SERVICE AND MAINTENANCE INSTRUCTIONS

R−410A Single Package Gas/Electric
RGS181/183, 210/213, 240/243, 300/303

Safety Labeling and Signal Words

DANGER, WARNING, CAUTION, and NOTE

The signal words **DANGER, WARNING**, **CAUTION**, and **NOTE** are used to identify levels of hazard seriousness. The signal word **DANGER** is only used on product labels to signify an immediate hazard. The signal words **WARNING**, **CAUTION**, and **NOTE** will be used on product labels and throughout this manual and other manual that may apply to the product.

DANGER − Immediate hazards which will result in severe personal injury or death.

WARNING −Hazards or unsafe practices which could result in severe personal injury or death.

CAUTION − Hazards or unsafe practices which may result in minor personal injury or product or property damage.

NOTE − Used to highlight suggestions which will result in enhanced installation, reliability, or operation.

Signal Words in Manuals

The signal word **WARNING** is used throughout this manual in the following manner:

⚠ WARNING

The signal word **CAUTION** is used throughout this manual in the following manner:

⚠ CAUTION

Signal Words on Product Labeling

Signal words are used in combination with colors and/or pictures or product labels.

This Service and Maintenance Manual supplements the basic unit instruction manual (which addressed the mechanical installation of the unit only). Start−up procedures, checklists and operating sequences are included in this manual.

IMPORTANT: Leave a copy of this manual with owner/operator for future reference. .

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SAFETY CONSIDERATIONS

Installation and servicing of air-conditioning equipment can be hazardous due to system pressure and electrical components. Only trained and qualified service personnel should install, repair, or service air-conditioning equipment. Untrained personnel can perform the basic maintenance functions of replacing filters. Trained service personnel should perform all other operations.

When working on air-conditioning equipment, observe precautions in the literature, tags and labels attached to the unit, and other safety precautions that may apply. Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for unbrazing operations. Have fire extinguishers available for all brazing operations.

Follow all safety codes. Wear safety glasses and work gloves. Use quenching cloth for brazing operations. Have fire extinguisher available. Read these instructions thoroughly and follow all warnings or cautions attached to the unit. Consult local building codes and National Electrical Code (NEC) for special requirements.

Recognize safety information. This is the safety−alert symbol ⚠. When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety−alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies a hazard which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **may** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

⚠ WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.

Refer to the User's Information Manual provided with this unit for more details.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

What to do if you smell gas:

DO NOT try to light any appliance.
DO NOT touch any electrical switch, or use any phone in your building.
IMMEDIATELY call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
If you cannot reach your gas supplier, call the fire department.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Before performing service or maintenance operations on unit, turn off main power switch to unit. Electrical shock and rotating equipment could cause injury.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Units with convenience outlet circuits may use multiple disconnects. Check convenience outlet for power status before opening unit for service. Locate its disconnect switch, if appropriate, and open it. Tag−out this switch, if necessary.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could cause personal injury, death and/or equipment damage.

R−410A refrigerant systems operate at higher pressures than standard R−22 systems. Do not use R−22 service equipment or components on R−410A refrigerant equipment.

⚠ WARNING

FIRE, EXPLOSION HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect gas piping from unit when pressure testing at pressure greater than 0.5 psig. Pressures greater than 0.5 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 0.5 psig, it *must* be replaced before use. When pressure testing field-supplied gas piping at pressures of 0.5 psig or less, a unit connected to such piping must be isolated by closing the manual gas valve(s).

⚠ CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing air conditioning units.

UNIT ARRANGEMENT AND ACCESS

General

FIGURE 1 and FIGURE 2 show general unit arrangement and access locations.

FIGURE 1 **Access Panels and Components, Front**

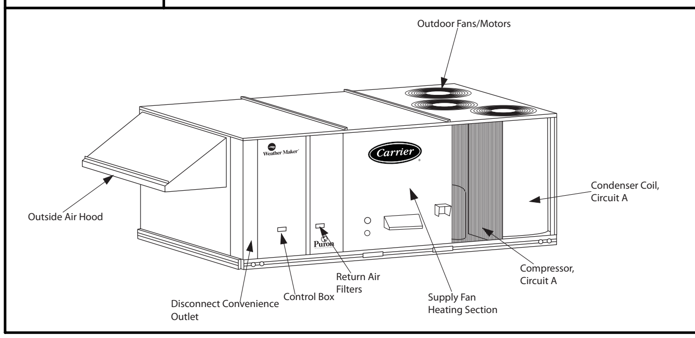
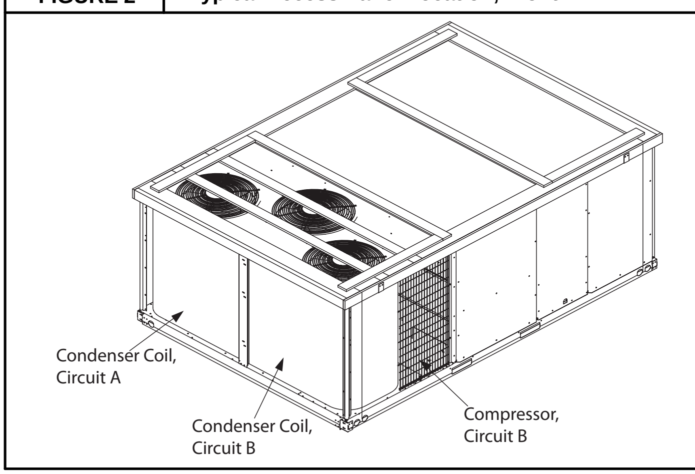


FIGURE 2 **Typical Access Panel Location, Front**



Routine Maintenance

These items should be part of a routine maintenance program, to be checked every month or two, until a specific schedule for each can be identified for this installation:

Quarterly Inspection (and 30 days after initial start)

- Return air filter replacement
- Outdoor hood inlet filters cleaned
- Belt tension checked
- Belt condition checked
- Pulley alignment checked
- Fan shaft bearing locking collar tightness checked
- Condenser coil cleanliness checked
- Condensate drain checked

Seasonal Maintenance

These items should be checked at the beginning of each season (or more often if local conditions and usage patterns dictate):

Air Conditioning

- Condenser fan motor mounting bolts tightness
- Compressor mounting bolts
- Condenser fan blade positioning
- Control box cleanliness and wiring condition
- Wire terminal tightness
- Refrigerant charge level
- Evaporator coil cleaning
- Evaporator blower motor amperage

Heating

- Heat exchanger flue passageways cleanliness
- Gas burner condition
- Gas manifold pressure
- Heating temperature rise

Economizer or Outside Air Damper

- Inlet filters condition
- Check damper travel (economizer)
- Check gear and dampers for debris and dirt

Air Filters and Screens

Each unit is equipped with return air filters. If the unit has an economizer, it will also have an outside air screen. If a manual outside air damper is added, an inlet air screen will also be present.

Each of these filters and screens will need to be periodically replaced or cleaned.

Return Air Filters

Return air filters are disposable fiberglass media type. Access to the filters is through the vertical panel to the right of the control box. Filters are situated on slide out racks for easy inspection and repair. (See FIGURE 1.)

To remove the filters:

1. Remove vertical filter access door.
2. Reach inside and extract the filters from the filter rack.
3. Replace these filters as required with similar replacement filters of same size.
4. Re−install filter access panel.

IMPORTANT: DO NOT OPERATE THE UNIT WITHOUT THESE FILTERS!

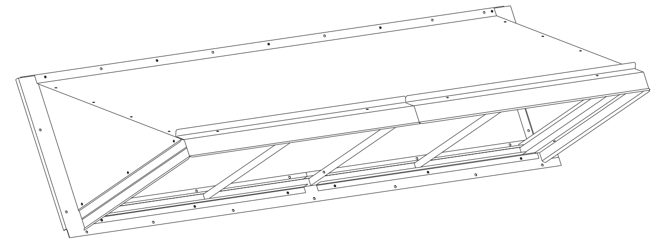
Outside Air Hood

Outside air hood inlet screens are permanent aluminum−mesh type filters. Check these for cleanliness. Remove the screens when cleaning is required. Clean by washing with hot low−pressure water and soft detergent and replace all screens before restarting the unit. Observe the flow direction arrows on the side of each filter frame.

Economizer and Manual Outside Air Screens

This air screen is retained by spring clips under the top edge of the hood. (See FIGURE 3.)

FIGURE 3 Filter Installation



To remove the filter, remove screws in horizontal filter retainers on leading edge of hood. Slide filters out.

To re−install filters, slide clean or new filters into hood side retainers. Once positioned, re−install horizontal filter retainer.

SUPPLY FAN (BLOWER) SECTION

⚠ WARNING

ELECTRICAL SHOCK HAZARD

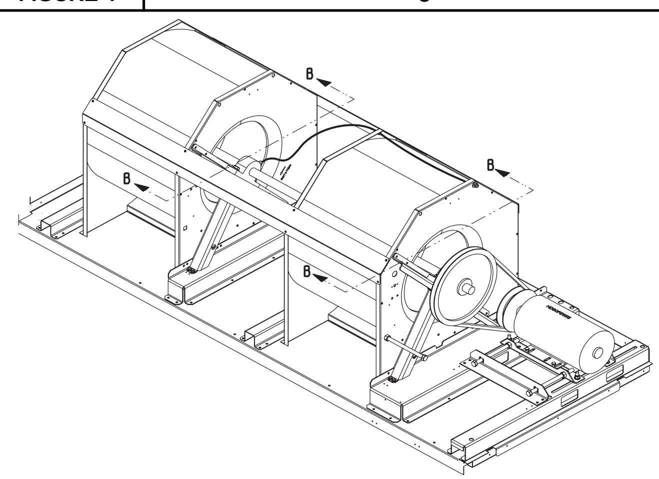
Failure to follow this warning could cause personal injury or death.

Before performing service or maintenance operations on the fan system, shut off all unit power and tag−out the unit disconnect switch. Do not reach into the fan section with power still applied to unit.

Supply Fan Assembly

The supply fan system consists of two forward−curved centrifugal blower wheels mounted on a solid blower shaft that is supported by two greaseable pillow block concentric bearings. A fixed−pitch driven (fan) pulley is attached to the fan shaft and an adjustable−pitch driver pulley is mounted on the motor. The pulleys are connected using a ”V” type belt. (See FIGURE 4.)

FIGURE 4 Belt Drive Motor Mounting



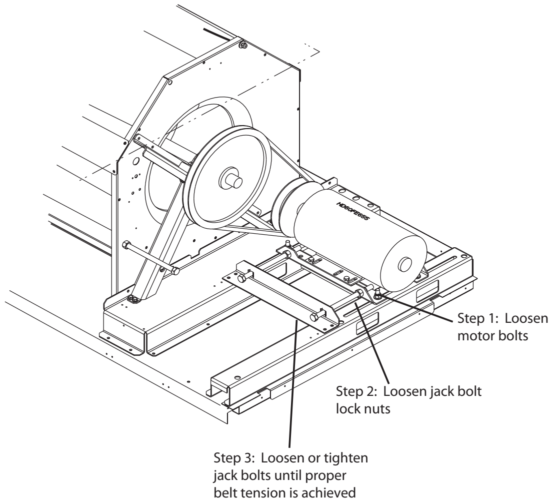
Belt

Check the belt condition and tension quarterly. Inspect the belt for signs of cracking, fraying or glazing along the inside surfaces. Check belt tension by using a spring-force tool (such as Browning’s Part Number “Belt Tension Checker” or equivalent tool); tension should be between 5−10-lbs with 5/8-in. deflection when measured at the centerline of the belt span. This point is at the center of the belt when measuring the distance between the motor shaft and the blower shaft.

NOTE: Without the spring−tension tool, place a straight edge across the belt surface at the pulleys, then deflect the belt at mid−span using one finger to a 1/2-in. deflection.

Adjust the belt tension by loosening the four motor mounting nuts and bolts where the motor bolts to the blower rail. There are two jack bolts and nuts that are used to slide the motor plate to either increase or decrease belt tension. There are locking nuts on the jack bolts that need to be loosened at the motor plate. Turn the jack bolts clockwise or counter clockwise until the correct belt tension is achieved. Ensure the fan shaft and motor shaft are parallel prior to tightening motor plate nuts. (See FIGURE 5.)

FIGURE 5 **Adjusting Belt Tension**



To replace the belt:

1. Use a belt with same section type or similar size. Do not substitute a "FHP" type belt. When installing the new belt, do not use a tool (screwdriver or pry−bar) to force the belt over the pulley flanges, this will stress the belt and cause a reduction in belt life.
2. Loosen the motor mounting plate front bolts and rear bolts.
3. Loosen the Jack bolt lock nuts and using the Jack bolts relieve the belt tension to allow easy removal of the belt by hand.
4. Remove the belt by gently lifting the old belt over one of the pulleys.
5. Install the new belt by gently sliding the belt over both pulleys, then using the Jack Bolts slide the motor plate away from the fan housing until proper belt tension is achieved.
6. Check the alignment of the pulleys, adjust if necessary.
7. Tighten all nuts to motor plate and Jack bolts.
8. Check the tension after a few hours of runtime and re−adjust as required.

Adjustable−Pitch Pulley on Motor

The motor pulley is an adjustable−pitch type that allows a servicer to implement changes in the fan wheel speed to match as−installed ductwork systems. The pulley consists of a fixed flange side that faces the motor (secured to the motor shaft) and a movable flange side that can be rotated around the fixed flange side that increases or reduces the pitch diameter of this driver pulley. (See FIGURE 6.)

As the pitch diameter is changed by adjusting the position of the movable flange, the centerline on this pulley shifts laterally (along the motor shaft). This creates a requirement for a realignment of the pulleys after any adjustment of the movable flange. Also reset the belt tension after each realignment. The factory setting of the adjustable pulley is five (5) turns open from full closed.

Check the condition of the motor pulley for signs of wear. Glazing of the belt contact surfaces and erosion on these surfaces are signs of improper belt tension and/or belt slippage. Pulley replacement may be necessary.

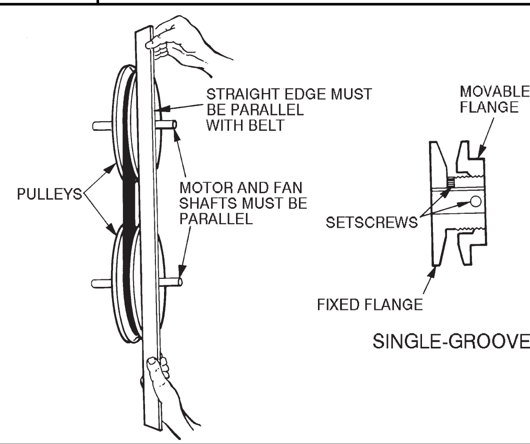
To change fan speed:

1. Shut off unit power supply and install lock−out tag.
2. Loosen belt by loosening the motor adjustment bolts as described in the Belt Adjustment section above. (See FIGURE 5.)
3. Loosen movable pulley flange setscrew. (See FIGURE 6.)
4. Screw movable flange toward fixed flange to increase speed and away from fixed flange to decrease speed. Increasing fan speed increases load on motor. Do not exceed maximum fan speed in the Product Data or motor amperage as listed on the unit rating plate.
5. Set movable flange at nearest keyway or flat of pulley hub and tighten setscrew to torque specifications. Torque pulley set screw to 72 +/− 5 (in−lbs).

To align fan and motor pulleys:

1. Loosen fan pulley setscrews.
2. Slide fan pulley along fan shaft. Make angular alignment by loosening motor from mounting.
3. Tighten fan pulley setscrews and motor mounting bolts to torque specifications.
4. Recheck belt tension.

FIGURE 6 **Supply Fan Pulley Alignment**



Bearings

This fan system uses bearings featuring concentric split locking collars. The collars are tightened through a cap screw bridging the split portion of the collar. The cap screw has a Torx T25 socket head. To tighten the locking collar: Hold the locking collar tightly against the inner race of the bearing and torque the cap screw to 65−70 in-lb (7.4−7.9 Nm). (See FIGURE 7.)

FIGURE 7 **Tightening Locking Collar**

Motor

When replacing the motor, also replace the external−tooth lock washer (star washer) under the motor mounting base; this is part of the motor grounding system. Ensure the teeth on the lock washer bite through and are in contact with the motor's painted base. Tighten motor mounting bolts to 120 +/− 12 in−lbs.

Changing Fan Wheel Speed by Changing Pulleys

The horsepower rating of the belt is primarily dictated by the pitch diameter of the smaller pulley in the drive system (typically the motor pulley in these units). Do not install a replacement motor pulley with a smaller pitch diameter than provided on the original factory pulley. Change fan wheel speed by changing the fixed sheave fan pulley (larger pitch diameter to reduce wheel speed, smaller pitch diameter to increase wheel speed) or select a new system (both pulleys and matching belt(s)).

Before changing pulleys to increase fan wheel speed, check the fan performance at the target speed and airflow rate to determine new motor loading (bhp). Use the fan performance tables or use the Packaged Rooftop Builder software program. Confirm that the motor in this unit is capable of operating at the new operating condition. Fan shaft loading increases dramatically as wheel speed is increased.

To reduce vibration, replace the motor's adjustable pitch pulley with a fixed pitch pulley (after the final airflow balance adjustment). This will reduce the amount of vibration generated by the motor/belt−drive system.

To determine variable pitch pulley diameter perform the following calculation:

1. Determine full open and full closed pulley diameter.
2. Subtract the full open diameter from the full closed diameter.
3. Divide that number by the number of pulley turns open from full closed
   This number is the change in pitch datum per turn open.

EXAMPLE
−Pulley dimensions 2.9 to 3.9 (full close to full open)
−3.9 − 2.9 = 1
−1 divided by 5 (turns from full close to full open)
−0.2 change in pulley diameter per turn open
−2.9 + 0.2 = 3.1" pulley diameter when pulley closed one turn from full open

COOLING

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

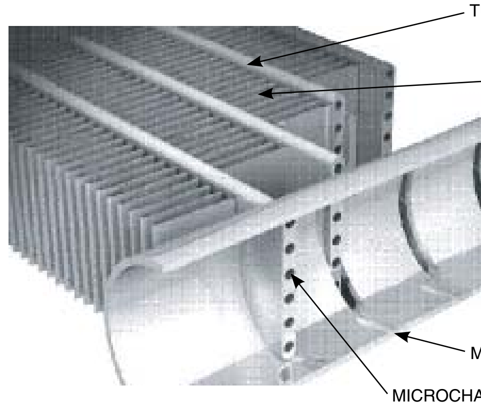
Failure to follow this warning could cause personal injury, death and/or equipment damage.

This system uses R−410A refrigerant which has higher pressures than R−22 and other refrigerants. No other refrigerant may be used in this system. Gauge set, hoses, and recovery system must be designed to handle R−410A refrigerant. If unsure about equipment, consult the equipment manufacturer.

Condenser Coil

The condenser coil is new microchannel Heat Exchanger Technology. This is an all−aluminum construction with louvered fins over single−depth crosstubes. The crosstubes have multiple small passages through which the refrigerant passes from header to header on each end. Tubes and fins are both aluminum construction. Connection tube joints are copper. The coil may be one−row or two−row. Two−row coils are spaced apart to assist in cleaning. See FIGURE 8.

FIGURE 8 Microchannel Coils



Evaporator Coil

The evaporator coil is traditional round−tube, plate−fin technology. Tube and fin construction is of various optional materials and coatings (see Model Number Format). Coils are multiple−row. On two compressor units, the evaporator coil is a face split design, meaning the two refrigerant circuits are independent in the coil. The bottom portion of the coil will always be circuit A with the top of the coil being circuit B.

Coil Maintenance and Cleaning Recommendation

Routine cleaning of coil surfaces is essential to maintain proper operation of the unit. Elimination of contamination and removal of harmful residues will greatly increase the life of the coil and extend the life of the unit. The following maintenance and cleaning procedures are recommended as part of the routine maintenance activities to extend the life of the coil.

Remove Surface Loaded Fibers

Surface loaded fibers or dirt should be removed with a vacuum cleaner. If a vacuum cleaner is not available, a soft non−metallic bristle brush may be used. In either case, the tool should be applied in the direction of the fins. Coil surfaces can be easily damaged (fin edges can be easily bent over and damage to the coating of a protected coil) if the tool is applied across the fins.

NOTE: Use of a water stream, such as a garden hose, against a surface loaded coil will drive the fibers and dirt into the coil. This will make cleaning efforts more difficult. Surface loaded fibers must be completely removed prior to using low velocity clean water rinse.

Periodic Clean Water Rinse

A periodic clean water rinse is very beneficial for coils that are applied in coastal or industrial environments. However, it is very important that the water rinse is made with very low velocity water stream to avoid damaging the fin edges. Monthly cleaning as described is recommended.

Routine Cleaning of microchannel Condenser Coil Surfaces

To clean the microchannel condenser coil, chemicals are NOT to be used; only water is approved as the cleaning solution. Only clean potable water is authorized for cleaning microchannel condensers. Carefully remove any foreign objects or debris attached to the coil face or trapped within the mounting frame and brackets. Using a high pressure water sprayer, purge any soap or industrial cleaners from hose and/or dilution tank prior to wetting the coil.

Clean condenser face by spraying the coil core steadily and uniformly from top to bottom, directing the spray straight into or toward the coil face. Do not exceed 900 psig or a 45 degree angle;

nozzle must be at least 12 in. (30 cm) from the coil face. Reduce pressure and use caution to prevent damage to air centers (fins). Do not fracture the braze between air centers and refrigerant tubes. Allow water to drain from the coil core and check for refrigerant leaks prior to start−up.

NOTE: Please see the microchannel Condenser Service section for specific information on the coil.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in personal injury or equipment damage.

Chemical cleaning should NOT be used on the aluminum microchannel condenser. Damage to the coil may occur. Only approved cleaning is recommended.

Routine Cleaning of Evaporator Coil Surfaces

Monthly cleaning with environmentally sound coil cleaner is essential to extend the life of coils. This cleaner is available from FAST parts It is recommended that all round tube coil cleaner as described below. Coil cleaning should be part of the unit's regularly scheduled maintenance procedures to ensure long life of the coil. Failure to clean the coils may result in reduced durability in the environment.

Avoid the use of

- coil brighteners
- acid cleaning prior to painting
- high pressure washers
- poor quality water for cleaning

Environmentally sound coil cleaner is non−flammable, hypoallergenic, non−bacterial, and a USDA accepted biodegradable agent that will not harm coil or surrounding components such as electrical wiring, painted metal surfaces, or insulation. Use of non−recommended coil cleaners is strongly discouraged since coil and unit durability could be affected.

Environmentally Sound Coil Cleaner Application Equipment

- 2-1/2 gallon garden sprayer
- water rinse with low velocity spray nozzle

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in corrosion and damage to the unit.

Harsh chemicals, household bleach or acid or basic cleaners should not be used to clean outdoor or indoor coils of any kind. These cleaners can be very difficult to rinse out of the coil and can accelerate corrosion at the fin/tube interface where dissimilar materials are in contact. If there is dirt below the surface of the coil, use the Totaline environmentally sound coil cleaner as described above.

⚠ CAUTION

PERSONAL INJURY HAZARD

Failure to follow this caution may result in reduced unit performance.

High velocity water from a pressure washer, garden hose, or compressed air should never be used to clean a coil. The force of the water or air jet will bend the fin edges and increase airside pressure drop.

Environmentally Sound Coil Cleaner Application Instructions

1. Proper eye protection such as safety glasses, gloves and protective clothing are recommended during mixing and application.
2. Remove all surface loaded fibers and dirt with a vacuum cleaner as described above.
3. Thoroughly wet finned surfaces with clean water and a low velocity garden hose, being careful not to bend fins.
4. Mix environmentally sound coil cleaner in a 2−1/2 gallon garden sprayer according to the instructions included with the cleaner. The optimum solution temperature is 100°F (38°C).

NOTE: Do NOT USE water in excess of 130°F (54°C), as the enzymatic activity will be destroyed.

1. Thoroughly apply environmentally sound coil cleaner solution to all coil surfaces including finned area, tube sheets and coil headers.
2. Hold garden sprayer nozzle close to finned areas and apply cleaner with a vertical, up−and−down motion. Avoid spraying in horizontal pattern to minimize potential for fin damage.
3. Ensure cleaner thoroughly penetrates deep into finned areas.
4. Interior and exterior finned areas must be thoroughly cleaned.
5. Finned surfaces should remain wet with cleaning solution for 10 minutes.
6. Ensure surfaces are not allowed to dry before rinsing. Reapply cleaner as needed to ensure 10−minute saturation is achieved.
7. Thoroughly rinse all surfaces with low velocity clean water using downward rinsing motion of water spray nozzle. Protect fins from damage from the spray nozzle.

Evaporator Coil Metering Devices

The metering devices are multiple fixed−bore devices (Acutrol™) swaged into the horizontal outlet tubes from the liquid header, located at the entrance to each evaporator coil circuit path. These are non−adjustable. Service requires replacing the entire liquid header assembly.

To check for possible blockage of one or more of these metering devices, disconnect the supply fan contactor (IFC) coil, then start the compressor and observe the frosting pattern on the face of the evaporator coil. A frost pattern should develop uniformly across the face of the coil starting at each horizontal header tube. Failure to develop frost at an outlet tube can indicate a plugged or a missing orifice.

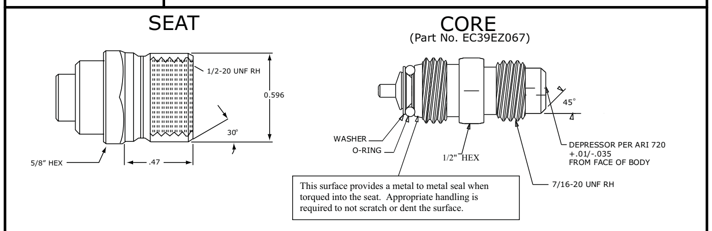
Refrigerant System Pressure Access Ports

There are two access ports in the system − on the suction tube near the compressor and on the discharge tube near the compressor. These are brass fittings with black plastic caps. The hose connection fittings are standard 1/4 SAE male flare couplings.

The brass fittings are two−piece High Flow valves, with a receptacle base brazed to the tubing and an integral spring-closed check valve core screwed into the base. (See FIGURE 9.) This schrader valve is permanently assembled into the core body and cannot be serviced separately; replace the entire core body if necessary. Service tools are available from RCD (P920−0010) that allow the replacement of the schrader valve core without having to recover the entire system refrigerant charge. Apply compressor refrigerant oil to the schrader valve core's bottom O-ring. Install the fitting body with 96+/−10 in-lbs of torque; do not overtighten.

NOTE: The High Flow valve has a black plastic cap with a rubber o−ring located inside the cap. This rubber o−ring must be in place in the cap to prevent refrigerant leaks.

FIGURE 9 **CoreMax Access Port Assembly**



EXAMPLE:

Model RGS300/303

Circuit A (from Fig. 14):

Outdoor Temperature .... 85°F (29°C)

Suction Pressure .... 125 psig (860 kPa)

Suction Temperature should be .... 63°F (17°C)

Circuit B (from Fig. 15):

Outdoor Temperature .... 85°F (29°C)

Suction Pressure .... 120 psig (830 kPa)

Suction Temperature should be .... 58°F (14°C)

R−410A REFRIGERANT

This unit is designed for use with R−410A refrigerant. Do not use any other refrigerant in this system.

R−410A refrigerant is provided in pink (rose) colored cylinders. These cylinders are available with and without dip tubes; cylinders with dip tubes will have a label indicating this feature. For a cylinder with a dip tube, place the cylinder in the upright position (access valve at the top) when adding liquid refrigerant for charging. For a cylinder without a dip tube, invert the cylinder (access valve on the bottom) when adding liquid refrigerant.

Because R−410A refrigerant is a blend, it is strongly recommended that refrigerant always be removed from the cylinder as a liquid. Admit liquid refrigerant into the system in the discharge line when breaking refrigerant system vacuum while the compressor is OFF. Only add refrigerant (liquid) into the suction line while the compressor is operating. If adding refrigerant into the suction line, use a commercial metering/expansion device at the gauge manifold; remove liquid from the cylinder, pass it through the metering device at the gauge set and then pass it into the suction line as a vapor. Do not remove R−410A refrigerant from the cylinder as a vapor.

Refrigerant Charge

Amount of refrigerant charge is listed on the unit's nameplate.

Unit panels must be in place when unit is operating during the charging procedure. To prepare the unit for charge adjustment:

No Charge

Use standard evacuating techniques. Evacuate system down to 500 microns and let set for 10 minutes to determine if system has a refrigerant leak. If evacuation level raises to 1100 microns and stabilizes, the system has moisture in it and should be dehydrated per GTAC2−5 recommends.

If system continues to rise above 1100 microns, the system has a leak and should be pressurized and leak tested using appropriate techniques as explained in GTAC2−5. After evacuating system, weigh in the specified amount of refrigerant as listed on the unit rating plate.

Low−Charge Cooling

Using Cooling Charging Charts (Fig.10 −15), vary refrigerant until the conditions of the appropriate chart are met. Note the charging charts are different from the type normally used. Charts are based on charging the units to the correct superheat for the various operating conditions. Accurate pressure gauge and temperature sensing devices are required. Connect the pressure gauge to the service port on the suction line. Mount the temperature sensing device on the suction line and insulate it so that outdoor ambient temperature does not affect the reading. Indoor−air cfm must be within the normal operating range of the unit.

To Use Cooling Charging Charts

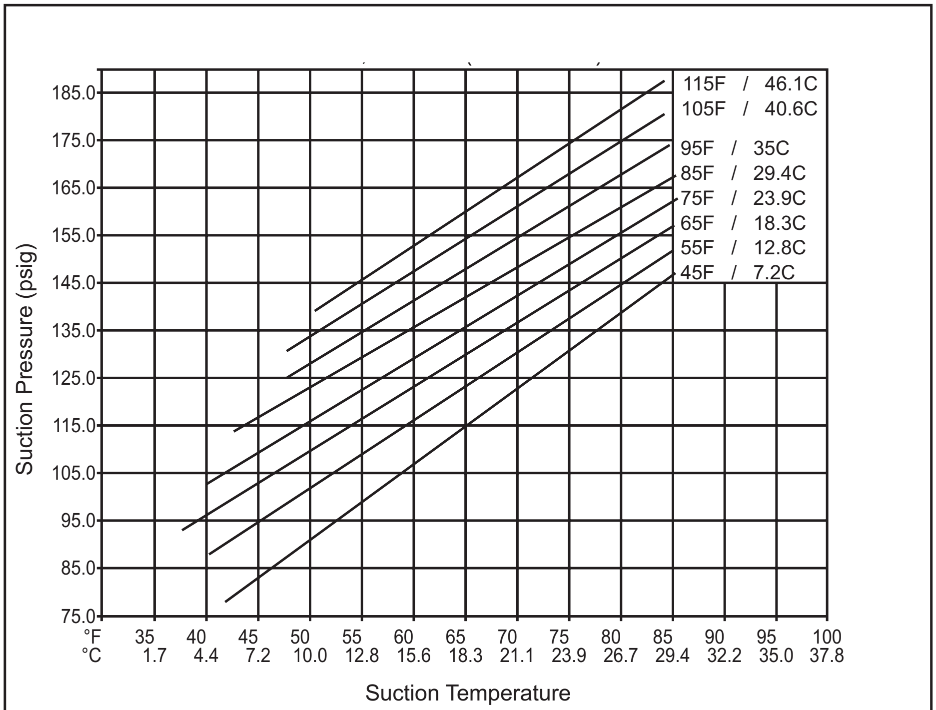
Select the appropriate unit charging chart from Fig. 10 − 15

- Sizes 181 − 243 contain two independent refrigerant circuits, Circuit A and Circuit B

Take the outdoor ambient temperature and read the suction pressure gauge. Refer to chart to determine what suction temperature should be. If suction temperature is high, add refrigerant. If suction temperature is low, carefully recover some of the charge. Recheck the suction pressure as charge is adjusted.

For 181−303 sizes, perform this procedure once for Circuit A (using the Circuit A chart) and once for Circuit B (using the Circuit B chart).

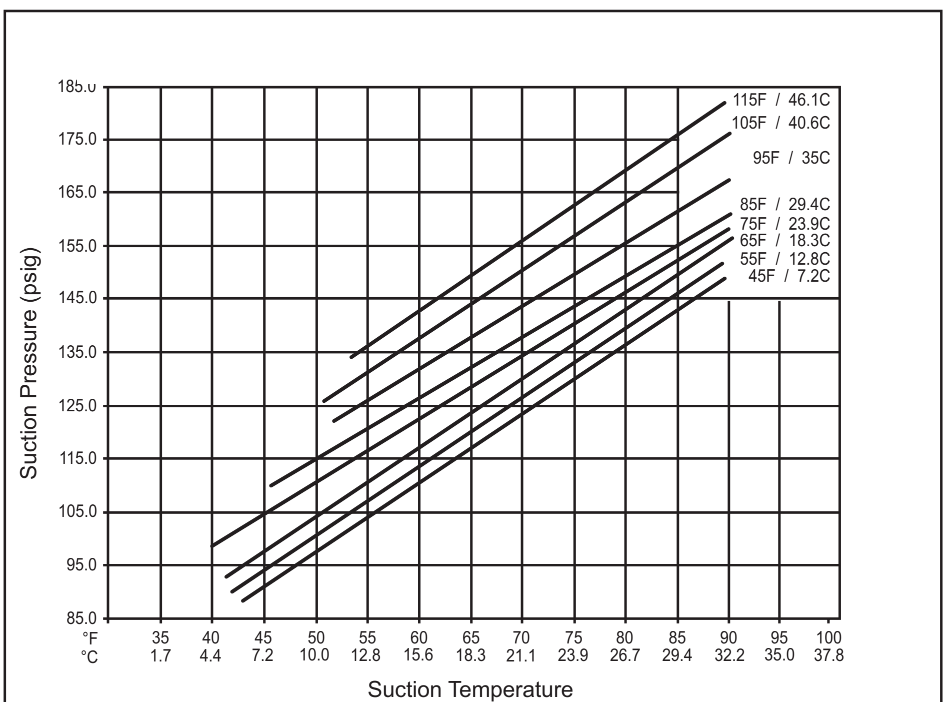
FIGURE 10 **Cooling Charging Chart for RGS 181/183/210/213, Circuit A**



IF CONDITIONS ARE OUTSIDE OF THE ABOVE ENVELOPE,
RECLAIM CHARGE AND RECHARGE UNIT PER NAMEPLATE

50HE501045 2.0

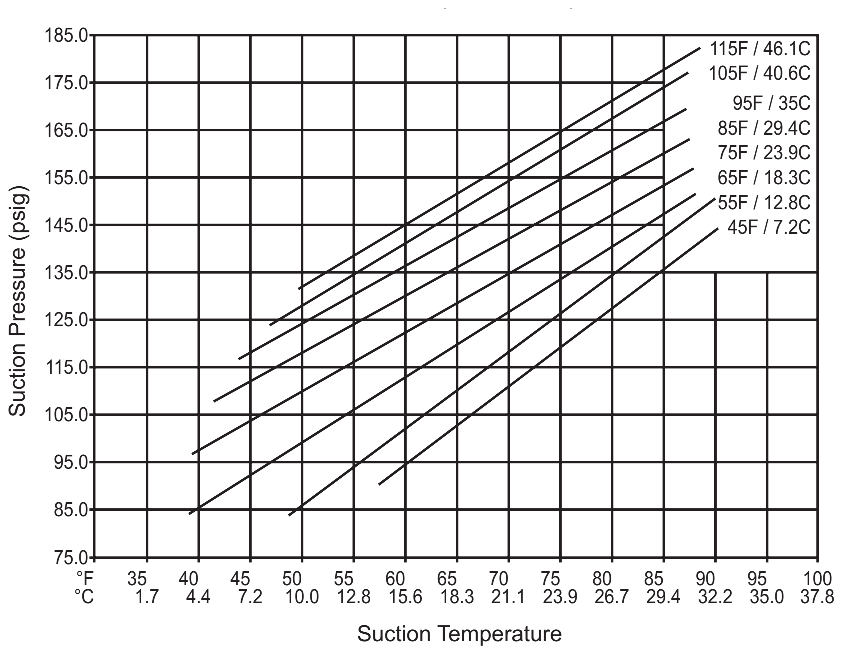
FIGURE 11 **Cooling Charging Chart for RGS 181/183/210/213, Circuit B**



IF CONDITIONS ARE OUTSIDE OF THE ABOVE ENVELOPE,
RECLAIM CHARGE AND RECHARGE UNIT PER NAMEPLATE

50HE501046 2.0

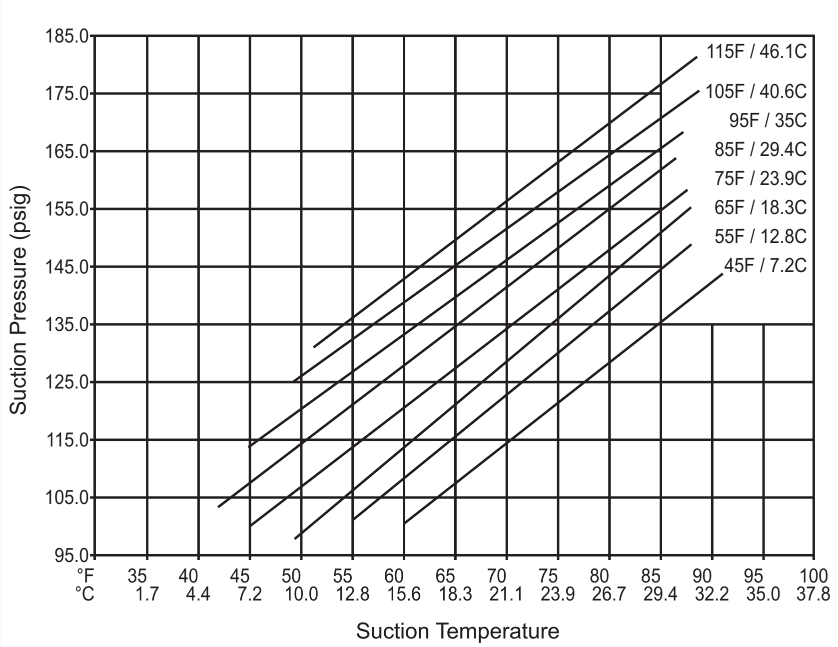
FIGURE 12 **Cooling Charging Chart for RGS240/243, Circuit A**



IF CONDITIONS ARE OUTSIDE OF THE ABOVE ENVELOPE,
RECLAIM CHARGE AND RECHARGE UNIT PER NAMEPLATE

50HE501089 2.0

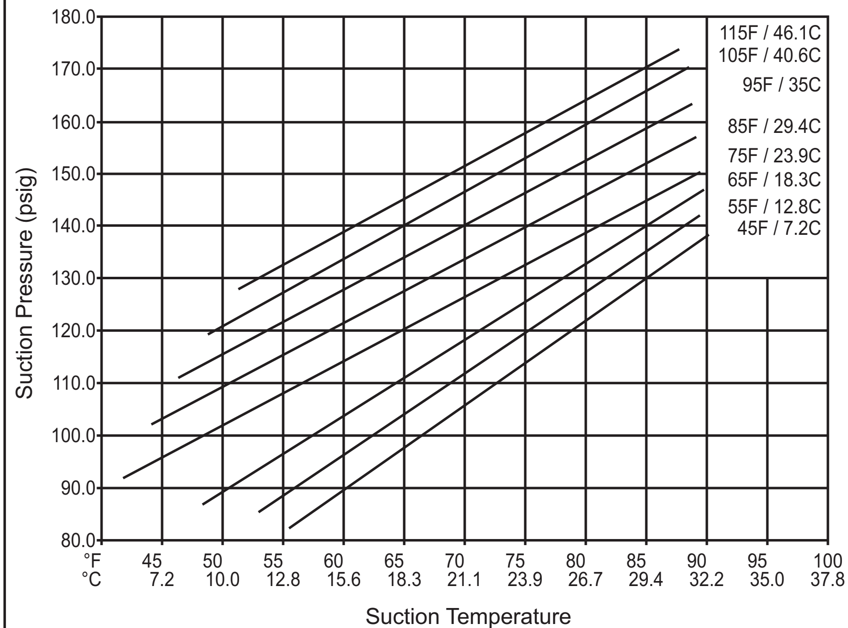
FIGURE 13 **Cooling Charging Chart for RGS240/243, Circuit B**



IF CONDITIONS ARE OUTSIDE OF THE ABOVE ENVELOPE,
RECLAIM CHARGE AND RECHARGE UNIT PER NAMEPLATE

50HE501090 2.0

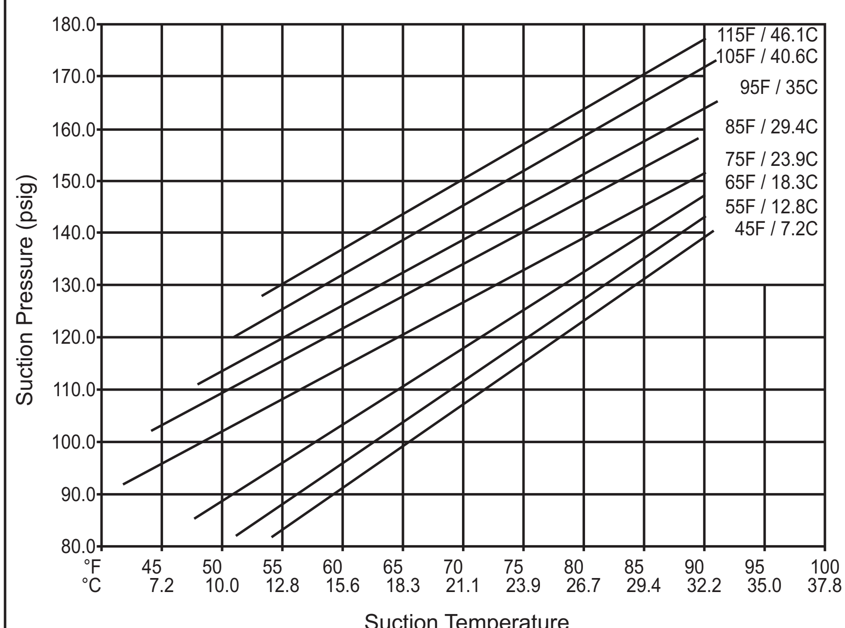
FIGURE 14 **Cooling Charging Chart for RGS300/303, Circuit A**



IF CONDITIONS ARE OUTSIDE OF THE ABOVE ENVELOPE,
RECLAIM CHARGE AND RECHARGE UNIT PER NAMEPLATE

50HE501091 2.0

FIGURE 15 **Cooling Charging Chart for RGS300/303, Circuit B**



IF CONDITIONS ARE OUTSIDE OF THE ABOVE ENVELOPE,
RECLAIM CHARGE AND RECHARGE UNIT PER NAMEPLATE

50HE501092 2.0

Table 1 – Cooling Service Analysis

PROBLEM	CAUSE	REMEDY
Compressor and Condenser Fan Will Not Start.	Power failure.	Call power company.
	Fuse blown or circuit breaker tripped.	Replace fuse or reset circuit breaker.
	Defective thermostat, contactor, transformer, or control relay.	Replace component.
	Insufficient line voltage.	Determine cause and correct.
	Incorrect or faulty wiring.	Check wiring diagram and rewire correctly.
	Thermostat setting too high.	Lower thermostat setting below room temperature.
Compressor Will Not Start But Condenser Fan Runs.	Faulty wiring or loose connections in compressor circuit.	Check wiring and repair or replace.
	Compressor motor burned out, seized, or internal overload open.	Determine cause. Replace compressor.
	Defective run/start capacitor, overload, start relay.	Determine cause and replace.
	One leg of three−phase power dead.	Replace fuse or reset circuit breaker. Determine cause.
Compressor Cycles (other than normally satisfying thermostat).	Refrigerant overcharge or undercharge.	Recover refrigerant, evacuate system, and recharge to nameplate.
	Defective compressor.	Replace and determine cause.
	Insufficient line voltage.	Determine cause and correct.
	Blocked condenser.	Determine cause and correct.
	Defective run/start capacitor, overload, or start relay.	Determine cause and replace.
	Defective thermostat.	Replace thermostat.
	Faulty condenser−fan motor or capacitor.	Replace.
	Restriction in refrigerant system.	Locate restriction and remove.
Compressor Operates Continuously.	Dirty air filter.	Replace filter.
	Unit undersized for load.	Decrease load or increase unit size.
	Thermostat set too low.	Reset thermostat.
	Low refrigerant charge.	Locate leak; repair and recharge.
	Leaking valves in compressor.	Replace compressor.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Condenser coil dirty or restricted.	Clean coil or remove restriction.
Excessive Head Pressure.	Dirty air filter.	Replace filter.
	Dirty condenser coil.	Clean coil.
	Refrigerant overcharged.	Recover excess refrigerant.
	Air in system.	Recover refrigerant, evacuate system, and recharge.
	Condenser air restricted or air short−cycling.	Determine cause and correct.
Head Pressure Too Low.	Low refrigerant charge.	Check for leaks; repair and recharge.
	Compressor valves leaking.	Replace compressor.
	Restriction in liquid tube.	Remove restriction.
Excessive Suction Pressure.	High head load.	Check for source and eliminate.
	Compressor valves leaking.	Replace compressor.
	Refrigerant overcharged.	Recover excess refrigerant.
Suction Pressure Too Low.	Dirty air filter.	Replace filter.
	Low refrigerant charge.	Check for leaks; repair and recharge.
	Metering device or low side restricted.	Remove source of restriction.
	Insufficient evaporator airflow.	Increase air quantity. Check filter and replace if necessary.
	Temperature too low in conditioned area.	Reset thermostat.
	Outdoor ambient below 25°F.	Install low−ambient kit.
Evaporator Fan Will Not Shut Off.	Time off delay not finished.	Wait for 30−second off delay.
Compressor Makes Excessive Noise.	Compressor rotating in wrong direction.	Reverse the 3−phase power leads.

Compressors

Lubrication

Compressors are charged with the correct amount of oil at the factory.

⚠ CAUTION

UNIT DAMAGE HAZARD

Failure to follow this caution may result in damage to components.

The compressor is in a R−410A refrigerant system and uses a polyolester (POE) oil. This oil is extremely hygroscopic, meaning it absorbs water readily. POE oils can absorb 15 times as much water as other oils designed for HCFC and CFC refrigerants. Avoid exposure of the oil to the atmosphere.

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could result in personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Wear safety glasses and gloves when handling refrigerants.

Keep torches and other ignition sources away from refrigerants and oils.

Replacing Compressor

The compressor used with R−410A refrigerant contains a POE oil. This oil has a high affinity for moisture. Do not remove the compressor's tube plugs until ready to insert the unit suction and discharge tube ends.

1. Remove all sources of power to the unit. Install lock−out tag.
2. Recover refrigerant using environmentally friendly procedures.
3. Remove electrical wires from compressor terminal. Caution must be used when removing wires from compressor terminals. Use pliers, gloves, safety glasses and do not face directly towards the compressor terminals. Terminal blow out could occur.
4. With refrigerant completely recovered, open both sides of manifold gauge set. Refrigerant system should now be at ambient pressures.
5. Prior to applying heat and removing compressor, procure a wet quenching cloth and fire extinguisher.
6. Using torch, heat compressor discharge line and remove hot gas tube from compressor.
7. Using torch, heat compressor suction line and remove suction tube from compressor.
8. Remove system filter drier and replace with new.
9. Loosen four compressor retaining bolts and save components for installation of new compressor.
10. Using proper lifting techniques or devices, remove compressor from system.

Compressor mounting bolt torque is 65−75 in-lbs
(7.3−8.5 N-m).

Compressor Rotation

On 3-phase units with scroll compressors, it is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start−up.

NOTE: If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

1. Note that the evaporator fan is probably also rotating in the wrong direction.
2. Turn off power to the unit. Install lock−out tag.
3. Reverse any two of the unit power leads.
4. Reapply power to the compressor.

The suction and discharge pressure levels should now move to their normal start−up levels.

NOTE: When the compressor is rotating in the wrong direction, the unit makes an elevated level of noise and does not provide cooling.

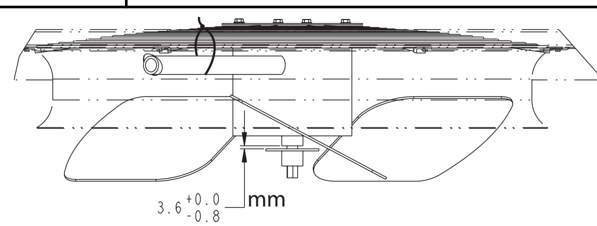
Filter Drier

Replace whenever refrigerant system is exposed to atmosphere. Only use factory specified liquid−line filter driers with working pressures no less than 650 psig. Do not install a suction−line filter drier in liquid line. A liquid−line filter drier designed for use with R−410A refrigerant is required on every unit.

Condenser−Fan Adjustment

1. Shut off unit power supply. Install lockout tag.
2. Remove condenser-fan assembly (grille, motor, and fan).
3. Loosen fan hub setscrews.
4. Adjust fan height as shown in FIGURE 16.
5. Tighten setscrews to 84 in-lbs (9.5 N-m).
6. Replace condenser-fan assembly.

FIGURE 16 **Condenser Fan Adjustment**



Troubleshooting Cooling System

Refer to Table 1 for additional troubleshooting topics.

CONVENIENCE OUTLETS

⚠ WARNING

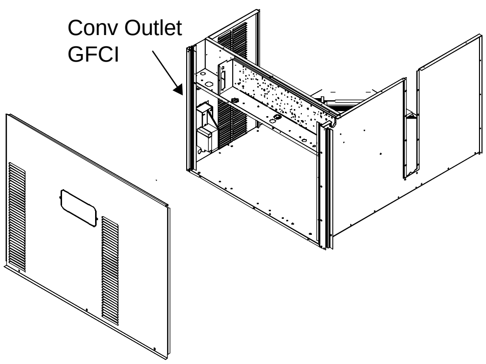
ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

Units with convenience outlet circuits may use multiple disconnects. Check convenience outlet for power status before opening unit for service. Locate its disconnect switch, if appropriate, and open it. Tag−out this switch, if necessary.

Non−powered convenience outlets are offered on RGS models. This provides a 125-volt GFCI (ground−fault circuit−interrupter) duplex receptacle rated at 15-A behind a hinged waterproof access cover, located on the end panel of the unit. (See FIGURE 17.)

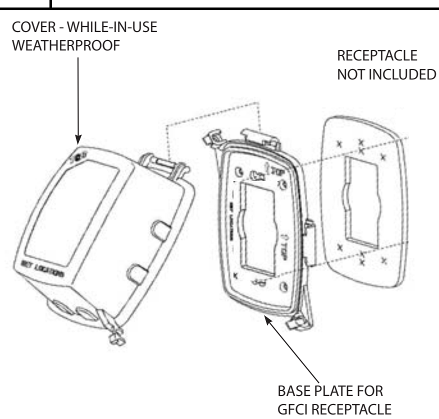
FIGURE 17 **Convenience Outlet Location**



Wet in Use Convenience Outlet Cover

The unit has a “wet in use” convenience outlet cover that must be installed on panel containing the convenience outlet. This cover provides protection against moisture entering the GFCI receptacle. This cover is placed in the unit control box during shipment. See FIGURE 18.

FIGURE 18 **Convenience Outlet**



Non−Powered Type

This type requires the field installation of a general−purpose 125−volt 15−A circuit powered from a source elsewhere in the building. Observe national and local codes when selecting wire size, fuse or breaker requirements and disconnect switch size and location. Route 125−v power supply conductors into the bottom of the utility box containing the duplex receptacle.

Maintenance

Periodically test the GFCI receptacle by pressing the TEST button on the face of the receptacle. This should cause the internal circuit of the receptacle to trip and open the receptacle. Check for proper grounding wires and power line phasing if the GFCI receptacle does not trip as required. Press the RESET button to clear the tripped condition.

Using Unit−Mounted Convenience Outlets

Units with unit−mounted convenience outlet circuits will often require that two disconnects be opened to de−energize all power to the unit. Treat all units as electrically energized until the convenience outlet power is also checked and de−energization is confirmed. Observe National Electrical Code Article 210, Branch Circuits, for use of convenience outlets. Always use a volt meter to verify no voltage is present at the GFIC receptacles before working on unit.

SMOKE DETECTORS

Smoke detectors are available as factory−installed options on RGS models. Smoke detectors may be specified for Supply Air only and/or for Return Air without or with economizer or in combination of Supply Air and Return Air. Return Air smoke detectors are arranged for vertical return configurations only. All components necessary for operation are factory−provided and mounted. The unit is factory−configured for immediate smoke detector shutdown operation. Additional wiring or modifications to unit terminal board may be necessary to complete the unit and smoke detector configuration to meet project requirements.

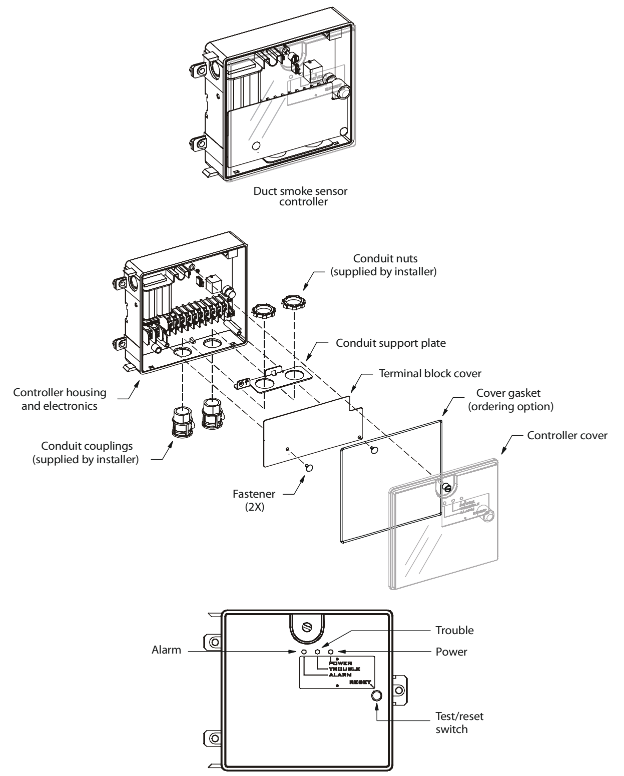
System

The smoke detector system consists of a four−wire controller (HT28TZ001) and one or two sensors (HT50TZ001). Its primary function is to shut down the rooftop unit in order to prevent smoke from circulating throughout the building. It is not to be used as a life saving device.

Controller

The controller includes a controller housing, a printed circuit board, and a clear plastic cover. (See FIGURE 19.) The controller can be connected to one or two compatible duct smoke sensors. The clear plastic cover is secured to the housing with a single captive screw for easy access to the wiring terminals. The controller has three LEDs (Power, Trouble and Alarm) and a manual test/reset button (on the cover face).

FIGURE 19 **Controller Assembly**



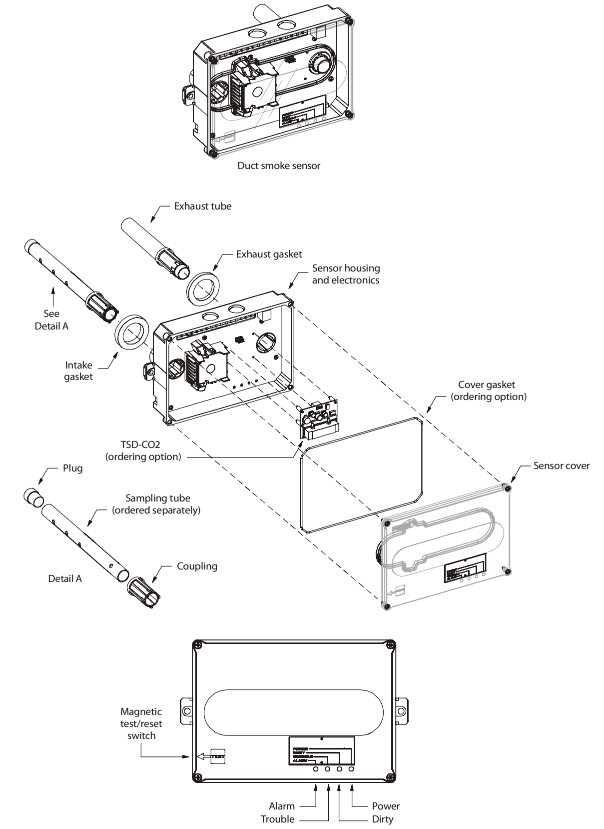
Sensor

The sensor includes a plastic housing, a printed circuit board, a clear plastic cover, a sampling tube inlet and an exhaust tube. (See FIGURE 20.) The sampling tube (when used) and exhaust tube are attached during installation. The sampling tube varies in length depending on the size of the rooftop unit. The clear plastic cover permits visual inspections without having to disassemble the sensor. The cover attaches to the sensor housing using four captive screws and forms an airtight chamber around the sensing electronics. Each sensor includes a harness with an RJ45 terminal for connecting to the controller. Each sensor has four LEDs (for Power, Trouble, Alarm and Dirty) and a manual test/reset button (on the left−side of the housing).

Air is introduced to the duct smoke detector sensor's sensing chamber through a sampling tube that extends into the HVAC duct and is directed back into the ventilation system through a (shorter) exhaust tube. The difference in air pressure between the two tubes pulls the sampled air through the sensing chamber. When a sufficient amount of smoke is detected in the sensing chamber, the sensor signals an alarm state and the controller automatically takes the appropriate action to shut down fans and blowers, change over air handling systems, notify the fire alarm control panel, etc.

The sensor uses a photoelectric (light scattering principle) process called differential sensing to prevent gradual environmental changes from triggering false alarms. A rapid change in environmental conditions, such as smoke from a fire, causes the sensor to signal an alarm state, but dust and debris accumulated over time does not.

FIGURE 20 **Smoke Detector Sensor**



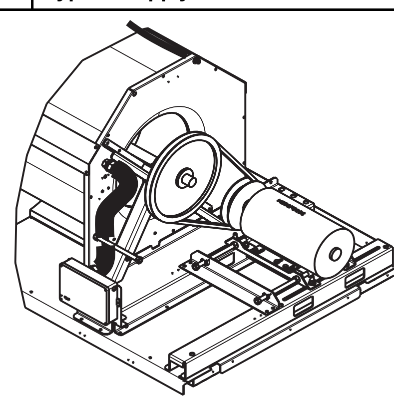
For installations using two sensors, the duct smoke detector does not differentiate which sensor signals an alarm or trouble condition.

Smoke Detector Locations

Supply Air

The Supply Air smoke detector sensor is located to the left of the unit's indoor (supply) fan. (See FIGURE 21.) Access is through the fan access panel. There is no sampling tube used at this location. The sampling tube inlet extends through the side plate of the fan housing (into a high pressure area). The control module is mounted in the left side of the control box, accessed by opening the Control Box access door.

FIGURE 21 **Typical Supply Air Smoke Detecto r Sensor Location**



FIOP Smoke Detector Wiring and Response

All units: FIOP smoke detector is configured to automatically shut down all unit operations when smoke condition is detected. See FIGURE 22, Smoke Detector Wiring.

Highlight A: JMP 3 is factory−cut, transferring unit control to smoke detector.

Highlight B: Smoke detector NC contact set will open on smoke alarm condition, de−energizing the ORN conductor.

Highlight C: 24−v power signal via ORN lead is removed at Smoke Detector input on LCTB; all unit operations cease immediately.

Highlight D: On smoke alarm condition, the smoke detector NO Alarm contact will close, supplying 24−v power to GRA conductor.

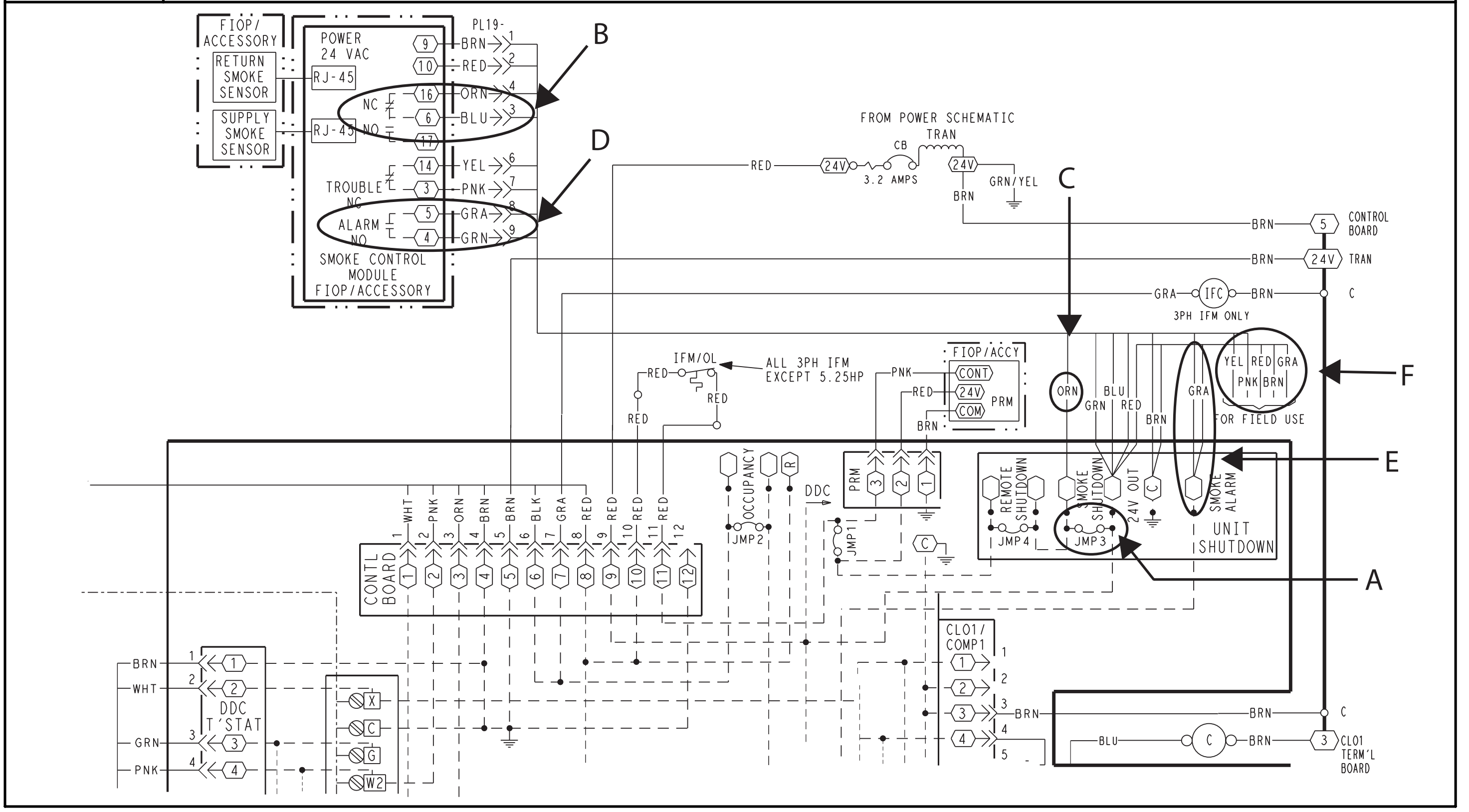
Highlight E: GRA lead at Smoke Alarm input on LCTB provides 24−v signal to FIOP DDC control.

RTU−MP: The 24−v signal is conveyed to RTU−MP's J1−10 input terminal. This signal initiates the FSD sequence by the RTU−MP control. FSD status is reported to connected BAS network.

Using Remote Logic: Five conductors are provided for field use (see Highlight F) for additional annunciation functions.

Additional Application Data — Refer to Catalog No. HKRNKA−1XA for discussions on additional control features of these smoke detectors including multiple unit coordination. (See FIGURE 22.)

FIGURE 22 **Typical Smoke Detector System Wiring**



Sensor and Controller Tests

Sensor Alarm Test

The sensor alarm test checks a sensor's ability to signal an alarm state. This test requires that you use a field provided SD−MAG test magnet.

⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

This test places the duct detector into the alarm state. Unless part of the test, disconnect all auxiliary equipment from the controller before performing the test. If the duct detector is connected to a fire alarm system, notify the proper authorities before performing the test.

Sensor Alarm Test Procedure

1. Hold the test magnet where indicated on the side of the sensor housing for seven seconds.
2. Verify that the sensor's Alarm LED turns on.
3. Reset the sensor by holding the test magnet against the sensor housing for two seconds.
4. Verify that the sensor's Alarm LED turns off.

Controller Alarm Test

The controller alarm test checks the controller's ability to initiate and indicate an alarm state.

⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

This test places the duct detector into the alarm state. Disconnect all auxiliary equipment from the controller before performing the test. If the duct detector is connected to a fire alarm system, notify the proper authorities before performing the test.

Controller Alarm Test Procedure

1. Press the controller's test/reset switch for seven seconds.
2. Verify that the controller's Alarm LED turns on.
3. Reset the sensor by pressing the test/reset switch for two seconds.
4. Verify that the controller's Alarm LED turns off.

Dirty Controller Test

The dirty controller test checks the controller's ability to initiate a dirty sensor test and indicate its results.

⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

Pressing the controller's test/reset switch for longer than seven seconds will put the duct detector into the alarm state and activate all automatic alarm responses.

Dirty Controller Test Procedure

- Press the controller's test/reset switch for two seconds.
- Verify that the controller's Trouble LED flashes.

Dirty Sensor Test

The dirty sensor test provides an indication of the sensor's ability to compensate for gradual environmental changes. A sensor that can no longer compensate for environmental changes is considered 100% dirty and requires cleaning or replacing. You must use a field provided SD−MAG test magnet to initiate a sensor dirty test. The sensor's Dirty LED indicates the results of the dirty test as shown in Table 2.

⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

Holding the test magnet against the sensor housing for more than seven seconds will put the duct detector into the alarm state and activate all automatic alarm responses.

Table 2 – Dirty LED Test

FLASHES	DESCRIPTION
1	0−25% dirty. (Typical of a newly installed detector)
2	25−50% dirty
3	51−75% dirty
4	76−99% dirty

Dirty Sensor Test Procedure

1. Hold the test magnet where indicated on the side of the sensor housing for two seconds.
2. Verify that the sensor's Dirty LED flashes.

⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

Changing the dirty sensor test operation will put the detector into the alarm state and activate all automatic alarm responses. Before changing dirty sensor test operation, disconnect all auxiliary equipment from the controller and notify the proper authorities if connected to a fire alarm system.

Changing the Dirty Sensor Test

By default, sensor dirty test results are indicated by:

- The sensor's Dirty LED flashing.
- The controller's Trouble LED flashing.
- The controller's supervision relay contacts toggle.

The operation of a sensor's dirty test can be changed so that the controller's supervision relay is not used to indicate test results. When two detectors are connected to a controller, sensor dirty test operation on both sensors must be configured to operate in the same manner.

To Configure the Dirty Sensor Test Operation

1. Hold the test magnet where indicated on the side of the sensor housing until the sensor's Alarm LED turns on and its Dirty LED flashes twice (approximately 60 seconds).
2. Reset the sensor by removing the test magnet then holding it against the sensor housing again until the sensor's Alarm LED turns off (approximately 2 seconds).

Remote Station Test

The remote station alarm test checks a test/reset station's ability to initiate and indicate an alarm state.

⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

This test places the duct detector into the alarm state. Unless part of the test, disconnect all auxiliary equipment from the controller before performing the test. If the duct detector is connected to a fire alarm system, notify the proper authorities before performing the test.

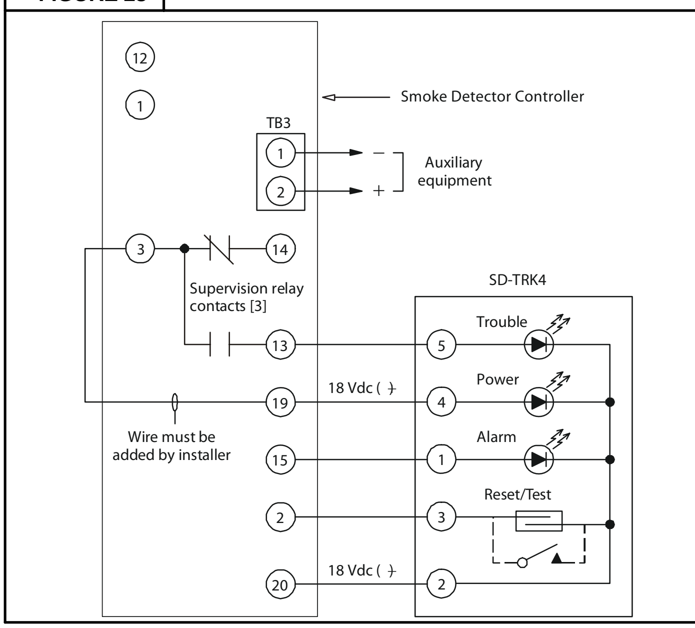
SD−TRK4 Remote Alarm Test Procedure

1. Turn the key switch to the RESET/TEST position for seven seconds.
2. Verify that the test/reset station's Alarm LED turns on.
3. Reset the sensor by turning the key switch to the RESET/TEST position for two seconds.
4. Verify that the test/reset station's Alarm LED turns off.

Remote Test/Reset Station Dirty Sensor Test

The test/reset station dirty sensor test checks the test/reset station's ability to initiate a sensor dirty test and indicate the results. It must be wired to the controller as shown in FIGURE 23 and configured to operate the controller's supervision relay. For more information, see "Changing the Dirty Sensor Test."

FIGURE 23 Remote Test/Reset Station Connections



⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

If the test/reset station's key switch is left in the RESET/TEST position for longer than seven seconds, the detector will automatically go into the alarm state and activate all automatic alarm responses.

⚠ CAUTION

OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

Holding the test magnet to the target area for longer than seven seconds will put the detector into the alarm state and activate all automatic alarm responses.

Dirty Sensor Test Using an SD−TRK4

1. Turn the key switch to the RESET/TEST position for two seconds.
2. Verify that the test/reset station's Trouble LED flashes.

Detector Cleaning

Cleaning the Smoke Detector

Clean the duct smoke sensor when the Dirty LED is flashing continuously or sooner if conditions warrant.

⚠ CAUTION

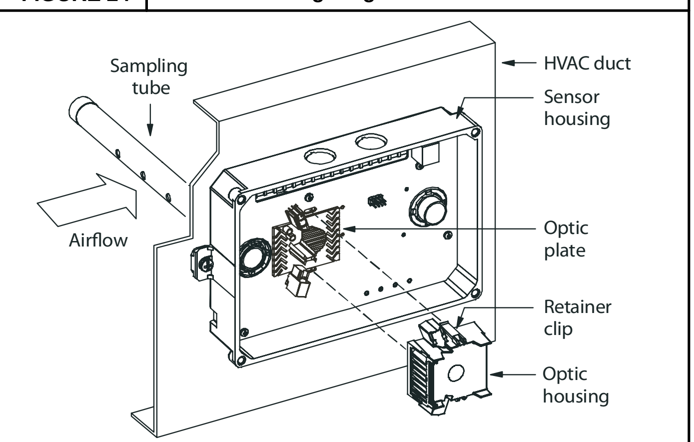
OPERATIONAL TEST HAZARD

Failure to follow this caution may result in personnel and authority concern.

If the smoke detector is connected to a fire alarm system, first notify the proper authorities that the detector is undergoing maintenance then disable the relevant circuit to avoid generating a false alarm.

1. Disconnect power from the duct detector then remove the sensor's cover. (See FIGURE 24.)

FIGURE 24 Sensor Cleaning Diagram



2. Using a vacuum cleaner, clean compressed air, or a soft bristle brush, remove loose dirt and debris from inside the sensor housing and cover.
   Use isopropyl alcohol and a lint−free cloth to remove dirt and other contaminants from the gasket on the sensor's cover.
3. Squeeze the retainer clips on both sides of the optic housing then lift the housing away from the printed circuit board.
4. Gently remove dirt and debris from around the optic plate and inside the optic housing.
5. Replace the optic housing and sensor cover.
6. Connect power to the duct detector then perform a sensor alarm test.

INDICATORS

Normal State

The smoke detector operates in the normal state in the absence of any trouble conditions and when its sensing chamber is free of smoke. In the normal state, the Power LED on both the sensor and the controller are on and all other LEDs are off.

Alarm State

The smoke detector enters the alarm state when the amount of smoke particulate in the sensor's sensing chamber exceeds the alarm threshold value. (See Table 3.) Upon entering the alarm state:

- The sensor's Alarm LED and the controller's Alarm LED turn on.
- The contacts on the controller's two auxiliary relays switch positions.
- The contacts on the controller's alarm initiation relay close.
- The controller's remote alarm LED output is activated (turned on).
- The controller's high impedance multiple fan shutdown control line is pulled to ground Trouble state.

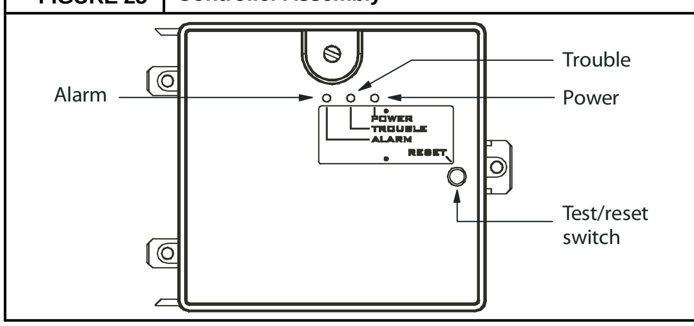
The SuperDuct duct smoke detector enters the trouble state under the following conditions:

- A sensor's cover is removed and 20 minutes pass before it is properly secured.
- A sensor's environmental compensation limit is reached (100% dirty).
- A wiring fault between a sensor and the controller is detected.

An internal sensor fault is detected upon entering the trouble state:

- The contacts on the controller's supervisory relay switch positions. (See FIGURE 25.)
- If a sensor trouble, the sensor's Trouble LED the controller's Trouble LED turn on.
- If 100% dirty, the sensor's Dirty LED turns on and the controller's Trouble LED flashes continuously.
- If a wiring fault between a sensor and the controller, the controller's Trouble LED turns on but not the sensor's.

FIGURE 25 Controller Assembly



NOTE: All troubles are latched by the duct smoke detector. The trouble condition must be cleared and then the duct smoke detector must be reset in order to restore it to the normal state.

Table 3 – Detector Indicators

CONTROL OR INDICATOR	DESCRIPTION
Magnetic test/reset switch	Resets the sensor when it is in the alarm or trouble state. Activates or tests the sensor when it is in the normal state.
Alarm LED	Indicates the sensor is in the alarm state.
Trouble LED	Indicates the sensor is in the trouble state.
Dirty LED	Indicates the amount of environmental compensation used by the sensor (flashing continuously = 100%)
Power LED	Indicates the sensor is energized.

Resetting Alarm and Trouble Condition Trips:

Manual reset is required to restore smoke detector systems to Normal operation. For installations using two sensors, the duct smoke detector does not differentiate which sensor signals an alarm or trouble condition. Check each sensor for Alarm or Trouble status (indicated by LED). Clear the condition that has generated the trip at this sensor. Then reset the sensor by pressing and holding the reset button (on the side) for 2 seconds. Verify that the sensor's Alarm and Trouble LEDs are now off. At the controller, clear its Alarm or Trouble state by pressing and holding the manual reset button (on the front cover) for 2 seconds. Verify that the controller's Alarm and Trouble LEDs are now off. Replace all panels.

Troubleshooting

Controller's Trouble LED is On

1. Check the Trouble LED on each sensor connected to the controller. If a sensor's Trouble LED is on, determine the cause and make the necessary repairs.
2. Check the wiring between the sensor and the controller. If wiring is loose or missing, repair or replace as required.

Controller's Trouble LED is Flashing

1. One or both of the sensors is 100% dirty.
2. Determine which Dirty LED is flashing then clean that sensor assembly as described in the detector cleaning section.

Sensor's Trouble LED is On

1. Check the sensor's Dirty LED. If it is flashing, the sensor is dirty and must be cleaned.
2. Check the sensor's cover. If it is loose or missing, secure the cover to the sensor housing.
3. Replace sensor assembly.

Sensor's Power LED is Off

1. Check the controller's Power LED. If it is off, determine why the controller does not have power and make the necessary repairs.
2. Check the wiring between the sensor and the controller. If wiring is loose or missing, repair or replace as required.

Controller's Power LED is Off

1. Make sure the circuit supplying power to the controller is operational. If not, make sure JP2 and JP3 are set correctly on the controller before applying power.
2. Verify that power is applied to the controller's supply input terminals. If power is not present, replace or repair wiring as required.

Remote Test/Reset Station's Trouble LED Does Not Flash When Performing a Dirty Test, But the Controller's Trouble LED Does

1. Verify that the remote test/station is wired as shown in FIGURE 23. Repair or replace loose or missing wiring.
2. Configure the sensor dirty test to activate the controller's supervision relay. See "Changing sensor dirty test operation."

Sensor's Trouble LED is On, But the Controller's Trouble LED is OFF

Remove JP1 on the controller.

PROTECTIVE DEVICES

Compressor Protection

Overcurrent

Each compressor has internal linebreak motor protection. Reset is automatic after compressor motor has cooled.

Overtemperature

Each compressor has an internal protector to protect it against excessively high discharge gas temperatures. Reset is automatic.

High Pressure Switch

Each system is provided with a high pressure switch mounted on the discharge line. The switch is stem−mounted and brazed into the discharge tube. Trip setting is 630 psig +/− 10 psig (4344 +/− 69 kPa) when hot. Reset is automatic at 505 psig (3482 kPa).

Low Pressure Switch

Each system is protected against a loss of charge and low evaporator coil loading condition by a low pressure switch located on the suction line near the compressor. The switch is stem−mounted. Trip setting is 54 psig +/− 5 psig (372 +/− 34 kPa). Reset is automatic at 117 +/− 5 psig (807 +/− 34 kPa).

Supply (Indoor) Fan Motor Protection

Disconnect and lockout power when servicing fan motor.

2.9 and 3.7 bhp motors are equipped with an overtemperature or protection device. The type of device depends on the motor size. (See Table 4.)

The High Static option supply fan motor is equipped with a pilot−circuit Thermik combination overtemperature/ overcurrent protection device. This device resets automatically. Do not bypass this switch to correct trouble. Determine the cause and correct it.

The Thermik device is a snap−action overtemperature protection device that is imbedded in the motor windings. The thermik can be identified by two blue wires extending out of the motor control box. It is a pilot−circuit device that is wired into the unit's 24−v control circuit. When this switch reaches its trip setpoint, it opens the 24−v control circuit and causes all unit operation to cease. This device resets automatically when the motor windings cool. Do not bypass this switch to correct trouble. Determine the cause and correct it.

The External motor overload device (used on motor with a horsepower rating of 4.7 hp or greater) is a specially−calibrated circuit breaker that is UL recognized as a motor overload controller. It is an overcurrent device. When the motor current exceeds the circuit breaker setpoint, the device opens all motor power leads and the motor shuts down. Reset requires a manual reset at the overload switch. This device (designated IFCB) is located on the side of the supply fan housing, behind the fan access panel. The Must Hold and Must Trip values are listed on the side of the External Overload Breaker.

Troubleshooting Supply Fan Motor Overload Trips

The supply fan used in RGS units is a forward−curved centrifugal wheel. At a constant wheel speed, this wheel has a characteristic that causes the fan shaft load to DECREASE when the static pressure in the unit−duct system increases and to INCREASE when the static pressure in the unit−duct system decreases (and fan airflow rate increases). Motor overload conditions typically develop when the unit is operated with an access panel removed, with unfinished duct work, in an economizer−open mode, or a leak develops in the duct system that allows a bypass back to unit return opening.

Table 4 − Overcurrent Device Type

Motor Size (bhp)	Overload Device	Reset
1.7	Internal Linebreak	Automatic
2.4	Internal Linebreak	Automatic
2.9	Thermik	Automatic
3.7	Thermik	Automatic
4.7	External (Circuit Breaker)	Manual

Condenser Fan Motor Protection

The condenser fan motor is internally protected against overtemperature.

Control Circuit, 24−V

The control circuit is protected against overcurrent conditions by a circuit breaker mounted on control transformer TRAN. Reset is manual.

GAS HEATING SYSTEM

General

The heat exchanger system consists of a gas valve feeding multiple inshot burners off a manifold. The burners fire into matching primary tubes. The primary tubes discharge into combustion plenum where gas flow converges into secondary tubes (dimpled tubes). The secondary tubes exit into the collector box, the into the induced draft fan wheel inlet. The induced fan wheel discharges into a flue passage and flue gases exit out a flue hood on the side of the unit. The induced draft fan motor includes a Hall Effect sensor circuit that confirms adequate wheel speed via the Integrated Gas Control (IGC) board. Safety switches include a Rollout Switch (at the top of the burner compartment) and a limit switch (mounted through the side of the fan deck, over the tubes). (See FIGURE 26 and FIGURE 28.)

FIGURE 26 **Burner Section Details**

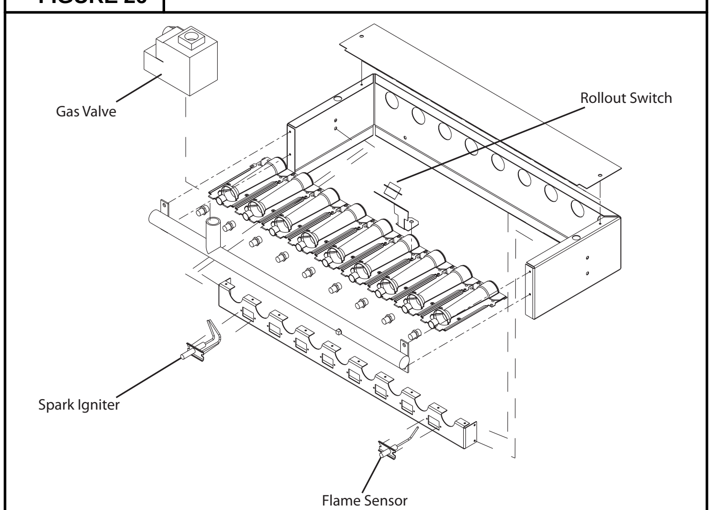


FIGURE 27 **Inducer Assembly**

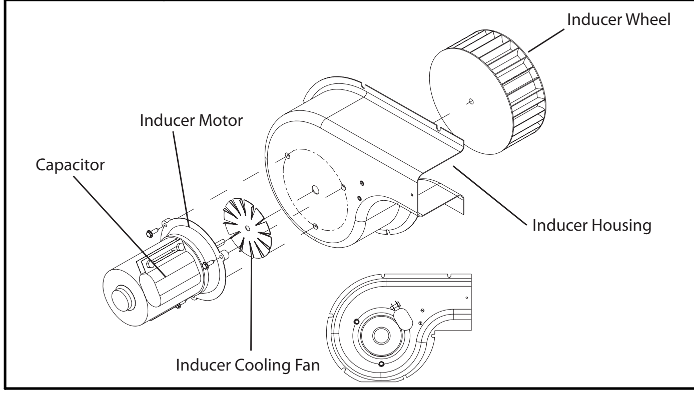
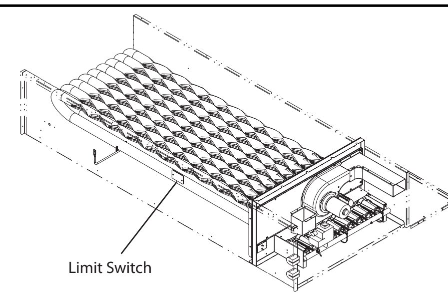


FIGURE 28 **Limit Switch Location**



Fuel Types and Pressures

Natural Gas

The RGS unit is factory−equipped for use with Natural Gas fuel at elevation under 2000 ft (610 m). See section Orifice Replacement for information in modifying this unit for installation at elevations above 2000 ft (610 m).

Gas line pressure entering the unit's main gas valve must be within specified ranges. (See Table 5.) Adjust unit gas regulator valve as required or consult local gas utility.

Table 5 – Natural Gas Supply Line Pressure Ranges

UNIT MODEL	UNIT SIZE	MIN	MAX
RGS	All	4.0 in. wg (996 Pa)	13.0 in. wg (3240 Pa)

Manifold pressure is factory−adjusted for NG fuel use. Adjust as required to obtain best flame characteristic. (See Table 6.)

Table 6 – Natural Gas Manifold Pressure Ranges

UNIT MODEL	UNIT SIZE	HIGH FIRE	LOW FIRE	RANGE
RGS	All	3.5 in. wg (872 Pa)	1.7 in. wg (423 Pa)	2.0−5.0 in. wg (Hi) (498−1245 Pa)

Liquid Propane

Accessory packages are available for field−installation that will convert the RGS unit to operate with Liquid Propane (LP) fuels. These kits include new orifice spuds, new springs for gas valves and a supply line low pressure switch. See section on Orifice Replacement for details on orifice size selections.

Fuel line pressure entering unit gas valve must remain within specified range. (See Table 7.)

Table 7 – Liquid Propane Supply Line Pressure Ranges

UNIT MODEL	UNIT SIZE	MIN	MAX
RGS	All	11.0 in. wg (2740 Pa)	13.0 in. wg (3240 Pa)

Manifold pressure for LP fuel use must be adjusted to specified range. (See Table 8.)Follow instructions in the accessory kit to make initial readjustment.

Table 8 – Liquid Propane Manifold Pressure Ranges

UNIT MODEL	UNIT SIZE	HIGH FIRE	LOW FIRE
RGS	All	10.0 in. wg (2490 Pa)	5.0 in. wg (1245 Pa)

Supply Pressure Switch

The LP conversion kit includes a supply low pressure switch. The switch contacts (from terminal C to terminal NO [Normally Open]) will open the gas valve power whenever the supply line pressure drops below the setpoint. (See FIGURE 29 and FIGURE 30.) The switch, HK02LB008, opens contacts on pressure “fall” at 7.2”±0.70” w.c. Contacts close on pressure rise above 10.2” w.c. If the low pressure remains open for 15 minutes during a call for heat, the IGC circuit will initiate a Ignition Fault (5 flashes) lockout. Reset of the low pressure switch is automatic on rise in supply line pressure. Reset of the IGC requires a recycle of unit power after the low pressure switch has closed.

FIGURE 29 Limit Switch Location

Typical Limit Switch Location

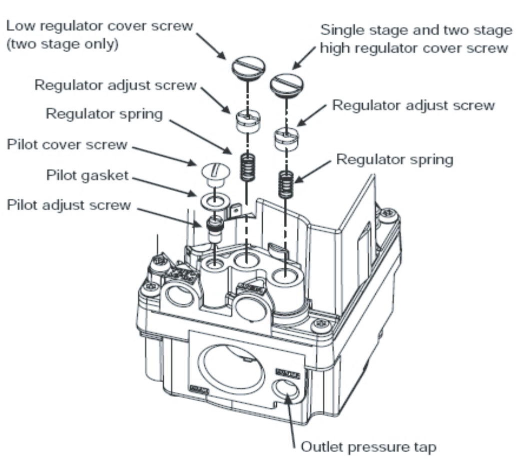
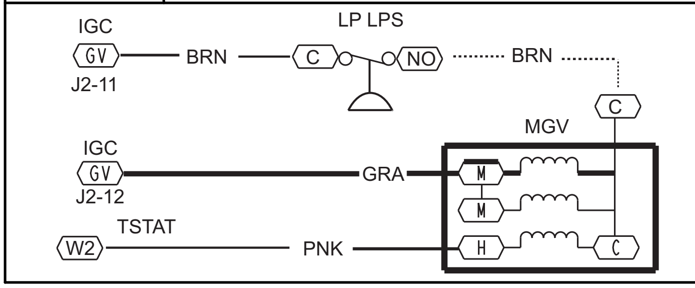


FIGURE 30 LP Supply Line Low Pressure Switch Wiring



This switch also prevents operation when the propane tank level is low which can result in gas with a high concentration of impurities, additives, and residues that have settled to the bottom of the tank. Operation under these conditions can cause harm to the heat exchanger system. Contact your fuel supplier if this condition is suspected.

Flue Gas Passageways

To inspect the flue collector box and upper areas of the heat exchanger:

1. Remove the combustion blower wheel and motor assembly according to directions in Combustion−Air Blower section. (See FIGURE 31.)
2. Remove the flue cover to inspect the heat exchanger.
3. Clean all surfaces as required using a wire brush.

Combustion−Air Blower

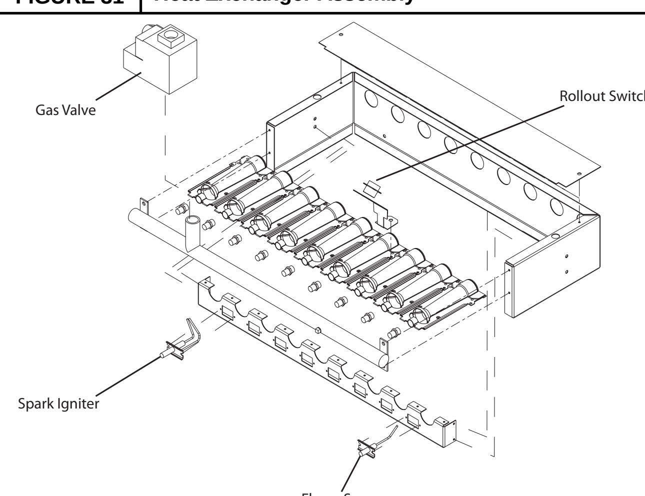
Clean periodically to assure proper airflow and heating efficiency. Inspect blower wheel every fall and periodically during heating season. For the first heating season, inspect blower wheel bi−monthly to determine proper cleaning frequency.

To access burner section, open the heater access door below the indoor fan panel.

To inspect blower wheel, shine a flashlight into draft hood opening. If cleaning is required, remove motor and wheel as follows:

1. Remove the 7 screws that attach induced−draft motor housing to vestibule plate. (See FIGURE 31.)
2. The blower wheel can be cleaned at this point. If additional cleaning is required, continue with Steps 4 and 5.
3. To remove blower from the motor shaft, remove 2 setscrews.
4. To remove motor, remove the 4 screws that hold the motor to mounting plate. Remove the motor cooling fan by removing one setscrew. Then remove nuts that hold motor to mounting plate.
5. To reinstall, reverse the procedure outlined above.

FIGURE 31 Heat Exchanger Assembly



Burners and Igniters

⚠ CAUTION

EQUIPMENT DAMAGE HAZARD

Failure to follow this caution may result in equipment damage.

When working on gas train, do not hit or plug orifice spuds.

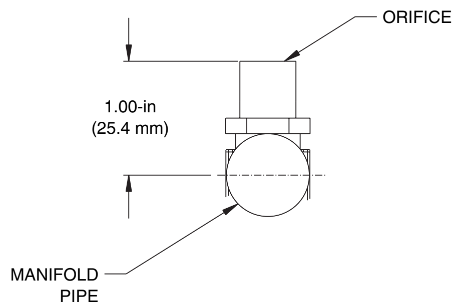
Main Burners

To access the burner section, open the heater access door below the indoor fan panel. At the beginning of each heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust, if necessary. Flames should be conical in shape and enter the heat exchanger tubes with minor impingement on sheet metal flame components.

Orifice Projection

Refer to FIGURE 32 for maximum projection dimension for orifice face to manifold tube.

FIGURE 32 Orifice Projection

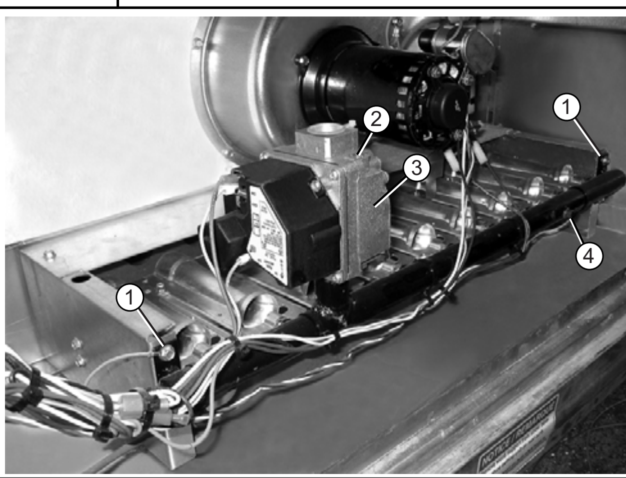


Removal and Replacement of Gas Train

See FIGURE 26, FIGURE 31, and FIGURE 33.

1. Shut off gas at the manual shut off located on the gas supply line, then turn off gas valve switch located on gas valve (ON/OFF).
2. Shut off power to unit and install lockout tag.
3. Disconnect gas piping at unit gas valve.
4. Remove wires connected to gas valve. Mark each wire.

FIGURE 33 Burner Tray Details



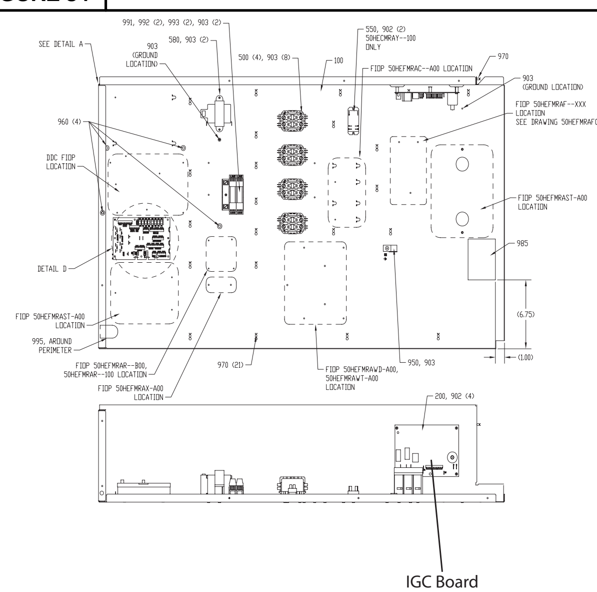
Item No.	Description
1	Gas Manifold Mounting Screws (qty 2)
2	Gas Valve Inlet Plug
3	Propane Conversion Label (apply label where indicated)
4	Gas Manifold Pressure Tap

5. Remove igniter wires and sensor wires at the Integrated Gas Unit Controller (IGC). (See FIGURE 34.)
6. Remove the 2 screws that attach the burner rack to the vestibule plate. (See FIGURE 31.)
7. Slide the burner tray out of the unit. (See FIGURE 33.)
8. To reinstall, reverse the procedure outlined above.

Cleaning and Adjustment

1. Remove burner rack from unit as described in Removal and Replacement of Gas Train section, above.
2. Inspect burners; if dirty, remove burners from rack. (Mark each burner to identify its position before removing from the rack.)
3. Use a soft brush to clean burners and cross−over port as required.
4. Adjust spark gap. The gap should be 0.12−0.14” (3.06−3.60 mm) and spaced 0.18” (4.60 mm) from the end of the burner. (See FIGURE 35.)
5. If factory orifice has been removed, check that each orifice is tight at its threads into the manifold pipe and that orifice projection does not exceed maximum valve. (See FIGURE 32).
6. Reinstall burners on rack in the same locations as factory−installed. (The outside crossover flame regions of the outermost burners are pinched off to prevent excessive gas flow from the side of the burner assembly. If the pinched crossovers are installed between two burners, the flame will not ignite properly.)

FIGURE 34 Unit Control Box/IGC Location



7. Reinstall burner rack as described in Removal and Replacement of Gas Train section.

Gas Valve

All unit sizes are equipped with 2−stage gas valves. See FIGURE 36 for locations of adjustment screws and features on the gas valves.

To adjust gas valve pressure settings:

IMPORTANT: Leak check (using a mixture of soapy water or leak detection fluid) all gas connections including the main service connection, gas valve, gas spuds, and manifold pipe plug. All leaks must be repaired before firing unit.

Check Unit Operation and Make Necessary Adjustments

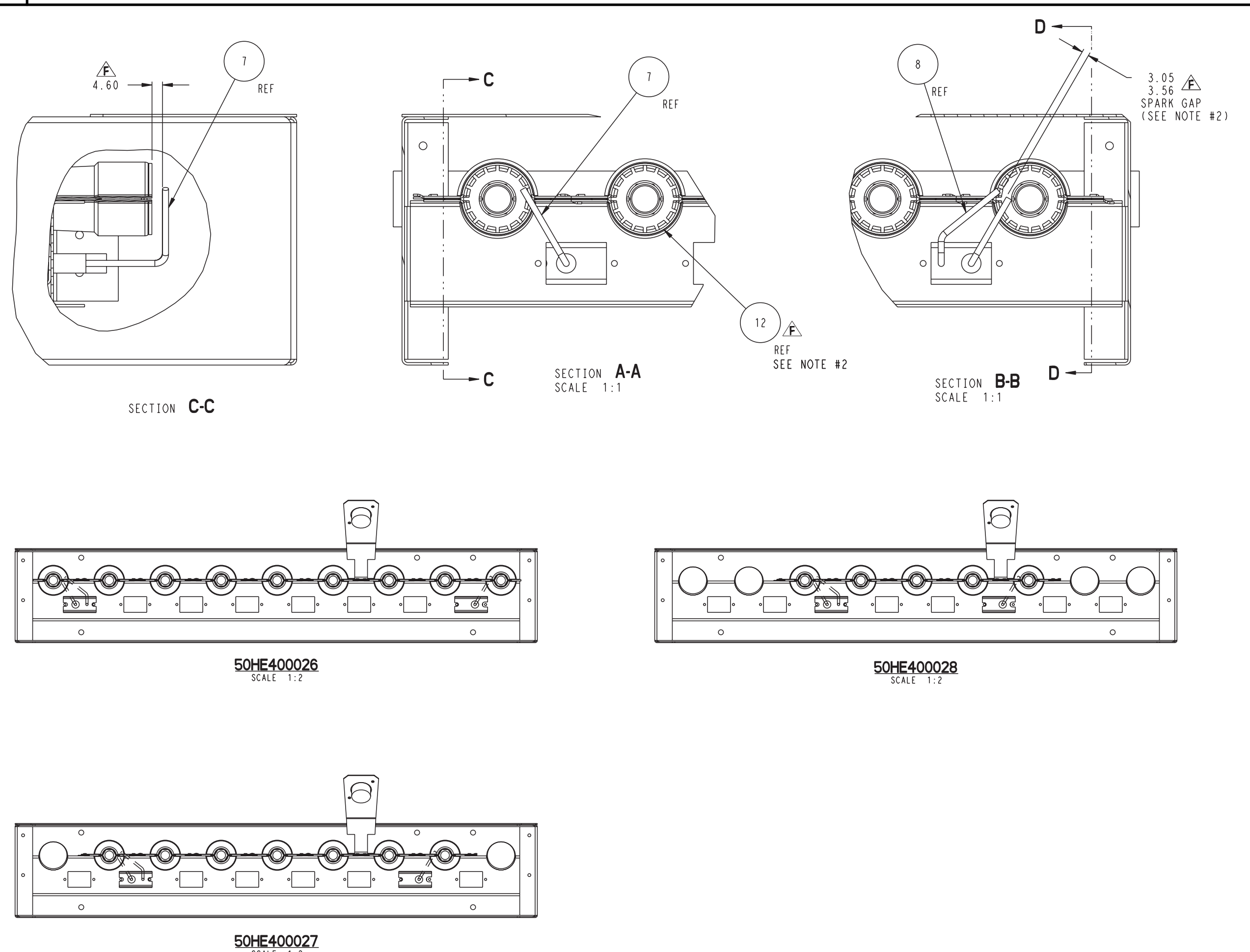
NOTE: Gas supply pressure at gas valve inlet must be within specified ranges for fuel type and unit size. (See Table 5, 6, 7, and 8.)

1. Shut off electrical power supplies to unit and install lockout tag.
2. Shut off manual gas shut off valve located on gas supply line.
3. Remove manifold pressure tap plug from manifold and connect pressure gauge or manometer. (See FIGURE 33.)
4. Turn on electrical supply.
5. Open manual shut off valve, then turn on unit main gas valve.
6. Set room thermostat to call for heat. Verify high−stage heat operation before attempting to adjust manifold pressure.
7. When main burners ignite, check all fittings, manifold, and orifices for leaks.
8. Adjust high−stage pressure to specified setting by turning the plastic adjustment screw clockwise to increase pressure, counter−clockwise to decrease pressure.
9. Set room thermostat to call for low−stage heat. Adjust low−stage pressure to specified setting.
10. Replace regulator cover screw(s) when finished.
11. With burner access panel removed, observe unit heating operation in both high stage and low stage operation. Observe burner flames to see if they are blue in appearance, and that the flames are approximately the same for each burner.
12. Turn off unit, close manual gas shut off valve, remove pressure manometer and replace the 1/8 in. pipe fitting on the gas manifold. (See FIGURE 33.)

Limit Switch

Remove blower access panel. Limit switch is located on the fan deck. (See FIGURE 28.)

FIGURE 35 | **Spark Adjustment**



Burner Ignition

Unit is equipped with a direct spark ignition 100% lockout system. Integrated Gas Unit Controller (IGC) is located in the control box. (See FIGURE 34.) The IGC contains a self−diagnostic LED (light−emitting diode). A single LED (see FIGURE 38) on the IGC provides a visual display of operational or sequential problems when the power supply is uninterrupted. When a break in power occurs, the IGC will be reset (resulting in a loss of fault history) and the indoor (evaporator) fan ON/OFF times will be reset. The LED error code can be observed through the viewport. During servicing refer to the label on the control box cover or Table 9 for an explanation of LED error code descriptions.

If lockout occurs, unit may be reset by interrupting power supply to unit for at least 5 seconds.

Table 9 – LED Error Code Description*

LED INDICATION	ERROR CODE DESCRIPTION
ON	Normal Operation
OFF	Hardware Failure
2 Flashes	Limit Switch Fault
3 Flashes	Flame Sense Fault
4 Flashes	4 Consecutive Limit Switch Faults
5 Flashes	Ignition Lockout Fault
6 Flashes	Induced−Draft Motor Fault
7 Flashes	Rollout Switch Fault
8 Flashes	Internal Control Fault
9 Flashes	Software Lockout

LEGEND
LED − Light Emitting Diode
* A 3 − second pause exists between LED error code flashes. If more than one error code exists, all applicable codes will be displayed in numerical sequence.

IMPORTANT: Refer to Troubleshooting Tables 13 and 14 for additional information.

Orifice Replacement

This unit uses orifice type LH32RFnnn (where nnn indicates orifice reference size). When replacing unit orifices, order the necessary parts via FAST. See Table 11 for available orifice sizes. See Table 12 for orifice sizes for Natural Gas and LP fuel usage at various elevations above sea level. Never drill or plug orifices for operation.

Check that each replacement orifice is tight at its threads into the manifold pipe and that orifice projection does not exceed maximum value. (See FIGURE 32.)

FIGURE 36 **Gas Valve**

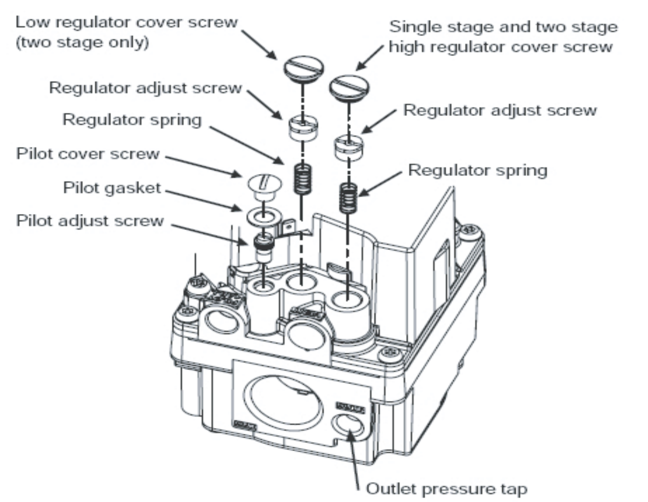


FIGURE 37 **Typical IGC Wiring Diagram**

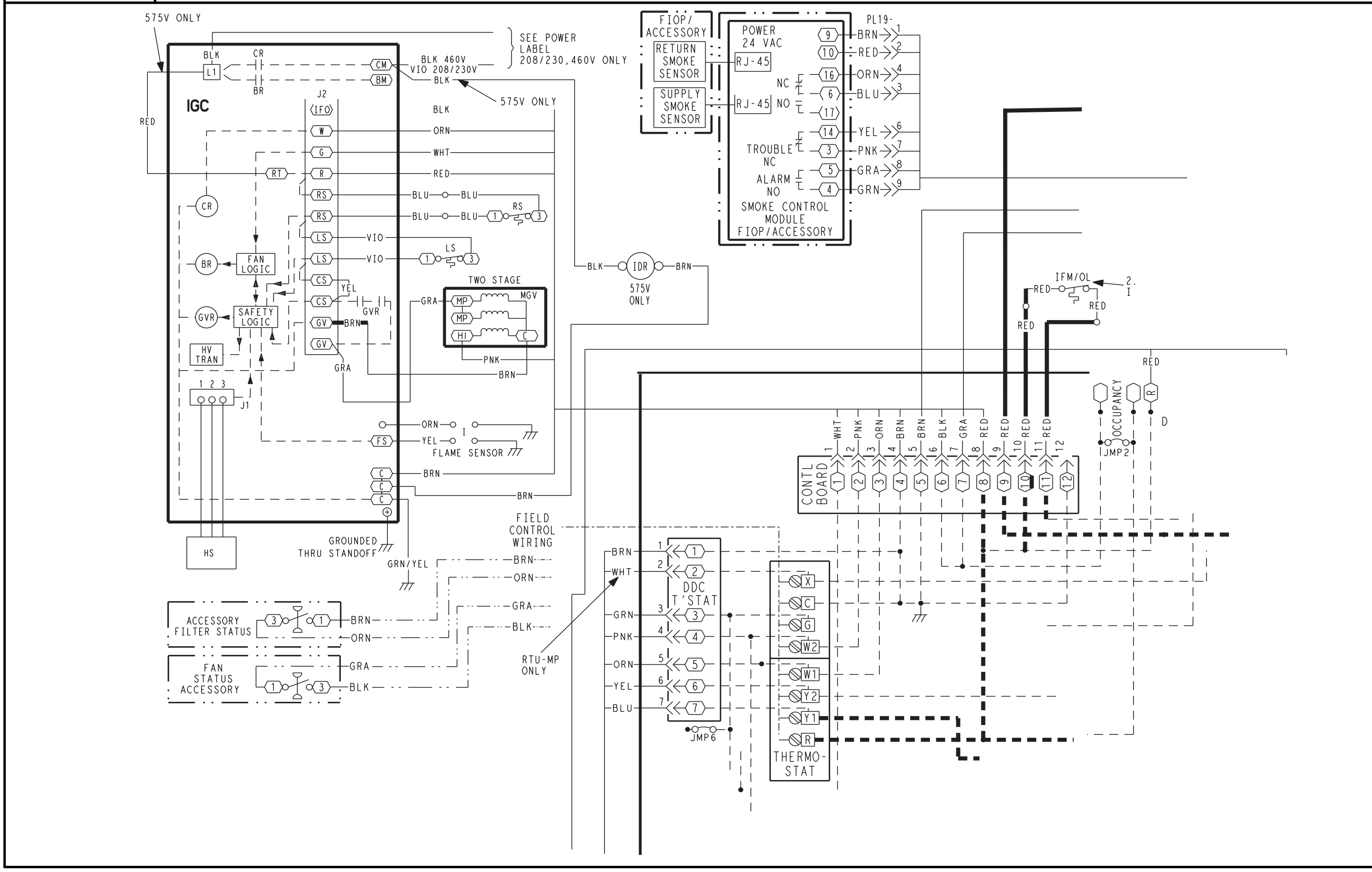


FIGURE 38	Integrated Gas Control Board (IGC)

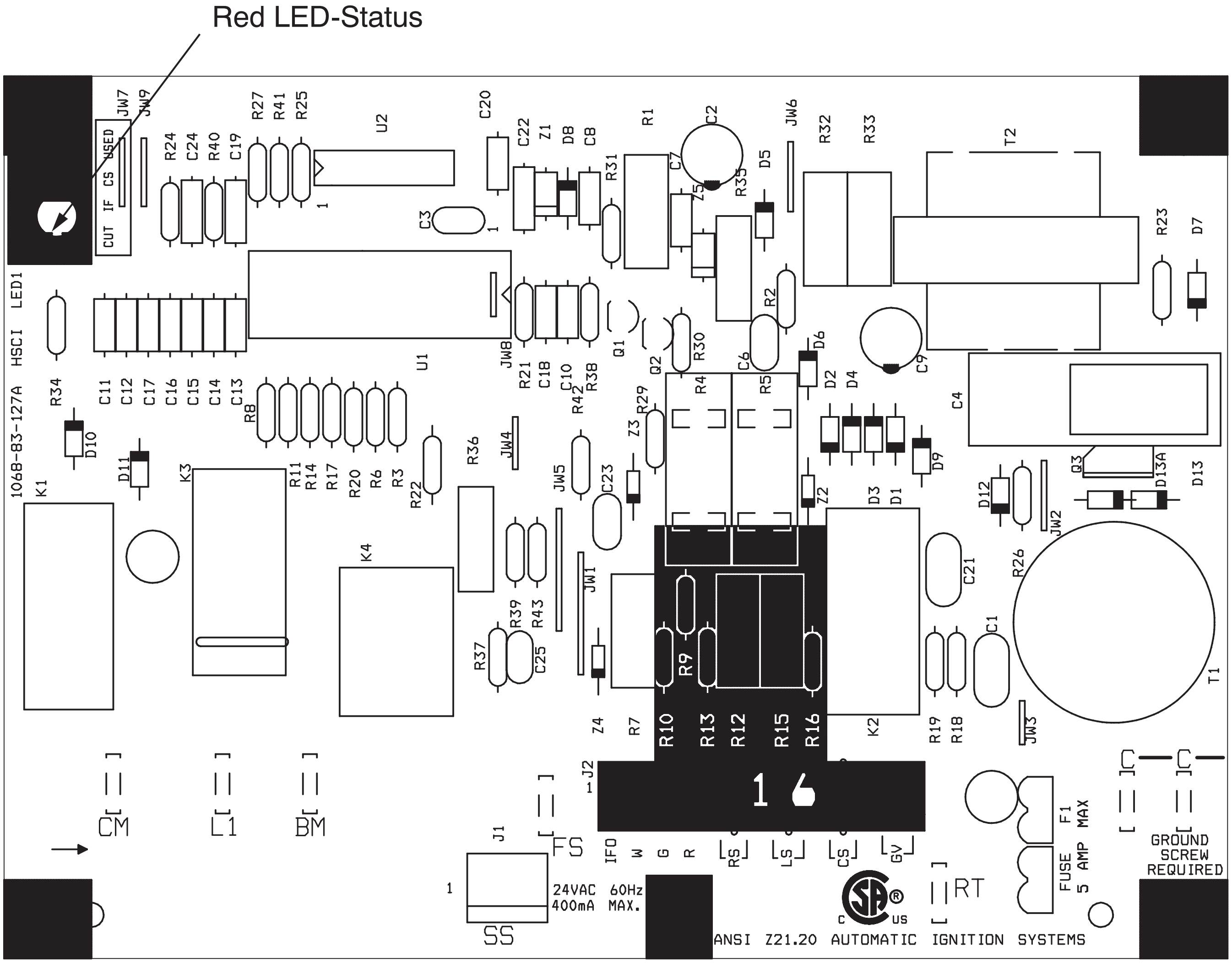


Table 10 – IGC Connections

TERMINAL LABEL	POINT DESCRIPTION	SENSOR LOCATION	TYPE OF I/O	CONNECTION PIN NUMBER
INPUTS				
RT, C	Input power from TRAN 1	control box	24 VAC	—
SS	Speed sensor	gas section	analog input	J1, 1-3
FS, T1	Flame sensor	gas section	switch input	—
W	Heat stage 1	LCTB	24 VAC	J2, 2
RS	Rollout switch	gas section	switch input	J2, 5-6
LS	Limit switch	fan section	switch input	J2, 7-8
CS	Centrifugal switch (not used)	—	switch input	J2, 9-10
OUTPUTS				
L1, CM	Induced draft combustion motor	gas section	line VAC	
IFO	Indoor fan	control box	relay	J2, 1
GV	Gas valve (heat stage 1)	gas section	relay	J2, 11-12

Table 11 – Orifice Sizes

ORIFICE DRILL SIZE	PART NUMBER	DRILL DIA. (in.)
#30	LH32RF129	0.1285
1/8	LH32RF125	0.1250
#31	LH32RF120	0.1200
#32	LH32RF116	0.1160
#33	LH32RF113	0.1130
#34	LH32RF111	0.1110
#35	LH32RF110	0.1100
#36	LH32RF105	0.1065
#37	LH32RF104	0.1040
#38	LH32RF102	0.1015
#39	LH32RF103	0.0995
#40	LH32RF098	0.0980
#41	LH32RF096	0.0960
#42	LH32RF094	0.0935
#43	LH32RF089	0.0890
#44	LH32RF086	0.0860
#45	LH32RF082	0.0820
#46	LH32RF080	0.0810
#47	LH32RF079	0.0785
#48	LH32RF076	0.0760
#49	LH32RF073	0.0730
#50	LH32RF070	0.0700
#51	LH32RF067	0.0670
#52	LH32RF065	0.0635
#53	LH32RF060	0.0595
#54	LH32RF055	0.0550
#55	LH32RF052	0.0520
#56	LH32RF047	0.0465
#57	LH32RF043	0.0430
#58	LH32RF042	0.0420

Table 12 − Altitude Compensation*

NATURAL GAS		NOMINAL HEAT INPUT					
ELEVATION		220k BTUH		310k BTUH		400k BTUH	
Feet	Meters	Orifice Size	Input (btu/hr)	Orifice Size	Input (btu/hr)	Orifice Size	Input (btu/hr)
0 – 2000	0 – 610	30	220,000	30	310,000	30	400,000
2000	610	30	202,400	30	285,200	30	368,000
3000	914	31[1]	193,600	31[1]	272,800	31[1]	352,000
4000	1219	31[1]	184,800	31[1]	260,400	31[1]	336,000
5000	1524	31[1]	176,000	31[1]	248,000	31[1]	320,000
6000	1829	31[1]	167,200	31[1]	235,600	31[1]	304,000
7000	2134	32[1]	158,400	32[1]	223,200	32[1]	288,000
8000	2438	32[1]	149,600	32[1]	210,800	32[1]	272,000
9000	2743	34[1]	140,800	34[1]	198,400	34[1]	256,000
10000	3048	35[2]	132,000	35[2]	186,000	35[2]	240,000
11000	3353	37[2]	123,200	37[2]	173,600	37[2]	224,000
12000	3658	37[2]	114,400	37[2]	161,200	37[2]	208,000
13000	3962	39[2]	105,600	39[2]	148,800	39[2]	192,000
14000	4267	39[2]	96,800	39[2]	136,400	39[2]	176,000

PROPANE GAS		NOMINAL HEAT INPUT					
ELEVATION		220k BTUH		310k BTUH		400k BTUH	
Feet	Meters	Orifice Size	Input (btu/hr)	Orifice Size	Input (btu/hr)	Orifice Size	Input (btu/hr)
0 – 2000	0 – 610	48[5]	220,000	48[5]	310,000	48[5]	400,000
2000	610	49[3]	202,400	49[3]	285,200	49[3]	368,000
3000	914	49[3]	193,600	49[3]	272,800	49[3]	352,000
4000	1219	49[3]	184,800	49[3]	260,400	49[3]	336,000
5000	1524	50[3]	176,000	50[3]	248,000	50[3]	320,000
6000	1829	50[3]	167,200	50[3]	235,600	50[3]	304,000
7000	2134	50[3]	158,400	50[3]	223,200	50[3]	288,000
8000	2438	51[3]	149,600	51[3]	210,800	51[3]	272,000
9000	2743	51[3]	140,800	51[3]	198,400	51[3]	256,000
10000	3048	52[4]	132,000	52[4]	186,000	52[4]	240,000
11000	3353	52[4]	123,200	52[4]	173,600	52[4]	224,000
12000	3658	53[4]	114,400	53[4]	161,200	53[4]	208,000
13000	3962	53[4]	105,600	53[4]	148,800	53[4]	192,000
14000	4267	53[4]	96,800	53[4]	136,400	53[4]	176,000

* As the height above sea level increases, there is less oxygen per cubic ft. of air. Therefore, heat input rate should be reduced at higher altitudes.

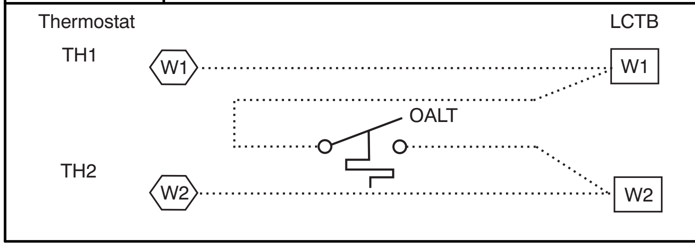
KIT NO.:

XX[1] = CRNGELEV001A00
XX[2] = CRNGELEV002A00
XX[3] = CRLPELEV005A00
XX[4] = CRLPELEV006A00
XX[5] = CRLPKIT9001A00

Minimum Heating Entering Air Temperature

When operating on first stage heating, the minimum temperature of air entering the dimpled heat exchanger is 50°F continuous and 45°F intermittent for standard heat exchangers and 40°F continuous and 35°F intermittent for stainless steel heat exchangers. To operate at lower return or mixed air temperatures, a field−supplied outdoor−air thermostat must be used to initiate both stages of heat when the temperature is below the minimum required temperature to ensure full fire operation. Wire the outdoor−air thermostat OALT (part no. HH22AG106) in series with the second stage gas valve. (See FIGURE 39.) Set the outdoor−air thermostat at 35°F for stainless steel heat exchangers or 45°F for standard heat exchangers. This temperature setting will bring on the second stage of heat whenever the ambient temperature is below the thermostat setpoint. Indoor comfort may be compromised when heating is initiated using low entering air temperatures with insufficient heating temperature rise.

FIGURE 39 **OATL Connections**



Troubleshooting Heating System

Refer to Table 13 and 14 for additional troubleshooting topics.

Table 13 – Heating Service Analysis

PROBLEM	CAUSE	REMEDY
Burners Will Not Ignite.	Misaligned spark electrodes.	Check flame ignition and sensor electrode positioning. Adjust as needed.
	No gas at main burners.	Check gas line for air, purge as necessary. After purging gas line of air, allow gas to dissipate for at least 5 minutes before attempting to relight unit.
		Check gas valve.
	Water in gas line.	Drain water and install drip leg to trap water.
	No power to furnace.	Check power supply, fuses, wiring, and circuit breaker.
	No 24 v power supply to control circuit.	Check transformer. Transformers with internal overcurrent protection require a cool down period before resetting.
	Miswired or loose connections.	Check all wiring and wire nut connections.
	Burned−out heat anticipator in thermostat.	Replace thermostat.
	Broken thermostat wires.	Run continuity check. Replace wires, if necessary.
Inadequate Heating.	Dirty air filter.	Clean or replace filter as necessary.
	Gas input to unit too low.	Check gas pressure at manifold. Clock gas meter for input. If too low, increase manifold pressure, or replace with correct orifices.
	Unit undersized for application.	Replace with proper unit or add additional unit.
	Restricted airflow.	Clean filter, replace filter, or remove any restrictions.
	Blower speed too low.	Use high speed tap, increase fan speed, or install optional blower, as suitable for individual units.
	Limit switch cycles main burners.	Check rotation of blower, thermostat heat anticipator settings, and temperature rise of unit. Adjust as needed.
	Too much outdoor air.	Adjust minimum position.
		Check economizer operation.
Poor Flame Characteristics.	Incomplete combustion (lack of combustion air) results in: Aldehyde odors, CO, sooting flame, or floating flame.	Check all screws around flue outlets and burner compartment. Tighten as necessary.
		Cracked heat exchanger.
		Overfired unit — reduce input, change orifices, or adjust gas line or manifold pressure.
		Check vent for restriction. Clean as necessary.
		Check orifice to burner alignment.
Burners Will Not Turn Off.	Unit is locked into Heating mode for a one minute minimum.	Wait until mandatory one−minute time period has elapsed or reset power to unit.

Table 14 – IGC Board LED Alarm Codes

LED FLASH CODE	DESCRIPTION	ACTION TAKEN BY CONTROL	RESET METHOD	PROBABLE CAUSE
On	Normal Operation	—	—	—
Off	Hardware Failure	No gas heating.	—	Loss of power to the IGC. Check 5 amp fuse on IGC, power to unit, 24V circuit breaker, transformer, and wiring to the IGC.
2 Flashes	Limit Switch Fault	Gas valve and igniter Off. Indoor fan and inducer On.	Limit switch closed, or heat call (W) Off.	High temperature limit switch is open. Check the operation of the indoor (evaporator) fan motor. Ensure that the supply-air temperature rise is within the range on the unit nameplate. Check wiring and limit switch operation. Check/clean return air filters. Check burner assembly manifold pressure to ensure proper firing rate.
3 Flashes	Flame Sense Fault	Indoor fan and inducer On.	Flame sense normal. Power reset for LED reset.	The IGC sensed a flame when the gas valve should be closed. The minimum flame sensing microamps is 0.5 ma. Check wiring, flame sensor, and gas valve operation.
4 Flashes	Four Consecutive Limit Switch Fault	No gas heating.	Heat call (W) Off. Power reset for LED reset.	4 consecutive limit switch faults within a single call for heat. See Limit Switch Fault.
5 Flashes	Ignition Fault	No gas heating.	Heat call (W) Off. Power reset for LED reset.	Unit unsuccessfully attempted ignition for 15 minutes. Check igniter and flame sensor electrode spacing, gaps, etc. Check flame sense and igniter wiring. Check gas valve operation and gas supply.
6 Flashes	Induced Draft Motor Fault	If heat off: no gas heating. If heat on: gas valve Off and inducer On.	Inducer sense normal, or heat call (W) Off.	Inducer sense On when heat call Off, or inducer sense Off when heat call On. Check wiring, voltage, and operation of IGC motor. Check speed sensor wiring to IGC. Check to ensure Hall Effect wires are not rubbing against cabinet sheet metal.
7 Flashes	Rollout Switch Lockout	Gas valve and igniter Off. Indoor fan and inducer On.	Power reset.	Rollout switch has opened. Check gas valve operation. Check induced-draft blower wheel is properly secured to motor shaft.
8 Flashes	Internal Control Lockout	No gas heating.	Power reset.	IGC has sensed internal hardware or software error. If fault is not cleared by resetting 24 v power, replace the IGC. Check gas valve connections to IGC terminals. BRN lead must be on Pin 11. Check that W1, W2 and Com are correctly connected to the gas valve terminals.
9 Flashes	Temporary Software Lockout	No gas heating.	1 hour auto reset, or power reset.	Electrical interference is disrupting the IGC software.

LEGEND
IGC – Integrated Gas Unit Control
LED – Light–Emitting Diode
NOTES:

1. There is a 3–second pause between alarm code displays.
2. If more than one alarm code exists, all applicable alarm codes will be displayed in numerical sequence.
3. Alarm codes on the IGC will be lost if power to the unit is interrupted.

CONDENSER COIL SERVICE

Condenser Coil

The condenser coil is new microchannel Heat Exchanger Technology. This is an all–aluminum construction with louvered fins over single–depth crosstubes. The crosstubes have multiple small passages through which the refrigerant passes from header to header on each end. Tubes and fins are both aluminum construction. Connection tube joints are copper. The coil may be one–row or two–row. Two–row coils are spaced apart to assist in cleaning.

Repairing microchannel Condenser Tube Leaks

FAST offers service repair kit Part Number 1178434 for repairing tube leaks in the microchannel coil crosstubes. This kit includes approved braze materials (aluminum flux core braze rods), a heat shield, a stainless steel brush, replacement fin segments, adhesive for replacing fin segments, and instructions specific to the microchannel aluminum coil.

The repair procedure requires the use of Butane or MAPP gas and torch (must be supplied by servicer) instead of conventional oxyacetylene fuel and torch. While the flame temperature for Butane/MAPP is lower than that of oxyacetylene (and thus provides more flexibility when working on aluminum), the flame temperature is still higher than the melting temperature of aluminum, so user caution is required. Follow instructions carefully. Use the heat shield.

Replacing Microchannel Condenser Coil

The service replacement coil is preformed and is equipped with transition joints with copper stub tubes. When brazing the connection joints to the unit tubing, use a wet cloth around the aluminum tube at the transition joint. Avoid applying torch flame directly onto the aluminum tubing.

ECONOMIZER SYSTEMS

The RGS units may be equipped with a factory−installed or accessory (field−installed) economizer system. See FIGURE 40 for component locations. See FIGURE 41 for economizer section wiring diagrams.

Both Economizers use direct−drive damper actuators.

FIGURE 40 **Economizer Component Location**

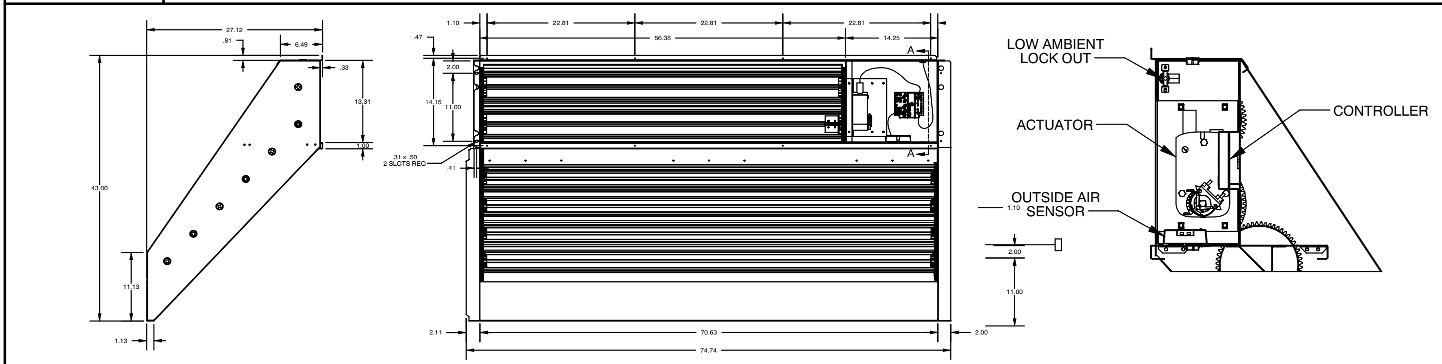


FIGURE 41 **Economizer Wiring**

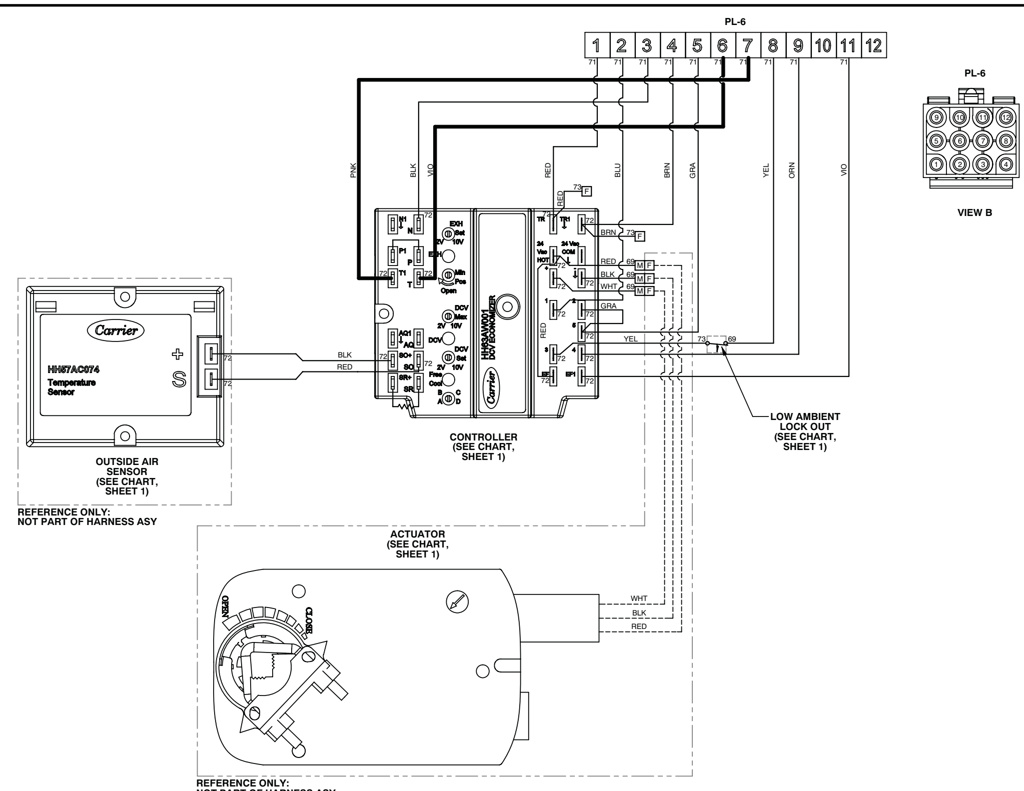
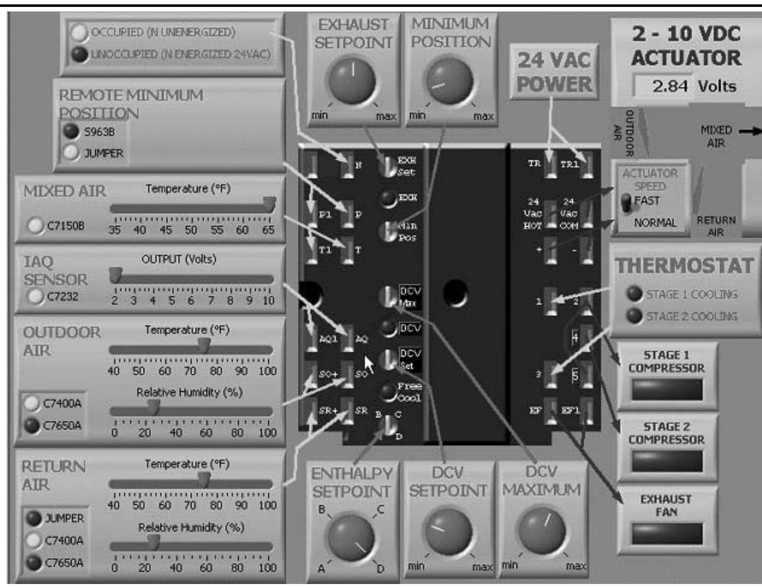


Table 15 – Economizer Input/Output Logic

INPUTS					OUTPUTS			
Demand Control Ventilation (DCV)	Enthalpy*		Y1	Y2	Compressor		N Terminal†	
	Outdoor	Return			Stage 1	Stage 2	Occupied	Unoccupied
							Damper	
Below set (DCV LED Off)	High (Free Cooling LED Off)	Low	On	On	On	On	Minimum position	Closed
			On	Off	On	Off		
			Off	Off	Off	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating** (between min. position and full-open)	Modulating** (between closed and full-open)
			On	Off	Off	Off		
			Off	Off	Off	Off	Minimum position	Closed
Above set (DCV LED On)	High (Free Cooling LED Off)	Low	On	On	On	On	Modulating†† (between min. position and DCV maximum)	Modulating†† (between closed and DCV maximum)
			On	Off	On	Off		
			Off	Off	Off	Off		
	Low (Free Cooling LED On)	High	On	On	On	Off	Modulating***	Modulating†††
			On	Off	Off	Off		
			Off	Off	Off	Off		

* For single enthalpy control, the module compares outdoor enthalpy to the ABCD setpoint.
† Power at N terminal determines Occupied/Unoccupied setting: 24 vac (Occupied), no power (Unoccupied).
** Modulation is based on the supply-air sensor signal.
†† Modulation is based on the DCV signal.
*** Modulation is based on the greater of DCV and supply-air sensor signals, between minimum position and either maximum position (DCV) or fully open (supply-air signal).
††† Modulation is based on the greater of DCV and supply-air sensor signals, between closed and either maximum position (DCV) or fully open (supply-air signal).

FIGURE 42 Economizer Functional View



Economizer

Table 15 provides a summary of Economizer. Troubleshooting instructions are enclosed.

A functional view of the EconoMi$er is shown in FIGURE 42. Typical settings, sensor ranges, and jumper positions are also shown.

Economizer Standard Sensors

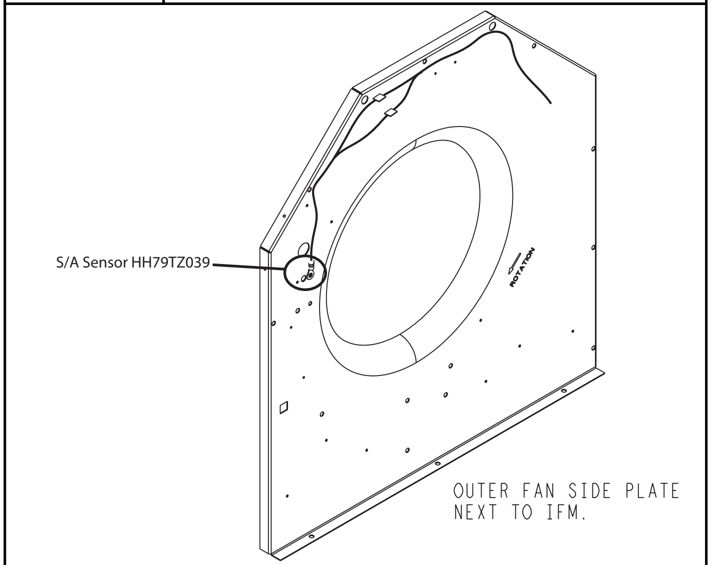
Outdoor Air Temperature (OAT) Sensor

The outdoor air temperature sensor (HH57AC074) is a 10 to 20 mA device used to measure the outdoor-air temperature. The outdoor-air temperature is used to determine when the Economizer can be used for free cooling. The sensor is factory-installed on the Economizer in the outdoor airstream. The operating range of temperature measurement is 40° to 100°F (4° to 38°C). (See FIGURE 45.)

Supply Air Temperature (SAT) Sensor

The supply air temperature sensor is a 3 K thermistor located at the inlet of the indoor fan. (See FIGURE 43.) This sensor is factory installed. The operating range of temperature measurement is 0° to 158°F (−18° to 70°C).

FIGURE 43 Supply Air Sensor Location



The temperature sensor looks like an eyelet terminal with wires running to it. The sensor is located in the "crimp end" and is sealed from moisture.

Outdoor Air Lockout Sensor

The Economizer is equipped with an ambient temperature lockout switch located in the outdoor airstream which is used to lock out the compressors below a 42°F (6°C) ambient temperature.

<u>Economizer Control Modes</u>

Determine the Economizer control mode before set up of the control. Some modes of operation may require different sensors. (See Table 15.) The Economizer is supplied from the factory with a supply-air temperature sensor and an outdoor-air temperature sensor. This allows for operation of the Economizer with outdoor air dry bulb changeover control. Additional accessories can be added to allow for different types of changeover control and operation of the Economizer and unit.

Outdoor Dry Bulb Changeover

The standard controller is shipped from the factory configured for outdoor dry bulb changeover control. The outdoor air and supply air temperature sensors are included as standard. For this control mode, the outdoor temperature is compared to an adjustable setpoint selected on the control. If the outdoor-air temperature is above the setpoint, the Economizer will adjust the outside air dampers to minimum position. If the outdoor-air temperature is below the setpoint, the position of the outside air dampers will be controlled to provided free cooling using outdoor air. When in this mode, the LED next to the free cooling setpoint potentiometer will be on. The changeover temperature setpoint is controlled by the free cooling setpoint potentiometer located on the control. (See FIGURE 44.)

The scale on the potentiometer is A, B, C, and D. See FIGURE 45 for the corresponding temperature changeover values.

FIGURE 44 Economizer Controller Potentiometer and LED Locations

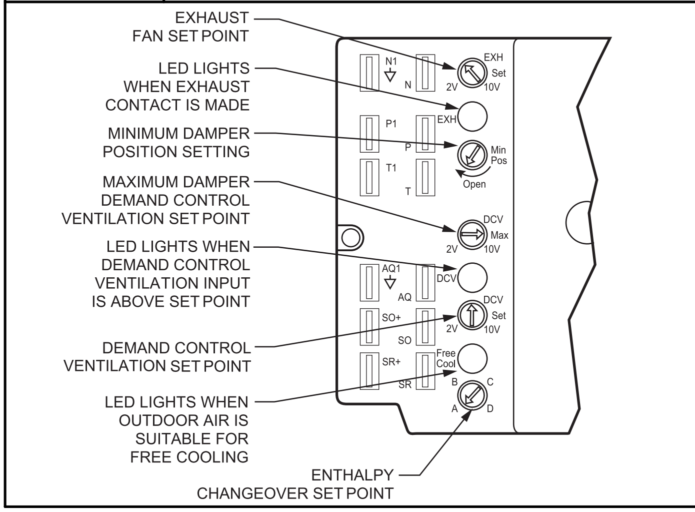


FIGURE 45 Outside Air Temperature Changeover Setpoints

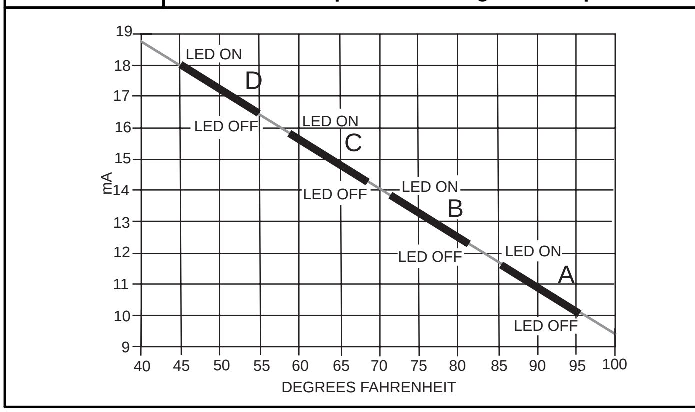
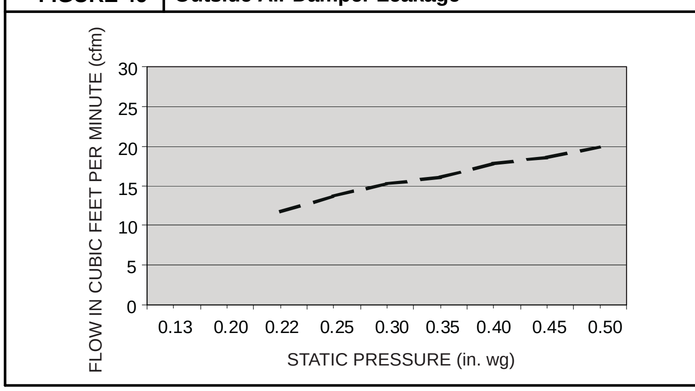


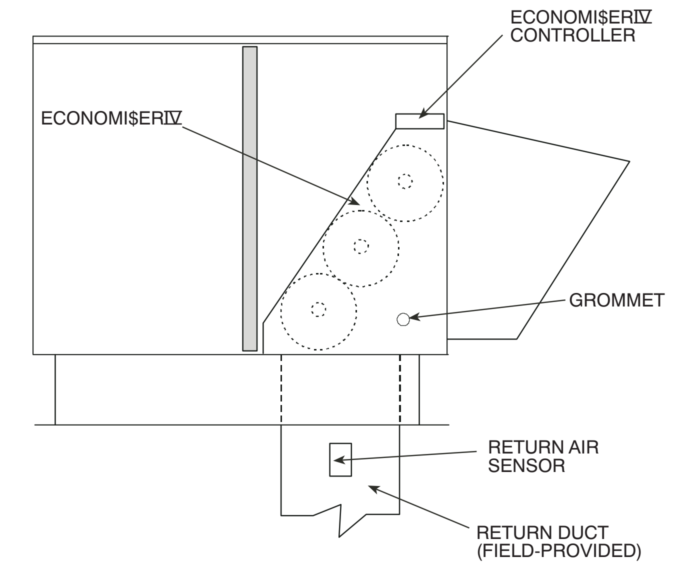
FIGURE 46 Outside Air Damper Leakage



Differential Dry Bulb Control

For differential dry bulb control the standard outdoor dry bulb sensor is used in conjunction with an additional accessory dry bulb sensor (part number DNTEMPSN002A00). The accessory sensor must be mounted in the return airstream. (See FIGURE 47.) Wiring is provided in the Economizer wiring harness. (See FIGURE 44.)

FIGURE 47	Return Air Temperature or Enthalpy Sensor Mounting Location



In this mode of operation, the outdoor-air temperature is compared to the return-air temperature and the lower temperature airstream is used for cooling. When using this mode of changeover control, turn the enthalpy setpoint potentiometer fully clockwise to the D setting. (See FIGURE 44.)

Outdoor Enthalpy Changeover

For enthalpy control, accessory enthalpy sensor (part number AXB078ENT) is required. Replace the standard outdoor dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. (See FIGURE 47.) When the outdoor air enthalpy rises above the outdoor enthalpy changeover setpoint, the outdoor-air damper moves to its minimum position. The outdoor enthalpy changeover setpoint is set with the outdoor enthalpy setpoint potentiometer on the Economizer controller. The setpoints are A, B, C, and D. (See FIGURE 48.) The factory-installed 620-ohm jumper must be in place across terminals S_R and SR+ on the Economizer controller.

FIGURE 48	Enthalpy Changeover Setpoints

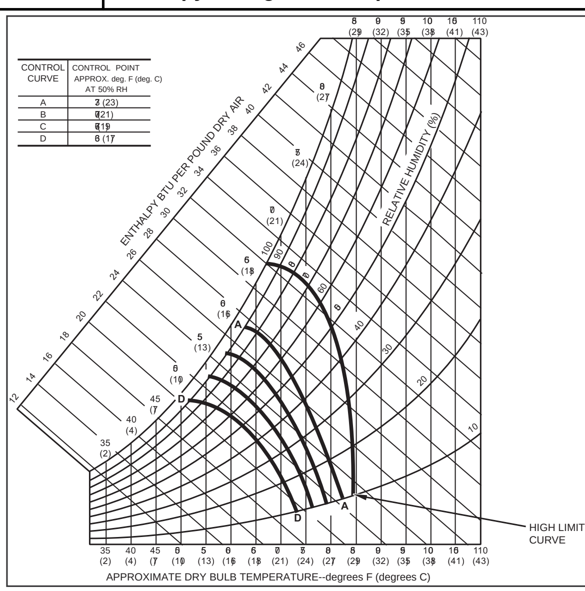
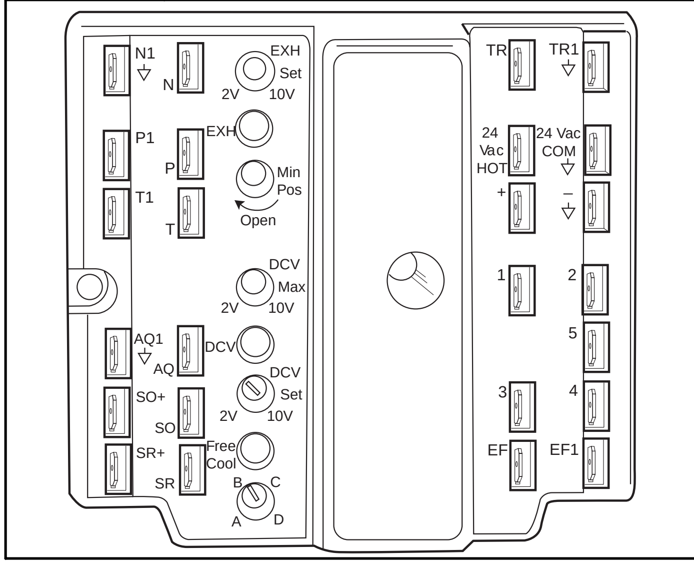


FIGURE 49	Economizer Control



Differential Enthalpy Control

For differential enthalpy control, the Economizer controller uses two enthalpy sensors (AXB078ENT and DNENTDIF004A00), one in the outside air and one in the return air duct. The Economizer controller compares the outdoor air enthalpy to the return air enthalpy to determine Economizer use. The controller selects the lower enthalpy air (return or outdoor) for cooling. For example, when the outdoor air has a lower enthalpy than the return air, the Economizer opens to bring in outdoor air for free cooling.

Replace the standard outside air dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. (See FIGURE 47.) Mount the return air enthalpy sensor in the return air duct. (See FIGURE 47.) Wiring is provided in the Economizer wiring harness. (See FIGURE 41.) The outdoor enthalpy changeover setpoint is set with the outdoor enthalpy setpoint potentiometer on the Economizer controller. When using this mode of changeover control, turn the enthalpy setpoint potentiometer fully clockwise to the D setting.

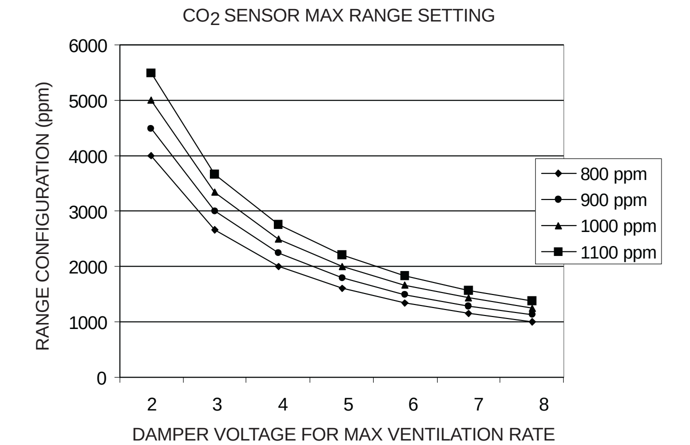
Indoor Air Quality (IAQ) Sensor Input

The IAQ input can be used for demand control ventilation control based on the level of CO_2 measured in the space or return air duct.

There is both a factory-installed (FIOP) CO_2 option (sensor 8001B with no display, which is mounted on the side of the Economizer) and a field-installed CO_2 option (sensor 8002 with display, which is mounted on the return air duct). While performing the same function, they differ in their ability to be configured. The FIOP version is preset and requires no changes in most applications. If a configuration change is required, service kit #UIP2072 (software CD, cables, and instructions) and a laptop PC are required. The field-installed version with display can be configured stand-alone. (See section “CO_2 Sensor Configuration”.)

Mount the accessory IAQ sensor according to manufacturer specifications. The IAQ sensor should be wired to the AQ and AQ1 terminals of the controller. Adjust the DCV potentiometers to correspond to the DCV voltage output of the indoor air quality sensor at the user-determined setpoint. (See FIGURE 50.)

FIGURE 50	CO_2 Sensor Maximum Range Settings



If a separate field-supplied transformer is used to power the IAQ sensor, the sensor must not be grounded or the Economizer control board will be damaged.

When using demand ventilation, the minimum damper position represents the minimum ventilation position for VOC (volatile organic compounds) ventilation requirements. The maximum demand ventilation position is used for fully occupied ventilation.

When demand ventilation control is not being used, the minimum position potentiometer should be used to set the occupied ventilation position. The maximum demand ventilation position should be turned fully clockwise.

Exhaust Setpoint Adjustment

The exhaust setpoint will determine when the exhaust fan runs based on damper position (if accessory power exhaust is installed). The setpoint is modified with the Exhaust Fan Setpoint (EXH SET) potentiometer. (See FIGURE 44.) The setpoint represents the damper position above which the exhaust fans will be turned on. When there is a call for exhaust, the Economizer controller provides a 45 ± 15 second delay before exhaust fan activation to allow the dampers to open. This delay allows the damper to reach the appropriate position to avoid unnecessary fan overload.

Minimum Position Control

There is a minimum damper position potentiometer on the Economizer controller. (See FIGURE 44.) The minimum damper position maintains the minimum airflow into the building during the occupied period.

When using demand ventilation, the minimum damper position represents the minimum ventilation position for VOC (volatile organic compound) ventilation requirements. The maximum demand ventilation position is used for fully occupied ventilation.

When demand ventilation control is not being used, the minimum position potentiometer should be used to set the occupied ventilation position. The maximum demand ventilation position should be turned fully clockwise.

Adjust the minimum position potentiometer to allow the minimum amount of outdoor air, as required by local codes, to enter the building. Make minimum position adjustments with at least 10°F temperature difference between the outdoor and return-air temperatures.

To determine the minimum position setting, perform the following procedure:

1. Calculate the appropriate mixed air temperature using the following formula:

$$\left(T_O \times \frac{OA}{100}\right) + \left(TR \times \frac{RA}{100}\right) = T_M$$

   T_O = Outdoor-Air Temperature

   OA = Percent of Outdoor Air

   T_R = Return-Air Temperature

   RA = Percent of Return Air

   T_M = Mixed-Air Temperature

   As an example, if local codes require 10% outdoor air during occupied conditions, outdoor-air temperature is 60°F, and return-air temperature is 75°F.

   (60 x .10) + (75 x .90) = 73.5°F
2. Disconnect the supply air sensor from terminals T and T1.
3. Ensure that the factory-installed jumper is in place across terminals P and P1. If remote damper positioning is being used, make sure that the terminals are wired according to FIGURE 41 and that the minimum position potentiometer is turned fully clockwise.
4. Connect 24 vac across terminals TR and TR1.
5. Carefully adjust the minimum position potentiometer until the measured mixed air temperature matches the calculated value.
6. Reconnect the supply air sensor to terminals T and T1.

Remote control of the Economizer damper is desirable when requiring additional temporary ventilation. If a field-supplied remote potentiometer (Honeywell part number S963B1128) is wired to the Economizer controller, the minimum position of the damper can be controlled from a remote location.

To control the minimum damper position remotely, remove the factory-installed jumper on the P and P1 terminals on the Economizer controller. Wire the field-supplied potentiometer to the P and P1 terminals on the Economizer controller. (See FIGURE 49.)

Damper Movement

Damper movement from full open to full closed (or vice versa) takes 2-1/2 minutes.

Thermostats

The Economizer control works with conventional thermostats that have a Y1 (cool stage 1), Y2 (cool stage 2), W1 (heat stage 1), W2 (heat stage 2), and G (fan). The Economizer control does not support space temperature sensors. Connections are made at the thermostat terminal connection board located in the main control box.

Demand Control Ventilation (DCV)

When using the Economizer for demand controlled ventilation, there are some equipment selection criteria which should be considered. When selecting the heat capacity and cool capacity of the equipment, the maximum ventilation rate must be evaluated for design conditions. The maximum damper position must be calculated to provide the desired fresh air.

Typically the maximum ventilation rate will be about 5 to 10% more than the typical cfm required per person, using normal outside air design criteria.

A proportional anticipatory strategy should be taken with the following conditions: a zone with a large area, varied occupancy, and equipment that cannot exceed the required ventilation rate at design conditions. Exceeding the required ventilation rate means the equipment can condition air at a maximum ventilation rate that is greater than the required ventilation rate for maximum occupancy. A proportional-anticipatory strategy will cause the fresh air supplied to increase as the room CO_2 level increases even though the CO_2 setpoint has not been reached. By the time the CO_2 level reaches the setpoint, the damper will be at maximum ventilation and should maintain the setpoint.

In order to have the CO_2 sensor control the economizer damper in this manner, first determine the damper voltage output for minimum or base ventilation. Base ventilation is the ventilation required to remove contaminants during unoccupied periods. The following equation may be used to determine the percent of outside air entering the building for a given damper position. For best results there should be at least a 10 degree difference in outside and return-air temperatures.

$$(T_O \times \frac{OA}{100}) + (TR \times \frac{RA}{100}) = T_M$$

T_O = Outdoor-Air Temperature

OA = Percent of Outdoor Air

T_R = Return-Air Temperature

RA = Percent of Return Air

T_M = Mixed-Air Temperature

Once base ventilation has been determined, set the minimum damper position potentiometer to the correct position.

The same equation can be used to determine the occupied or maximum ventilation rate to the building. For example, an output of 3.6 volts to the actuator provides a base ventilation rate of 5% and an output of 6.7 volts provides the maximum ventilation rate of 20% (or base plus 15 cfm per person). Use FIGURE 50 to determine the maximum setting of the CO_2 sensor. For example, an 1100 ppm setpoint relates to a 15 cfm per person design. Use the 1100 ppm curve on FIGURE 50 to find the point when the CO_2 sensor output will be 6.7 volts. Line up the point on the graph with the left side of the chart to determine that the range configuration for the CO_2 sensor should be 1800 ppm. The Economizer controller will output the 6.7 volts from the CO_2 sensor to the actuator when the CO_2 concentration in the space is at 1100 ppm. The DCV setpoint may be left at 2 volts since the CO_2 sensor voltage will be ignored by the Economizer controller until it rises above the 3.6 volt setting of the minimum position potentiometer.

Once the fully occupied damper position has been determined, set the maximum damper demand control ventilation potentiometer to this position. Do not set to the maximum position as this can result in over-ventilation to the space and potential high humidity levels.

CO_2 Sensor Configuration

The CO_2 sensor has preset standard voltage settings that can be selected anytime after the sensor is powered up. (See Table 16.)

Use setting 1 or 2. (See Table 16.)

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.

Table 16 – CO_2 Sensor Standard Settings

SETTING	EQUIPMENT	OUTPUT	VENTILATION RATE (CFM/Person)	ANALOG OUTPUT	CO_2 CONTROL RANGE (ppm)	OPTIONAL RELAY SETPOINT (ppm)	RELAY HYSTERESIS (ppm)
1	Interface w/Standard Building Control System	Proportional	Any	0–10V 4–20mA	0–2000	1000	50
2		Proportional	Any	2–10V 7–20mA	0–2000	1000	50
3		Exponential	Any	0–10V 4–20mA	0–2000	1100	50
4	Economizer	Proportional	15	0–10V 4–20mA	0–1100	1100	50
5		Proportional	20	0–10V 4–20mA	0–900	900	50
6		Exponential	15	0–10V 4–20mA	0–1100	1100	50
7		Exponential	20	0–10V 4–20mA	0–900	900	50
8	Health & Safety	Proportional	—	0–10V 4–20mA	0–9999	5000	500
9	Parking/Air Intakes/ Loading Docks	Proportional	—	0–10V 4–20mA	0–2000	700	50

Table 17 – Economizer Sensor Usage

APPLICATION	Economizer WITH OUTDOOR AIR DRY BULB SENSOR
	Accessories Required
Outdoor Air Dry Bulb	None. The outdoor air dry bulb sensor is factory installed.
Differential Dry Bulb	DNTEMPSN002A00*
Single Enthalpy	AXB078ENT
Differential Enthalpy	AXB078ENT and DNENTDIF004A00*
CO_2 for DCV Control using a Duct-Mounted CO_2 Sensor	DNCBDIOX005A00††

* DNENTDIF004A00 and DNTEMPSN002A00 accessories are used on many different base units. As such, these kits may contain parts that will not be needed for installation.

†† CRCBDIOX005A00 is an accessory that contains both 33ZCSENCO2 and 33ZCASPCO2 accessories.

3. Use the Up/Down button to select the preset number. (See Table 16.)
4. Press Enter to lock in the selection.
5. Press Mode to exit and resume normal operation.

The custom settings of the CO_2 sensor can be changed anytime after the sensor is energized. Follow the steps below to change the non-standard settings:

1. Press Clear and Mode buttons. Hold at least 5 seconds until the sensor enters the Edit mode.
2. Press Mode twice. The STDSET Menu will appear.
3. Use the Up/Down button to toggle to the NONSTD menu and press Enter.
4. Use the Up/Down button to toggle through each of the nine variables, starting with Altitude, until the desired setting is reached.
5. Press Mode to move through the variables.
6. Press Enter to lock in the selection, then press Mode to continue to the next variable.

Dehumidification of Fresh Air with DCV (Demand Controlled Ventilation) Control

If normal rooftop heating and cooling operation is not adequate for the outdoor humidity level, an energy recovery unit and/or a dehumidification option should be considered.

Economizer Preparation

This procedure is used to prepare the Economizer for troubleshooting. No troubleshooting or testing is done by performing the following procedure.

NOTE: This procedure requires a 9−v battery, 1.2 kilo−ohm resistor, and a 5.6 kilo−ohm resistor which are not supplied with the Economizer.

IMPORTANT: Be sure to record the positions of all potentiometers before starting troubleshooting.

1. Disconnect power at TR and TR1. All LEDs should be off. Exhaust fan contacts should be open.
2. Disconnect device at P and P1.
3. Jumper P to P1.
4. Disconnect wires at T and T1. Place 5.6 kilo−ohm resistor across T and T1.
5. Jumper TR to 1.
6. Jumper TR to N.
7. If connected, remove sensor from terminals SO and +. Connect 1.2 kilo−ohm 4074EJM checkout resistor across terminals SO and +.
8. Put 620−ohm resistor across terminals SR and +.
9. Set minimum position, DCV setpoint, and exhaust potentiometers fully CCW (counterclockwise).
10. Set DCV maximum position potentiometer fully CW (clockwise).
11. Set enthalpy potentiometer to D.
12. Apply power (24 vac) to terminals TR and TR1.

Differential Enthalpy

To check differential enthalpy:

1. Make sure Economizer preparation procedure has been performed.
2. Place 620−ohm resistor across SO and +.
3. Place 1.2 kilo−ohm resistor across SR and +. The Free Cool LED should be lit.
4. Remove 620−ohm resistor across SO and +. The Free Cool LED should turn off.
5. Return Economizer settings and wiring to normal after completing troubleshooting.

Single Enthalpy

To check single enthalpy:

1. Make sure Economizer preparation procedure has been performed.
2. Set the enthalpy potentiometer to A (fully CCW). The Free Cool LED should be lit.
3. Set the enthalpy potentiometer to D (fully CW). The Free Cool LED should turn off.
4. Return Economizer settings and wiring to normal after completing troubleshooting.

DCV (Demand Controlled Ventilation) and Power Exhaust

To check DCV and Power Exhaust:

1. Make sure Economizer preparation procedure has been performed.
2. Ensure terminals AQ and AQ1 are open. The LED for both DCV and Exhaust should be off. The actuator should be fully closed.
3. Connect a 9−v battery to AQ (positive node) and AQ1 (negative node). The LED for both DCV and Exhaust should turn on. The actuator should drive to between 90 and 95% open.
4. Turn the Exhaust potentiometer CW until the Exhaust LED turns off. The LED should turn off when the potentiometer is approximately 90%. The actuator should remain in position.
5. Turn the DCV setpoint potentiometer CW until the DCV LED turns off. The DCV LED should turn off when the potentiometer is approximately 9−v. The actuator should drive fully closed.
6. Turn the DCV and Exhaust potentiometers CCW until the Exhaust LED turns on. The exhaust contacts will close 30 to 120 seconds after the Exhaust LED turns on.
7. Return Economizer settings and wiring to normal after completing troubleshooting.

DCV Minimum and Maximum Position

To check the DCV minimum and maximum position:

1. Make sure Economizer preparation procedure has been performed.

2. Connect a 9−v battery to AQ (positive node) and AQ1 (negative node). The DCV LED should turn on. The actuator should drive to between 90 and 95% open.
3. Turn the DCV Maximum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
4. Turn the DCV Maximum Position potentiometer to fully CCW. The actuator should drive fully closed.
5. Turn the Minimum Position potentiometer to midpoint. The actuator should drive to between 20 and 80% open.
6. Turn the Minimum Position Potentiometer fully CW. The actuator should drive fully open.
7. Remove the jumper from TR and N. The actuator should drive fully closed.
8. Return Economizer settings and wiring to normal after completing troubleshooting.

Supply−Air Sensor Input

To check supply−air sensor input:

1. Make sure Economizer preparation procedure has been performed.
2. Set the Enthalpy potentiometer to A. The Free Cool LED turns on. The actuator should drive to between 20 and 80% open.
3. Remove the 5.6 kilo−ohm resistor and jumper T to T1. The actuator should drive fully open.
4. Remove the jumper across T and T1. The actuator should drive fully closed.
5. Return Economizer settings and wiring to normal after completing troubleshooting.

Economizer Troubleshooting Completion

This procedure is used to return the Economizer to operation. No troubleshooting or testing is done by performing the following procedure.

1. Disconnect power at TR and TR1.
2. Set enthalpy potentiometer to previous setting.
3. Set DCV maximum position potentiometer to previous setting.
4. Set minimum position, DCV setpoint, and exhaust potentiometers to previous settings.
5. Remove 620−ohm resistor from terminals SR and +.
6. Remove 1.2 kilo−ohm checkout resistor from terminals SO and +. If used, reconnect sensor from terminals SO and +.
7. Remove jumper from TR to N.
8. Remove jumper from TR to 1.
9. Remove 5.6 kilo−ohm resistor from T and T1. Reconnect wires at T and T1.
10. Remove jumper from P to P1. Reconnect device at P and P1.
11. Apply power (24 vac) to terminals TR and TR1.

WIRING DIAGRAMS

See FIGURE 51, FIGURE 52 and FIGURE 53 for typical wiring diagrams.

FIGURE 51 **Typical Wiring Diagram 208/230−3−60**

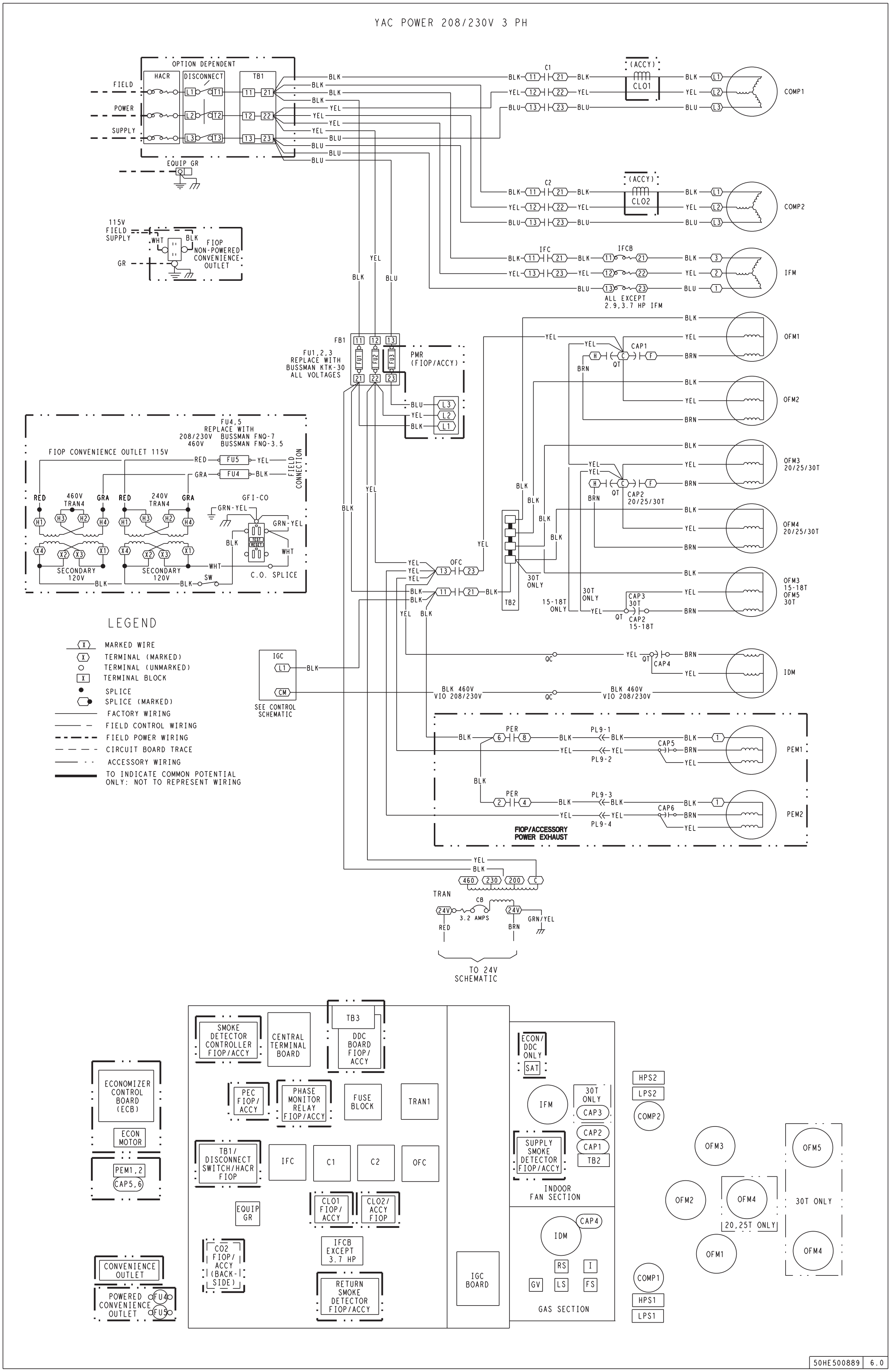


FIGURE 52 | **Typical Wiring Diagram 460−3−60**

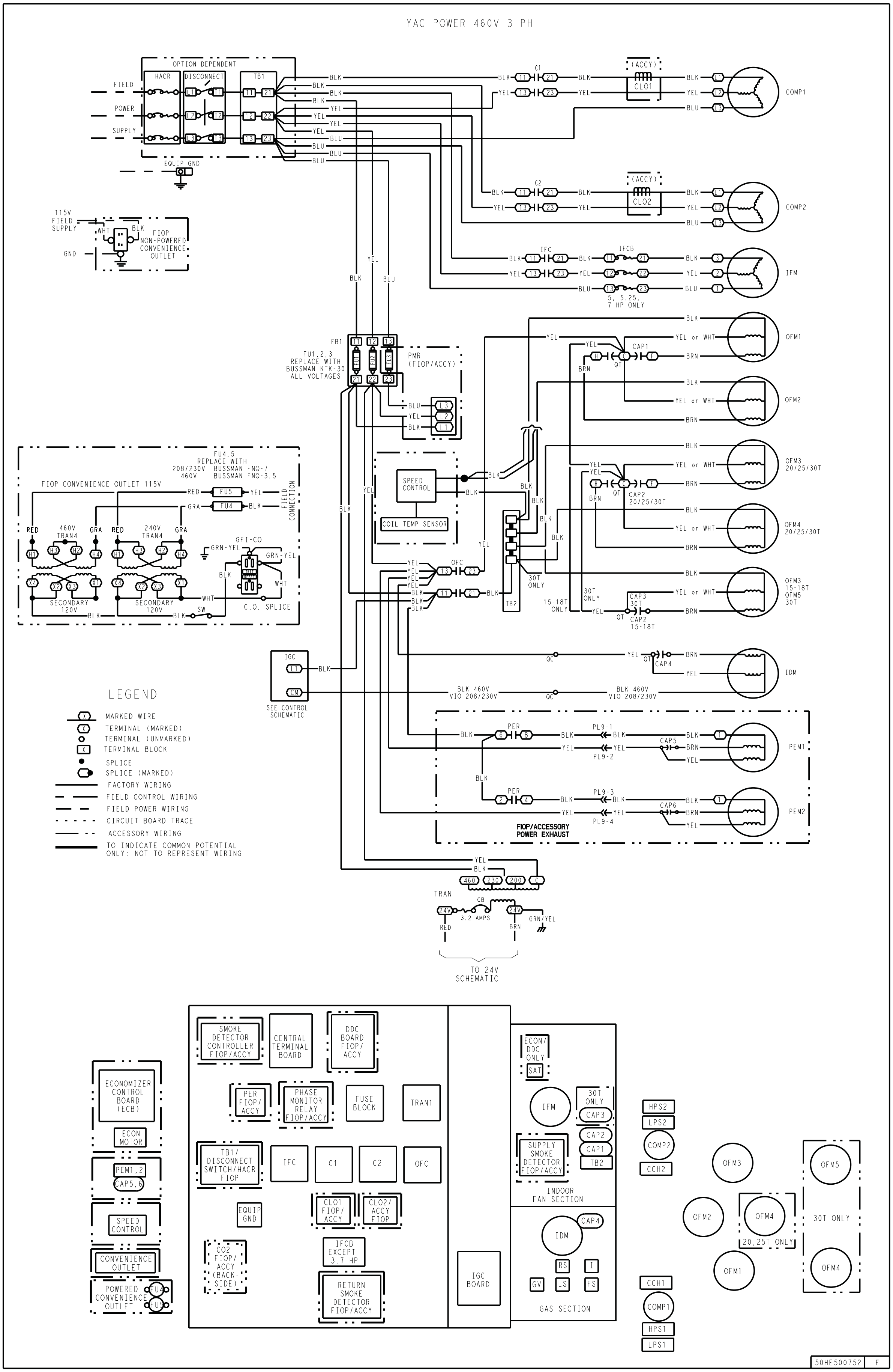


FIGURE 53	Typical Wiring Diagram 575−3−60

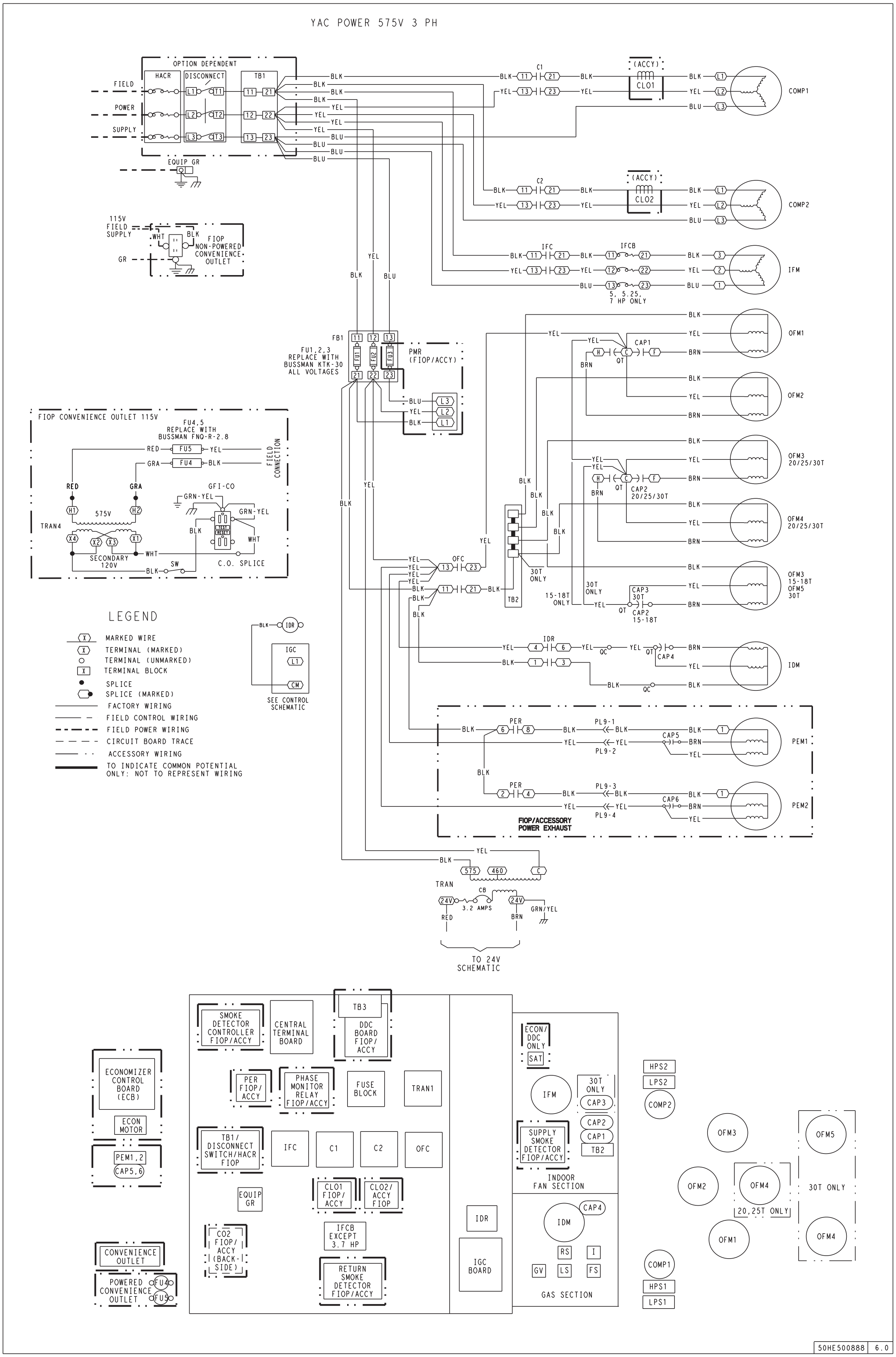
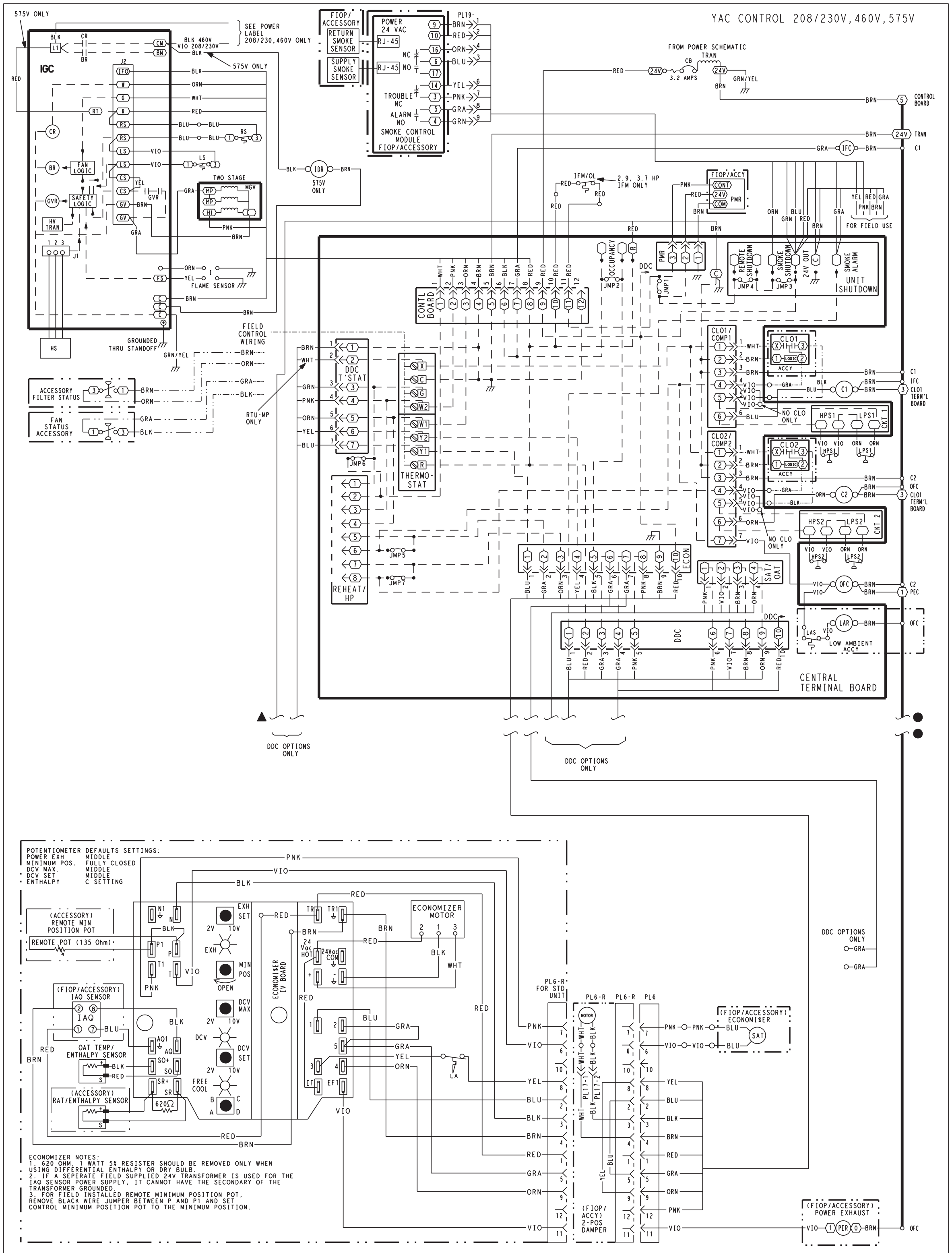


FIGURE 54 Typical Control Diagram



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. THREE PHASE MOTORS ARE PROTECTED AGAINST PRIMARY SINGLE PHASING CONDITIONS.
3. 208/230V UNIT TRAN IS WIRED FOR 230V UNIT. IF UNIT IS TO BE RUN WITH 208V POWER SUPPLY DISCONNECT BLK WIRE FROM 230V TAP AND CONNECT TO 200V TAP.
4. USE COPPER CONDUCTOR ONLY.

C	CONTACTOR,COMPRESSOR	LOOP PWR	CURRENT LOOP POWER
CAP	CAPACITOR	LPS	LOW PRESSURE SWITCH
CB	CIRCUIT BREAKER	LSM	LIMIT SWITCH (MANUAL RESET)
CCH	CRANKCASE HEATER	MGV	MAIN GAS VALVE
CCN	CARRIER COMFORT NETWORK	OAQ	OUTDOOR AIR QUALITY
CMP SAFE	COMPRESSOR SAFFETY	OAT	OUTDOOR AIR TEMP. SEN
COMP	COMPRESSOR MOTOR	OFC	OUTDOOR FAN CONTACTOR
DDC	DIRECT DIGITAL CONTROL	OFM	OUTDOOR FAN MOTOR
FSD	FIRE SHUT DOWN	OLR	OVERLOAD RELAY
FU	FUSE	PER	POWER EXHAUST RELAY
GND	GROUND	PL	PLUG ASSEMBLY
GVR	GAS VALVE RELAY	POT	POTENTIOMETER
HPS	HIGH PRESSURE SWITCH	PMR	PHASE MONITOR RELAY
HS	HALL EFFECT SENSOR	QT	QUADRUPLE TERMINAL
I	IGNITOR	R	RELAY
IAQ	INDOOR AIR QUALITY SENSORS	RAT	RETURN AIR TEMP. SEN
IDM	INDUCED DRAFT MOTOR	RMT OCC	REMOTE OCCUPANCY
IDR	INDUCED DRAFT RELAY	RS	ROLLOUT SWITCH
IFC	INDOOR FAN CONTACTOR	SAT	SUPPLY AIR TEMP. SENSOR
IFM	INDOOR FAN MOTOR	SEN	SENSOR
IGC	INTEGRATED GAS CONTROL	SET	SET POINT OFFSET
IRH	INDOOR RELATIVE HUMIDITY	SFS	SUPPLY FAN STATUS
LA	LOW AMBIENT LOCKOUT	TDR	TIME DELAY RELAY
LAR	LOW AMBIENT RELAY	TRAN	TRANSFORMER
LAS	LOW AMBIENT SWITCH		

50HE500751 6.0

PRE−START−UP

⚠ WARNING

PERSONAL INJURY HAZARD

Failure to follow this warning could result in personal injury or death.

1. Follow recognized safety practices and wear protective goggles when checking or servicing refrigerant system.
2. Do not operate compressor or provide any electric power to unit unless compressor terminal cover is in place and secured.
3. Do not remove compressor terminal cover until all electrical sources are disconnected.
4. Relieve all pressure from system before touching or disturbing anything inside terminal box if refrigerant leak is suspected around compressor terminals.
5. Never attempt to repair soldered connection while refrigerant system is under pressure.
6. Do not use torch to remove any component. System contains oil and refrigerant under pressure. To remove a component, wear protective goggles and proceed as follows:
   a. Shut off electrical power and then gas to unit.
   b. Recover refrigerant to relieve all pressure from system using both high−pressure and low pressure ports.
   c. Cut component connection tubing with tubing cutter and remove component from unit.
   d. Carefully unsweat remaining tubing stubs when necessary. Oil can ignite when exposed to torch flame.

⚠ WARNING

ELECTRICAL OPERATION HAZARD

Failure to follow this warning could result in personal injury or death.

The unit must be electrically grounded in accordance with local codes and NEC ANSI/NFPA 70 (American National Standards Institute/National Fire Protection Association.)

Proceed as follows to inspect and prepare the unit for initial start−up:

1. Remove all access panels.
2. Read and follow instructions on all WARNING, CAUTION, and INFORMATION labels attached to, or shipped with, unit.

⚠ WARNING

PERSONAL INJURY AND ENVIRONMENTAL HAZARD

Failure to follow this warning could result in personal injury or death.

Relieve pressure and recover all refrigerant before system repair or final unit disposal.

Wear safety glasses and gloves when handling refrigerants.

Keep torches and other ignition sources away from refrigerants and oils.

3. Make the following inspections:
   a. Inspect for shipping and handling damages such as broken lines, loose parts, or disconnected wires, etc.
   b. Inspect for oil at all refrigerant tubing connections and on unit base. Detecting oil generally indicates a refrigerant leak. Leak−test all refrigerant tubing connections using electronic leak detector, halide torch, or liquid−soap solution.
   c. Inspect all field−wiring and factory−wiring connections. Be sure that connections are completed and tight. Be sure that wires are not in contact with refrigerant tubing or sharp edges.
   d. Inspect coil fins. If damaged during shipping and handling, carefully straighten fins with a fin comb.
4. Verify the following conditions:
   a. Make sure that condenser−fan blades are correctly positioned in fan orifice. See Condenser−Fan Adjustment section for more details.
   b. Make sure that air filter(s) are in place.
   c. Make sure that condensate drain trap is filled with water to ensure proper drainage.
   d. Make sure that all tools and miscellaneous loose parts have been removed.

START−UP, GENERAL

Unit Preparation

Make sure that unit has been installed in accordance with installation instructions and applicable codes.

Gas Piping

Check gas piping for leaks.

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

Failure to follow this warning could result in personal injury or death.

Disconnect gas piping from unit when leak testing at pressure greater than 1/2 psig. Pressures greater than 1/2 psig will cause gas valve damage resulting in hazardous condition. If gas valve is subjected to pressure greater than 1/2 psig, it must be replaced before use. When pressure testing field−supplied gas piping at pressures of 1/2 psig or less, a unit connected to such piping must be isolated by manually closing the gas valve.

Return−Air Filters

Make sure correct filters are installed and clean prior to starting unit. (see Appendix II − Physical Data). Do not operate unit without return−air filters.

Outdoor−Air Inlet Screens

Outdoor−air inlet screen must be in place before operating unit.

Compressor Mounting

Compressors are internally spring mounted. Do not loosen or remove compressor hold down bolts.

Internal Wiring

Check all factory and field electrical connections for tightness. Tighten as required.

Refrigerant Service Ports

Each unit system has two 1/4” SAE flare (with schrader valves) service ports: one on the suction line, and one on the compressor discharge line. These schraders use black plastic caps with an O−ring inside the cap. Should this O−ring be blown or fall out, refrigerant may leak out of schrader port. Be sure that caps on the ports are tight.

Compressor Rotation

On 3−phase units with scroll compressors, it is important to be certain compressor is rotating in the proper direction. To determine whether or not compressor is rotating in the proper direction:

1. Connect service gauges to suction and discharge pressure fittings.
2. Energize the compressor.
3. The suction pressure should drop and the discharge pressure should rise, as is normal on any start−up.

If the suction pressure does not drop and the discharge pressure does not rise to normal levels:

4. Note that the evaporator fan is probably also rotating in the wrong direction.
5. Turn off power to the unit and install lockout tag.
6. Reverse any two of the unit power leads.
7. Re−energize to the compressor. Check pressures.

The suction and discharge pressure levels should now move to their normal start−up levels.

NOTE: When the compressor is rotating in the wrong direction, the unit will make an elevated level of noise and will not provide cooling.

Cooling

Set space thermostat to OFF position. To start unit, turn on main power supply. Set system selector switch at COOL position and fan switch at AUTO. position. Adjust thermostat to a setting approximately 5°F (3°C) below room temperature. Both compressors start on closure of contactors.

Check unit charge. Allow system to operate a minimum of 15 minutes prior to checking refrigerant charge. Refer to Refrigerant Charge section.

Reset thermostat at a position above room temperature. Both compressors will shut off. Evaporator fan will shut off immediately.

To shut off unit, set system selector switch at OFF position. Resetting thermostat at a position above room temperature shuts unit off temporarily until space temperature exceeds thermostat setting.

Main Burners

Main burners are factory set and should require no adjustment.

To check ignition of main burners and heating controls, move thermostat setpoint above room temperature and verify that the burners light and evaporator fan is energized. Check heating effect, then lower the thermostat setting below the room temperature and verify that the burners and evaporator fan turn off.

Refer to Table 11 for the correct orifice to use at high altitudes.

Heating

1. Purge gas supply line of air by opening union ahead of the gas valve. When gas odor is detected, tighten union and wait 5 minutes before proceeding.
2. Turn on electrical supply and manual gas valve.
3. Set system switch selector at HEAT position and fan switch at AUTO. or ON position. Set heating temperature lever above room temperature.
4. The induced−draft motor will start.
5. After a call for heating, the main burners should light within 5 seconds. If the burner does not light, then there is a 22−second delay before another 5−second try. If the burner still does not light, the time delay is repeated. If the burner does not light within 15 minutes, there is a lockout. To reset the control, break the 24 v power to W1.
6. The evaporator−fan motor will turn on 45 seconds after burner ignition.
7. The evaporator−fan motor will turn off in 45 seconds after the thermostat temperature is satisfied.
8. Adjust airflow to obtain a temperature rise within the range specified on the unit nameplate.

NOTE: The default value for the evaporator−fan motor on/off delay is 45 seconds. The Integrated Gas Unit Controller (IGC) modifies this value when abnormal limit switch cycles occur. Based upon unit operating conditions, the on delay can be reduced to 0 seconds and the off delay can be extended to 180 seconds.

If the limit switch trips at the start of the heating cycle during the evaporator on delay, the time period of the on delay for the next cycle will be 5 seconds less than the time at which the switch tripped. (Example: If the limit switch trips at 30 seconds, the evaporator−fan on delay for the next cycle will occur at 25 seconds.) To prevent short−cycling, a 5−second reduction will only occur if a minimum of 10 minutes has elapsed since the last call for heating.

The evaporator−fan off delay can also be modified. Once the call for heating has ended, there is a 10−minute period during which the modification can occur. If the limit switch trips during this period, the evaporator−fan off delay will increase by 15 seconds. A maximum of 9 trips can occur, extending the evaporator-fan off delay to 180 seconds.

To restore the original default value, reset the power to the unit.

To shut off unit, set system selector switch at OFF position. Resetting heating selector lever below room temperature will temporarily shut unit off until space temperature falls below thermostat setting.

Ventilation (Continuous Fan)

Set fan and system selector switches at ON and OFF positions, respectively. Evaporator fan operates continuously to provide constant air circulation. When the evaporator-fan selector switch is turned to the OFF position, there is a 30−second delay before the fan turns off.

OPERATING SEQUENCES

Base Unit Controls

Cooling, Units Without Economizer

When thermostat calls for Stage 1 cooling, terminals G and Y1 are energized. The indoor−fan contactor (IFC), outdoor fan contactor (OFC) and Compressor 1 contactor (C1) are energized and indoor-fan motor, outdoor fans and Compressor 1 start. The outdoor fan motors runs continuously while unit is in Stage 1 or Stage 2 cooling.

If Stage 1 cooling does not satisfy the space load , the space temperature will rise until thermostat calls for Stage 2 cooling (Y2 closes). Compressor 2 contactor (C2) is energized; Compressor 2 starts and runs.

Heating, Units Without Economizer

When the thermostat calls for heating, terminal W1 is energized. To prevent thermostat short-cycling, the unit is locked into the Heating mode for at least 1 minute when W1 is energized. The induced-draft motor is energized and the burner ignition sequence begins. The indoor (evaporator) fan motor (IFM) is energized 45 seconds after a flame is ignited.

If Stage 1 heating does not satisfy the space load, the space temperature will fall until thermostat calls for Stage 2 heating (W2 closes). Terminal W2 is energized and the high-fire solenoid on the main gas valve (MGV) is energized. Firing rate increases to high-fire. When space load is partially satisfied, terminal W2 is deenergized; the high-fire solenoid is deenergized and heating operation continues on low−fire.

When the space heating load is fully satisfied, thermostat terminal W1 is also deenergized. All heating operations cease. The IFM stops after a 45-second time off delay.

Cooling, Unit With Economizer

For Occupied mode operation of Economizer, there must be a 24-v signal at terminals TR and N (provided through PL6-3 from the unit's IFC coil). Removing the signal at N places the Economizer control in Unoccupied mode.

During Occupied mode operation, indoor fan operation will be accompanied by economizer dampers moving to Minimum Position setpoint for ventilation. If indoor fan is off, dampers will close. During Unoccupied mode operation, dampers will remain closed unless a Cooling (by free cooling) or DCV demand is received.

When free cooling using outside air is not available, the unit cooling sequence will be controlled directly by the space thermostat as described above as Cooling, Unit Without Economizer. Outside air damper position will be closed or Minimum Position as determined by occupancy mode and fan signal.

When free cooling is available as determined by the appropriate changeover command (dry bulb, outdoor enthalpy, differential dry bulb or differential enthalpy), a call for cooling (Y1 closes at the thermostat) will cause the economizer control to modulate the dampers open and closed to maintain the unit supply air temperature at 50 to 55°F. Compressor will not run.

During free cooling operation, a supply air temperature (SAT) above 50°F will cause the dampers to modulate between Minimum Position setpoint and 100% open. With SAT from 50°F to 45°F, the dampers will maintain at the Minimum Position setting. With SAT below 45°F, the outside air dampers will be closed. When SAT rises to 48°F, the dampers will re-open to Minimum Position setting.

Should 100% outside air not be capable of satisfying the space temperature, space temperature will rise until Y2 is closed. The economizer control will call for compressor operation. Dampers will modulate to maintain SAT at 50 to 55°F concurrent with Compressor 1 operation. The Low Ambient Lockout Thermostat will block compressor operation with economizer operation below 42°F outside air temperature.

When space temperature demand is satisfied (thermostat Y1 opens), the dampers will return to Minimum Damper position if indoor fan is running or fully closed if fan is off.

If accessory power exhaust is installed, the power exhaust fan motors will be energized by the economizer control as the dampers open above the PE-On setpoint and will be de−−energized as the dampers close below the PE-On setpoint.

Damper movement from full closed to full open (or vice versa) will take between 1-1/2 and 2-1/2 minutes.

Heating With Economizer

During Occupied mode operation, indoor fan operation will be accompanied by economizer dampers moving to Minimum Position setpoint for ventilation. If indoor fan is off, dampers will close. During Unoccupied mode operation, dampers will remain closed unless a DCV demand is received.

When the room temperature calls for heat (W1 closes), the heating controls are energized as described in Heating, Unit Without Economizer above.

Demand Controlled Ventilation

If a field-installed CO_2 sensor is connected to the Economize IV control, a Demand Controlled Ventilation strategy will operate automatically. As the CO_2 level in the space increases above the setpoint (on the Economizer controller), the minimum position of the dampers will be increased proportionally, until the Maximum Ventilation setting is reached. As the space CO_2 level decreases because of the increase in fresh air, the outdoor-damper will follow the higher demand condition from the DCV mode or from the free-cooling mode.

DCV operation is available in Occupied and Unoccupied periods with Economizer. However, a control modification will be required on the RGS unit to implement the Unoccupied period function.

Supplemental Controls

Compressor Lockout Relay (CLO)

The CLO is available as a factory-installed option or as a field−installed accessory. Each compressor has a CLO. The CLO compares the demand for compressor operation (via a 24-v input from Y at CLO terminal 2) to operation of the compressor (determined via compressor current signal input at the CLO's current transformer loop); if the compressor current signal is lost while the demand input still exists, the CLO will trip open and prevent the compressor from restarting until the CLO has been manually reset. In the lockout condition, 24-v will be available at terminal X. Reset is accomplished by removing the input signal at terminal 2; open the thermostat briefly or cycle the main power to the unit.

Phase Monitor Relay (PMR)

The PMR protects the unit in the event of a loss of a phase or a reversal of power line phase in the three−phase unit power supply. In normal operation, the relay K1 is energized (contact set closed) and red LED indicator is on steady. If the PMR detects a loss of a phase or a phase sequence reversal, the relay K1 is energized, its contact set is opened and unit operation is stopped; red LED indicator will blink during lockout condition. Reset of the PMR is automatic when all phases are restored and phase sequence is correct. If no 24−v control power is available to the PMR, the red LED will be off.

Smoke Detectors

Factory−installed smoke detectors are discussed in detail starting on page 17.

As air quality within the space changes, the minimum position of the economizer damper will be changed thus allowing more or less outdoor air into the space depending on the relationship of the indoor air quality to the differential setpoint. If all the above conditions are true, the IAQ algorithm will run and calculates an IAQ minimum position value using a PID loop. The IAQ minimum damper position is then compared against the user configured economizer minimum position and the greatest value becomes the final minimum damper position of the economizer output.

If the calculated IAQ minimum position is greater than the IAQ maximum damper position configuration then it will be clamped to the configured value.

FASTENER TORQUE VALUES

See Table 18 for torque values.

Table 18 – Torque Values

Supply fan motor mounting	120 ± 12 in–lbs	13.5 ± 1.4 Nm
Supply fan motor adjustment plate	120 ± 12 in–lbs	13.5 ± 1.4 Nm
Motor pulley setscrew	72 ± 5 in–lbs	8.1 ± 0.6 Nm
Fan pulley setscrew	72 ± 5 in–lbs	8.1 ± 0.6 Nm
Blower wheel hub setscrew	192 ± 12 in–lbs	2.2 ± 1.3 Nm
Bearing locking collar setscrew	65 to70 in–lbs	7.3 to 7.9 Nm
Compressor mounting bolts	65 to75 in–lbs	7.3 to 7.9 Nm
Condenser fan motor mounting bolts	20 ± 2 in–lbs	2.3 ± 0.2 Nm
Condenser fan hub setscrew	84 ± 12 in–lbs	9.5 ± 1.4 Nm

APPENDIX I. MODEL NUMBER NOMENCLATURE

MODEL SERIES	R	G	S	1	8	1	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)
G = Gas/Electric
Type

S = Standard ASHRAE 90.1-2010 Efficiency **Efficiency**

181 = 181,000 = 15 Tons Dedicated Vertical SA/RA (SA = Supply Air, RA = Return Air)
183 = 180,000 = 15 Tons Dedicated Horizontal SA/RA
210 = 210,000 = 17.5 Tons Dedicated Vertical SA/RA
213 = 210,000 = 17.5 Tons Dedicated Horizontal SA/RA
240 = 240,000 = 20 Tons Dedicated Vertical SA/RA
243 = 240,000 = 20 Tons Dedicated Horizontal SA/RA
300 = 300,000 = 25 Tons Dedicated Vertical SA/RA
303 = 300,000 = 25 Tons Dedicated Horizontal SA/RA
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
S = Low Heat, Stainless Steel Heat Exchanger
R = Medium Heat, Stainless Steel Heat Exchanger
T = High Heat, Stainless Steel Heat Exchanger
Heating Capacity

A = Standard Motor
B = High Static Motor
Motor Option

A = None
B = Economizer w/Bara-relief, OA Temp sensor
E = Economizer w/Bara-relief + CO_2 sensor, OA Temp sensor
H = Economizer w/Bara-relief, Enthalpy sensor
L = Economizer w/Bara-relief + CO_2 sensor, Enthalpy sensor
P = 2-Position damper w/Baro-relief
Outdoor Air Options / Control

0A = No Options
4B = Non-fused Disconnect
AT = Non-powered 115v Convenience Outlet.
BR = Supply Air Smoke Detector
7C = Non-fused Disconnect + Non-powered 115v Convenience Outlet.
7K = Non-fused Disconnect + Non-powered 115v Convenience Outlet. + Supply Air Smoke Detector
BA = Non-fused Disconnect + Supply Air Smoke Detector
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 = Sales Code

APPENDIX II. PHYSICAL DATA − COOLING

	RHS181/183	RGS210/213	RGS240/243	RGS300/303
Refrigeration System				
# Circuits / # Comp. / Type	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll
R−410a charge A/B (lbs)	9.5/12.0	9.5/12.0	14.4/12.5	12.1/12.4
Metering device	FIXED ORIFICE			
High−press. Trip / Reset (psig)	630 / 505	630 / 505	630 / 505	630 / 505
Low−press. Trip / Reset (psig)	54 / 117	54 / 117	54 / 117	54 / 117
Evap. Coil				
Material	Cu / Al	Cu / Al	Cu / Al	Cu / Al
Tube Diameter	3/8”	3/8”	3/8”	3/8”
Rows / FPI	4 / 15	4 / 15	4 / 15	4 / 15
Total face area (ft2)	19.56	19.56	22.00	23.11
Condensate drain conn. size	3/4”	3/4”	3/4”	3/4”
Evap. fan and motor				
VERTICAL				
Standard Static				
Motor Qty / Drive type	1 / Belt	1 / Belt	1 / Belt	1 / Belt
Max BHP	2.2	3.3	4.9	4.9
RPM range	518−713	604−819	676−819	767−958
Motor frame size	56	56	56	56
Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
Fan Diameter (in)	15 x 15	15 x 15	15 x 15	15 x 15
Medium Static				
Motor Qty / Drive type	1 / Belt	1 / Belt	1 / Belt	1 / Belt
Max BHP	3.3	4.9	6.5	6.5
RPM range	700−876	767−958	814−1008	916−1134
Motor frame size	56	56	184T	184T
Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
Fan Diameter (in)	15 x 15	15 x 15	15 x 15	15 x 15
High Static				
Motor Qty / Drive type	1 / Belt	1 / Belt	1 / Belt	1 / Belt
Max BHP	4.9	6.5	8.7	8.7
RPM range	836−1049	846−1061	965−1170	1080−1290
Motor frame size	56	184T	213T	213T
Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
Fan Diameter (in)	15 x 15	15 x 15	15 x 15	15 x 15
HORIZONTAL				
Standard Static				
Motor Qty / Drive type	1 / Belt	1 / Belt	1 / Belt	1 / Belt
Max BHP	2.2	3.3	4.9	4.9
RPM range	518−713	604−819	676−819	676−819
Motor frame size	56	56	56	56
Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
Fan Diameter (in)	18 x 15 & 15 X 11	18 x 15 & 15 X 11	18 x 15 & 15 X 11	18 x 15 & 15 X 11
Medium Static				
Motor Qty / Drive type	1 / Belt	1 / Belt	1 / Belt	1 / Belt
Max BHP	3.3	4.9	6.5	6.5
RPM range	700−876	767−958	814−1008	814−1009
Motor frame size	56	56	184T	184T
Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
Fan Diameter (in)	18 x 15 & 15 X 11	18 x 15 & 15 X 11	18 x 15 & 15 X 11	18 x 15 & 15 X 11
High Static				
Motor Qty / Drive type	1 / Belt	1 / Belt	1 / Belt	1 / Belt
Max BHP	4.9	6.5	8.7	8.7
RPM range	836−1049	846−1061	965−1170	965−1171
Motor frame size	56	184T	213T	213T
Fan Qty / Type	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal	2 / Centrifugal
Fan Diameter (in)	18 x 15 & 15 X 11	18 x 15 & 15 X 11	18 x 15 & 15 X 11	18 x 15 & 15 X 11

APPENDIX II. PHYSICAL DATA − COOLING (CONT.)

	RHS181/183	RGS210/213	RGS240/243	RGS300/303
Cond. Coil (Circuit A)				
Coil type	Microchannel	Microchannel	Microchannel	Microchannel
Coil Length (in)	70	70	82	75
Coil Height (in)	44	44	44	52
Number of Passes	2	2	2	2
Total face area (ft2)	21.4	21.4	25.1	27.1
Cond. Coil (Circuit B)				
Coil type	Microchannel	Microchannel	Microchannel	Microchannel
Coil Length (in)	70	70	57	75
Coil Height (in)	44	44	44	52
Rows / FPI	2	2	2	2
Total face area (ft2)	21.4	21.4	17.4	27.1
Cond. fan / motor				
Qty / Motor drive type	3 / direct	3 / direct	4 / direct	4 / direct
Motor HP / RPM	1/4 / 1100	1/4 / 1100	1/4 / 1100	1/4 / 1100
Fan diameter (in)	22	22	22	22
Filters				
RA Filter # / size (in)	6 / 20 x 25 x 2	6 / 20 x 25 x 2	6 / 20 x 25 x 2	9 / 16 x 25 x 2
OA inlet screen # / size (in)	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1	4 / 16 x 25 x 1

		RGS181/183	RGS210/213	RGS240/243	RGS300/303
Gas Connection					
	# of Gas Valves	1	1	1	1
	Nat. gas supply line press (in. w.g.)/(PSIG)	5 −13 / 0.18−0.47	5 −13 / 0.18−0.47	5 −13 / 0.18−0.47	5 −13 / 0.18−0.47
	Propane 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	11−13 / 0.40−0.47
Heat Anticipator Setting (Amps)					
	1st stage	0.14	0.14	0.14	0.14
	2nd stage	0.14	0.14	0.14	0.14
Natural Gas Heat					
	# of stages / # of burners (total)	2 / 5	2 / 5	2 / 5	2 / 5
LOW	Connection size	3/4” NPT	3/4” NPT	3/4” NPT	3/4” NPT
	Rollout switch opens / closes	195 / 115	195 / 115	195 / 115	195 / 115
	Temperature rise range (F)	25 − 55	25 − 55	25 − 55	25 − 55
	# of stages / # of burners (total)	2 / 7	2 / 7	2 / 7	2 / 7
MED	Connection size	3/4” NPT	3/4” NPT	3/4” NPT	3/4” NPT
	Rollout switch opens / closes	195 / 115	195 / 115	195 / 115	195 / 115
	Temperature rise range (F)	30− 60	30− 60	30− 60	30− 60
	Connection size	2 / 10	2 / 10	2 / 10	2 / 10
HIGH	# of stages / # of burners (total)	3/4” NPT	3/4” NPT	3/4” NPT	3/4” NPT
	Rollout switch opens / closes	195 / 115	195 / 115	195 / 115	195 / 115
	Temperature rise range (F)	35− 65	35− 65	35− 65	35− 65
Liquid Propane Heat					
	# of stages / # of burners (total)	2 / 5	2 / 5	2 / 5	2 / 5
LOW	Connection size	3/4” NPT	3/4” NPT	3/4” NPT	3/4” NPT
	Rollout switch opens / closes	195 / 115	195 / 115	195 / 115	195 / 115
	Temperature rise range (F)	25 − 55	25 − 55	25 − 55	25 − 55
	# of stages / # of burners (total)	2 / 7	2 / 7	2 / 7	2 / 7
MED	Connection size	3/4” NPT	3/4” NPT	3/4” NPT	3/4” NPT
	Rollout switch opens / closes	195 / 115	196 / 115	197 / 115	198 / 115
	Temperature rise range (F)	30− 60	30− 60	30− 60	30− 60
	# of stages / # of burners (total)	2 / 10	2 / 10	2 / 10	2 / 10
HIGH	Connection size	3/4” NPT	3/4” NPT	3/4” NPT	3/4” NPT
	Rollout switch opens / closes	195 / 115	195 / 115	195 / 115	195 / 115
	Temperature rise range (F)	35− 65	35− 65	35− 65	35− 65

APPENDIX III. FAN PERFORMANCE

RGS181 — **15 TON VERTICAL SUPPLY / RETURN**

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
3900	453	0.57	546	0.86	630	1.18	705	1.54	**776**	**1.92**
4400	482	0.71	568	1.02	647	1.36	720	1.73	**787**	**2.13**
4800	518	0.88	592	1.20	667	1.56	**736**	**1.95**	**801**	**2.36**
5300	541	1.08	618	1.42	688	1.79	**754**	**2.19**	**817**	**2.62**
5700	572	1.31	644	1.67	**711**	**2.06**	**775**	**2.48**	**834**	**2.92**
6100	604	1.56	672	1.95	**736**	**2.36**	**796**	**2.79**	**853**	**3.25**
6600	646	1.86	**700**	**2.26**	**761**	**2.69**	**819**	**3.14**	874	3.62
7000	668	2.19	**729**	**2.61**	**787**	**3.06**	843	3.53	896	4.03
7400	701	2.56	**759**	**3.01**	815	3.47	868	3.96	919	4.48

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
3900	**842**	**2.34**	904	2.79	962	3.27	1019	3.77	1072	4.29
4400	**851**	**2.56**	911	3.02	968	3.50	1023	4.01	1075	4.54
4800	**862**	**2.80**	921	3.27	976	3.77	1029	4.29	1081	4.83
5300	**876**	**3.08**	932	3.56	986	4.07	1038	4.60	– – – –	– – – –
5700	891	3.39	946	3.89	998	4.41	1048	4.90	– – – –	– – – –
6100	908	3.74	961	4.25	1012	4.78	– – – –	– – – –	– – – –	– – – –
6600	927	4.12	978	4.65	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
7000	947	4.55	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
7400	968	4.90	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –

White background with black font – Field–supplied drive
Light shading – Standard static motor and drive
– – – – Outside operating range
Bold font – Medium static motor and drive
Med shade – High static motor and drive

RGS210 — **17.5 TON VERTICAL SUPPLY / RETURN**

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
3900	453	0.57	546	0.86	630	1.18	705	1.54	776	1.92
4400	482	0.71	568	1.02	647	1.36	720	1.73	787	2.13
4800	511	0.88	592	1.20	667	1.56	736	1.95	801	2.36
5300	541	1.08	618	1.42	688	1.79	754	2.19	817	2.62
5700	572	1.31	644	1.67	711	2.06	775	2.48	**834**	**2.92**
6100	604	1.56	672	1.95	736	2.36	796	2.79	**853**	**3.25**
6600	636	1.86	700	2.26	761	2.69	819	3.14	**874**	**3.62**
7000	668	2.19	729	2.61	787	3.06	**843**	**3.53**	896	4.03
7400	701	2.56	759	3.01	**815**	**3.47**	**868**	**3.96**	919	4.48
7900	734	2.97	**790**	**3.44**	**843**	**3.93**	**894**	**4.44**	943	4.97
8300	**768**	**3.43**	**820**	**3.92**	**871**	**4.43**	920	4.96	968	5.51
8700	**801**	**3.94**	**852**	**4.45**	900	4.97	947	5.52	993	6.09

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
3900	**842**	**2.34**	904	2.79	962	3.27	1019	3.77	1072	4.29
4400	**851**	**2.56**	911	3.02	968	3.50	1023	4.01	1075	4.54
4800	**862**	**2.80**	921	3.27	976	3.77	1029	4.29	1081	4.83
5300	**876**	**3.08**	932	3.56	986	4.07	1038	4.60	1088	5.15
5700	891	3.39	946	3.89	998	4.41	1048	4.95	1097	5.51
6100	908	3.74	961	4.25	1012	4.78	1061	5.33	1108	5.91
6600	927	4.12	978	4.65	1027	5.19	1074	5.76	1120	6.35
7000	947	4.55	996	5.09	1044	5.65	1090	6.23	– – – –	– – – –
7400	968	5.01	1016	5.57	1062	6.15	– – – –	– – – –	– – – –	– – – –
7900	990	5.52	1036	6.10	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
8300	1013	6.08	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –
8700	1038	6.68	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –	– – – –

White background with black font – Field–supplied drive
Light shading – Standard static motor and drive
– – – – Outside operating range
Bold font – Medium static motor and drive
Med shade – High static motor and drive

FAN PERFORMANCE (cont.)

RGS240 — **20 TON VERTICAL SUPPLY / RETURN**

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
4500	493	0.72	578	0.95	653	1.20	721	1.47	784	1.76
5000	529	0.93	608	1.18	680	1.45	745	1.74	806	2.04
5500	567	1.18	641	1.45	708	1.74	771	2.05	**829**	**2.37**
6000	605	1.48	674	1.77	738	2.08	798	2.41	**854**	**2.74**
6500	644	1.82	709	2.14	770	2.47	**827**	**2.81**	**881**	**3.17**
7000	683	2.22	744	2.56	802	2.91	**857**	**3.28**	**908**	**3.65**
7500	722	2.68	781	3.04	**836**	**3.41**	**888**	**3.80**	**938**	**4.19**
8000	762	3.20	818	3.58	**870**	**3.97**	**920**	**4.38**	**968**	**4.79**
8500	803	3.78	**855**	**4.19**	**905**	**4.60**	**953**	**5.02**	**999**	**5.46**
9000	**843**	**4.43**	**893**	**4.86**	**941**	**5.30**	**987**	**5.74**	1032	6.19
9500	**884**	**5.15**	**932**	**5.61**	**978**	**6.06**	1022	6.50	1065	7.01
10000	**925**	**5.95**	**970**	**6.43**	1015	6.91	1057	7.40	1098	7.89

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
4500	**843**	**2.07**	**899**	**2.39**	**952**	**2.72**	**1002**	**3.08**	1050	3.44
5000	**863**	**2.36**	**917**	**2.70**	**968**	**3.05**	1017	3.41	1063	3.79
5500	**884**	**2.70**	**936**	**3.05**	**986**	**3.42**	1034	3.79	1079	4.18
6000	**907**	**3.10**	**958**	**3.46**	**1006**	**3.84**	1052	4.23	1097	4.63
6500	**932**	**3.54**	**981**	**3.92**	1027	4.31	1073	4.72	1116	5.14
7000	**958**	**4.04**	**1005**	**4.43**	1051	4.84	1094	5.27	1137	5.70
7500	**985**	**4.59**	1031	5.01	1075	5.44	1118	5.87	1159	6.32
8000	1014	5.21	1058	5.65	1101	6.09	1142	6.55	1183	7.01
8500	1044	5.90	1087	6.35	1128	6.82	1168	7.29	1207	7.77
9000	1075	6.66	1116	7.13	1156	7.61	1195	8.10	————	————
9500	1106	7.49	1146	7.98	1185	8.48	————	————	————	————
10000	1139	8.40	————	————	————	————	————	————	————	————

RGS300 — **25 TON VERTICAL SUPPLY / RETURN**

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
5600	564	1.04	644	1.31	715	1.61	780	1.93	840	2.26
6500	624	1.47	697	1.78	763	2.11	824	2.45	881	2.81
6900	656	1.74	725	2.07	789	2.41	848	2.77	904	3.14
7500	713	2.19	778	2.53	838	2.90	894	3.28	946	3.68
8100	767	2.72	823	3.09	879	3.48	933	3.88	**983**	**4.30**
8800	811	3.33	868	3.73	922	4.14	**973**	**4.57**	**1022**	**5.01**
9400	860	4.03	914	4.45	**966**	**4.89**	**1014**	**5.34**	**1061**	**5.80**
10000	910	4.83	**961**	**5.28**	**1010**	**5.74**	**1057**	**6.21**	1102	6.70
10600	**960**	**5.72**	**1009**	**6.20**	1085	6.68	1100	7.18	1143	7.69
11200	1010	6.73	1056	7.23	1101	7.74	1144	8.26	1185	8.70
11900	1060	7.85	1105	8.37	————	————	————	————	————	————

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
5600	896	2.62	949	3.00	**999**	**3.39**	**1047**	**3.81**	**1092**	**4.24**
6500	935	3.19	**985**	**3.59**	**1034**	**4.00**	**1080**	**4.44**	**1124**	**4.88**
6900	956	3.54	**1005**	**3.95**	**1053**	**4.37**	**1098**	**4.81**	1141	5.27
7500	**996**	**4.10**	**1044**	**4.53**	**1089**	**4.98**	**1133**	**5.45**	1175	5.94
8100	**1031**	**4.74**	**1077**	**5.19**	**1122**	**5.66**	1164	6.14	1205	6.64
8800	**1068**	**5.46**	**1112**	**5.93**	**1155**	**6.42**	1196	6.92	1236	7.44
9400	**1106**	**6.28**	1149	6.77	1190	7.28	1230	7.80	1269	8.33
10000	1145	7.19	1186	7.71	1226	8.23	1265	8.70	————	————
10600	1185	8.21	1225	————	————	————	————	————	————	————
11200	————	————	————	————	————	————	————	————	————	————
11900	————	————	————	————	————	————	————	————	————	————

White background with black font — Field−supplied drive
Light shading — Standard static motor and drive
———— Outside operating range
Bold font — Medium static motor and drive
Med shade — High static motor and drive

RGS183 — 15 TON HORIZONTAL SUPPLY / RETURN

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (IN. WG) 0.2 RPM	0.2 BHP	0.4 RPM	0.4 BHP	0.6 RPM	0.6 BHP	0.8 RPM	0.8 BHP	1.0 RPM	1.0 BHP
4000	482	0.84	557	1.23	623	1.65	683	2.12	**737**	**2.61**
4500	523	1.09	593	1.51	655	1.96	**712**	**2.46**	**765**	**2.98**
5000	565	1.40	630	1.84	689	2.33	**744**	**2.85**	**795**	**3.30**
5500	608	1.76	669	2.20	**725**	**2.76**	**777**	**3.30**	826	3.89
6000	652	2.19	**709**	**2.70**	**762**	**3.25**	812	3.83	859	4.44
6500	**697**	**2.70**	**751**	**3.24**	801	3.82	848	4.43	893	5.07
7000	**742**	**3.28**	793	3.85	840	4.47	886	5.11	929	5.78
7500	788	3.94	836	4.55	881	5.20	924	5.87	966	6.57
8000	834	4.69	879	5.34	923	6.02	964	6.73	1004	7.46

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (IN. WG) 1.2 RPM	1.2 BHP	1.4 RPM	1.4 BHP	1.6 RPM	1.6 BHP	1.8 RPM	1.8 BHP	2.0 RPM	2.0 BHP
4000	787	3.13	836	3.68	878	4.25	919	4.84	————	————
4500	814	3.53	859	4.11	903	4.71	944	4.90	————	————
5000	842	3.98	887	4.59	————	————	————	————	————	————
5500	872	4.50	915	5.14	————	————	————	————	————	————
6000	903	5.08	945	5.75	————	————	————	————	————	————
6500	936	5.74	977	6.43	————	————	————	————	————	————
7000	970	6.48	1010	7.20	————	————	————	————	————	————
7500	1005	7.30	————	————	————	————	————	————	————	————
8000	————	————	————	————	————	————	————	————	————	————

White background with black font – Field–supplied drive
Light shading – Standard static motor and drive
———— Outside operating range
Bold font – Medium static motor and drive
Med shade – High static motor and drive

RGS213 — 17.5 TON HORIZONTAL SUPPLY / RETURN

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (IN. WG) 0.2 RPM	0.2 BHP	0.4 RPM	0.4 BHP	0.6 RPM	0.6 BHP	0.8 RPM	0.8 BHP	1.0 RPM	1.0 BHP
4500	523	1.09	593	1.51	655	1.96	712	2.46	765	2.98
5000	565	1.40	630	1.84	689	2.33	744	2.85	**795**	**3.40**
5500	608	1.76	669	2.24	725	2.76	777	3.31	**826**	**3.89**
6000	652	2.19	709	2.70	762	3.25	**812**	**3.83**	**859**	**4.44**
6500	697	2.70	751	3.24	**801**	**3.82**	**848**	**4.43**	893	5.07
7000	742	3.28	**793**	**3.85**	**840**	**4.47**	886	5.11	929	5.78
7500	**788**	**3.94**	**836**	**4.55**	**881**	**5.20**	924	5.87	966	6.57
8000	**834**	**4.69**	879	5.34	923	6.02	964	6.73	1004	7.46
8500	881	5.54	924	6.23	965	6.94	————	————	————	————

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (IN. WG) 1.2 RPM	1.2 BHP	1.4 RPM	1.4 BHP	1.6 RPM	1.6 BHP	1.8 RPM	1.8 BHP	2.0 RPM	2.0 BHP
4500	**814**	**3.53**	**859**	**4.11**	**903**	**4.71**	944	5.33	983	5.97
5000	**842**	**3.98**	**887**	**4.59**	929	5.22	969	5.87	1008	6.50
5500	**872**	**4.50**	915	5.14	957	5.79	996	6.47	————	————
6000	**903**	**4.90**	945	5.75	986	6.44	————	————	————	————
6500	936	5.74	977	6.43	————	————	————	————	————	————
7000	970	6.48	————	————	————	————	————	————	————	————
7500	————	————	————	————	————	————	————	————	————	————
8000	————	————	————	————	————	————	————	————	————	————
8500	————	————	————	————	————	————	————	————	————	————

White background with black font – Field–supplied drive
Light shading – Standard static motor and drive
———— Outside operating range
Bold font – Medium static motor and drive
Med shade – High static motor and drive

FAN PERFORMANCE (cont.)

RGS243 **20 TON HORIZONTAL SUPPLY / RETURN**

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
5000	565	1.40	630	1.84	689	2.33	744	2.85	795	3.40
5500	608	1.76	669	2.24	725	2.76	777	3.31	**826**	**3.89**
6000	652	2.19	709	2.70	762	3.25	812	3.83	**859**	**4.44**
6500	697	2.70	751	3.24	801	3.82	**848**	**4.43**	**893**	**5.07**
7000	742	3.28	793	3.85	**840**	**4.47**	**886**	**5.11**	**929**	**5.78**
7500	788	3.94	**836**	**4.55**	**881**	**5.20**	**924**	**5.87**	**966**	**6.50**
8000	**834**	**4.69**	**879**	**5.34**	**923**	**6.02**	964	6.73	1004	7.46
8500	**881**	**5.54**	**924**	**6.23**	965	6.94	1004	7.68	1042	8.44
9000	**928**	**6.50**	968	7.21	1008	7.96	1045	8.70	––––	––––

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
5000	**842**	**3.98**	**887**	**4.59**	**929**	**5.22**	**969**	**5.87**	1008	6.54
5500	**872**	**4.50**	**915**	**5.14**	**957**	**5.79**	**996**	**6.47**	1034	7.17
6000	**903**	**5.08**	**945**	**5.75**	**986**	**6.44**	1024	7.14	1061	7.87
6500	**936**	**5.74**	**977**	**6.43**	1016	7.15	1053	7.89	1090	8.65
7000	**970**	**6.48**	1010	7.20	1047	7.94	1084	8.71	––––	––––
7500	1005	7.30	1044	8.05	––––	––––	––––	––––	––––	––––
8000	1042	8.22	––––	––––	––––	––––	––––	––––	––––	––––
8500	––––	––––	––––	––––	––––	––––	––––	––––	––––	––––
9000	––––	––––	––––	––––	––––	––––	––––	––––	––––	––––

White background with black font – Field–supplied drive
Light shading – Standard static motor and drive
–––– Outside operating range
Bold font – Medium static motor and drive
Med shade – High static motor and drive

RGS303 **25 TON HORIZONTAL SUPPLY / RETURN**

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
7500	715	3.12	767	3.68	815	4.28	**862**	**4.90**	**906**	**5.58**
8000	751	3.65	800	4.25	**847**	**4.87**	**892**	**5.53**	**934**	**6.21**
8500	786	4.24	**834**	**4.86**	**879**	**5.51**	**922**	**6.19**	963	6.90
9000	822	4.88	**867**	**5.53**	**910**	**6.21**	952	6.91	991	7.64
9500	**856**	**5.57**	**916**	**6.25**	941	6.95	981	7.68	1020	8.44
10000	**890**	**6.33**	932	7.03	973	7.76	1011	8.52	––––	––––
10500	924	7.14	965	7.87	1004	8.62		––––	––––	––––
11000	958	8.01	997	8.70	––––	––––	––––	––––	––––	––––
11500	991	8.94	1029	9.73	––––	––––	––––	––––	––––	––––

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
7500	**948**	**6.27**	988	6.98	1027	7.72	1065	8.49	––––	––––
8000	975	6.93	1014	7.67	1052	8.43	––––	––––	––––	––––
8500	1002	7.64	1041	8.40	––––	––––	––––	––––	––––	––––
9000	1030	8.41	––––	––––	––––	––––	––––	––––	––––	––––
9500	––––	––––	––––	––––	––––	––––	––––	––––	––––	––––
10000	––––	––––	––––	––––	––––	––––	––––	––––	––––	––––
10500	––––	––––	––––	––––	––––	––––	––––	––––	––––	––––
11000	––––	––––	––––	––––	––––	––––	––––	––––	––––	––––
11500	––––	––––	––––	––––	––––	––––	––––	––––	––––	––––

White background with black font – Field–supplied drive
Light shading – Standard static motor and drive
–––– Outside operating range
Bold font – Medium static motor and drive
Med shade – High static motor and drive

Pulley Adjustment

UNIT RGS	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
181/183	Standard Static	819	798	776	755	733	712	690	669	647	626	604
	Medium Static	958	939	920	901	882	863	843	824	805	786	767
	High Static	1134	1112	1090	1069	1047	1025	1003	981	960	938	916
210/213	Standard Static	819	798	776	755	733	712	690	669	647	626	604
	Medium Static	958	939	920	901	882	863	843	824	805	786	767
	High Static	1134	1112	1090	1069	1047	1025	1003	981	960	938	916
240/243	Standard Static	819	798	776	755	733	712	690	669	647	626	604
	Medium Static	1008	989	969	950	930	911	892	872	853	833	814
	High Static	1170	1150	1129	1109	1088	1068	1047	1027	1006	986	965
300/303	Standard Static	819	805	790	776	762	748	733	719	705	690	676
	Medium Static	1134	1112	1090	1069	1047	1025	1003	981	960	938	916
	High Static	1293	1273	1252	1232	1211	1191	1170	1150	1129	1109	1088

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

▬ – Factory settings

ELECTRICAL INFORMATION

2−Stage Cooling

UNIT RGS	V−PH−HZ	VOLTAGE RANGE		COMP 1		COMP 2		OFM (ea)		IFM				
		MIN	MAX	RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	Max WATTS	Max AMP Draw	EFF at Full Load	FLA
181/183	208−3−60	187	253	29.5	195	30.1	225	350	1.5	STD	2278	7.875	81.3%	7.5
										MED	2694	10.71	83.8%	10.2
										HIGH	4559	15.75	83.6%	15.0
	230−3−60	187	253	29.5	195	30.1	225	350	1.5	STD	2278	7.875	81.3%	7.5
										MED	2694	10.71	83.8%	10.2
										HIGH	4559	15.75	83.6%	15.0
	460−3−60	414	506	14.7	95	16.7	114	277	0.9	STD	2278	3.57	81.3%	3.4
										MED	2694	5.04	83.8%	4.8
										HIGH	4559	7.77	83.6%	7.4
	575−3−60	518	633	12.2	80	12.2	80	397	0.6	STD	1870	2.94	81.1%	2.8
										MED	1870	2.94	81.1%	2.8
										HIGH	4470	5.88	83.6%	5.6
210/213	208−3−60	187	253	29.5	195	30.1	225	350	1.5	STD	2694	10.71	83.8%	10.2
										MED	4559	15.75	83.6%	15.0
										HIGH	4278	13.44	87.5%	12.8
	230−3−60	187	253	29.5	195	30.1	225	350	1.5	STD	2694	10.71	83.8%	10.2
										MED	4559	15.75	83.6%	15.0
										HIGH	4278	13.44	87.5%	12.8
	460−3−60	414	506	14.7	95	16.7	114	277	0.9	STD	2694	5.04	83.8%	4.8
										MED	4559	7.77	83.6%	7.4
										HIGH	4278	6.72	87.5%	6.4
	575−3−60	518	633	12.2	80	12.2	80	397	0.6	STD	1870	2.94	81.1%	2.8
										MED	4470	5.88	83.6%	5.6
										HIGH	4231	5.355	87.5%	5.1
240/243	208−3−60	187	253	48.1	245	29.5	195	350	1.5	STD	4559	15.75	83.6%	15.0
										MED	4278	13.44	87.5%	12.8
										HIGH	6360	20.37	88.5%	19.4
	230−3−60	187	253	48.1	245	29.5	195	350	1.5	STD	4559	15.75	83.6%	15.0
										MED	4278	13.44	87.5%	12.8
										HIGH	6360	20.37	88.5%	19.4
	460−3−60	414	506	18.6	125	14.7	95	277	0.9	STD	4559	7.77	83.6%	7.4
										MED	4278	6.72	87.5%	6.4
										HIGH	6360	10.185	88.5%	9.7
	575−3−60	518	633	14.7	100	12.2	80	397	0.6	STD	4470	5.88	83.6%	5.6
										MED	4231	5.355	87.5%	5.1
										HIGH	6331	8.19	88.5%	7.8
300/303	208−3−60	187	253	48.1	245	48.1	245	350	1.5	STD	4559	15.75	83.6%	15.0
										MED	4278	13.44	87.5%	12.8
										HIGH	6360	20.37	88.5%	19.4
	230−3−60	187	253	48.1	245	48.1	245	350	1.5	STD	4559	15.75	83.6%	15.0
										MED	4278	13.44	87.5%	12.8
										HIGH	6360	20.37	88.5%	19.4
	460−3−60	414	506	18.6	125	18.6	125	277	0.9	STD	4559	7.77	83.6%	7.4
										MED	4278	6.72	87.5%	6.4
										HIGH	6360	10.185	88.5%	9.7
	575−3−60	518	633	14.7	100	14.7	100	397	0.6	STD	4470	5.88	83.6%	5.6
										MED	4231	5.355	87.5%	5.1
										HIGH	6331	8.19	88.5%	7.8

MCA/MOCP DETERMINATION NO C.O. OR UNPWRD C.O.

UNIT RGS	NOM. V−Ph−Hz	IFM TYPE	COMBUSTION FAN MOTOR FLA	POWER EXHAUST FLA	NO C.O. or UNPWR C.O.							
					NO P.E.				w/ P.E. (pwrd fr/ unit)			
							DISC. SIZE				DISC. SIZE	
					MCA	MOCP	FLA	LRA	MCA	MOCP	FLA	LRA
181/183	208/230−3−60	STD	0.52	5.9	79.1	100.0	82	485	90.9	100.0	96	485
		MED			81.8	100.0	85	502	93.6	110.0	99	502
		HIGH			86.6	100.0	91	511	98.4	125.0	105	511
	460−3−60	STD	0.3	3.1	41.7	50.0	43	243	47.9	60.0	50	243
		MED			43.1	50.0	45	252	49.3	60.0	52	252
		HIGH			45.7	60.0	48	256	51.9	60.0	55	256
	575−3−60	STD	0.24	2.4	32.1	40.0	33	188	36.9	45.0	39	188
		MED			32.1	40.0	33	188	36.9	45.0	39	188
		HIGH			34.9	45.0	37	202	39.7	50.0	42	202
210/213	208/230−3−60	STD	0.52	5.9	81.8	100.0	85	502	93.6	110.0	99	502
		MED			86.6	100.0	91	511	98.4	125.0	105	511
		HIGH			84.4	100.0	88	513	96.2	125.0	102	513
	460−3−60	STD	0.3	3.1	43.1	50.0	45	252	49.3	60.0	52	252
		MED			45.7	60.0	48	256	51.9	60.0	55	256
		HIGH			44.7	60.0	47	257	50.9	60.0	54	257
	575−3−60	STD	0.24	2.4	32.1	40.0	33	188	36.9	45.0	39	188
		MED			34.9	45.0	37	202	39.7	50.0	42	202
		HIGH			34.4	45.0	36	191	39.2	50.0	42	191
240/243	208/230−3−60	STD	0.52	5.9	110.6	150.0	113	534	122.4	150.0	127	534
		MED			108.4	150.0	111	536	120.2	150.0	124	536
		HIGH			115.0	150.0	118	572	126.8	150.0	132	572
	460−3−60	STD	0.3	3.1	49.0	60.0	51	269	55.2	60.0	58	269
		MED			48.0	60.0	50	270	54.2	60.0	57	270
		HIGH			51.3	60.0	54	288	57.5	70.0	61	288
	575−3−60	STD	0.24	2.4	38.6	50.0	40	224	43.4	50.0	46	224
		MED			38.1	50.0	40	213	42.9	50.0	45	213
		HIGH			40.8	50.0	43	239	45.6	60.0	48	239
300/303	208/230−3−60	STD	0.52	5.9	129.2	175.0	135	584	141.0	175.0	148	584
		MED			127.0	175.0	132	586	138.8	175.0	146	586
		HIGH			133.6	175.0	140	622	145.4	175.0	153	622
	460−3−60	STD	0.3	3.1	52.9	60.0	55	299	59.1	70.0	63	299
		MED			51.9	60.0	54	300	58.1	70.0	61	300
		HIGH			55.2	60.0	58	318	61.4	70.0	65	318
	575−3−60	STD	0.24	2.4	41.1	50.0	43	244	45.9	60.0	49	244
		MED			40.6	50.0	42	233	45.4	60.0	48	233
		HIGH			43.3	50.0	46	259	48.1	60.0	51	259

LEGEND:

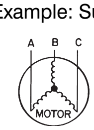
C.O.	–	Convenient outlet
DISC	–	Disconnect
FLA	–	Full load amps
IFM	–	Indoor fan motor
LRA	–	Locked rotor amps
MCA	–	Minimum circuit amps
MOCP	–	Maximum over current protection
P.E.	–	Power exhaust
UNPWRD CO	–	Unpowered convenient outlet

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.

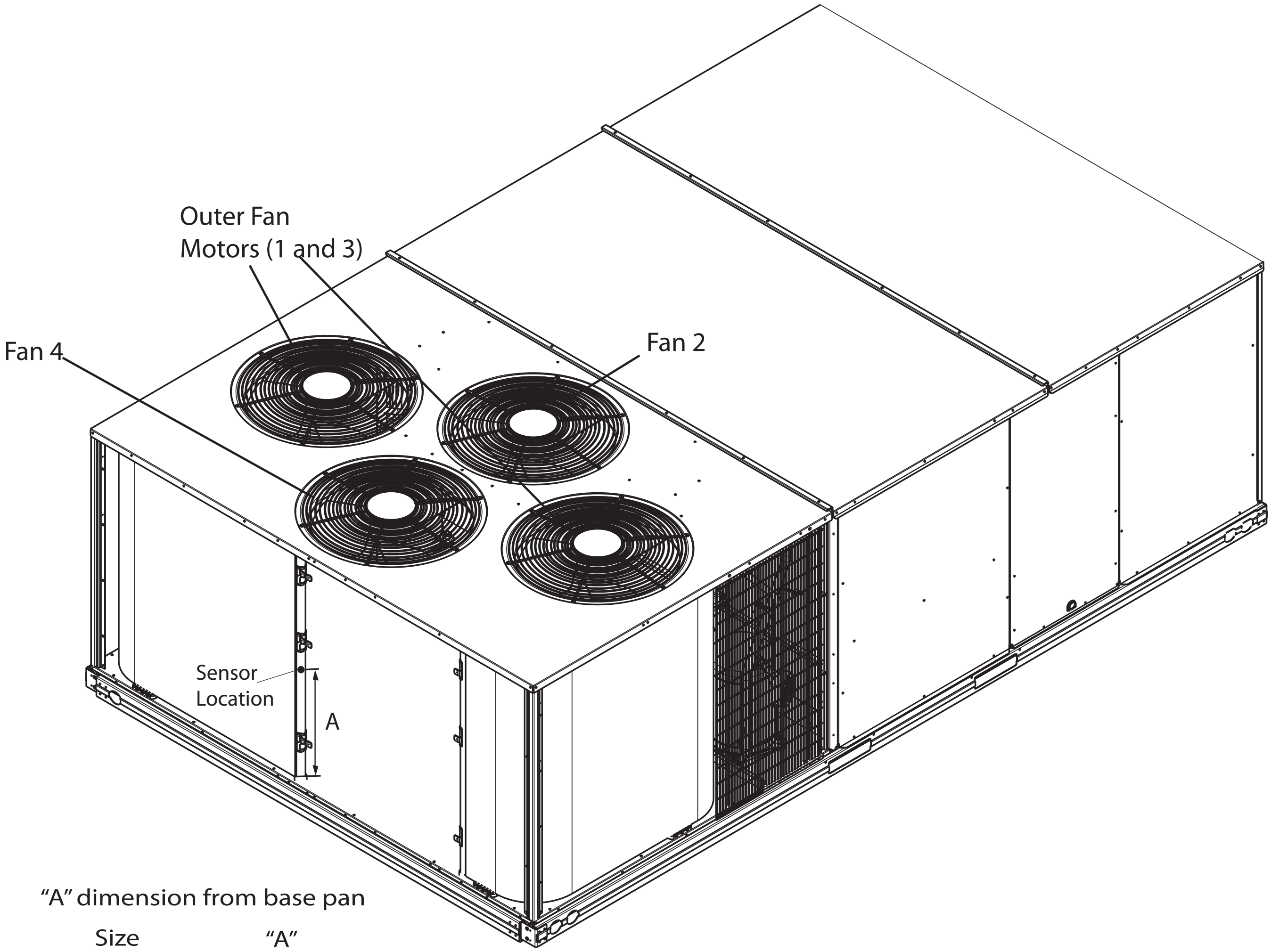
$$\%\ \text{Voltage Imbalance} = 100 \times \frac{4}{227}$$

$$= 1.76\%$$

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.

APPENDIX IV. MOTORMASTER SENSOR LOCATIONS



"A" dimension from base pan

Size	"A"
17, 20, 24	22"
28	26"

UNIT START-UP CHECKLIST

I. PRELIMINARY INFORMATION:

MODEL NO.:________________________________ SERIAL NO: ____________________________________

DATE:____ TECHNICIAN: __________________________________

BUILDING LOCATION:____________________________

II. PRE-START-UP (insert check mark in box as each item is completed):

- ☐ CHECK RATING PLATE VOLTAGE MATCHES POWER SUPPLY TO UNIT
- ☐ VERIFY THAT ALL PACKAGING MATERIALS HAVE BEEN REMOVED FROM UNIT
- ☐ VERIFY THAT CONDENSATE CONNECTION IS INSTALLED PER INSTALLATION INSTRUCTIONS
- ☐ VERIFY THAT FLUE HOOD IS INSTALLED
- ☐ CHECK ALL ELECTRICAL CONNECTIONS AND TERMINALS FOR TIGHTNESS
- ☐ CHECK TO ENSURE NO WIRES ARE TOUCHING REFRIGERANT TUBING OR SHARP EDGES
- ☐ CHECK GAS PIPING FOR LEAKS
- ☐ CHECK THAT RETURN−AIR FILTER IS CLEAN AND IN PLACE
- ☐ VERIFY THAT UNIT INSTALLATION IS LEVEL
- ☐ CHECK FAN WHEEL AND PROPELLER FOR LOCATION IN HOUSING/ORIFICE AND VERIFY SETSCREW IS TIGHT
- ☐ VERIFY PULLEY ALIGNMENT AND BELT TENSION ARE CORRECT

III. START-UP

ELECTRICAL

SUPPLY VOLTAGE	L1-L2	________	L2-L3	________	L3-L1	________
COMPRESSOR 1	L1	________	L2	________	L2	________
COMPRESSOR 2	L1	________	L2	________	L2	________
INDOOR FAN AMPS	L1	________	L2	________	L2	________

TEMPERATURES

OUTDOOR-AIR TEMPERATURE	________	DB	________	WB
RETURN-AIR TEMPERATURE	________	DB	________	WB
COOLING SUPPLY AIR	________	DB	________	WB
GAS HEAT SUPPLY AIR	________	DB		

PRESSURES

GAS INLET PRESSURE		________	IN. WG		
GAS MANIFOLD PRESSURE		________	IN. WG (LOW FIRE)	________	IN. WG (HI FIRE)
REFRIGERANT SUCTION	CIR 1	________	PSIG	________	TEMP °F
	CIR 2	________	PSIG	________	TEMP °F
REFRIGERANT DISCHARGE	CIR 1	________	PSIG	________	TEMP °F
	CIR 2	________	PSIG	________	TEMP °F

- ☐ VERIFY REFRIGERANT CHARGE USING CHARGING CHARTS
- ☐ VERIFY THAT 3−PHASE SCROLL COMPRESSORS ARE ROTATING IN CORRECT DIRECTION