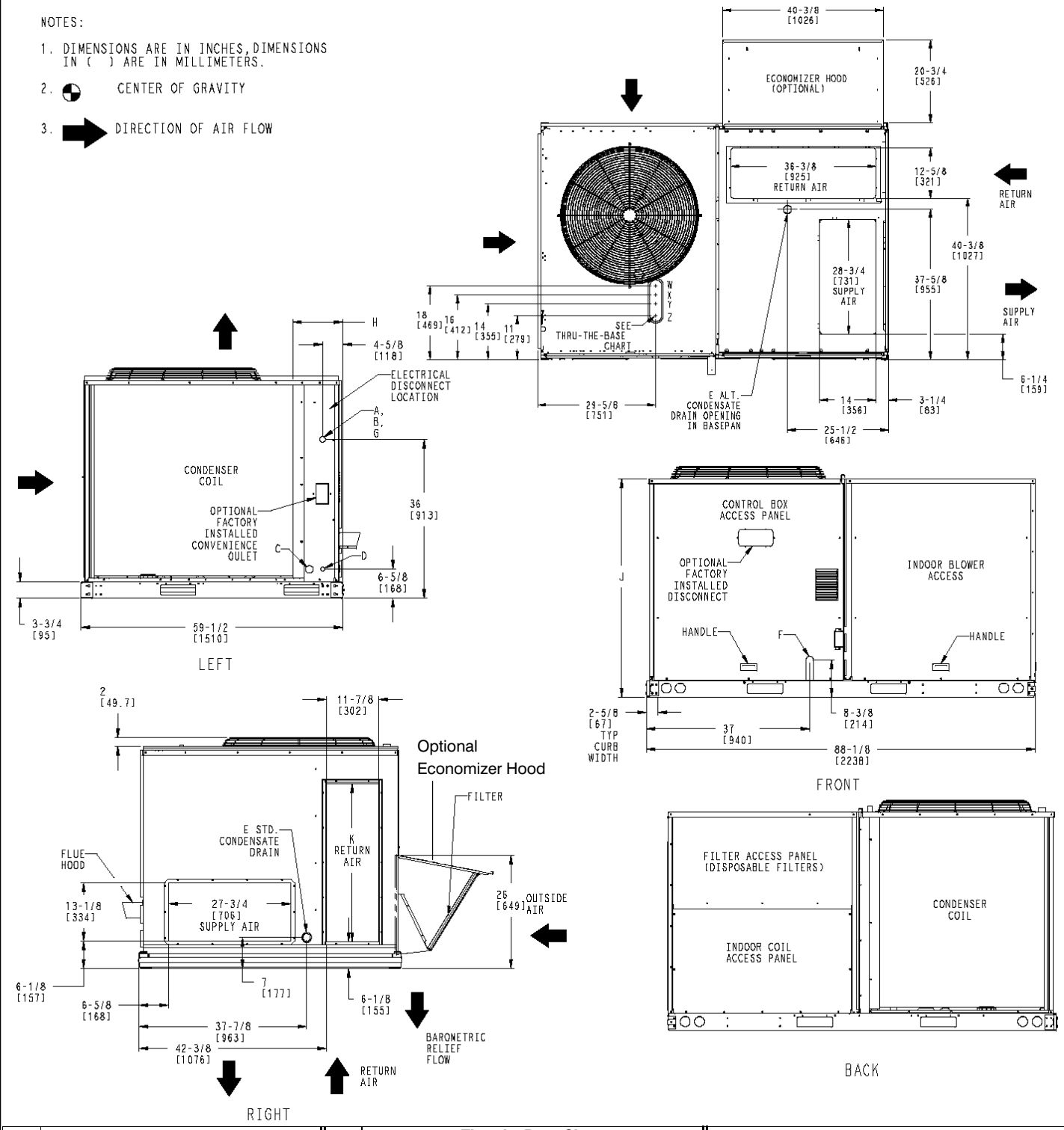








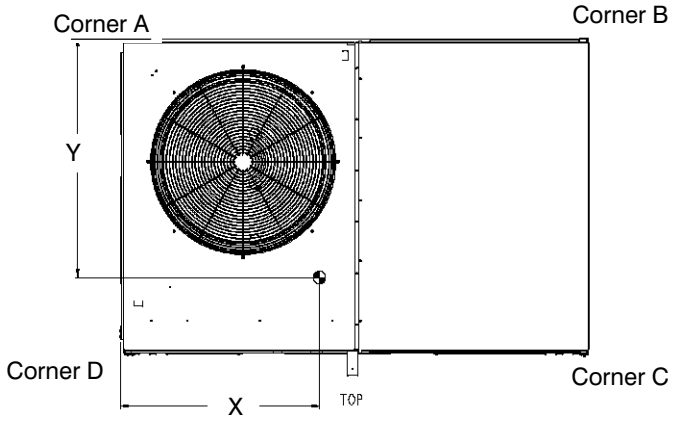
BASE UNIT DIMENSIONS − RGS150

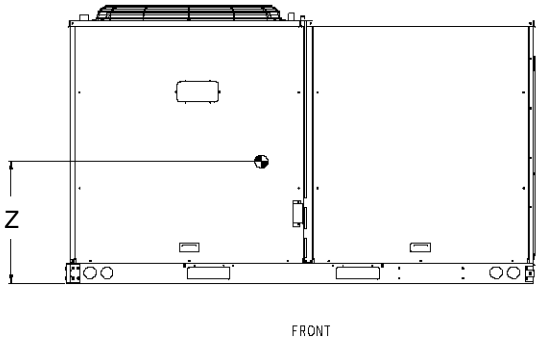


	Connection Sizes		Thru the Base Chart These Holes Req'd For Use CRBTMPWR002A01, 004A01						
			Threaded Conduit Size	Wire Use	Req'd Hole Sizes (Max.)	Unit	H	J	K
A	1-3/8" [35] DIA Field Power Supply Hole	W	1/2"	Acc.	7/8" [22.2]	150	11-3/8 [1048]	49-3/8 [1253]	35-5/8 [905]
B	2-1/2" [64] DIA Power Supply Knockout	X	1/2"	24V	7/8" [22.2]				
C	1-3/4" [51] DIA Gauge Access Plug	Y	1-1/4" (002, 004)	Power*	1-3/4" [44.4]				
D	7/8" [22] DIA Field Control Wiring Hole	Z**	3/4" FTP (004)	Gas	1-5/8" [41.3]				
E	3/4" 14 NPT Condensate Drain	* Select either 3/4" or 1-1/4" for power, depending on wire size.							
F	3/4" 14 NPT Gas Connection								
G	2" [51] DIA Power Supply Knockout	** Provides 3/4" FPT Thru Curb Flange & Fitting.							

WEIGHT & CLEARANCE DIMENSIONS − RGS150 (cont.)

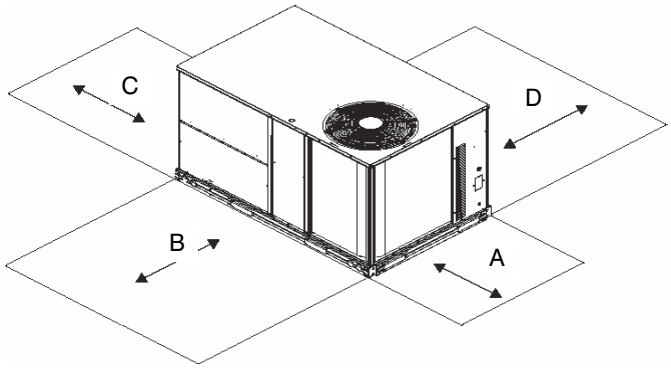
UNIT	BASE UNIT WEIGHT		Corner Weight A		Corner Weight B		Corner Weight C		Corner Weight D		Center of Gravity In [mm]		
	LBS	KG	LBS	KG	LBS	KG	LBS	KG	LBS	KG	X	Y	Z
RGS150	1116	506	297	135	157	71	229	104	434	197	29−1/2 [749]	34−1/4 [870]	20−1/4 [514]





UNIT CLEARANCES

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



APPLICATION DATA

Min operating ambient temp (cooling):

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

Max operating ambient temp (cooling):

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

Min mixed air temp (heating):

Using the factory settings, the minimum temperatures for the mixed air (the combined temperature of the warm return air and the cold outdoor air) entering the dimpled, gas heat exchangers are:

Aluminized	Stainless Steel
50°F (10°C) continuous	40°F (4°C) continuous
45°F (7°C) intermittent	35°F (2°C) intermittent

Operating at lower mixed−air temperatures may be possible, if a field−supplied, outdoor air thermostat initiates both heat stages when the temperature is less than the minimum temperatures listed above. Please contact your local representative for assistance.

Min and max airflow (heating and cooling):

To maintain safe and reliable operation of this rooftop, operate within the heating airflow limits during heating mode and cooling airflow limits during cooling mode. Operating above the max may cause blow−off, undesired airflow noise, or airflow related problems with the rooftop unit. Operating below the min may cause problems with coil freeze−up and unsafe heating operation. Heating and cooling limitations differ when evaluating operating CFM, the minimum value is the HIGHER of the cooling and heating minimum CFM values published in Table 6 and the maximum value is the LOWER of the cooling and heating minimum values published in Table 6.

Heating−to−cooling changeover:

This unit will automatically change from heating to cooling mode when using a thermostat with an auto−change−over feature.

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 7 and 9, 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.

Liquid propane heating:

Liquid propane (LP) has different physical qualities than natural gas. As a result, LP requires different fuel to air mixture. To optimize the fuel/air mixture for LP, different burner orifices in an easy to install accessory kits are available from your dealer. To select the correct burner orifices or determine the heat capacity for an LP application, use either the selection software, or the unit's service manual.

High altitude heating:

High altitudes have less oxygen, which affects the fuel/air mixture in heat exchangers. In order to maintain a proper fuel/air mixture, heat exchangers operating in altitudes above 2000 ft (610m) require different orifices. To select the correct burner orifices or determine the heat capacity for a high altitude application, use either the selection software, or the unit's service manual.

High altitudes have less oxygen, which means heat exchangers need less fuel. The new gas orifices in this field−installed kit make the necessary adjustment for high altitude applications. They restore the optimal fuel to air mixture and maintain healthy combustion on altitudes above 2000 ft (610m).

NOTE: Typical natural gas heating value ranges from 975 to 1050 Btu/ft3 at sea level nationally. The heating value goes down approximately 1.7% per every thousand feet elevation. Standard factory orifices can typically be used up to 2000 ft (610m) elevation without any operational issues.

Sizing a rooftop

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

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

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

Low ambient applications

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

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

Table 8 – COOLING CAPACITIES 7.5 TONS (2 Stage Cooling)

RGS090				AMBIENT TEMPERATURE											
				85			95			105			115		
				EAT (db)			EAT (db)			EAT (db)			EA (db)		
				75	80	85	75	80	85	75	80	85	75	80	85
2250 Cfm	EAT (wb)	58	TC	77.4	77.4	87.8	73.8	73.8	83.8	70.1	70.1	79.5	66.0	66.0	74.9
			SHC	66.9	77.4	87.8	63.9	73.8	83.8	60.6	70.1	79.5	57.1	66.0	74.9
		62	TC	82.2	82.2	83.9	77.5	77.5	81.7	72.6	72.6	79.2	67.3	67.3	76.4
			SHC	60.8	72.4	83.9	58.6	70.1	81.7	56.3	67.7	79.2	53.6	65.0	76.4
		67	TC	90.1	90.1	90.1	86.0	86.0	86.0	81.4	81.4	81.4	75.9	75.9	75.9
			SHC	50.2	61.8	73.3	48.5	60.1	71.6	46.5	58.1	69.7	44.2	55.8	67.4
		72	TC	98.0	98.0	98.0	94.0	94.0	94.0	89.5	89.5	89.5	84.3	84.3	84.3
			SHC	39.1	50.7	62.4	37.5	49.2	60.9	35.8	47.5	59.2	33.8	45.5	57.2
		76	TC	–	104.3	104.3	–	100.4	100.4	–	95.9	95.9	–	90.7	90.7
			SHC	–	41.7	54.0	–	40.3	52.7	–	38.7	51.0	–	36.8	49.0
2625 Cfm	EAT (wb)	58	TC	82.1	82.1	93.2	78.4	78.4	89.0	74.4	74.4	84.4	70.0	70.0	79.5
			SHC	71.0	82.1	93.2	67.8	78.4	89.0	64.3	74.4	84.4	60.6	70.0	79.5
		62	TC	84.9	84.9	91.8	80.4	80.4	89.5	75.4	75.4	86.7	70.2	70.2	82.9
			SHC	65.4	78.6	91.8	63.2	76.3	89.5	60.6	73.7	86.7	57.6	70.2	82.9
		67	TC	92.5	92.5	92.5	88.3	88.3	88.3	83.6	83.6	83.6	78.3	78.3	78.3
			SHC	53.0	66.3	79.5	51.3	64.6	78.0	49.4	62.8	76.1	47.2	60.6	73.9
		72	TC	100.4	100.4	100.4	96.4	96.4	96.4	91.7	91.7	91.7	86.4	86.4	86.4
			SHC	40.2	53.5	66.7	38.7	52.0	65.3	36.9	50.3	63.7	35.0	48.4	61.8
		76	TC	–	106.5	106.5	–	102.6	102.6	–	98.0	98.0	–	92.7	92.7
			SHC	–	43.3	57.6	–	41.8	55.9	–	40.2	54.1	–	38.4	52.2
3000 Cfm	EAT (wb)	58	TC	85.7	85.7	97.3	82.2	82.2	93.3	78.0	78.0	88.6	73.5	73.5	83.4
			SHC	74.1	85.7	97.3	71.1	82.2	93.3	67.5	78.0	88.6	63.6	73.5	83.4
		62	TC	86.9	86.9	98.7	82.8	82.8	96.4	78.2	78.2	92.3	73.6	73.6	86.9
			SHC	69.3	84.0	98.7	67.2	81.8	96.4	64.1	78.2	92.3	60.3	73.6	86.9
		67	TC	94.3	94.3	94.3	90.1	90.1	90.1	85.2	85.2	85.2	79.8	79.8	80.1
			SHC	55.6	70.5	85.4	54.0	68.9	83.9	52.1	67.1	82.2	49.9	65.0	80.1
		72	TC	102.2	102.2	102.2	98.1	98.1	98.1	93.3	93.3	93.3	87.9	87.9	87.9
			SHC	41.2	56.0	70.7	39.7	54.6	69.5	38.0	53.0	68.0	36.0	51.1	66.2
		76	TC	–	108.1	108.1	–	104.2	104.2	–	99.5	99.5	–	94.2	94.2
			SHC	–	44.5	60.2	–	43.2	58.7	–	41.6	57.0	–	39.8	55.2
3375 Cfm	EAT (wb)	58	TC	88.5	88.5	100.4	85.0	85.0	96.4	81.0	81.0	92	76.5	76.5	86.8
			SHC	76.5	88.5	100.4	73.5	85.0	96.4	70.1	81.0	92	66.1	76.5	86.8
		62	TC	88.9	88.9	103.9	85.1	85.1	100.4	81.1	81.1	95.7	76.5	76.5	90.3
			SHC	72.3	88.1	103.9	69.7	85.1	100.4	66.5	81.1	95.7	62.7	76.5	90.3
		67	TC	95.8	95.8	95.8	91.5	91.5	91.5	86.6	86.6	87.9	81.1	81.1	85.8
			SHC	58.0	74.4	90.9	56.4	73.0	89.6	54.6	71.3	87.9	52.4	69.1	85.8
		72	TC	103.6	103.6	103.6	99.4	99.4	99.4	94.6	94.6	94.6	89.1	89.1	89.1
			SHC	42.0	58.3	74.5	40.6	57.0	73.4	38.9	55.5	72.0	37.0	53.7	70.3
		76	TC	–	109.2	109.2	–	105.4	105.4	–	100.7	100.7	–	95.3	95.3
			SHC	–	45.6	62.6	–	44.4	61.3	–	42.8	59.7	–	41.0	58.0
3750 Cfm	EAT (wb)	58	TC	90.8	90.8	103.0	87.3	87.3	99.1	83.3	83.3	94.5	78.8	78.8	89.4
			SHC	78.5	90.8	103.0	75.5	87.3	99.1	72.0	83.3	94.5	68.2	78.8	89.4
		62	TC	90.9	90.9	107.2	87.4	87.4	103.1	83.3	83.3	98.4	78.9	78.9	93.1
			SHC	74.5	90.9	107.2	71.6	87.4	103.1	68.3	83.3	98.4	64.7	78.9	93.1
		67	TC	97.0	97.0	97.0	92.6	92.6	95.1	87.6	87.6	93.4	82.1	82.1	91.2
			SHC	60.3	78.2	96.2	58.8	76.9	95.1	56.9	75.2	93.4	54.8	73.0	91.2
		72	TC	104.7	104.7	104.7	100.5	100.5	100.5	95.6	95.6	95.6	90.1	90.1	90.1
			SHC	42.9	60.5	78.1	41.4	59.3	77.1	39.8	57.8	75.9	37.9	56.1	74.3
		76	TC	–	110.2	110.2	–	106.2	106.2	–	101.6	101.6	–	96.1	96.1
			SHC	–	46.7	64.8	–	45.4	63.6	–	44.0	62.3	–	42.2	60.6

LEGEND:

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

Table 9 – COOLING CAPACITIES 10 TONS (2 Stage Cooling)

RGS120				AMBIENT TEMPERATURE											
				85			95			105			115		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85
3000 Cfm	EAT (wb)	58	TC	107.6	107.6	121.9	102.5	102.5	116.2	96.8	96.8	109.7	90.5	90.5	102.6
			SHC	93.2	107.6	121.9	88.8	102.5	116.2	83.9	96.8	109.7	78.4	90.5	102.6
		62	TC	113.6	113.6	116.5	107.1	107.1	113.4	99.7	99.7	109.8	91.8	91.8	104.9
			SHC	84.6	100.6	116.5	81.5	97.4	113.4	78.0	93.9	109.8	73.7	89.3	104.9
		67	TC	124.4	124.4	124.4	118.4	118.4	118.4	111.5	111.5	111.5	103.3	103.3	103.3
			SHC	69.7	85.7	101.7	67.1	83.2	99.2	64.3	80.3	96.3	60.8	76.8	92.8
		72	TC	135.8	135.8	135.8	129.7	129.7	129.7	122.8	122.8	122.8	115	115	115
			SHC	54.3	70.4	86.6	52.0	68.1	84.2	49.3	65.4	81.6	46.4	62.5	78.6
		76	TC	–	145.3	145.3	–	139	139	–	131.9	131.9	–	124.1	124.1
			SHC	–	57.8	74.3	–	55.6	72.1	–	53.1	69.6	–	50.4	66.9
3500 Cfm	EAT (wb)	58	TC	114.2	114.2	129.4	108.9	108.9	123.4	102.9	102.9	116.6	96.3	96.3	109.1
			SHC	98.9	114.2	129.4	94.3	108.9	123.4	89.1	102.9	116.6	83.4	96.3	109.1
		62	TC	117.2	117.2	127.9	111.0	111.0	124.7	104.0	104.0	119.5	96.5	96.5	113.7
			SHC	91.1	109.5	127.9	88.1	106.4	124.7	83.9	101.7	119.5	79.3	96.5	113.7
		67	TC	127.8	127.8	127.8	121.7	121.7	121.7	114.5	114.5	114.5	106.6	106.6	106.6
			SHC	73.8	92.3	110.8	71.3	89.8	108.3	68.4	87.0	105.5	65.2	83.8	102.3
		72	TC	139.4	139.4	139.4	133.0	133.0	133	125.8	125.8	125.8	117.9	117.9	117.9
			SHC	56.0	74.6	93.1	53.7	72.2	90.8	51.0	69.6	88.2	48.1	66.7	85.4
		76	TC	–	148.8	148.8	–	142.2	142.2	–	134.9	134.9	–	126.8	126.8
			SHC	–	60.2	79.5	–	58.0	77.1	–	55.4	74.5	–	52.7	71.6
4000 Cfm	EAT (wb)	58	TC	119.0	119.0	134.9	114.0	114.0	129.2	108.0	108.0	122.4	101.1	101.1	114.6
			SHC	103.1	119.0	134.9	98.7	114.0	129.2	93.6	108.0	122.4	87.6	101.1	114.6
		62	TC	120.3	120.3	137.1	114.7	114.7	132.8	108.2	108.2	127.5	101.3	101.3	119.3
			SHC	96.5	116.8	137.1	93.0	112.9	132.8	88.9	108.2	127.5	83.2	101.3	119.3
		67	TC	130.5	130.5	130.5	124.1	124.1	124.1	116.8	116.8	116.8	108.7	108.7	111.1
			SHC	77.7	98.6	119.5	75.2	96.2	117.2	72.3	93.3	114.4	69.1	90.1	111.1
		72	TC	142.1	142.1	142.1	135.5	135.5	135.5	128.2	128.2	128.2	120.0	120.0	120.0
			SHC	57.6	78.4	99.3	55.2	76.1	97.1	52.5	73.6	94.6	49.7	70.7	91.8
		76	TC	–	151.4	151.4	–	144.7	144.7	–	137.1	137.1	–	–	–
			SHC	–	62.3	83.8	–	60.0	81.4	–	57.5	78.8	–	–	–
4500 Cfm	EAT (wb)	58	TC	123.0	123.0	139.5	117.8	117.8	133.6	111.9	111.9	126.9	105.3	105.3	119.3
			SHC	106.6	123.0	139.5	102.1	117.8	133.6	97.0	111.9	126.9	91.2	105.3	119.3
		62	TC	123.4	123.4	144.4	117.9	117.9	139.0	112.0	112.0	132.0	105.4	105.4	124.2
			SHC	100.9	122.7	144.4	96.9	117.9	139	92.1	112.0	132	86.6	105.4	124.2
		67	TC	132.6	132.6	132.6	126.0	126	126.0	118.7	118.7	122.9	110.4	110.4	119.6
			SHC	81.4	104.6	127.9	78.9	102.3	125.7	76.1	99.5	122.9	72.9	96.2	119.6
		72	TC	144.2	144.2	144.2	137.4	137.4	137.4	129.9	129.9	129.9	121.6	121.6	121.6
			SHC	59.0	82.1	105.2	56.6	79.8	103.1	54.0	77.3	100.7	51.1	74.5	98
		76	TC	–	153.4	153.4	–	146.6	146.6	–	138.9	138.9	–	–	–
			SHC	–	64.1	87.8	–	61.9	85.6	–	59.4	83	–	–	–
5000 Cfm	EAT (wb)	58	TC	126.5	126.5	143.3	121.2	121.2	137.4	115.1	115.1	130.5	108.4	108.4	122.8
			SHC	109.6	126.5	143.3	105.0	121.2	137.4	99.8	115.1	130.5	93.9	108.4	122.8
		62	TC	126.5	126.5	149.1	121.3	121.3	142.9	115.2	115.2	135.8	108.5	108.5	127.8
			SHC	104.0	126.5	149.1	99.7	121.3	142.9	94.7	115.2	135.8	89.1	108.5	127.8
		67	TC	134.2	134.2	135.9	127.5	127.5	133.8	120.1	120.1	131.0	111.9	111.9	127.6
			SHC	84.9	110.4	135.9	82.4	108.1	133.8	79.6	105.3	131	76.4	102.0	127.6
		72	TC	145.8	145.8	145.8	139.0	139.0	139.0	131.3	131.3	131.3	122.9	122.9	122.9
			SHC	60.3	85.6	110.8	57.9	83.4	108.9	55.3	81.0	106.6	52.5	78.2	104
		76	TC	–	155.1	155.1	–	148.2	148.2	–	–	–	–	–	–
			SHC	–	65.9	91.5	–	63.7	89.5	–	–	–	–	–	–

LEGEND:

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

Table 10 – COOLING CAPACITIES 12.5 TONS (2 Stage Cooling)

RGS150				AMBIENT TEMPERATURE											
				85			95			105			115		
				EAT (db)			EAT (db)			EAT (db)			EAT (db)		
				75	80	85	75	80	85	75	80	85	75	80	85
3600 Cfm	EAT (wb)	58	TC	127.6	127.6	142.9	121.7	121.7	137.6	115.0	115.0	130	108.3	108.3	122.6
			SHC	110.3	126.6	142.9	105.8	121.7	137.6	99.9	115.0	130	94.1	108.3	122.6
		62	TC	136.1	136.1	136.1	131.1	131.1	131.1	123.8	123.8	124.5	114.9	114.9	120.3
			SHC	96.6	112.8	129.0	94.7	111.2	127.7	91.4	108.0	124.5	87.3	103.8	120.3
		67	TC	146.2	146.2	146.2	142.0	142.0	142.0	136.2	136.2	136.2	128.8	128.8	128.8
			SHC	78.5	94.4	110.3	76.9	93.1	109.2	74.7	91.0	107.3	71.7	88.1	104.6
		72	TC	155.9	155.9	155.9	152.4	152.4	152.4	147.2	147.2	147.2	140.1	140.1	140.1
			SHC	60.1	76.6	93.2	58.7	75.2	91.7	56.8	73.3	89.7	54.2	70.6	87.0
		76	TC	–	163.0	163	–	160.0	160	–	155.1	155.1	–	148.2	148.2
			SHC	–	62.0	81.8	–	61.1	80.9	–	59.5	79.3	–	57.0	76.3
4200 Cfm	EAT (wb)	58	TC	132.2	132.2	149.5	128.2	128.2	144.9	121.9	121.9	137.8	115.0	115.0	130.1
			SHC	115.0	132.2	149.5	111.5	128.2	144.9	106.0	121.9	137.8	99.9	115.0	130.1
		62	TC	139.6	139.6	139.6	134.7	134.7	138	128.0	128.0	135.6	119.1	119.1	131.2
			SHC	102.5	120.8	139	100.8	119.4	138	98.1	116.8	135.6	93.9	112.6	131.2
		67	TC	149.5	149.5	149.5	145.4	145.4	145.4	139.6	139.6	139.6	132.1	132.1	132.1
			SHC	81.8	99.6	117.4	80.6	98.7	116.8	78.5	96.9	115.2	75.7	94.3	112.8
		72	TC	159.0	159.0	159.0	155.5	155.5	155.5	150.3	150.3	150.3	143.1	143.1	143.1
			SHC	61.4	79.6	97.8	60.2	78.5	96.8	58.3	76.7	95	55.8	74.2	92.5
		76	TC	–	165.7	165.7	–	162.8	162.8	–	157.8	157.8	–	150.8	150.8
			SHC	–	64.6	87.7	–	63.5	86.3	–	61.5	83.3	–	58.9	79.9
4800 Cfm	EAT (wb)	58	TC	136.7	136.7	154.5	133.0	133.0	150.3	127.7	127.7	144.3	120.6	120.6	136.4
			SHC	118.9	136.7	154.5	115.7	133.0	150.3	111.0	127.7	144.3	104.9	120.6	136.4
		62	TC	142.2	142.2	147.8	137.4	137.4	147.1	131.0	131.0	144.7	122.8	122.8	140.3
			SHC	107.7	127.8	147.8	106.2	126.7	147.1	103.6	124.2	144.7	99.3	119.8	140.3
		67	TC	152.1	152.1	152.1	148.0	148	148	142.2	142.2	142.2	134.6	134.6	134.6
			SHC	84.8	104.3	123.7	83.8	103.8	123.7	82.0	102.3	122.6	79.4	99.9	120.4
		72	TC	161.3	161.3	161.3	157.8	157.8	157.8	152.5	152.5	152.5	145.4	145.4	145.4
			SHC	62.6	82.2	101.9	61.4	81.4	101.3	59.7	79.7	99.8	57.2	77.3	97.5
		76	TC	–	167.7	167.7	–	164.9	164.9	–	159.9	159.9	–	152.8	152.8
			SHC	–	66.4	91.4	–	65	89.2	–	63.1	86.4	–	60.5	83.1
5400 Cfm	EAT (wb)	58	TC	140.5	140.5	158.8	136.9	136.9	154.7	131.8	131.8	149	125.2	125.2	141.6
			SHC	122.2	140.5	158.8	119	136.9	154.7	114.7	131.8	149	108.9	125.2	141.6
		62	TC	144.3	144.3	155.7	139.6	139.6	155	133.5	133.5	152.4	125.8	125.8	147.8
			SHC	112.2	133.9	155.7	110.9	132.9	155	108.1	130.2	152.4	103.9	125.8	147.8
		67	TC	154.2	154.2	154.2	150.0	150.0	150.0	144.2	144.2	144.2	136.7	136.7	136.7
			SHC	87.6	108.6	129.6	86.8	108.5	130.1	85.2	107.3	129.4	82.8	105.1	127.4
		72	TC	163.1	163.1	163.1	159.7	159.7	159.7	154.3	154.3	154.3	147.1	147.1	147.1
			SHC	63.6	84.6	105.6	62.5	83.9	105.4	60.8	82.5	104.2	58.4	80.2	102
		76	TC	–	169.3	169.3	–	166.5	166.5	–	161.5	161.5	–	154.2	154.2
			SHC	–	67.6	93.7	–	66.4	91.7	–	64.5	89.2	–	61.9	86.1
6000 Cfm	EAT (wb)	58	TC	143.6	143.6	162.3	140.1	140.1	158.3	135.1	135.1	152.7	128.7	128.7	145.5
			SHC	124.9	143.6	162.3	121.8	140.1	158.3	117.5	135.1	152.7	111.9	128.7	145.5
		62	TC	146.1	146.1	162.4	141.7	141.7	161.5	135.6	135.6	159.2	128.8	128.8	151.2
			SHC	116.1	139.3	162.4	114.7	138.1	161.5	112.1	135.6	159.2	106.4	128.8	151.2
		67	TC	155.8	155.8	155.8	151.6	151.6	151.6	145.9	145.9	145.9	138.3	138.3	138.3
			SHC	90.1	112.6	135	89.6	112.8	136	88.3	112.0	135.8	85.9	110.0	134.1
		72	TC	164.5	164.5	164.5	161.2	161.2	161.2	155.8	155.8	155.8	148.5	148.5	148.5
			SHC	64.5	86.7	108.9	63.5	86.3	109.1	61.9	85.1	108.2	59.6	82.9	106.3
		76	TC	–	170.6	170.6	–	167.8	167.8	–	162.8	162.8	–	155.5	155.5
			SHC	–	68.7	95.8	–	67.5	94.1	–	65.7	91.8	–	63.3	88.8

LEGEND:

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

Table 11 – STATIC PRESSURE ADDERS (Factory Options and/or Accessories)

Economizer

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

* Available as field installed accessories only.

General fan performance notes:

1. Interpolation is permissible. Do not extrapolate.
2. External static pressure is the static pressure difference between the return duct and the supply duct plus the static pressure caused by any FIOPs or accessories.
3. Tabular data accounts for pressure loss due to clean filters, unit casing, and wet coils. Factory options and accessories may add static pressure losses, as shown in Table 21. Selection software is available, through your salesperson, to help you select the best motor/drive combination for your application.
4. The Fan Performance tables offer motor/drive recommendations. In cases when two motor/drive combinations would work, recommend the lower horsepower option.
5. For information on the electrical properties of motors, please see the Electrical information section of this book.
6. For more information on the performance limits of motors, see the application data section of this book.

FAN PERFORMANCE

Table 12 – RGS090, 3 PHASE, 7.5 TON HORIZONTAL SUPPLY

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard Static Option								High Static Option with Field Supplied Drive[2]	
2250	505	0.52	586	0.73	657	0.97	722	1.22	782	1.50
2438	533	0.62	610	0.85	679	1.09	742	1.36	800	1.65
2625	562	0.74	635	0.98	701	1.23	762	1.51	819	1.81
2813	591	0.88	661	1.13	725	1.39	783	1.68	839	1.98
3000	621	1.03	688	1.29	749	1.57	806	1.87	859	2.18
3188	652	1.21	715	1.48	774	1.77	829	2.07	881	2.40
3375	682	1.40	743	1.68	800	1.98	853	2.30	903	2.63
3563	713	1.61	772	1.91	826	2.22	878	2.55	927	2.89
3750	745	1.85	801	2.15	853	2.48	903	2.82	951	3.18

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	High Static Option with Field Supplied Drive[2]						High Static Option			
2250	838	1.81	891	2.12	941	2.46	988	2.82	1033	3.19
2438	854	1.96	906	2.28	955	2.63	1001	2.99	1046	3.37
2625	872	2.12	922	2.46	970	2.81	1016	3.17	1060	3.56
2813	890	2.31	940	2.65	986	3.01	1031	3.38	1074	3.77
3000	910	2.51	958	2.86	1004	3.23	1048	3.61	1090	4.01
3188	930	2.74	977	3.10	1022	3.47	1065	3.86	**1107**	**4.26**
3375	951	2.99	997	3.35	1041	3.74	1083	4.13	**1124**	**4.54**
3563	973	3.26	1018	3.63	1061	4.02	**1103**	**4.43**	**1143**	**4.85**
3750	996	3.55	1040	3.93	1082	4.34	**1122**	**4.75**	**1162**	**5.18**

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

Boldface indicates field–supplied drive is required.

1. Recommend using field–supplied blower pulley (part no. 1175896), and belt (part no. 1178182).
2. Recommend using field–supplied motor pulley (part number 1175720) blower pulley (part no. 1175896), and belt (part number 1178449)

Table 13 – RGS090, 3 PHASE, 7.5 TON VERTICAL SUPPLY

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard Static Option								High Static Option with Field Supplied Drive[2]	
2250	513	0.54	595	0.76	665	1.01	728	1.27	786	1.56
2438	541	0.65	620	0.89	688	1.14	750	1.42	806	1.71
2625	570	0.77	645	1.02	712	1.29	772	1.58	827	1.88
2813	600	0.91	672	1.18	736	1.46	794	1.76	848	2.07
3000	629	1.07	699	1.35	761	1.64	818	1.95	871	2.28
3188	660	1.25	726	1.54	787	1.85	842	2.17	894	2.51
3375	690	1.45	754	1.75	813	2.07	867	2.41	917	2.76
3563	721	1.67	783	1.98	840	2.32	892	2.67	941	3.03
3750	752	1.91	812	2.24	867	2.59	918	2.95	966	3.32

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	High Static Option with Field Supplied Drive[2]						High Static Option			
2250	839	1.86	889	2.18	935	2.52	980	2.87	1022	3.23
2438	858	2.02	907	2.35	953	2.70	997	3.06	1039	3.43
2625	878	2.20	926	2.54	972	2.89	1015	3.26	1056	3.64
2813	899	2.40	946	2.75	991	3.11	1033	3.49	1074	3.88
3000	920	2.62	966	2.98	1010	3.35	1052	3.74	1093	4.14
3188	942	2.86	987	3.23	1031	3.61	1072	4.01	**1112**	**4.42**
3375	964	3.12	1009	3.50	1052	3.89	1093	4.30	**1132**	**4.72**
3563	988	3.41	1032	3.80	1074	4.20	**1114**	**4.61**	**1152**	**5.04**
3750	1011	3.71	1054	4.11	1096	4.53	**1135**	**4.95**	–	–

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

Boldface indicates field–supplied drive is required.

1. Recommend using field–supplied blower pulley (part no. 1175896), and belt (part no. 1178182).
2. Recommend using field–supplied motor pulley (part number 1175720) blower pulley (part no. 1175896), and belt (part number 1178449)

FAN PERFORMANCE (cont.)

Table 14 – RGS120, 3 PHASE, 10 TON HORIZONTAL SUPPLY

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field−Supplied Drive[1]		Standard Static Option						High Static Option with Field Supplied Drive[2]	
3000	**579**	**0.70**	660	0.89	732	1.09	799	1.29	860	1.50
3250	613	0.85	690	1.06	760	1.27	823	1.49	883	1.71
3500	648	1.03	721	1.25	788	1.48	850	1.71	907	1.95
3750	683	1.23	753	1.47	817	1.71	877	1.96	933	2.21
4000	719	1.45	786	1.71	848	1.97	905	2.23	959	2.50
4250	756	1.71	819	1.98	879	2.26	934	2.53	987	2.81
4500	792	1.99	853	2.28	910	2.57	964	2.87	1015	3.16
4750	830	2.31	888	2.62	943	2.92	995	3.23	1044	3.54
5000	867	2.66	923	2.98	976	3.30	1026	3.63	1074	3.95

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	High Static Option with Field Supplied Drive[2]								High Static Option	
3000	917	1.70	970	1.91	1021	2.13	1070	2.34	1117	2.56
3250	938	1.93	991	2.16	1041	2.38	1089	2.61	1134	2.85
3500	961	2.18	1013	2.42	1062	2.66	1108	2.91	1153	3.15
3750	985	2.46	1035	2.71	1083	2.97	1129	3.23	1173	3.49
4000	1011	2.76	1059	3.03	1106	3.30	1151	3.58	1194	3.85
4250	1037	3.09	1084	3.38	1130	3.66	1174	3.95	1216	4.24
4500	1064	3.46	1110	3.76	1155	4.06	1198	4.36	1239	4.66
4750	1091	3.85	1137	4.16	1180	4.48	1222	4.80	**1263**	**5.12**
5000	1120	4.28	1164	4.61	1207	4.94	–	–	–	–

NOTE: For more information, see General Fan Performance Notes on page 21.
Boldface indicates field−supplied drive is required.
1. Recommend using field−supplied blower pulley (part no. 1178190), and belt (part no. 1178181).
2. Recommend using field−supplied motor pulley (part number 1175720) blower pulley (part no. 1175315), and belt (part number 1178255).

Table 15 – RGS120, 3 PHASE, 10 TON VERTICAL SUPPLY

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard Static Option								High Static Option with Field Supplied Drive[1]	
3000	616	0.79	689	0.97	757	1.16	821	1.36	882	1.57
3250	655	0.96	724	1.16	788	1.37	849	1.58	907	1.80
3500	695	1.17	760	1.38	821	1.60	879	1.83	934	2.06
3750	736	1.41	797	1.63	855	1.86	910	2.10	963	2.35
4000	777	1.68	834	1.91	889	2.16	942	2.41	993	2.67
4250	818	1.98	873	2.23	925	2.49	976	2.75	1025	3.02
4500	860	2.32	912	2.58	962	2.85	1010	3.13	1057	3.41
4750	902	2.69	951	2.97	999	3.26	1046	3.55	1091	3.84
5000	944	3.11	991	3.40	1037	3.70	1082	4.00	1125	4.31

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	High Static Option with Field Supplied Drive[1]						High Static Option			
3000	939	1.79	994	2.01	1047	2.24	1098	2.47	1147	2.71
3250	962	2.03	1015	2.26	1066	2.50	1115	2.75	1163	3.00
3500	987	2.30	1038	2.54	1088	2.80	1135	3.05	1181	3.32
3750	1014	2.60	1063	2.86	1111	3.12	1157	3.39	1202	3.66
4000	1042	2.93	1090	3.20	1136	3.48	1180	3.76	1224	4.04
4250	1072	3.30	1118	3.58	1162	3.87	1205	4.16	**1247**	**4.46**
4500	1103	3.70	1147	4.00	1190	4.29	1232	4.60	**1273**	**4.91**
4750	1135	4.14	1177	4.45	1219	4.76	**1259**	**5.08**	–	–
5000	1167	4.63	1209	4.95	–	–	–	–	–	–

NOTE: For more information, see General Fan Performance Notes on page 21.
Boldface indicates field−supplied drive is required.
1. Recommend using field−supplied motor pulley (part number 1175720) blower pulley (part no. 1175315), and belt (part number 1178255).

FAN PERFORMANCE (cont.)

Table 16 – RGS150, 3 PHASE, 12.5 TON HORIZONTAL SUPPLY

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field−Supplied Drive		Standard Static Option						High Static Option with Field Supplied Drive	
3438	**639**	**0.98**	713	1.20	781	1.43	843	1.65	901	1.88
3750	683	1.23	753	1.47	817	1.71	877	1.96	933	2.21
4063	728	1.52	794	1.78	855	2.04	912	2.31	966	2.57
4375	774	1.85	836	2.13	894	2.41	949	2.70	1001	2.98
4688	820	2.23	879	2.53	935	2.83	987	3.14	1037	3.44
5000	867	2.66	923	2.98	976	3.30	1026	3.63	1074	3.95
5313	914	3.15	967	3.49	**1018**	**3.83**	1066	4.17	1112	4.52
5625	962	3.69	**1012**	**4.05**	1061	4.42				
5938	**1009**	**4.30**	1058	4.68						
6250										

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	High Static Option with Field Supplied Drive						High Static Option			
3438	955	2.12	1007	2.35	1056	2.59	1103	2.83	1148	3.08
3750	985	2.46	1035	2.71	1083	2.97	1129	3.23	1173	3.49
4063	1017	2.84	1066	3.12	1112	3.39	1157	3.67	1200	3.95
4375	1050	3.27	1097	3.56	1142	3.86	1186	4.15	1228	4.45
4688	1084	3.75	1130	4.06	1174	4.37	1216	4.68	**1257**	**5.00**
5000	1120	4.28	1164	4.61			**1248**	**5.27**	**1288**	**5.60**
5313										
5625										

NOTE: For more information, see General Fan Performance Notes on page 21.
Boldface indicates field−supplied drive is required.

Table 17 – RGS150, 3 PHASE, 12.5 TON VERTICAL SUPPLY

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Standard Static Option						High Static Option with Field Supplied Drive			
3438	685	1.12	751	1.32	813	1.54	871	1.76	927	1.99
3750	736	1.41	797	1.63	855	1.86	910	2.10	963	2.35
4063	787	1.75	844	1.99	898	2.24	951	2.49	1001	2.75
4375	839	2.14	892	2.40	943	2.67	993	2.94	1041	3.21
4688	891	2.60	941	2.87	990	3.15	1037	3.44	1082	3.73
5000	944	3.11	991	3.40	1037	3.70	1082	4.00	1125	4.31
5313	997	3.69	1042	4.00	1085	4.32	1128	4.64		
5625	1051	4.34	1093	4.67						
5938										
6250										

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	High Static Option with Field Supplied Drive						High Static Option			
3438	981	2.23	1032	2.47	1082	2.72	1130	2.97	1177	3.23
3750	1014	2.60	1063	2.86	1111	3.12	1157	3.39	1202	3.66
4063	1049	3.02	1097	3.29	1142	3.57	1186	3.85	1230	4.14
4375	1087	3.49	1132	3.78	1176	4.08	1218	4.37	**1260**	**4.68**
4688	1126	4.03	1169	4.33	1211	4.64				
5000	1167	4.63								
5313										

NOTE: For more information, see General Fan Performance Notes on page 21.
Boldface indicates field−supplied drive is required.

FAN PERFORMANCE (cont.)

Table 18 – PULLEY ADJUSTMENT

UNIT		MOTOR/DRIVE COMBO	MOTOR PULLEY TURNS OPEN										
			0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
RGS090	3 phase	Standard Static	747	721	695	670	644	618	592	566	541	515	489
		High Static	1102	1083	1063	1044	1025	1006	986	967	948	928	909
RGS120	3 phase	Standard Static	838	813	789	764	739	715	690	665	640	616	591
		High Static	1240	1218	1196	1175	1153	1131	1109	1087	1066	1044	1022
RGS150	3 phase	Standard Static	838	813	789	764	739	715	690	665	640	616	591
		High Static	1240	1218	1196	1175	1153	1131	1109	1087	1066	1044	1022

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

– Factory settings

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

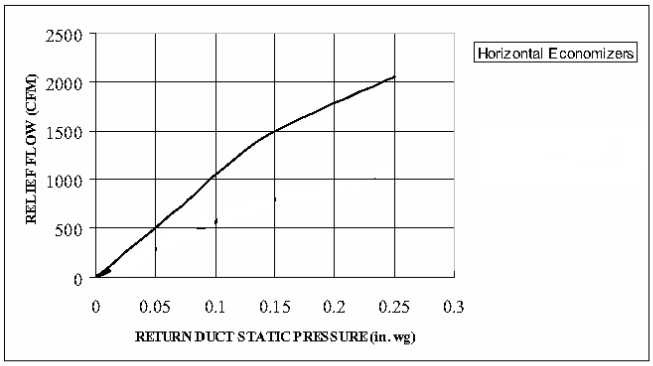


Fig 1 − Barametric Relief Flow Capacity

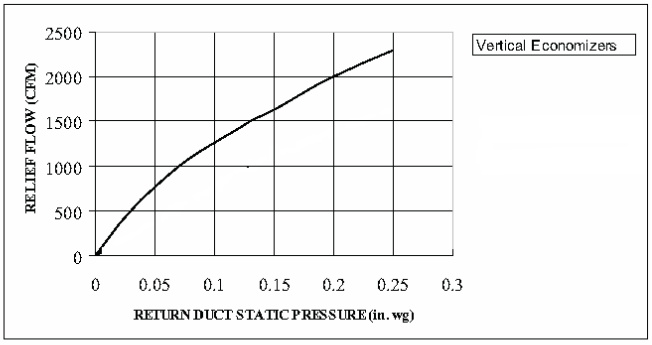


Fig 5 − Barametric Relief Flow Capacity

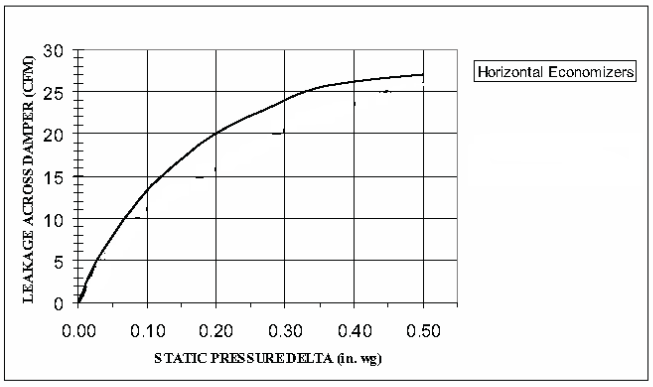


Fig 2 − Outdoor Air Damper Leakage

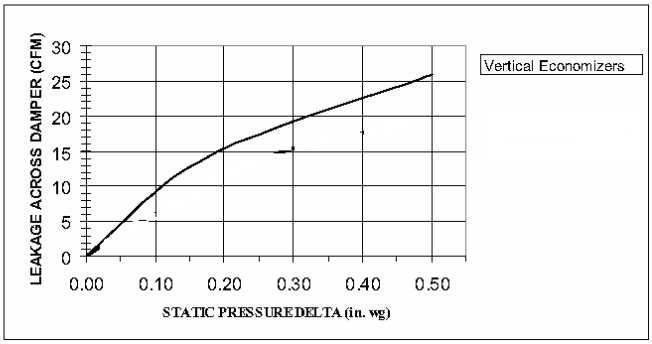


Fig 6 − Outdoor Air Damper Leakage

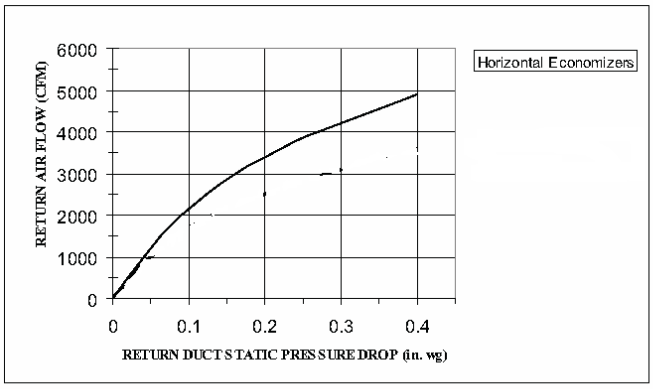


Fig 3 − Return Air Pressure Drop

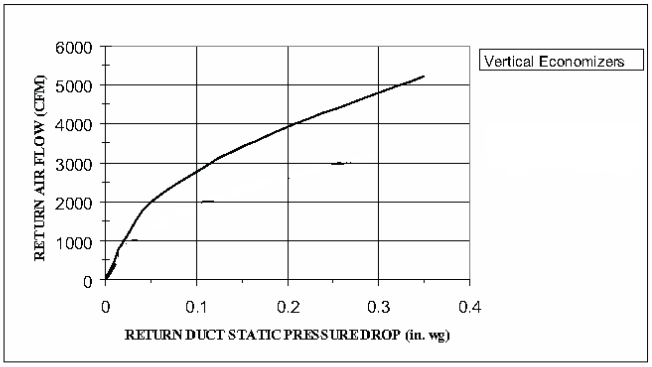


Fig 7 − Return Air Pressure Drop

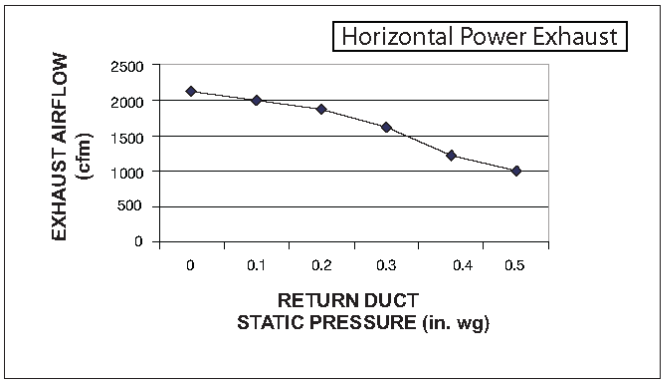


Fig 4 − Horizontal Power Exhaust Performance

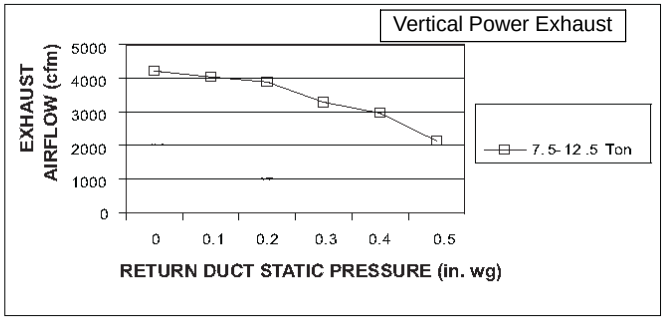


Fig 8 − Vertical Power Exhaust Performance

ELECTRICAL INFORMATION

Table 19 – RGS090, 7.5 TONS (2 Stage Cooling)

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

Table 20 – RGS120, 10 TONS (2 Stage Cooling)

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

Table 21 – RGS150, 12.5 TONS (2 Stage Cooling)

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

Table 22 – MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.

Unit	NOM. V–Ph–Hz	IFM TYPE	Combustion Fan Motor FLA	Power Exhaust FLA	NO C.O. or UNPWRD C.O. NO P.E.				NO C.O. or UNPWRD C.O. w/ P.E. (pwrd fr/ unit)			
							DISC. SIZE				DISC. SIZE	
					MCA	MOCP	FLA	LRA	MCA	MOCP	FLA	LRA
RGS090	208/230–3–60	STD	0.48	3.8	38.8	50	41	193	42.6	50	45	197
		MED*			41.1	50	43	230	44.9	50	48	234
		HIGH			49.0	60	52	256	52.8	60	56	260
	460–3–60	STD	0.25	1.8	17.9	20	19	95	19.7	25	21	97
		MED*			18.7	25	20	114	20.5	25	22	116
		HIGH			23.1	30	24	127	24.9	30	26	129
	575–3–60	STD	0.24	3.8	13.1	15	14	77	16.9	20	18	81
		MED*			13.5	15	14	92	17.3	20	19	96
		HIGH			16.6	20	17	106	20.4	25	22	110
RGS120	208/230–3–60	STD	0.48	3.8	43.7	50	46	258	47.5	60	50	262
		MED*			48.5	60	51	301	52.3	60	56	305
		HIGH			53.5	60	57	310	57.3	70	61	314
	460–3–60	STD	0.25	1.8	21.5	25	23	123	23.3	30	25	125
		MED*			23.3	30	25	145	25.1	30	27	147
		HIGH			26.3	30	28	149	28.1	35	30	151
	575–3–60	STD	0.24	3.8	16.2	20	17	93	20.0	25	21	97
		MED*			17.0	20	18	104	20.8	25	22	108
		HIGH			19.8	25	21	118	23.6	30	25	122
RGS150	208/230–3–60	STD	0.48	3.8	60.7	80	63	360	64.5	80	68	364
		MED*			63.2	80	66	377	67.0	80	71	381
		HIGH			68.2	80	72	386	72.0	80	76	390
	460–3–60	STD	0.25	1.8	29.5	40	31	181	31.3	40	33	183
		MED*			30.5	40	32	190	32.3	40	34	192
		HIGH			33.5	40	35	194	35.3	45	37	196
	575–3–60	STD	0.24	3.8	22.3	30	23	142	26.1	30	28	146
		MED*			22.3	30	23	142	26.1	30	28	146
		HIGH			25.1	30	27	156	28.9	35	31	100

* Available from FAST Parts
[1]Fuse or breaker

LEGEND:

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

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.

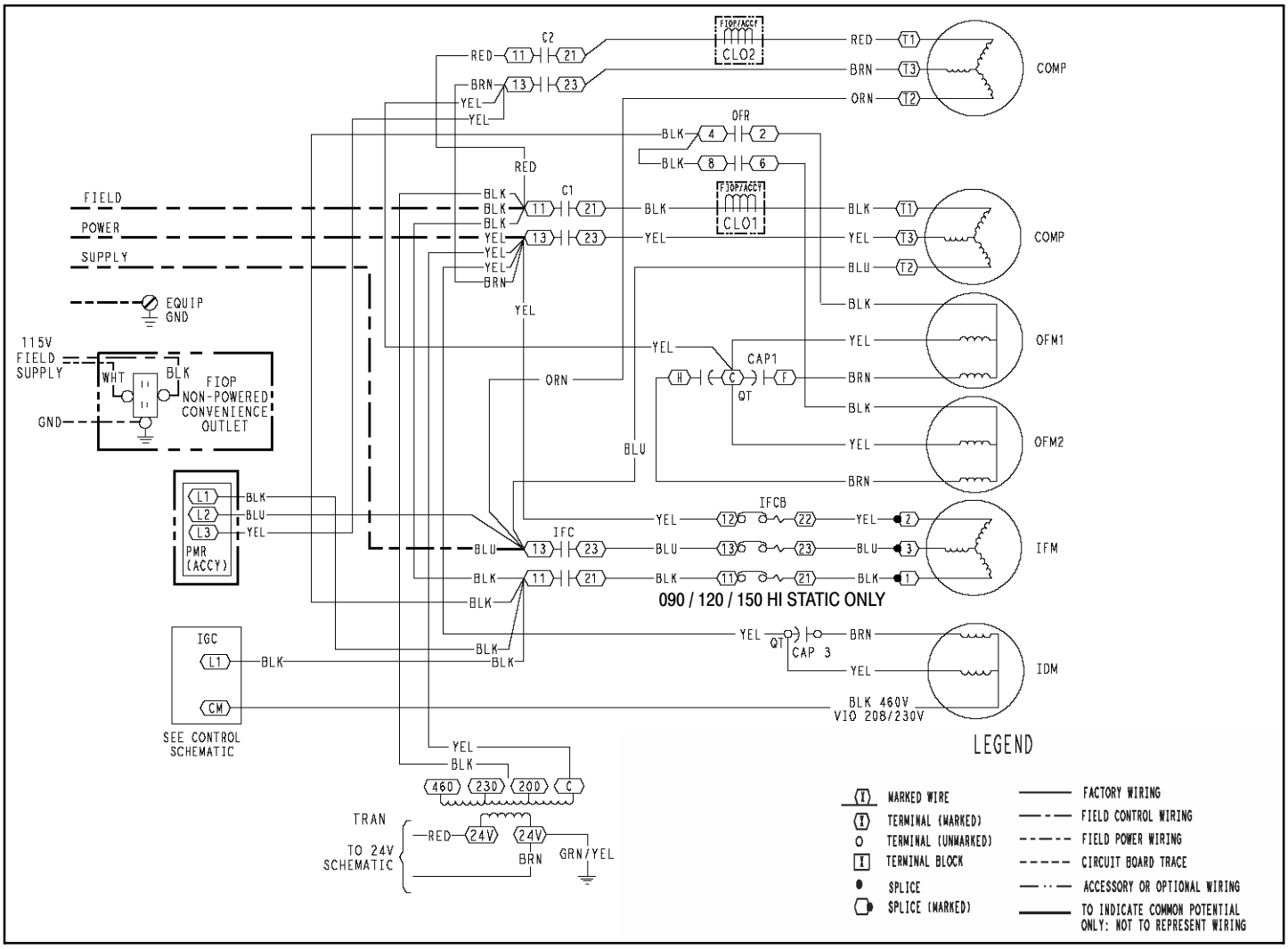


Fig. 10 Typical Power Diagram (2 Stage Cooling)

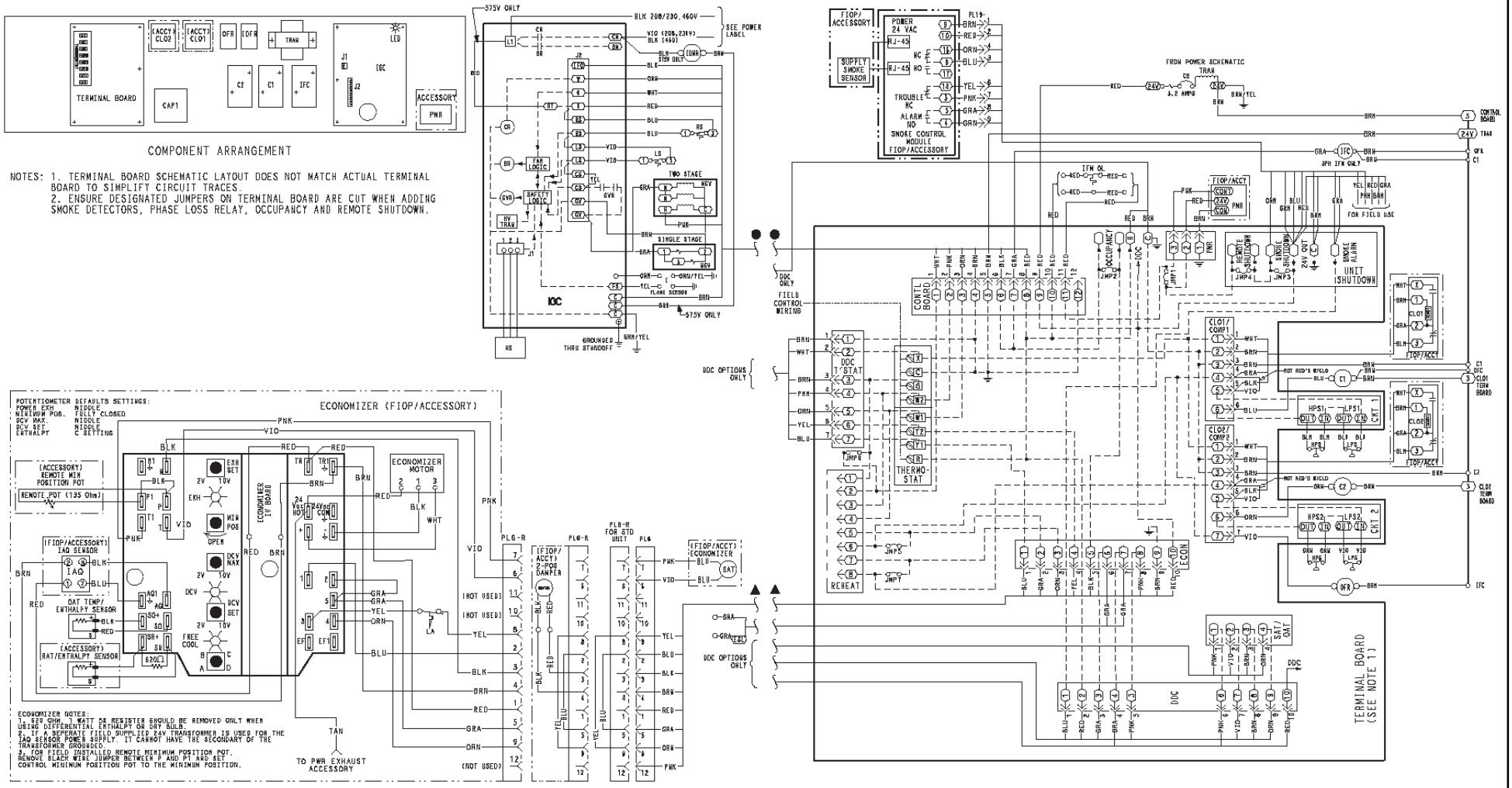
LEGEND

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

NOTES:

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

Fig. 10 Typical Power Diagram (2 Stage Cooling)



NOTES:

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

ECONOMIZER NOTES:

1. 620 ohm, 1 watt, 5% resister should be removed only when using differential enthalpy or dry bulb.

2. If a separate field−supplied 24V transformer is used for the IAQ sensor power supply, it cannot have the secondary of the transformer grounded.

3. For field−installed remote minimum position POT, remove black wire jumper between P and P1 and set control minimum position POT to the minimum position.

SEQUENCE OF OPERATION

General

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

Units with no Economizer

Cooling —

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

Heating

NOTE: RGS units have either 2 stages of gas heat.

When the thermostat calls for heating, power is sent to W on the Integrated Gas Controller (IGC) board. An LED (light−emitting diode) on the IGC board turns on and remains on during normal operation. A check is made to ensure that the rollout switch and limit switch are closed and the induced−draft motor is running. If the check was successful, the induced−draft motor is energized, and when its speed is satisfactory, as proven by the “hall effect” sensor, the ignition activation period begins. The burners will ignite within 5 seconds. If the burners do not light, there is a 22−second delay before another 5−second attempt. This sequence is repeated for 15 minutes or until the burners light. If, after the 15 minutes, the burners still have not lit, heating is locked out. To reset the control, break 24−v power to the thermostat.

When ignition occurs, the IGC board will continue to monitor the condition of the rollout switch, the limit switches, the “hall effect” sensor, as well as the flame sensor. 45 seconds after ignition occurs, assuming the unit is controlled through a room thermostat set for fan auto, the indoor−fan motor will energize (and the outdoor−air dampers will open to their minimum position). If, for some reason, the over−temperature limit opens prior to the start of the indoor fan blower, the unit will shorten the 45−second delay to 5 seconds less than the time from initiation of heat to when the limit tripped. Gas will not be interrupted to the burners and heating will continue. Once the fan−on delay has been modified, it will not change back to 45 seconds until power is reset to the control.

When additional heat is required, W2 closes and initiates power to the second stage of the main gas valve. When the thermostat is satisfied, W1 and W2 open and the gas valve closes, interrupting the flow of gas to the main burners.

If the call for W1 lasted less than 1 minute, the heating cycle will not terminate until 1 minute after W1 became active. If the unit is controlled through a room thermostat set for fan auto, the indoor−fan motor will continue to operate for an additional 45 seconds then stop. If the over−temperature limit opens after the indoor motor is stopped, but within 10 minutes of W1 becoming inactive, on the next cycle the time will be extended by 15 seconds. The maximum delay is 3 minutes. Once modified, the fan off delay will not change back to 45 seconds unless power is reset to the control. A LED indicator is provided on the IGC to monitor operation.

Units with an Economizer

Cooling —

When free cooling is not available, the compressors will be controlled by the zone thermostat. When free cooling is available, the outdoor−air damper is modulated by the economizer control to provide a 50°F (10°C) to 55°F (13°C) mixed−air temperature into the zone. As the mixed air temperature fluctuates above 55°F (13°C)or below 50°F (10°C) dampers will be modulated (open or close) to bring the mixed−air temperature back within control. If mechanical cooling is utilized with free cooling, the outdoor−air damper will maintain its current position at the time the compressor is started. If the increase in cooling capacity causes the mixed−air temperature to drop below 45°F (7°C), then the outdoor−air damper position will be decreased to the minimum position. If the mixed−air temperature continues to fall, the outdoor−air damper will close. Control returns to normal once the mixed−air temperature rises above 48°F (9°C). The power exhaust fans will be energized and de−energized, if installed, as the outdoor−air damper opens and closes.

If field−installed accessory CO2 sensors are connected to the economizer control, a demand controlled ventilation strategy will begin to operate. As the CO2 level in the zone increases above the CO2 set point, the minimum position of the damper will be increased proportionally. As the CO2 level decreases because of the increase in fresh air, the outdoor−air damper will be proportionally closed. For economizer operation, there must be a thermostat call for the fan (G). If the unit is occupied and the fan is on, the damper will operate at minimum position. Otherwise, the damper will be closed.

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

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

Heating

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

Note about this specification:

GAS HEAT PACKAGED ROOFTOP

HVAC Guide Specifications

Size Range:7.5 to 12.5 Nominal Tons

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

Section Description

23 06 80 Schedules for Decentralized HVAC Equipment

23 06 80.13 Decentralized Unitary HVAC Equipment Schedule

23 06 80.13.A. Rooftop unit schedule

1. Schedule is per the project specification requirements.

23 07 16 HVAC Equipment Insulation

23 07 16.13 Decentralized, Rooftop Units:

23 07 16.13.A. Evaporator fan compartment:

1. Interior cabinet surfaces shall be insulated with a minimum 1/2−in. thick, minimum 1 1/2 lb density, flexible fiberglass insulation bonded with a phenolic binder, neoprene coated on the air side.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

23 07 16.13.B. Gas heat compartment:

1. Aluminum foil−faced fiberglass insulation shall be used.
2. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

23 09 13 Instrumentation and Control Devices for HVAC

23 09 13.23 Sensors and Transmitters

23 09 13.23.A, Thermostats

1. Thermostat must
   a. energize both “W” and “G” when calling for heat.
   b. have capability to energize 2 different stages of cooling, and 2 different stages of heating.
   c. must include capability for occupancy scheduling.

23 09 33 Electric and Electronic Control System for HVAC

23 09 33.13 Decentralized, Rooftop Units:

23 09 33.13.A. General:

1. Shall be complete with self−contained low−voltage control circuit protected by a 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, gas controller, economizer, thermostat, and low and high pressure switches.
4. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor. See heat exchanger section of this specification.
5. Unit shall include a minimum of one 8−pin screw terminal connection board for connection of control wiring.

23 09 33.23.B, Safeties:

1. Compressor over−temperature, over−current. High internal pressure differential.
2. Low−pressure switch.

a. Units shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross−wiring of the safety switches between circuits 1 and 2.

b. Low pressure switch shall use different color wire than the high pressure switch. The purpose is to assist the installer and service person to correctly wire and or troubleshoot the rooftop unit.

3. High−pressure switch.

a. Units shall have different sized connectors for the circuit 1 and circuit 2 low and high pressure switches. They shall physically prevent the cross−−wiring of the safety switches between circuits 1 and 2.

b. High pressure switch shall use different color wire than the low pressure switch. The purpose is to assist the installer and service person to correctly wire and or troubleshoot the rooftop unit.

4. Automatic reset, motor thermal overload protector.

5. Heating section shall be provided with the following minimum protections:

a. High−temperature limit switches.

b. Induced draft motor speed sensor.

c. Flame rollout switch.

d. Flame proving controls.

23 09 93 Sequence of Operations for HVAC Controls

23 09 93.13 Decentralized, Rooftop Units:

23 09 93.13 INSERT SEQUENCE OF OPERATION

23 40 13 Panel Air Filters

23 40 13.13 Decentralized, Rooftop Units:

23 40 13.13.A. Standard filter section shall

1. Shall consist of factory−installed, low velocity, throwaway 2−in. thick fiberglass filters of commercially available sizes.
2. Unit shall use only one filter size. Multiple sizes are not acceptable.
3. Filter face velocity shall not exceed 365 fpm at nominal airflows.
4. Filters shall be accessible through an access panel with “no−tool” removal as described in the unit cabinet section of this specification (23 81 19.13.H).

23 81 19 Self−Contained Air Conditioners

23 81 19.13 Small−Capacity Self−Contained Air Conditioners (RGS090−150)

23 81 19.13.A. General

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

23 81 19.13.B. Quality Assurance

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

12. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
13. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 mph.
14. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.

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

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

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 ARI Standard 210/240 or 360 at ± 10% voltage.
2. Compressor with standard controls shall be capable of operation down to 40°F (4°C), ambient outdoor temperatures. Accessory winter start kit is necessary if mechanically cooling at ambient temperatures below 40°F (4°C) to 25°F (−4°C) below 25°F (−4°C) an accessory Motormaster low ambient control is required and the outdoor fan motor needs to be changed to a ball−bearing speed control motor design except on 150 size, no OD fan motor change is required.
3. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.
4. Unit shall be factory configured for vertical supply & return configurations.
5. Unit shall be field convertible from vertical to horizontal configuration
6. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.

23 81 19.13.G. Electrical Requirements

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

23 81 19.13.H. Unit Cabinet

1. Unit cabinet shall be constructed of galvanized steel, and shall be bonderized and coated with a pre−painted baked enamel finish on all externally exposed surfaces.
2. Unit cabinet exterior paint shall be: film thickness, (dry) 0.003 inches (.076mm) minimum, gloss (per ASTM D523, 60°F (16°C): 60, Hardness: H−2H Pencil hardness.
3. Evaporator fan compartment interior cabinet insulation shall conform to ARI Standards 210 or 360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2−in. thick, 1 lb density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil−faced fiberglass insulation shall be used in the gas heat compartment.
4. Base of unit shall have a minimum of four locations for thru−the−base gas and electrical connections (factory installed or field installed), standard.
5. Base Rail
   a. Unit shall have base rails on a minimum of 2 sides.
   b. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
   c. Holes shall be provided in the base rail for moving the rooftop by fork truck.
   d. Base rail shall be a minimum of 16 gauge thickness.
6. Condensate pan and connections:
   a. Shall be a sloped condensate drain pan made of a non−corrosive material.
   b. Shall comply with ASHRAE Standard 62.
   c. Shall use a 3/4" −14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer's recommendations.
7. Top panel:
   a. Shall be a single piece top panel on 090 to 120 models and two piece on 150 models.
8. Gas Connections:
   a. All gas piping connecting to unit gas valve shall enter the unit cabinet at a single location on side of unit (horizontal plane).
   b. Thru−the−base capability
      i. Standard unit shall have a thru−the−base gas−line location using a raised, embossed portion of the unit basepan.

ii. Optional, factory−approved, water−tight connection method must be used for thru−the−base gas connections.

iii. No basepan penetration, other than those authorized by the manufacturer, is permitted.

9. Electrical Connections
   a. All unit power wiring shall enter unit cabinet at a single, factory−prepared, knockout location.
   b. Thru−the−base capability
      i. Standard unit shall have a thru−the−base electrical location(s) using a raised, embossed portion of the unit basepan.
      ii. Optional, factory−approved, water−tight connection method must be used for thru−the−base electrical connections.
      iii. No basepan penetration, other than those authorized by the manufacturer, is permitted.
10. Component access panels (standard)
   a. Cabinet panels shall be easily removable for servicing.
   b. Unit shall have one factory installed, tool−less, removable, filter access panel.
   c. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have a molded composite handles.
   d. Handles shall be UV modified, composite. They shall be 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. Gas Heat

1. General
   a. Heat exchanger shall be an induced draft design. Positive pressure heat exchanger designs shall not be allowed.
   b. Shall incorporate a direct−spark ignition system and redundant main gas valve.
   c. Heat exchanger design shall allow combustion process condensate to gravity drain; maintenance to drain the gas heat exchanger shall not be required.
   d. Gas supply pressure at the inlet to the rooftop unit gas valve must match that required by the manufacturer.
2. The heat exchanger shall be controlled by an integrated gas controller (IGC) microprocessor.
   a. IGC board shall notify users of fault using an LED (light−emitting diode).
   b. The Light Emitting Diode (LED) shall be visible without removing the control box access panel.
   c. IGC board shall contain algorithms that modify evaporator−fan operation to prevent future cycling on high temperature limit switch.
   d. Unit shall be equipped with anti−cycle protection with one short cycle on unit flame rollout switch or 4 continuous short cycles on the high temperature limit switch. Fault indication shall be made using an LED.
3. Standard Heat Exchanger construction
   a. Heat exchanger shall be of the tubular−section type constructed of a minimum of 20−gauge steel coated with a nominal 1.2 mil aluminum−silicone alloy for corrosion resistance.
   b. Burners shall be of the in−shot type constructed of aluminum−coated steel.
   c. Burners shall incorporate orifices for rated heat output up to 2000 ft (610m) elevation. Additional accessory kits may be required for applications above 2000 ft (610m) elevation, depending on local gas supply conditions.
   d. Each heat exchanger tube shall contain multiple dimples for increased heating effectiveness.
4. Induced draft combustion motor and blower
   a. Shall be a direct−drive, single inlet, forward−curved centrifugal type.
   b. Shall be made from steel with a corrosion−resistant finish.
   c. Shall have permanently lubricated sealed bearings.
   d. Shall have inherent thermal overload protection.
   e. Shall have an automatic reset feature.

23 81 19.13.J. Coils

5. Optional E−coated aluminum tube / aluminum fin condenser coil.
   a. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins.

b. A polymer strip shall prevent coil assembly from contacting sheet metal coil pan to maintain coating integrity and minimize corrosion potential between coil and pan.
c. Coating process shall ensure complete coil encapsulation of tubes, fins and headers.
d. Color shall be high gloss black with gloss per ASTM D523−89.
e. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges
f. Superior hardness characteristics of 2H per ASTM D3363−92A and cross−hatch adhesion of 4B−5B per ASTM D3359−93.
g. Impact resistance shall be up to 160 in.−lb (ASTM D2794−93).
h. Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247−92 and ASTM D870−92).
i. Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117−90.

6. Standard Coils: (090 −150 two compressor /two stage cooling models only)
a. Standard evaporator coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
b. Evaporator coils shall be leak tested to 150 psig, pressure tested to 450 psig, and qualified to UL 1995 burst test at 1775 psig.
c. Standard condenser coils shall have all aluminum microchannel Heat Exchanger Technology design consisting of aluminum multi port flat tube design and aluminum fin. Coils shall be a furnace brazed design and contain epoxy lined shrink wrap on all aluminum to copper connections.
d. Condenser coils shall be leak tested to 150 psig, pressure tested to 650 psig, and qualified to UL 1995 burst test at 1980 psig.

23 81 19.13.K. Refrigerant Components

1. Refrigerant circuit shall include the following control, safety, and maintenance features:
a. Fixed orifice metering system shall prevent mal−distribution of two−phase refrigerant by including multiple fixed orifice devices in each refrigeration circuit. Each orifice is to be optimized to the coil circuit it serves.
b. Refrigerant filter drier.
c. Service gauge connections on suction and discharge lines.
d. Pressure gauge access through a specially designed access port in the top panel of the unit.
2. Compressors
a. Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.
b. Models shall be available with 2 compressor (stage) models from 090 −150 sizes with microchannel condenser coils.
c. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
d. Compressors shall be internally protected from high discharge temperature conditions.
e. Compressors shall be protected from an over−temperature and over−amperage conditions by an internal, motor overload device.
f. Compressor shall be factory mounted on rubber grommets.
g. Compressor motors shall have internal line break thermal and current overload protection.
h. Crankcase heaters shall not be required for normal operating range.

23 81 19.13.L. Filter Section

1. Filters access is specified in the unit cabinet section of this specification.
2. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
3. Shall consist of factory−installed, low velocity, throw−away 2−in. thick fiberglass filters.
4. Filter face velocity shall not exceed 320 fpm at nominal airflows.
5. Filters shall be standard, commercially available sizes.
6. Only one size filter per unit is allowed.

23 81 19.13.M. Evaporator Fan and Motor

1. Evaporator fan motor:
a. Shall have permanently lubricated bearings
b. Shall have inherent automatic−reset thermal overload protection.
c. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.
2. Belt−driven Evaporator Fan:
a. Belt drive shall include an adjustable−pitch motor pulley.

b. Shall use sealed, permanently lubricated ball−bearing type.
c. Blower fan shall be double−inlet type with forward−curved blades.
d. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.

23 81 19.13.N. Condenser Fans and Motors

1. Condenser fan motors:
   a. Shall be a totally enclosed motor.
   b. Shall use permanently lubricated bearings.
   c. Shall have inherent thermal overload protection with an automatic reset feature.
   d. Shall use a shaft−down designon 090−120 models and shaft−up design on 150 with rain shield.
2. Condenser Fans shall:
   a. Shall be a direct−driven propeller type fan
   b. Shall have aluminum blades riveted to corrosion−resistant steel spiders and shall be dynamically balanced.

23 81 19.13.O. Special Features

1. Integrated Economizers:
   a. Integrated, gear−driven parallel modulating blade design type capable of simultaneous economizer and compressor operation.
   b. Independent modules for vertical or horizontal return configurations shall be available. Vertical return modules shall be available as a factory installed option.
   c. Damper blades shall be galvanized steel with composite gears. Plastic or composite blades on intake or return shall not be acceptable.
   d. Shall include all hardware and controls to provide free cooling with outdoor air when temperature and/or humidity are below setpoints.
   e. Shall be equipped with gear driven dampers for both the outdoor ventilation air and the return air for positive air stream control.
   f. Shall be equipped with low−leakage dampers, not to exceed 2% leakage at 1 in. wg pressure differential.
   g. Shall be capable of introducing up to 100% outdoor air.
   h. Shall be equipped with a barometric relief damper capable of relieving up to 100% return air.
   i. Shall be designed to close damper(s) during loss−of−power situations with spring return built into motor.
   j. Dry bulb outdoor−air temperature sensor shall be provided as standard. Outdoor air sensor set point shall be adjustable and shall range from 40 to 100°F / 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 set point.
   m. Dampers shall be completely closed when the unit is in the unoccupied mode.
   n. Economizer controller shall accept a 2−10Vdc CO2 sensor input for IAQ/DCV control. In this mode, dampers shall modulate the outdoor−air damper to provide ventilation based on the sensor input.
   o. Compressor lockout sensor shall open at 35°F (2°C) and close closes at 50°F (10°C).
   p. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
   q. Economizer controller shall provide indications when in free cooling mode, in the DCV mode, or the exhaust fan contact is closed.
   r. Economizer uses a mixed air thermister (MAT) located on indoor fan housing to modulate outdoor air dampers and return air dampers to control to a 55°F (13°C) discharge air temperature
2. Two−Position Damper
   a. Damper shall be a Two−Position Damper. Damper travel shall be from the full closed position to the field adjustable %−open setpoint.
   b. Damper shall include adjustable damper travel from 25% to 100% (full open).
   c. Damper shall include single or dual blade, gear driven dampers and actuator motor.
   d. Actuator shall be direct coupled to economizer gear. No linkage arms or control rods shall be acceptable.
   e. Damper will admit up to 100% outdoor air for applicable rooftop units.
   f. Damper shall close upon indoor (evaporator) fan shutoff and/or loss of power.
   g. Design shall incorporate inherent barometric relief capabilities for barometric relief of rooftop unit return air.
   h. The damper actuator shall plug into the rooftop unit's wiring harness plug. No hard wiring shall be required.

i. Outside air hood shall include aluminum water entrainment filter

3. Manual damper
   a. Manual damper field installed accessory package shall consist of damper, air inlet screen, and rain hood which can be preset to admit up to 50% outdoor air for year round ventilation.
4. Head Pressure Control Package
   a. Controller shall control coil head pressure by condenser−fan speed modulation or condenser−fan cycling and wind baffles.
   b. Shall consist of solid−state control and condenser−coil temperature sensor to maintain condensing temperature between 90°F (32°C) and 110°F (43°C) at outdoor ambient temperatures down to −20°F (−29°C).
5. Liquid Propane (LP) Conversion Kit
   a. Package shall contain all the necessary hardware and instructions to convert a standard natural gas unit for use with liquefied propane, up to 2000 ft (610m) elevation.
   b. Additional accessory kits may be required for applications above 2000 ft (610m) elevation.
6. Flue Shield
   a. Flue shield shall provide protection from the hot sides of the gas flue hood.
7. Condenser Coil louvered Hail Guard Assembly
   a. Shall protect against damage from hail.
   b. Shall be louvered design that provides coil protection from hail
8. Unit−Mounted, Non−Fused Disconnect Switch:
   a. Switch shall be internally mounted.
   b. National Electric Code (NEC) and UL approved non−fused switch shall provide unit power shutoff.
   c. Shall be accessible from outside the unit
   d. Shall provide local shutdown and lockout capability.
9. Convenience Outlet:
   a. Non−Powered convenience outlet.
   b. Outlet shall be powered from a separate 115−120v power source.
   c. A transformer shall not be included.
   d. Outlet shall be and internally mounted with easily accessible 115−v female receptacle.
   e. Outlet shall include 15 amp GFI receptacles with independent fuse protection.
   f. Outlet shall be accessible from outside the unit.
10. Flue Discharge Deflector:
    a. Flue discharge deflector shall direct unit exhaust vertically instead of horizontally.
    b. Deflector shall be defined as a “natural draft” device by the National Fuel and Gas (NFG) code.
11. Thru−the−Base Connectors:
    a. Kits shall provide connectors to permit gas and electrical connections to be brought to the unit through the unit basepan.
    b. Minimum of four connection locations per unit.
12. Fan/Filter Status Switch:
    a. Switch shall provide status of indoor evaporator fan (ON/OFF) or filter (CLEAN/DIRTY).
    b. Status shall be displayed with an indicator light at the thermostat.
13. Propeller Power Exhaust:
    a. Power exhaust shall be used in conjunction with an integrated economizer.
    b. Independent modules for vertical or horizontal return configurations shall be available.
    c. Horizontal power exhaust is shall be mounted in return ductwork.
    d. Power exhaust shall be controlled by economizer controller operation. Exhaust fans shall be energized when dampers open past the 0−100% adjustable setpoint on the economizer control.
14. Roof Curbs (Vertical):
    a. Full perimeter roof curb with exhaust capability providing separate airstreams for energy recovery from the exhaust air without supply air contamination.
    b. Formed galvanized steel with wood nailer strip and shall be capable of supporting entire unit weight.
    c. Permits installation and securing of ductwork to curb prior to mounting unit on the curb.
15. High−Altitude Gas Conversion Kit:

a. Package shall contain all the necessary hardware and instructions to convert a standard natural gas unit to operate from 2000−7000 ft (610 to 2134m) elevation with natural gas or from 0−7000 ft 90−2134m) elevation with liquefied propane.

16. High−Static Indoor Fan Motor(s) and Drive(s) (090−150):
    a. High−static motor(s) and drive(s) shall be factory−installed to provide additional performance range.
17. 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.
18. 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.
19. Indoor Air Quality (CO2) Sensor:
    a. Shall be able to provide demand ventilation indoor air quality (IAQ) control.
    b. The IAQ sensor shall be available in duct mount. The set point shall have adjustment capability.
20. Winter start kit
    a. Shall contain a bypass device around the low pressure switch.
    b. Shall be required when mechanical cooling below an outdoor ambient of 40°F (4°C) to 25°F (−4°C).
    c. Shall not be required to operate an equipped economizer when below an outdoor ambient of 40°F (4°C).
21. Barometric relief included with optional economizer
    a. Shall include damper, seals, hard−ware, and hoods to relieve excess building pressure.
    b. Damper shall gravity−close upon unit shutdown.
22. 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.
23. Phase Monitor Control
    a. Field installed accessory that provides phase loss / phase reversal protection.
    b. Mounts in unit control box and connects to unit main terminal board.