

RGS Series 7.5 to 12.5 Ton Package Gas/Electric Cooling Units With R-410A Refrigerant And Micro-channel Condenser Coils

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Service and Maintenance Instructions


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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 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

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

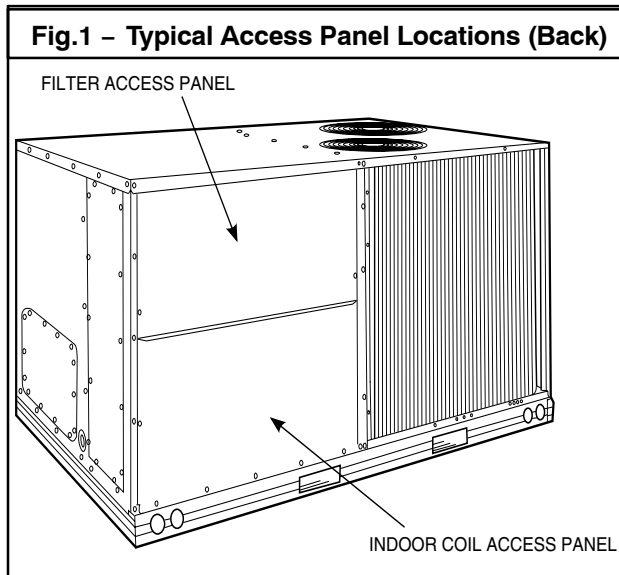
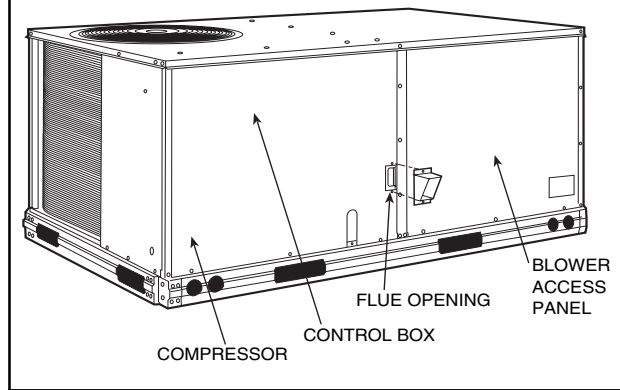


Fig.2–Typical Access Panel Location (Front)



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 small lift-out panel located on the rear side of the unit, above the evaporator/return air access panel. (See Fig.3.)

To remove the filters:

1. Grasp the bottom flange of the upper panel.
2. Lift up and swing the bottom out until the panel disengages and pulls out.
3. Reach inside and extract the filters from the filter rack.
4. Replace these filters as required with similar replacement filters of same size.

To re-install the access panel:

1. Slide the top of the panel up under the unit top panel.
2. Slide the bottom into the side channels.
3. Push the bottom flange down until it contacts the top of the lower panel (or economizer top).

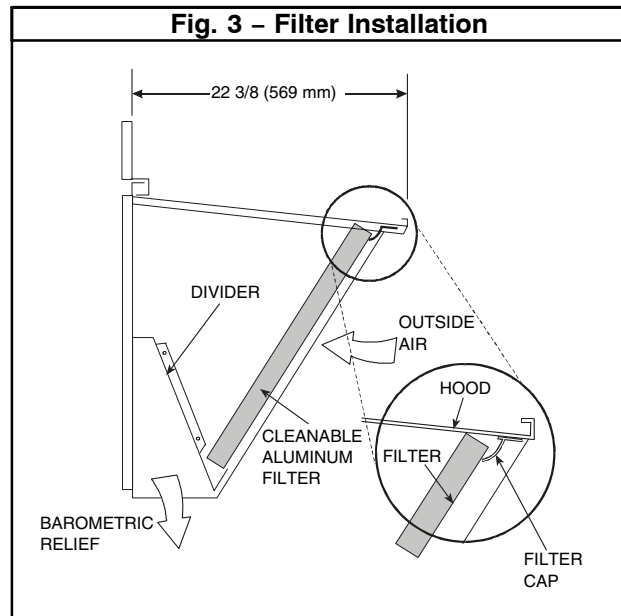
IMPORTANT: DO NOT OPERATE THE UNIT WITHOUT THESE FILTERS!

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 Inlet Air Screen

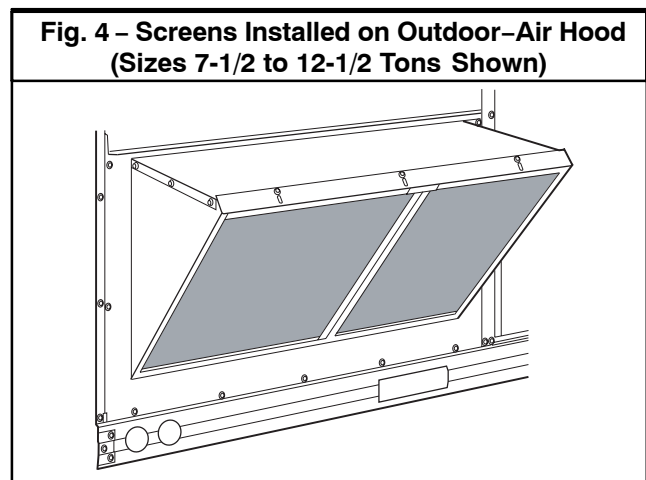
This air screen is retained by spring clips under the top edge of the hood. (See Fig.3.)



To remove the filter, open the spring clips. Re-install the filter by placing the frame in its track, then closing the spring clips.

Manual Outside Air Hood Screen

This inlet screen is secured by a retainer angle across the top edge of the hood. (See Fig.4.)



To remove the screen, loosen the screws in the top retainer and slip the retainer up until the filter can be removed. Re-install by placing the frame in its track, rotating the retainer back down and tighten all screws.

SUPPLY FAN (BLOWER) SECTION

⚠ WARNING

ELECTRICAL SHOCK HAZARD

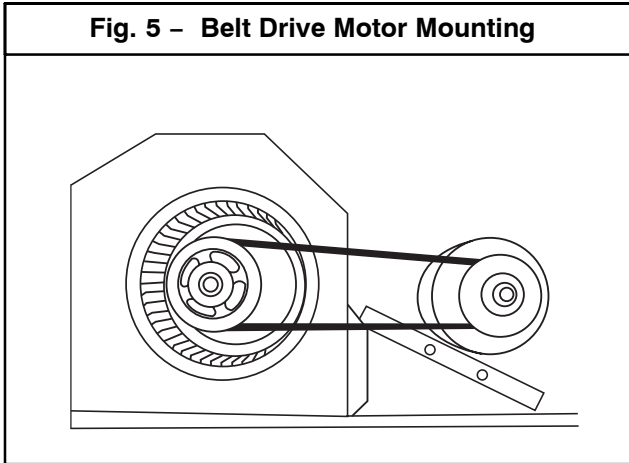
Failure to follow this warning could cause personal injury or death.

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 (Belt-Drive)

The supply fan system consists of a forward-curved centrifugal blower wheel on a solid shaft with two concentric type bearings, one on each side of the blower housing. A fixed-pitch driven pulley is attached to the fan shaft and an adjustable-pitch driver pulley is on the motor. The pulleys are connected using a "V" type belt. (See Fig.5.)

Fig. 5 – 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 6-lbs at a 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 belt tension by loosening the motor mounting plate front bolts and rear bolt and sliding the plate toward the fan (to reduce tension) or away from fan (to increase tension). Ensure the blower shaft and the motor shaft are parallel to each other (pulleys aligned). Tighten all bolts when finished.

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. Push the motor and its mounting plate towards the blower housing as close as possible to reduce the center distance between fan shaft and motor shaft.
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 and then sliding the motor and plate away from the fan housing until proper tension is achieved.
6. Check the alignment of the pulleys, adjust if necessary.
7. Tighten all 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 Fig.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.

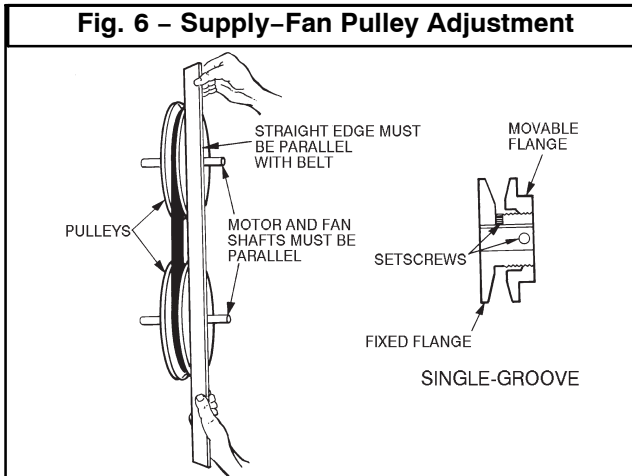
Check the condition of the motor pulley for signs of wear. Glazing of the belt contact surfaces and erosion on these surfaces are signs of improper belt tension and/or belt slippage. Pulley replacement may be necessary.

To change fan speed:

1. Shut off unit power supply.
2. Loosen belt by loosening fan motor mounting nuts. (See Fig.5.)
3. Loosen movable pulley flange setscrew. (See Fig.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 speed specified.
5. Set movable flange at nearest keyway of pulley hub and tighten setscrew to torque specifications.

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.



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 Fig.7.)



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 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 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). Using the fan performance tables, 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.

COOLING

⚠ WARNING

UNIT OPERATION AND SAFETY HAZARD

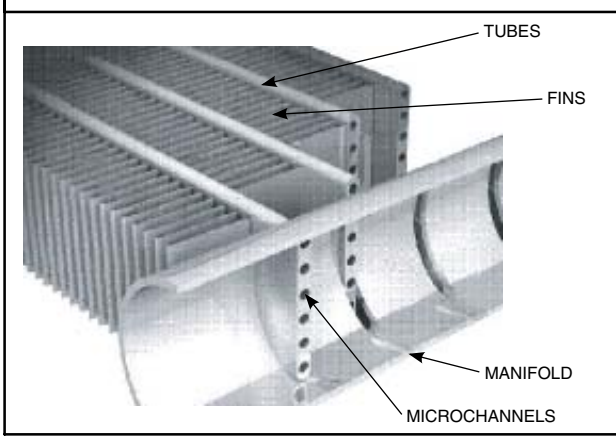
Failure to follow this warning could cause personal injury, death and/or equipment damage.

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

Condenser Coil

The condenser coil is new Micro-channel 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.

Fig. 8 – Micro-channel 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.

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 below is recommended.

Routine Cleaning of Micro-channel Condenser Coil Surfaces

To clean the Micro-channel condenser coil, chemicals are NOT to be used; only water is approved as the cleaning solution. Only clean potable water is authorized for cleaning Micro-channel 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 Micro-channel 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 Micro-channel 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 Replacement parts division as part number 1178704 for one gallon container, and part number 1178705 for a 5 gallon container. 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 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.

1. Proper eye protection such as safety glasses is 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 fixed metering device 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 Fig.9.) This check valve is permanently assembled into this core body and cannot be serviced separately; replace the entire core body if necessary. Service tools are available from RCD that allow the replacement of the check valve core without having to recover the entire system refrigerant charge. Apply compressor refrigerant oil to the check valve core's bottom O-ring. Install the fitting body with 96 +/- 10 in-lbs of torque; do not overtighten.

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 removing liquid refrigerant for charging. For a cylinder without a dip tube, invert the cylinder (access valve on the bottom) when removing 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. 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. Refer to FAST Charging, Recovery, Recycling and Reclamation training manual and the following procedures.

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. After evacuating system, weigh in the specified amount of refrigerant.

Low-Charge Cooling

Using Cooling Charging Charts (Figs.10, 11, 12, and 13), 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 device 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

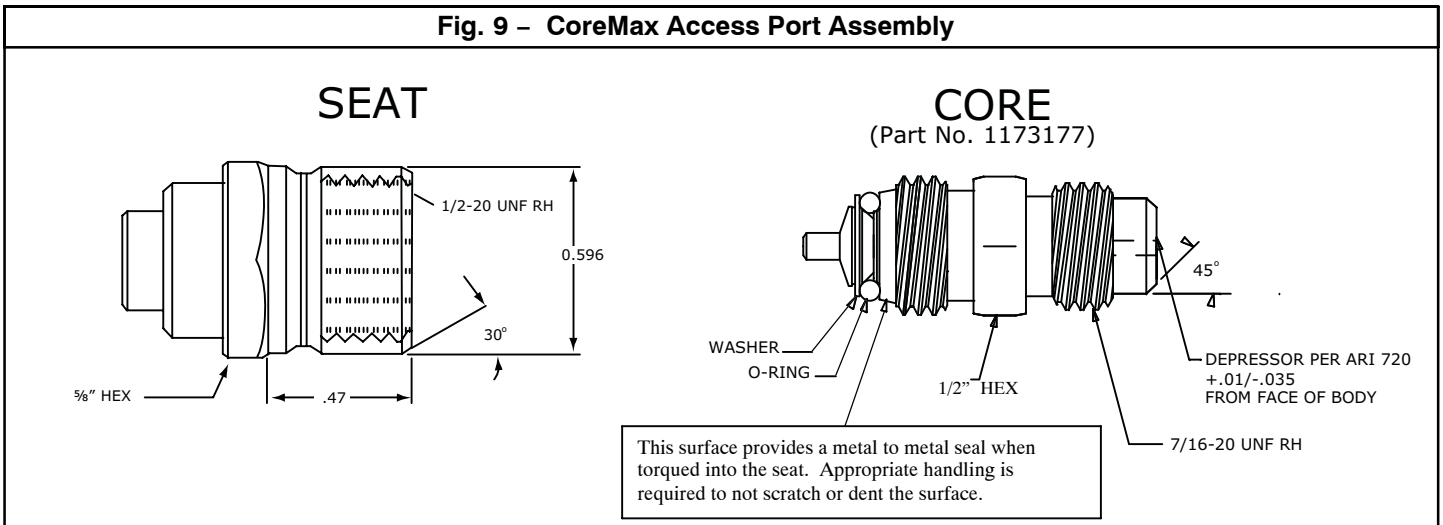
Select the appropriate unit charging chart from Figs.10, 11, 12, and 13.

- Sizes RGS090 and RGS120 each have one cooling charging chart
- Size RGS150 has two cooling charging charts: 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 RGS150 size, perform this procedure once for Circuit A (using the Circuit A chart) and once for Circuit B (using the Circuit B chart).

Fig. 9 – CoreMax Access Port Assembly



EXAMPLE:

Model RGS120

Circuit A:

Outdoor Temperature 85°F (29°C)
 Suction Pressure 125 psig (860 kPa)
 Suction Temperature should be 58°F (14°C)

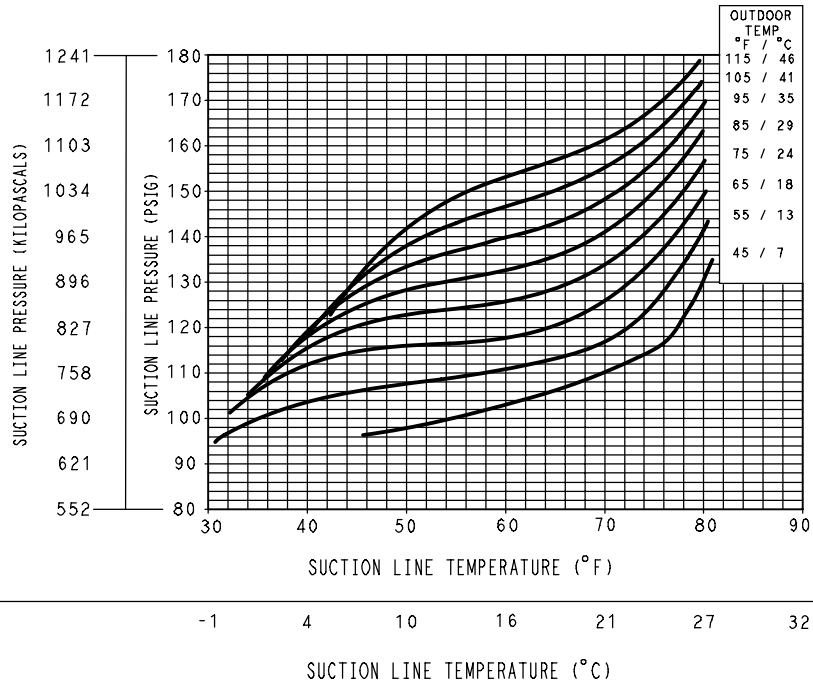
Circuit B:

Outdoor Temperature 85°F (29°C)
 Suction Pressure 120 psig (830 kPa)
 Suction Temperature should be 60°F (16°C)

COOLING CHARGING CHARTS

Fig. 10 – Cooling Charging Charts

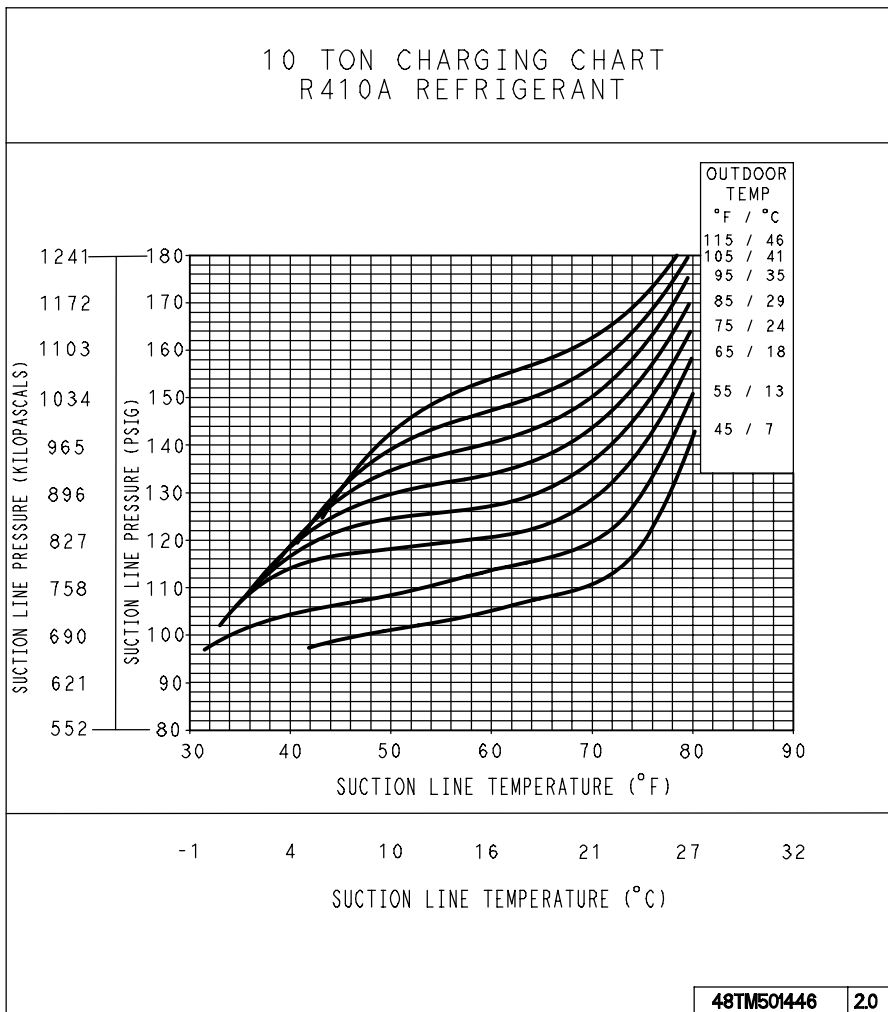
7.5 TON CHARGING CHART
R410A REFRIGERANT



48TM501445 20

COOLING CHARGING CHARTS

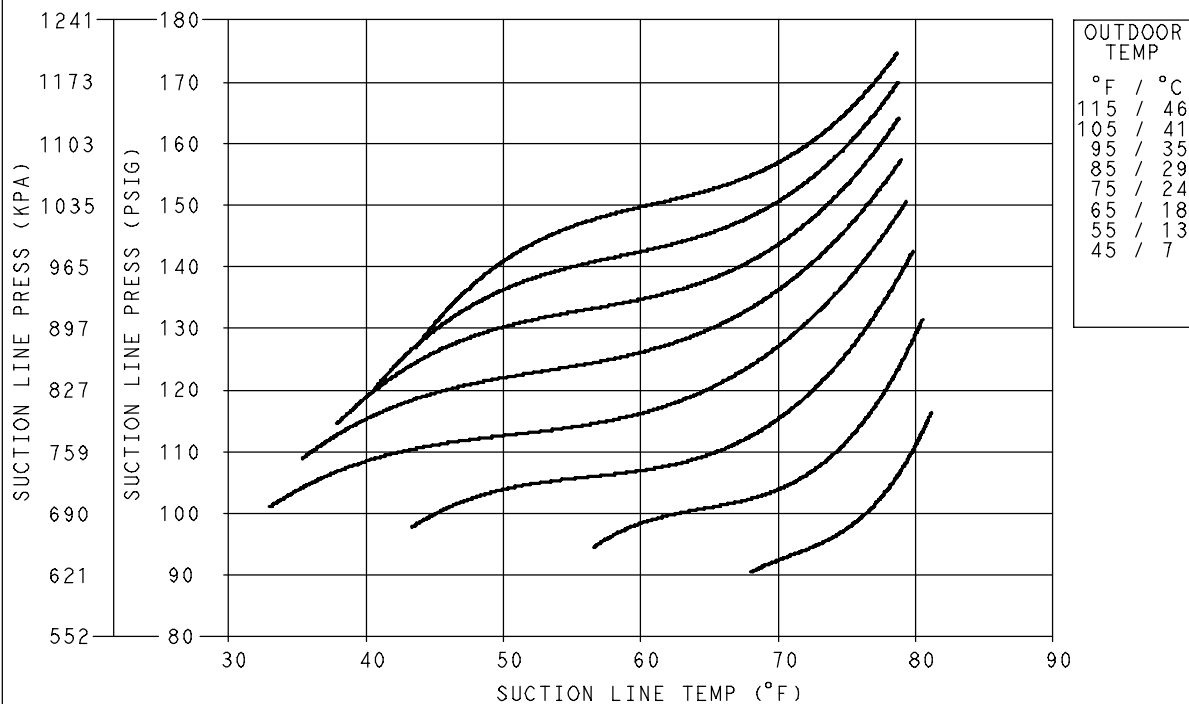
Fig. 11 – Cooling Charging Chart



COOLING CHARGING CHARTS

Fig. 12 - Cooling Charging Chart (Circuit A)

12.5 Ton CIRCUIT A CHARGING CHART R410A REFRIGERANT



OUTDOOR TEMP	
°F	°C
115	46
105	41
95	35
85	29
75	24
65	18
55	13
45	7

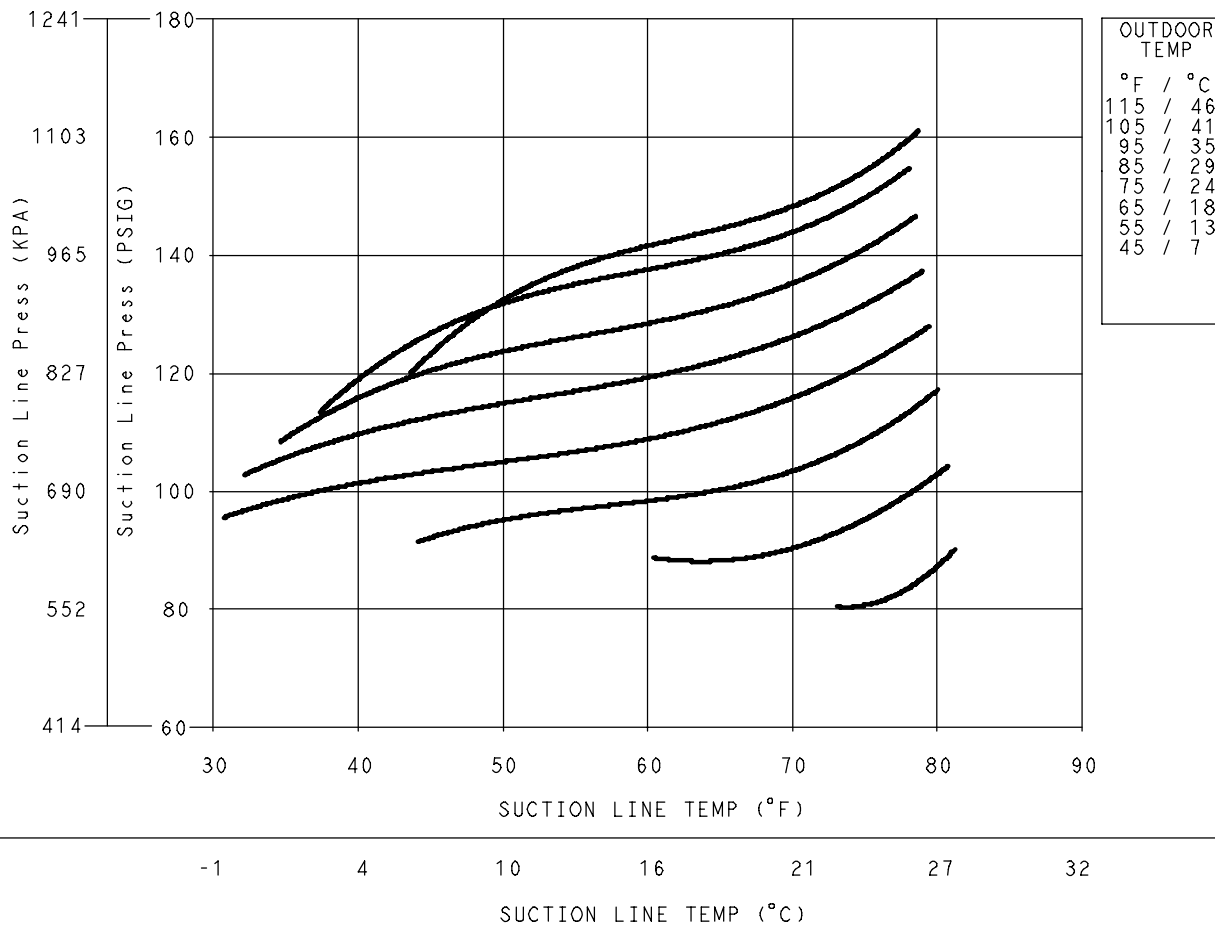
-1 4 10 16 21 27 32
SUCTION LINE TEMP (°C)

48TM501378 2.0

COOLING CHARGING CHARTS

Fig. 13 - Cooling Charging Chart (Circuit B)

12.5 Ton CIRCUIT B CHARGING CHART R410A REFRIGERANT



48TM501547 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 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 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.

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:

4. Note that the evaporator fan is probably also rotating in the wrong direction.
5. Turn off power to the unit.

6. Reverse any two of the unit power leads.
7. 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.

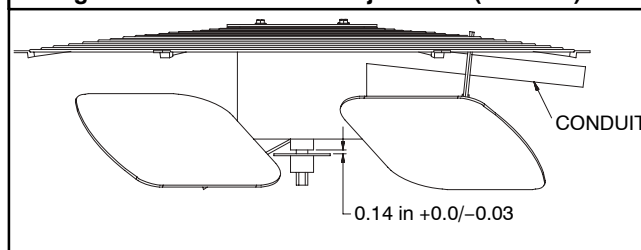
Filter Drier

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 refrigerant is required on every unit.

Condenser-Fan Adjustment (RGS090–120)

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 Fig.14.
5. Tighten setscrews to 84 in-lbs (9.5 N-m).
6. Replace condenser-fan assembly.

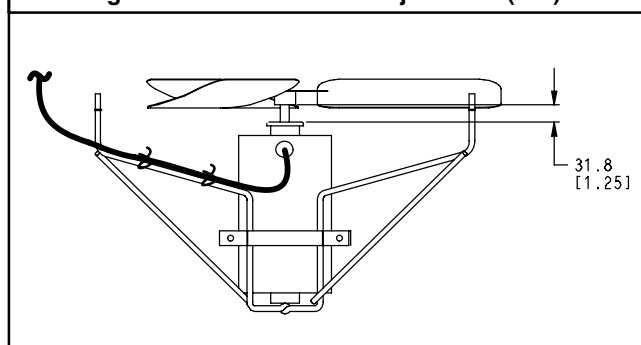
Fig. 14 – Condenser Fan Adjustment (090–120)



Condenser-Fan Adjustment (RGS150)

1. Shut off unit power supply. Install lockout tag.
2. Remove condenser fan grille.
3. Loosen fan hub setscrews.
4. Adjust fan height as shown in Fig.15.
5. Tighten set screws to 84 in-lbs (9.5 N-m).
6. Replace fan grille.

Fig. 15 – Condenser Fan Adjustment (150)



Troubleshooting Cooling System

Refer to Table 1 for additional troubleshooting topics.

CONVENIENCE OUTLET

⚠ WARNING

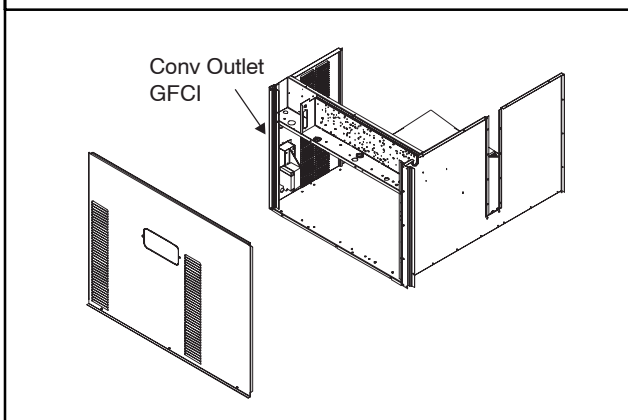
ELECTRICAL OPERATION HAZARD

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.

A Non-powered convenience outlets is offered and 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 Fig.16.)

Fig. 16 – Convenience Outlet Location



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.

Duty Cycle

The unit-powered convenience outlet has a duty cycle limitation. The transformer is intended to provide power on an intermittent basis for service tools, lamps, etc; it is not intended to provide 15-amps loading for continuous duty loads (such as

electric heaters for overnight use). Observe a 50% limit on circuit loading above 8-amps (i.e., limit loads exceeding 8-amps to 30 minutes of operation every hour).

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.

SMOKE DETECTORS

Supply Air Smoke detectors are available as factory-installed options without or with economizer. 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.

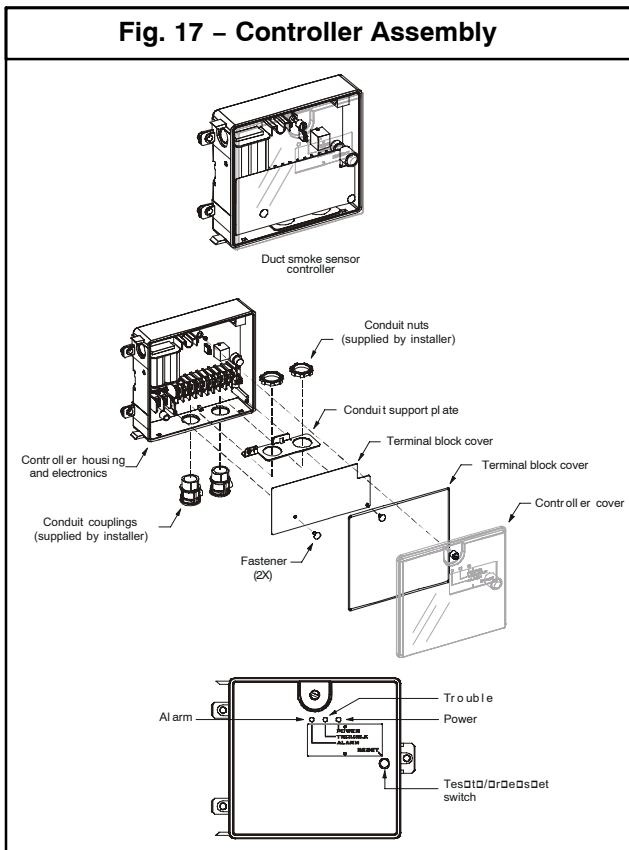
System

The smoke detector system consists of a four-wire controller and one or two sensors. 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 (see Fig.17) includes a controller housing, a printed circuit board, and a clear plastic cover. 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 (for Power, Trouble and Alarm) and a manual test/reset button (on the cover face).

Fig. 17 – Controller Assembly



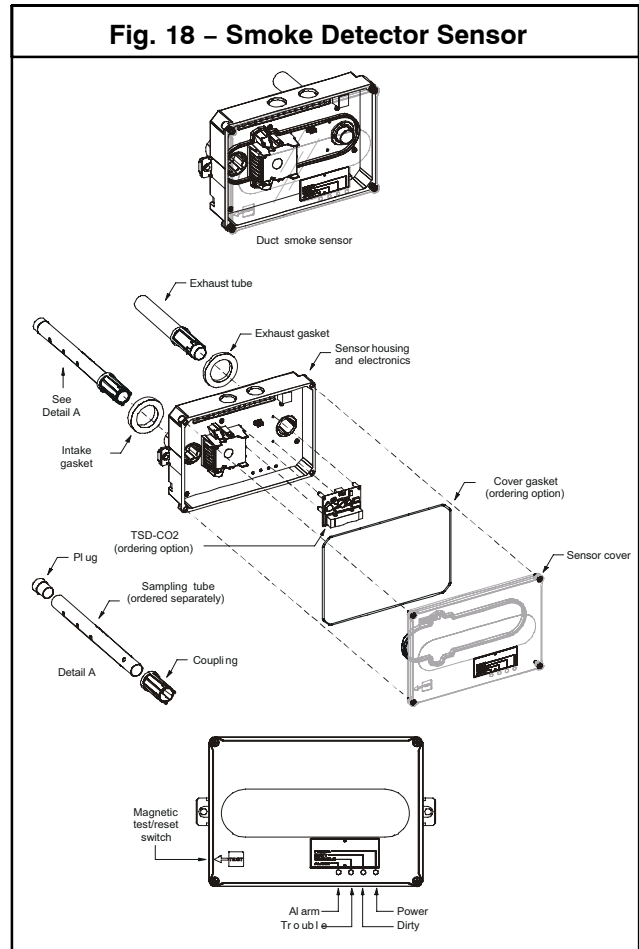
Sensor

The sensor (see Fig.18) includes a plastic housing, a printed circuit board, a clear plastic cover, a sampling tube inlet and an exhaust tube. 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 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.

Fig. 18 – Smoke Detector Sensor

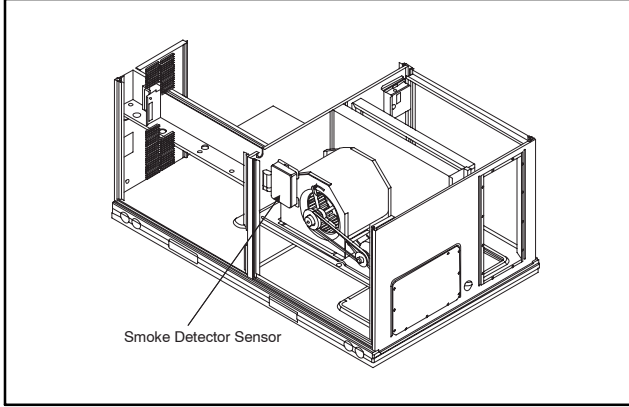


For installations using two sensors, the duct smoke detector does not differentiate which sensor signals an alarm or trouble condition.

Smoke Detector Locations

Supply Air — The Supply Air smoke detector sensor is located to the left of the unit's indoor (supply) fan. (See Fig.19.) 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 controller is located on a bracket to the right of the return filter, accessed through the lift-off filter panel.

Fig. 19 – Typical Supply Air Smoke Detector Sensor Location



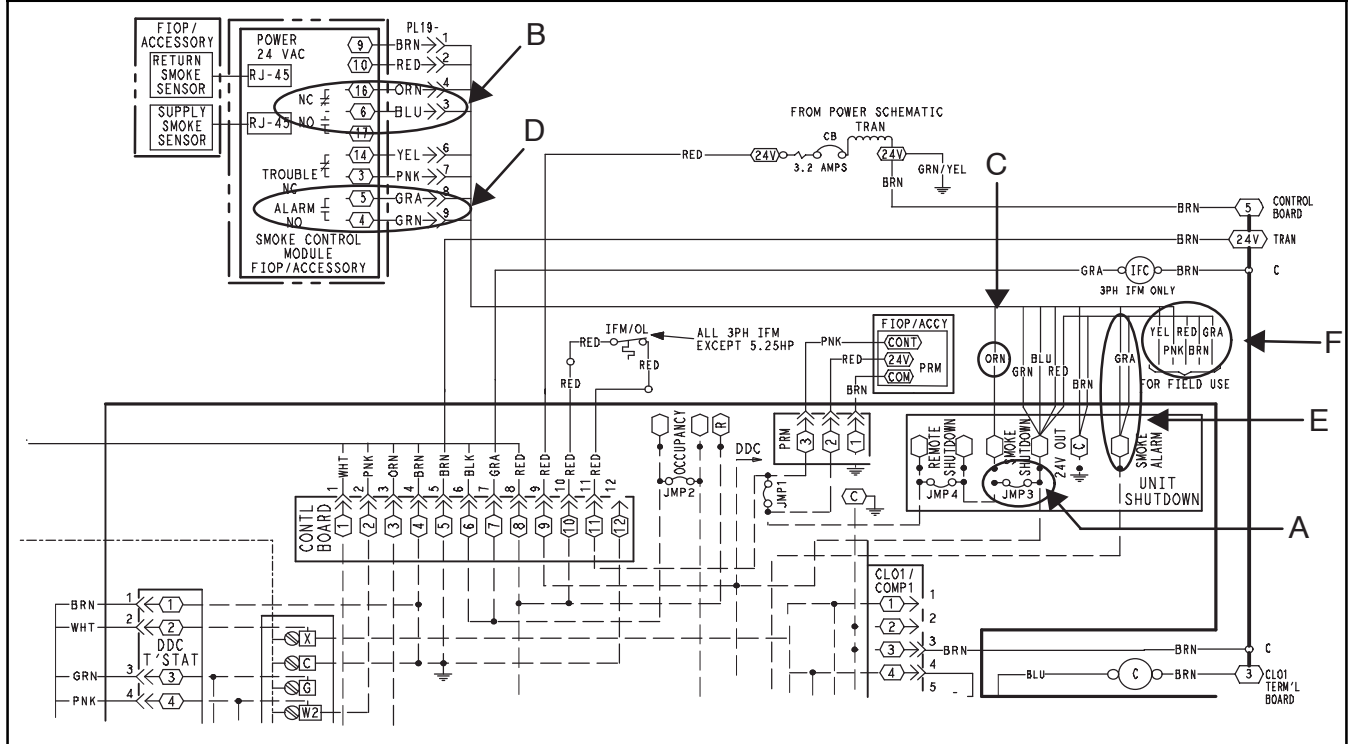
FIOP Smoke Detector Wiring and Response

All units: FIOP smoke detector is configured to automatically shut down all unit operations when smoke condition is detected. See Fig.20, 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.

Fig. 20 – Typical Smoke Detector System Wiring



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.

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 Fig.20.)

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.

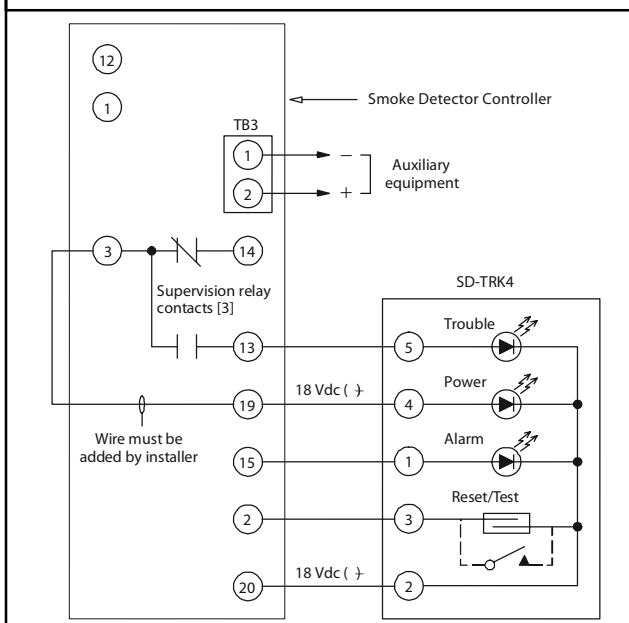
SD-TRK4 Remote Alarm Test Procedure

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 Fig. 21 and configured to operate the controller's supervision relay. For more information, see "Changing the Dirty Sensor Test."

Fig. 21 – 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

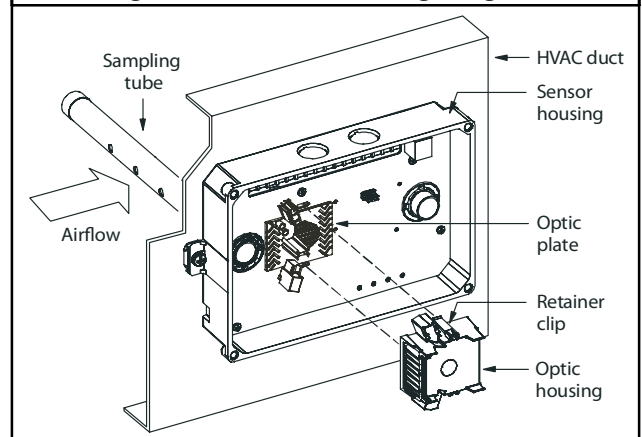
OPERATIONAL TEST HAZARD

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 Fig.22.)

Fig. 22 – 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:

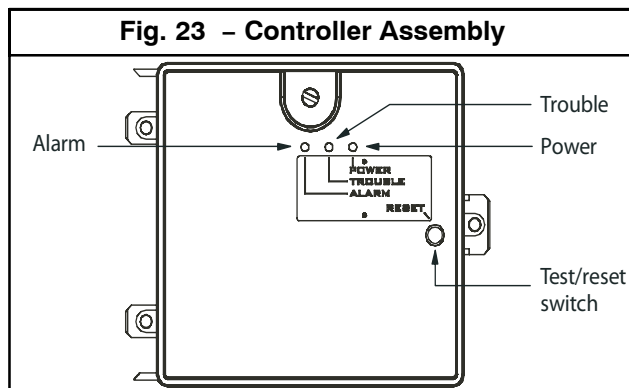
- The sensor's Alarm LED and the controller's Alarm LED turn on.
- The contacts on the controller's two auxiliary relays switch positions.
- The contacts on the controller's alarm initiation relay close.
- The controller's remote alarm LED output is activated (turned on).
- The controller's high impedance 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 Fig.23.)
- 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.



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.

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.

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.

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 Fig. 21. 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 Thermix 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. 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 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.

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. The secondary tubes exit 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 fan deck, over the tubes). (See Fig.24 and 25.)

Fig. 24 – Burner Section Details

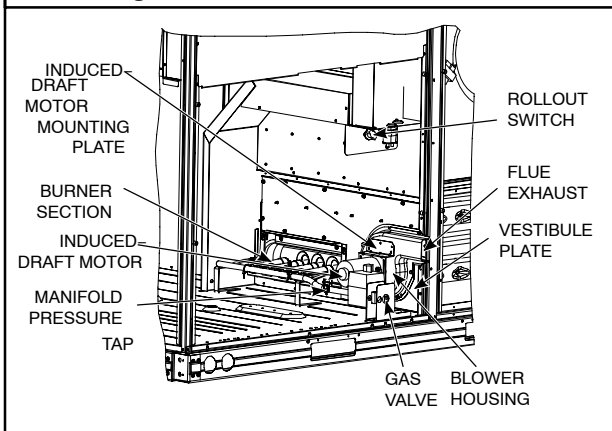
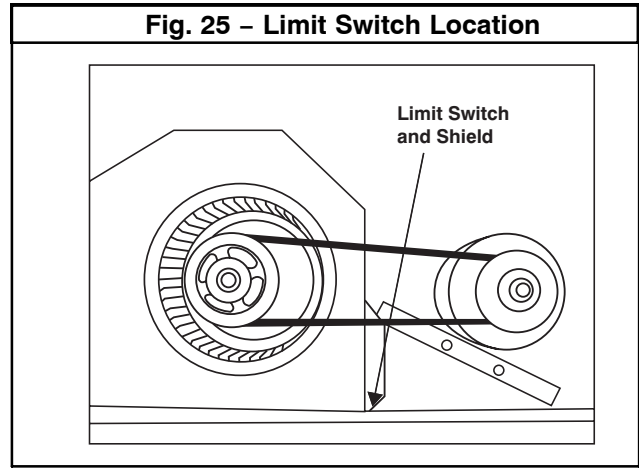


Fig. 25 – Limit Switch Location



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. 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.

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.

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)

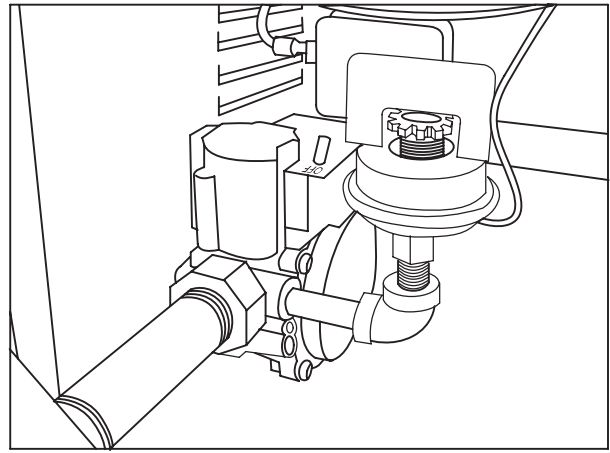
Manifold pressure for LP fuel use must be adjusted to specified range. Follow instructions in the accessory kit to make initial readjustment.

Table 8 – Liquid Propane Manifold Pressure Ranges

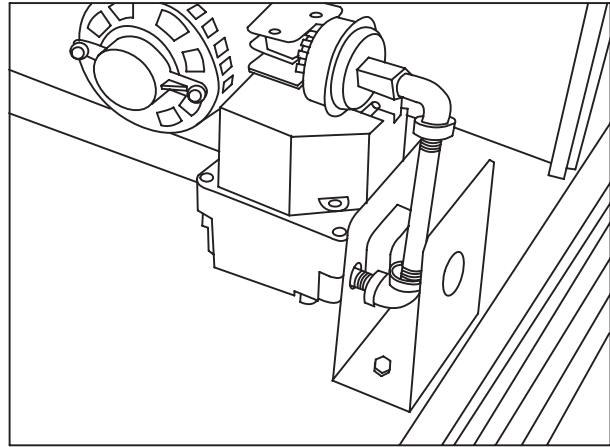
UNIT MODEL	UNIT SIZE	HIGH FIRE	LOW FIRE
RGS	All	10.0 in. wg (2490 Pa)	5.0 in. wg (1245 Pa)

Supply Pressure Switch — The LP conversion kit includes a supply low pressure switch. The switch contacts (from terminal C to terminal NO) will open the gas valve power whenever the supply line pressure drops below the setpoint. (See Fig.26 and 27.) 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.

Fig. 26 – LP Low Pressure Switch (Installed)

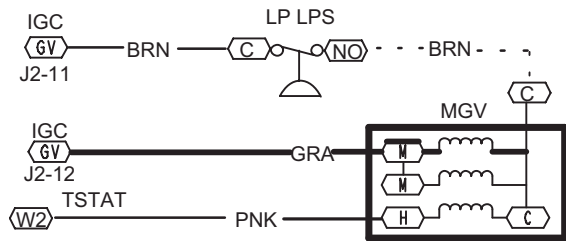


RGS090 only



All RGS except RGS090

Fig. 27 – 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 Fig.28.)
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, slide the sliding burner partition out of the unit.

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

1. Slide burner access panel out.
2. Remove the 7 screws that attach induced–draft motor housing to vestibule plate. (See Fig.28.)
3. The blower wheel can be cleaned at this point. If additional cleaning is required, continue with Steps 4 and 5.
4. To remove blower from the motor shaft, remove 2 setscrews.
5. 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.
6. To reinstall, reverse the procedure outlined above.

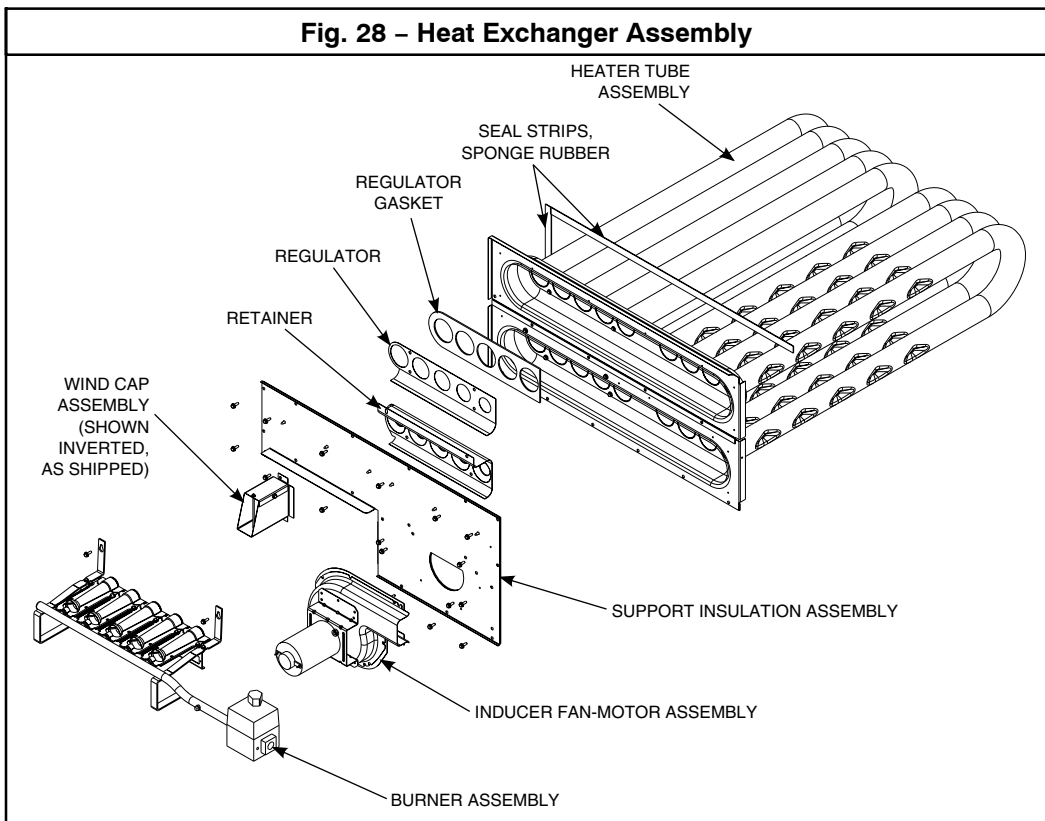


Fig. 28 – Heat Exchanger Assembly

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.

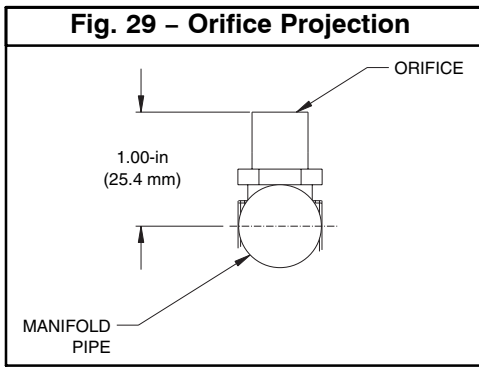
heating season, inspect for deterioration or blockage due to corrosion or other causes. Observe the main burner flames and adjust, if necessary.

Orifice projection — Refer to Fig.29 for maximum projection dimension for orifice face to manifold tube.

Main Burners

To access burners, remove burner access panel and slide out burner partition. At the beginning of each

Fig. 29 – Orifice Projection

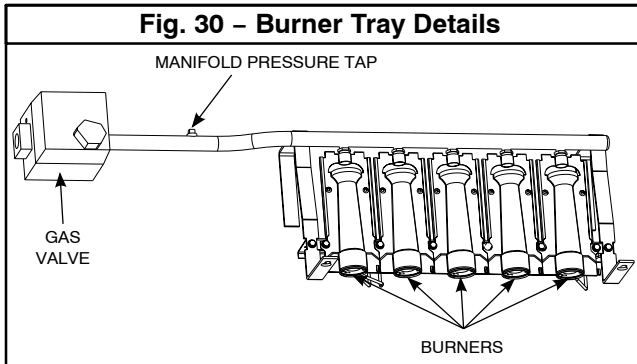


Removal and Replacement of Gas Train

See Fig.24, 28, and 30.

1. Shut off manual gas valve.
2. Shut off power to unit.
3. Slide out burner partition.
4. Disconnect gas piping at unit gas valve.
5. Remove wires connected to gas valve. Mark each wire.

Fig. 30 – Burner Tray Details



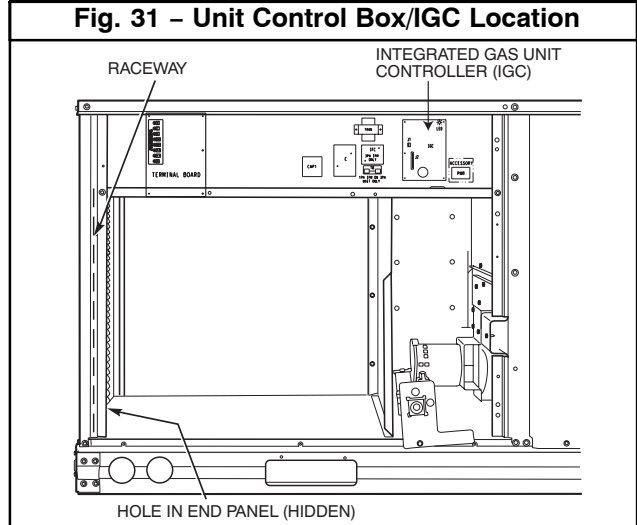
6. Remove igniter wires and sensor wires at the Integrated Gas Unit Controller (IGC). (See Fig.31.)
7. Remove the 2 screws that attach the burner rack to the vestibule plate. (See Fig.28.)
8. Slide the burner tray out of the unit. (See Fig.30.)
9. To reinstall, reverse the procedure outlined above.

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. (See Fig.32.)
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 Fig.29.)
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.)

Fig. 31 – Unit Control Box/IGC Location



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

Gas Valve — All unit sizes are equipped with 2-stage gas valves. See Fig.33 for locations of adjustment screws and features on the gas valves.

To adjust gas valve pressure settings:

IMPORTANT: Leak check 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.)

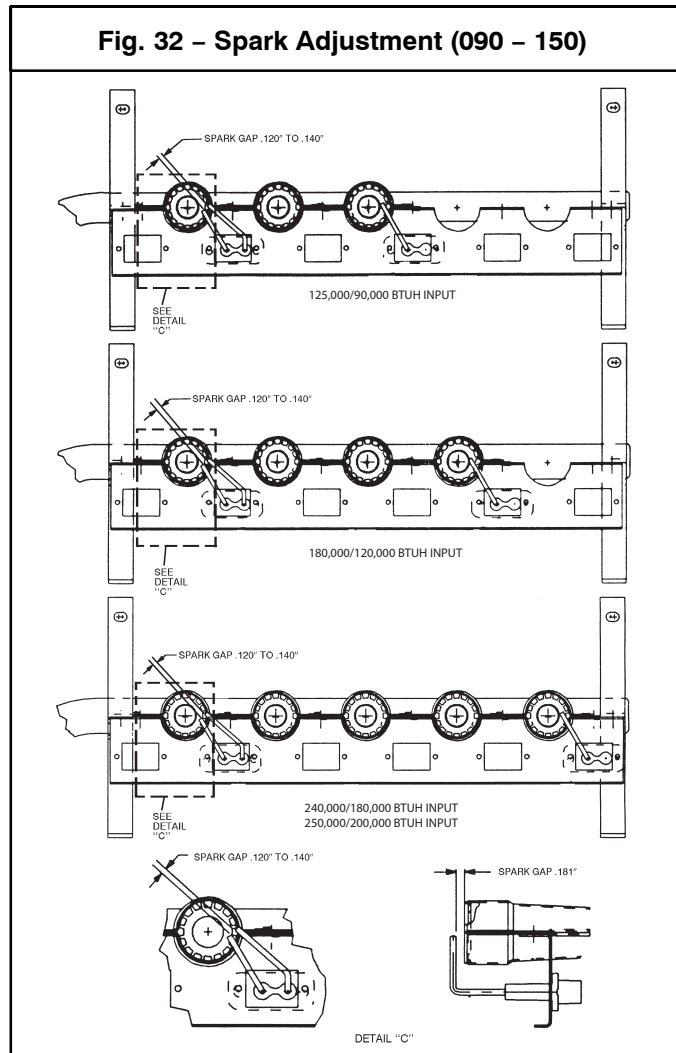
1. Remove manifold pressure tap plug from manifold and connect pressure gauge or manometer. (See Fig.30.)
2. Turn on electrical supply.
3. Turn on unit main gas valve.
4. Set room thermostat to call for heat. Verify high-stage heat operation before attempting to adjust manifold pressure.
5. When main burners ignite, check all fittings, manifold, and orifices for leaks.
6. Adjust high-stage pressure to specified setting by turning the plastic adjustment screw clockwise to increase pressure, counter-clockwise to decrease pressure.
7. Set room thermostat to call for low-stage heat. Adjust low-stage pressure to specified setting.
8. Replace regulator cover screw(s) when finished.
9. 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.

- Turn off unit, remove pressure manometer and replace the 1/8 in. pipe fitting on the gas manifold. (See Fig.30.)

Limit Switch

Remove blower access panel. Limit switch is located on the fan deck. (See Fig.25.)



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 Fig.31.) The IGC contains a self-diagnostic LED (light-emitting diode). A single LED (see Fig.34) 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*

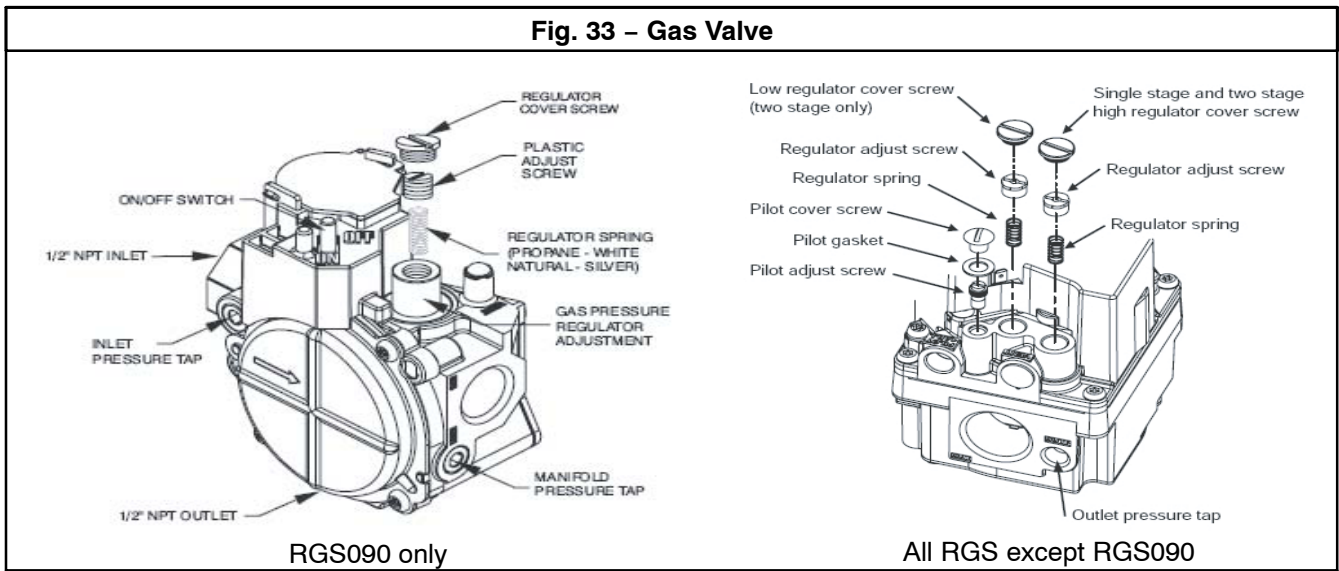
LED INDICATION	ERROR CODE DESCRIPTION
ON	Normal Operation
OFF	Hardware Failure
2 Flashes	Limit Switch Fault
3 Flashes	Flame Sense Fault
4 Flashes	4 Consecutive Limit Switch Faults
5 Flashes	Ignition Lockout Fault
6 Flashes	Induced-Draft Motor Fault
7 Flashes	Rollout Switch Fault
8 Flashes	Internal Control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

LED – Light Emitting Diode
LEGEND

* 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.

Fig. 33 – Gas Valve



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.

Check that each replacement orifice is tight at its threads into the manifold pipe and that orifice projection does not exceed maximum value. (See Fig.29.)

Fig. 34 - Integrated Gas Control (IGC) Board

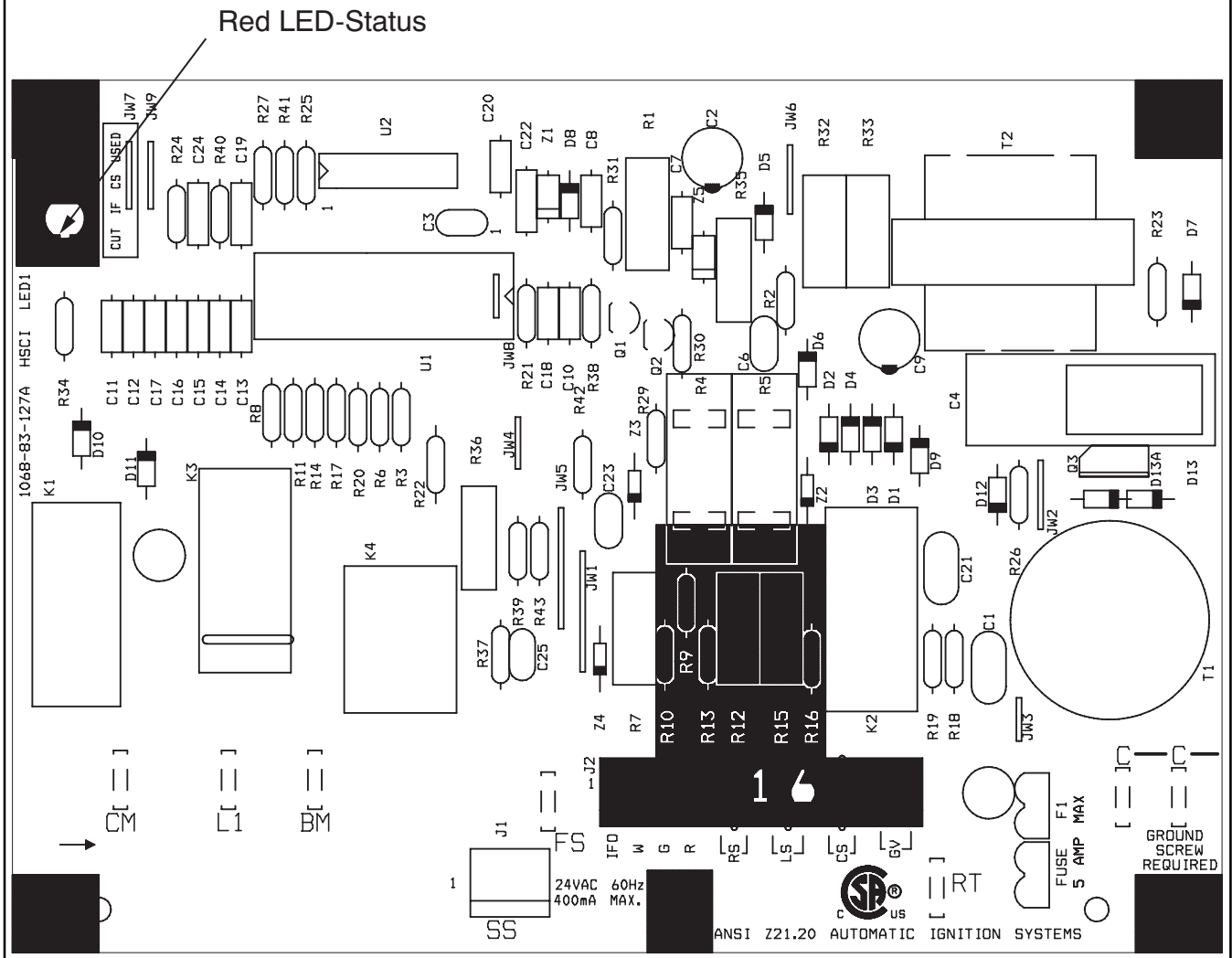


Table 10 – IGC Connections

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* (08-14)

ELEVATION ft (m)	125,000 BTUH Nominal		250,000 BTUH Nominal		180,000, 224,000 BTUH Nominal	
	NG Orifice Size	LP Orifice Size	NG Orifice Size	LP Orifice Size	NG Orifice Size	LP Orifice Size
0 – 2000 (610)	31 ¹	49 ³	†30	46 ³	31 ¹	48 ³
2000 (610)	32 ¹	50 ³	†30	47 ³	32 ¹	49 ³
3000 (914)	32 ¹	50 ³	31 ¹	47 ³	32 ¹	49 ³
4000 (1219)	33 ¹	50 ³	31 ¹	48 ³	33 ¹	49 ³
5000 (1524)	33 ¹	51 ⁴	31 ¹	48 ³	33 ¹	50 ³
6000 (1829)	34 ¹	51 ⁴	31 ¹	48 ³	34 ¹	50 ³
7000 (2134)	35 ¹	51 ⁴	32 ¹	49 ³	35 ¹	50 ³
8000 (2438)	36 ¹	52 ⁴	33 ¹	49 ³	36 ¹	51 ⁴
9000 (2743)	37 ²	52 ⁴	34 ¹	50 ³	37 ²	51 ⁴
10000 (3048)	38 ²	52 ⁴	35 ¹	50 ³	38 ²	52 ⁴
11000 (3353)	39 ²	53 ⁴	36 ¹	51 ⁴	39 ²	52 ⁴
12000 (3658)	†41	53 ⁴	37 ²	51 ⁴	†41	53 ⁴
13000 (3962)	†42	54 ⁴	38 ²	52 ⁴	†42	53 ⁴
14000 (4267)	†43	54 ⁴	†40	53 ⁴	†43	54 ⁴

LEGEND

NG = Natural Gas

LP = Liquid Propane

* 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.

† Not included in kit. May be purchased separately through dealer.

1 = CRLPELEV001A00

2 = CRLPELEV002A00

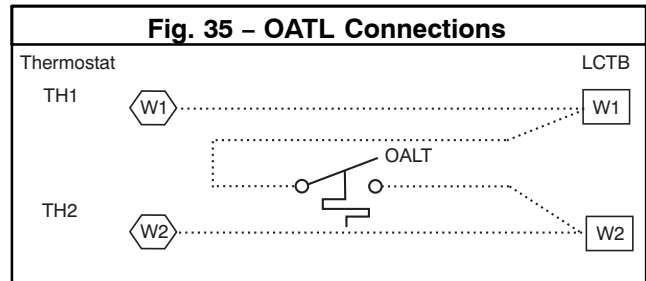
3 = CRLPELEV003A00

4 = CRLPELEV004A00

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 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 Fig. 35. 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.



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.
Inadequate Heating.	Broken thermostat wires.	Run continuity check. Replace wires, if necessary.
	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.
Poor Flame Characteristics.	Too much outdoor air.	Adjust minimum position. Check economizer operation.
	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.
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. 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.
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.
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 Micro-channel 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 Micro-channel Condenser Tube Leaks

FAST offers service repair kit for repairing tube leaks in the Micro-channel 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 Micro-channel aluminum coil.

The repair procedure requires the use of MAPP gas and torch (must be supplied by servicer) instead of conventional oxyacetylene fuel and torch. While the flame temperature for 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 Micro-channel 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 Fig.36 for component locations. Fig.37 for economizer section wiring diagrams.

Economizers use direct-drive damper actuators.

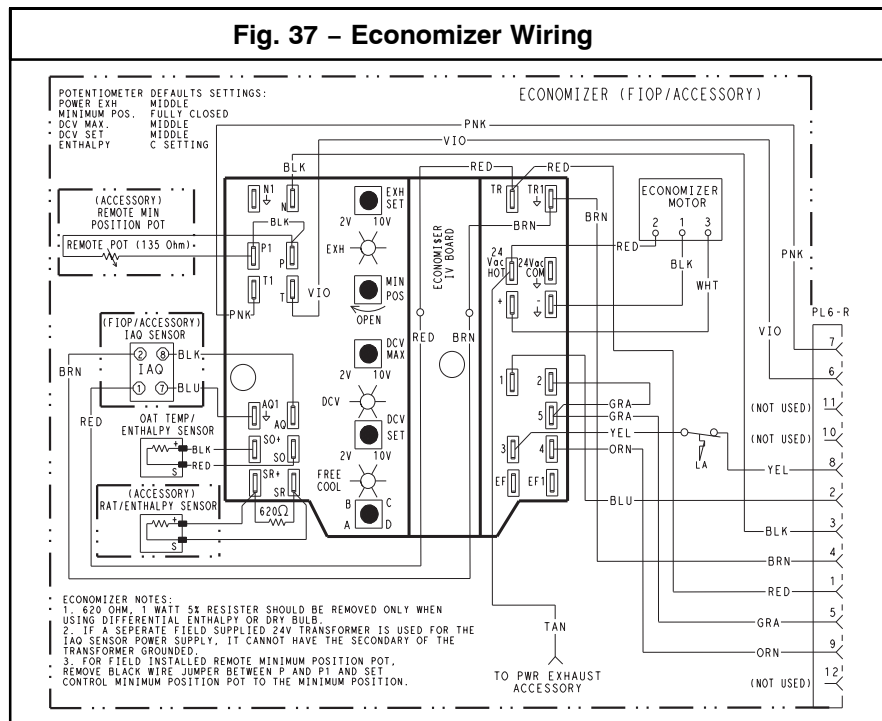
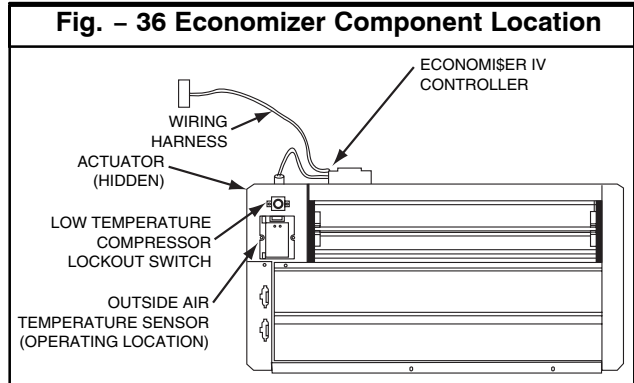
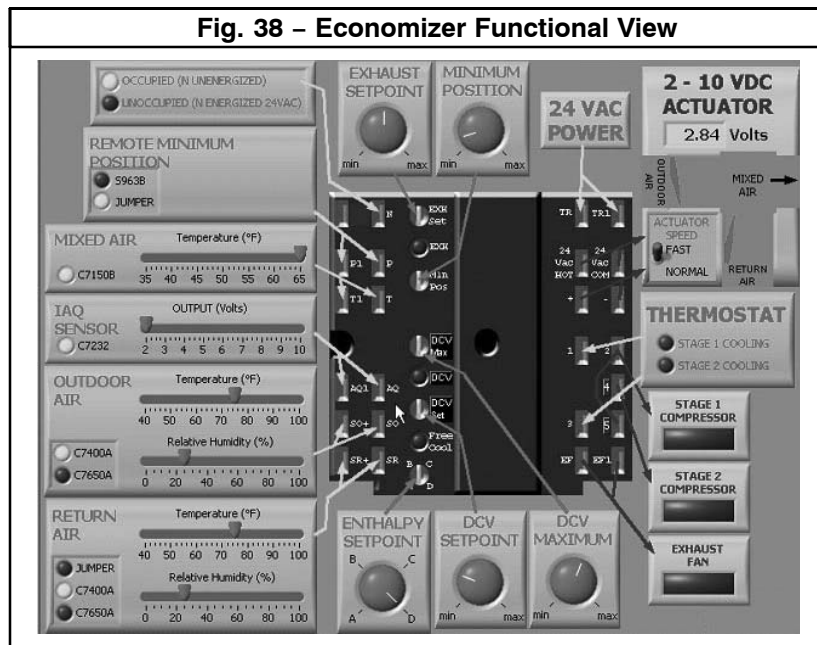


Table 15 – Economizer Input/Output Logic

Demand Control Ventilation (DCV)	Enthalpy*		Y1	Y2	Compressor		N Terminal†	
	Outdoor	Return			Stage 1	Stage 2	Occupied	Unoccupied
							Damper	
INPUTS				OUTPUTS				
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).



Economizer

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

A functional view of the Economizer is shown in Fig.38. 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. (See Fig.36.) The operating range of temperature measurement is 40° to 100°F (4° to 38°C). (See Fig.41.)

Supply Air Temperature (SAT) Sensor

The supply air temperature sensor is a 3 K thermistor located at the inlet of the indoor fan. (See Fig.36.) This sensor is factory installed. The operating range of temperature measurement is 0° to 158°F (-18° to 70°C).

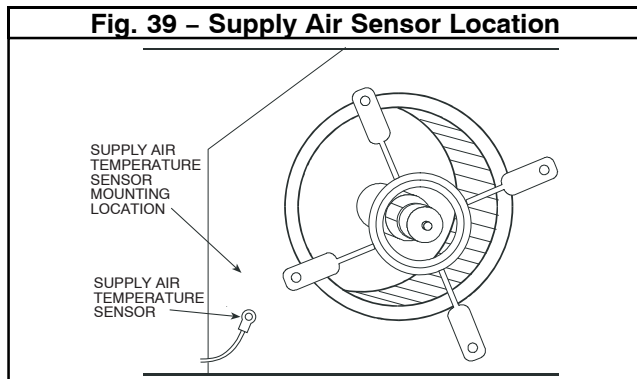


Fig. 39 – Supply Air Sensor Location

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. (See Fig.36.)

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 Fig.41.)

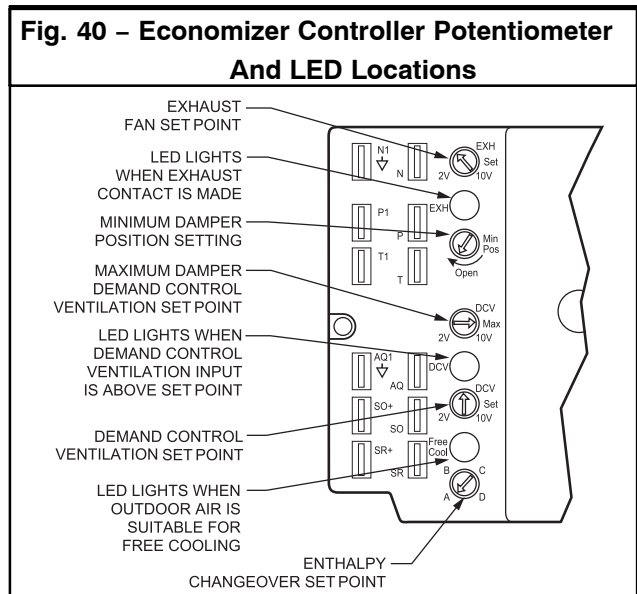
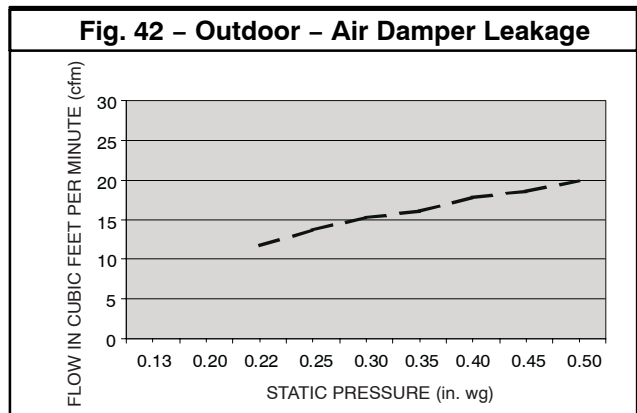
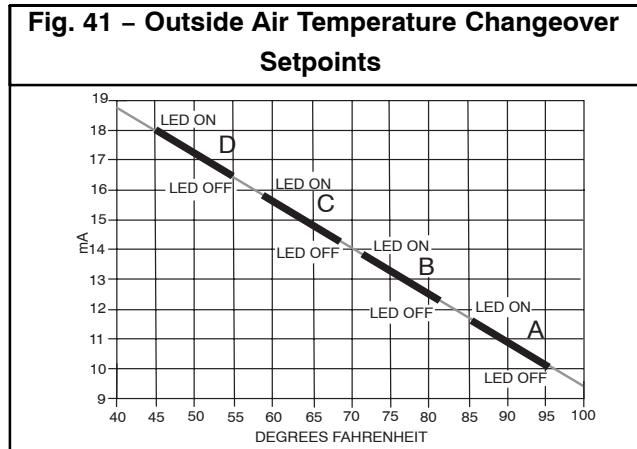


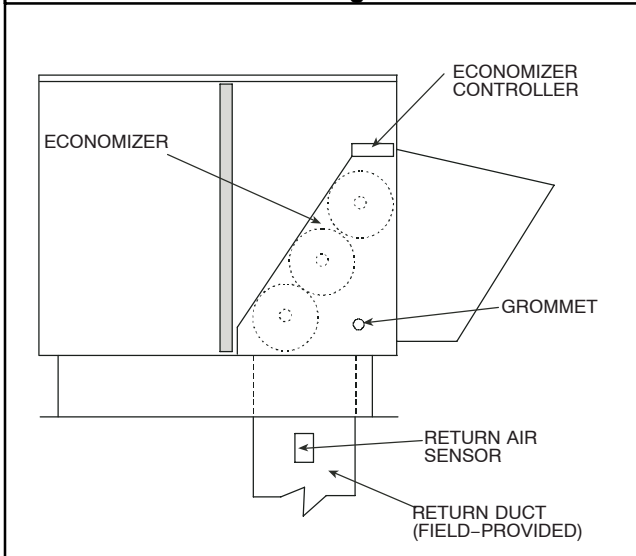
Fig. 40 – Economizer Controller Potentiometer And LED Locations



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 Fig 43.) Wiring is provided in the Economizer wiring harness. (See Fig.37.)

Fig. 43 – Return Air Temperature or Enthalpy Sensor Mounting Location

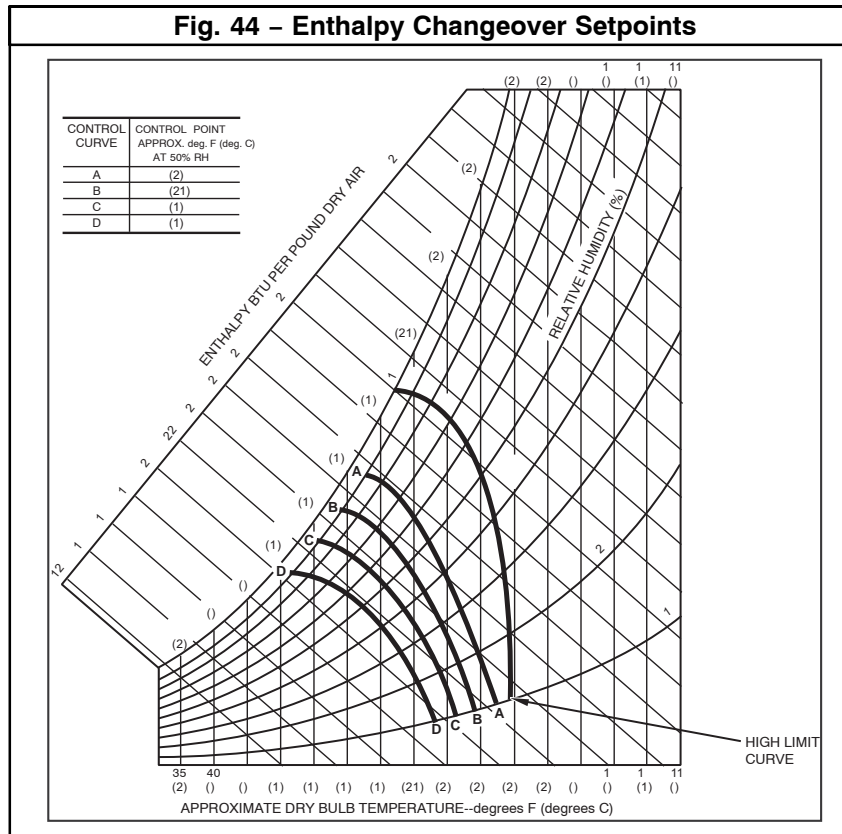


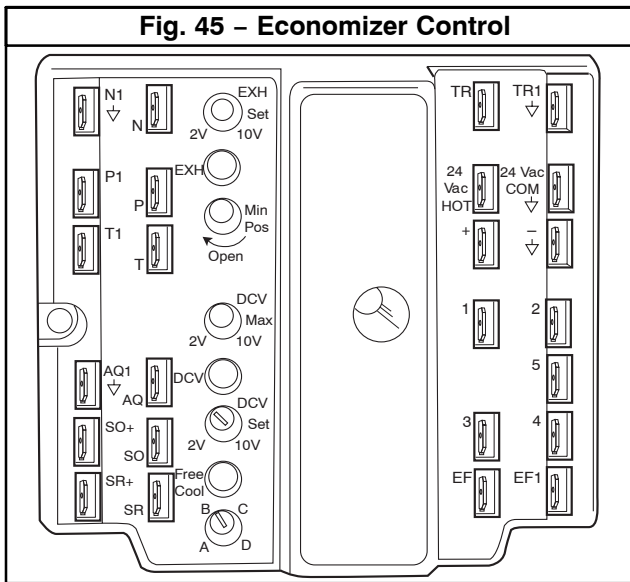
For enthalpy control, accessory enthalpy sensor (part number AXB078ENT) is required. Replace the standard outdoor dry bulb temperature sensor with the accessory enthalpy sensor in the same mounting location. (See Fig.40.) When the outdoor air enthalpy rises above the outdoor enthalpy changeover setpoint, 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 Fig.44.) The factory-installed 620-ohm jumper must be in place across terminals S_R and $SR+$ on the Economizer controller.

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 Fig.40.)

Outdoor Enthalpy Changeover

Fig. 44 – Enthalpy Changeover Setpoints





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 Fig.36.) Mount the return air enthalpy sensor in the return air duct. (See Fig.43.) Wiring is provided in the Economizer wiring harness. (See Fig.37.) 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.

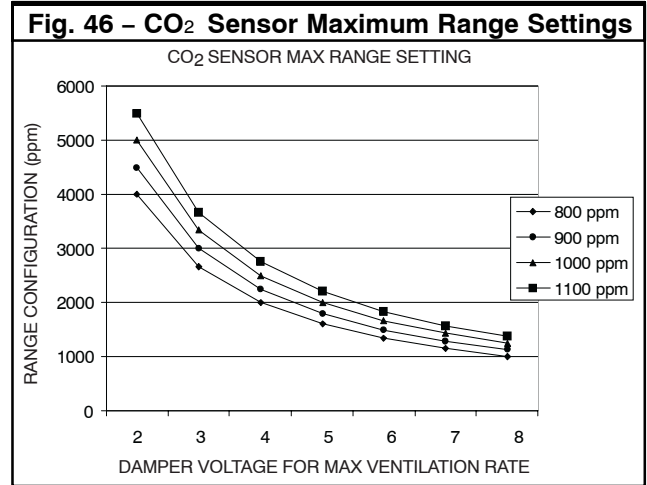
Indoor Air Quality (IAQ) Sensor Input

The IAQ input can be used for demand control ventilation control based on the level of CO₂ measured in the space or return air duct.

There is both a factory-installed (FIOP) CO₂ option (sensor 8001B with no display, which is mounted on the side of the Economizer) and a field-installed CO₂ 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 "CO₂ 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 Fig.46.)



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 Fig 40.) 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 Fig.40.) 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:

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

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

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.

$$(60 \times .10) + (75 \times .90) = 73.5^\circ\text{F}$$

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 Fig.37 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 Fig.37.)

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 CO₂ level increases even though the CO₂ setpoint has not been reached. By the time the CO₂ level reaches the setpoint, the damper will be at maximum ventilation and should maintain the setpoint.

In order to have the CO₂ 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.

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

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 Fig. 46 to determine the maximum setting of the CO₂ sensor. For example, an 1100 ppm setpoint relates to a 15 cfm per person design. Use the 1100 ppm curve on Fig. 46 to find the point when the CO₂ 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 CO₂ sensor should be 1800 ppm. The Economizer controller will output the 6.7 volts from the CO₂ sensor to the actuator when the CO₂ concentration in the space is at 1100 ppm. The DCV setpoint may be left at 2 volts since the CO₂ 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.

CO₂ Sensor Configuration

The CO₂ 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 – CO₂ Sensor Standard Settings

SETTING	EQUIPMENT	OUTPUT	VENTILATION RATE (cmf/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	
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

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 CO₂ 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.

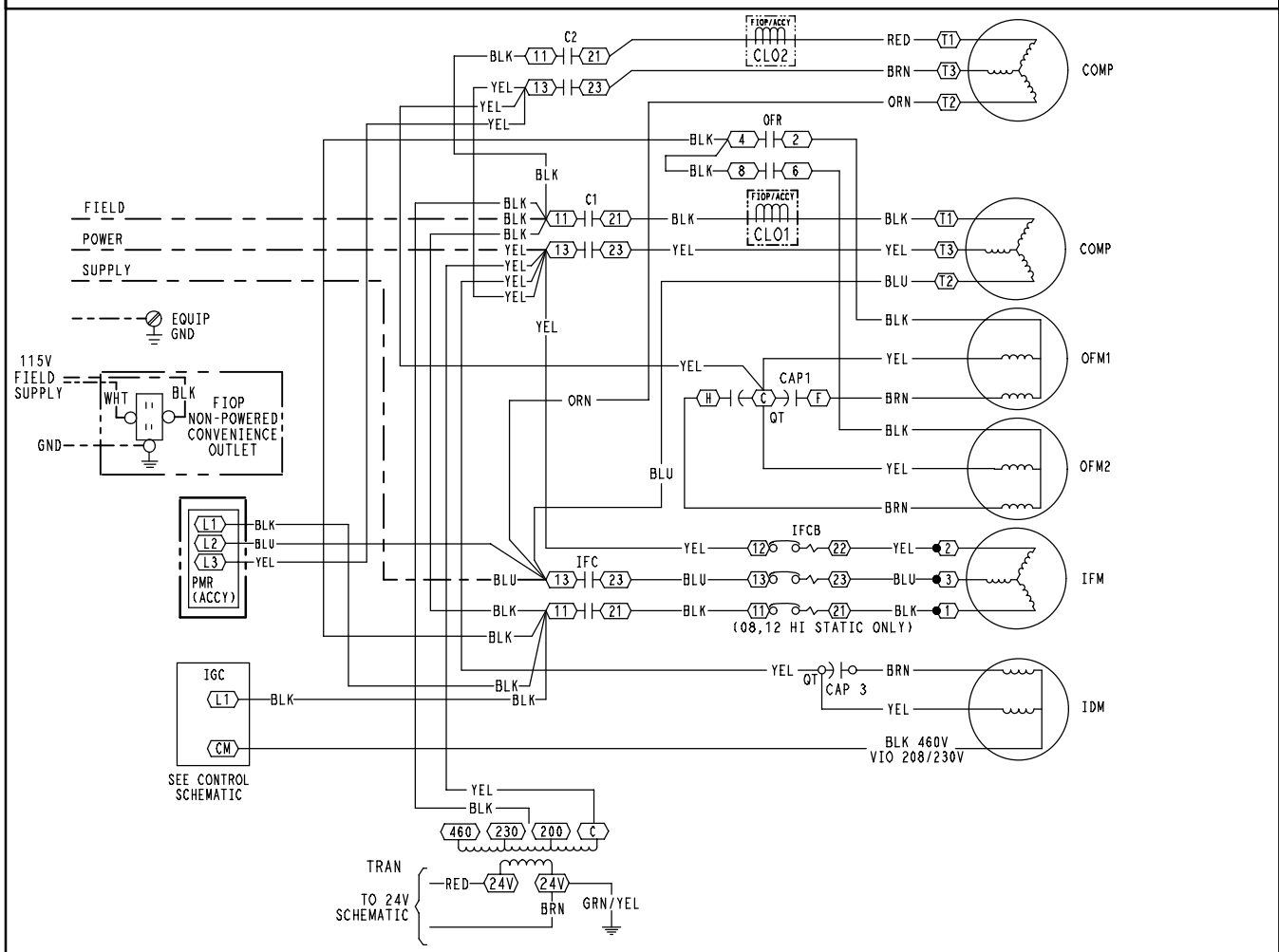
1. Disconnect power at TR and TR1.

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 Fig.47 and 48 for typical wiring diagrams.

Fig. 47 – Typical Unit Wiring Diagram – Power (208/230–3–60)



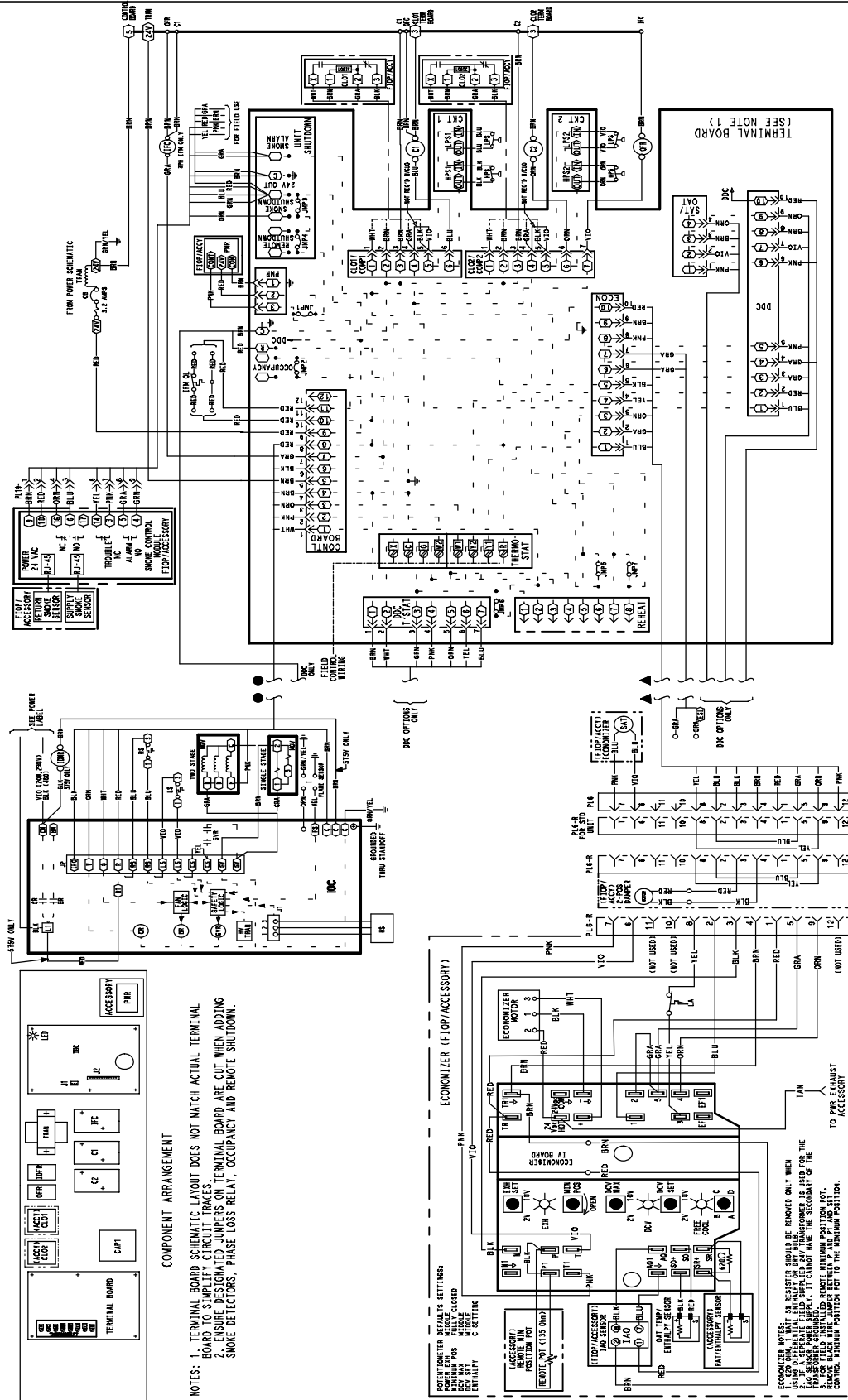
LEGEND

- X MARKED WIRE
- X TERMINAL (MARKED)
- TERMINAL (UNMARKED)
- X TERMINAL BLOCK
- SPLICE
- SPLICE (MARKED)
- FACTORY WIRING
- FIELD CONTROL WIRING
- FIELD POWER WIRING
- CIRCUIT BOARD TRACE
- ACCESSORY OR OPTIONAL WIRING
- TO INDICATE COMMON POTENTIAL ONLY: NOT TO REPRESENT WIRING

- 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, COPPER CLAD, ALUMINUM OR ALUMINUM CONNECTORS.
 5. USE COPPER CONDUCTOR ONLY.

<p>C CONTACTOR, COMPRESSOR</p> <p>CAP CAPACITOR</p> <p>CB CIRCUIT BREAKER</p> <p>CCH CRANKCASE HEATER</p> <p>CCN CARRIER COMFORT NETWORK</p> <p>CMP SAFE COMPRESSOR SAFETY</p> <p>CLO COMPRESSOR LOCKOUT</p> <p>COMP COMPRESSOR MOTOR</p> <p>DDC DIRECT DIGITAL CONTROL</p> <p>FSD FIRE SHUT DOWN</p> <p>FS FLAME SENSOR</p> <p>FU FUSE</p> <p>GND GROUND</p> <p>GVR GAS VALVE RELAY</p> <p>HPS HIGH PRESSURE SWITCH</p> <p>HS HALL EFFECT SENSOR</p> <p>I IGNITOR</p> <p>IAQ INDOOR AIR QUALITY SENSORS</p> <p>IDM INDUCED DRAFT MOTOR</p> <p>IFC INDOOR FAN CONTACTOR</p> <p>IFCB INDOOR FAN CIRCUIT BREAKER</p> <p>IFM INDOOR FAN MOTOR</p> <p>IGC INTEGRATED GAS CONTROL</p> <p>IRH INDOOR RELATIVE HUMIDITY</p> <p>JMP JUMPER</p> <p>LA LOW AMBIENT LOCKOUT</p> <p>LOOP PWR CURRENT LOOP POWER</p> <p>LPS LOW PRESSURE SWITCH</p> <p>LSM LIMIT SWITCH (MANUAL RESET)</p> <p>LS LIMIT SWITCH</p> <p>MGV MAIN GAS VALVE</p> <p>OFR OUTDOOR FAN RELAY</p>	<p>OAO OUTDOOR AIR QUALITY</p> <p>OAT OUTDOOR AIR TEMP. SEN</p> <p>OFM OUTDOOR FAN MOTOR</p> <p>OL OVERLOAD</p> <p>PL PLUG ASSEMBLY</p> <p>POT POTENTIOMETER</p> <p>PMR PHASE MONITOR RELAY</p> <p>QT QUADRUPLE TERMINAL RELAY</p> <p>R RELAY</p> <p>RAT RETURN AIR TEMP. SEN</p> <p>RMT OCC REMOTE OCCUPANCY</p> <p>RS ROLLOUT SWITCH</p> <p>SAT SUPPLY AIR TEMP. SENSOR</p> <p>SEN SENSOR</p> <p>SET SET POINT OFFSET</p> <p>SFS SUPPLY FAN STATUS</p> <p>TDR TIME DELAY RELAY</p> <p>TRAN TRANSFORMER</p>
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Fig. 48 - Typical Unit Wiring Diagram - Control (208/230-3-60)



COMPONENT ARRANGEMENT

- NOTES:
1. TERMINAL BOARD SCHEMATIC LAYOUT DOES NOT MATCH ACTUAL TERMINAL BOARD TO SIMPLIFY CIRCUIT TRACES.
 2. ENSURE DESIGNATED JUMPERS ON TERMINAL BOARD ARE CUT WHEN ADDING SMOKE DETECTORS, PHASE LOSS RELAY, OCCUPANCY AND REMOTE SHUTDOWN.

PROTECTOR DETAIL SETTINGS:
 MINIMUM POS FULLY CLOSED
 MINIMUM POS FULLY OPEN
 MINIMUM POS SET
 MINIMUM POS SET
 MINIMUM POS SET
 MINIMUM POS SET

ECONOMIZER NOTE:
 1. 250 OHM 1/2 WATT 5% RESISTOR SHOULD BE REMOVED ONLY WHEN 250 OHM 1/2 WATT 5% RESISTOR IS USED FOR THE ECONOMIZER BOARD. IF A SEPARATE FIELD SUPPLY TRANSFORMER IS USED FOR THE ECONOMIZER BOARD, IT CANNOT HAVE THE SECONDARY OF THE TRANSFORMER REWOUND.
 2. THE ECONOMIZER BOARD MUST BE INSTALLED IN THE CONTROL CABINET WITH THE ECONOMIZER BOARD POT TO THE MINIMUM POSITION.
 3. THE ECONOMIZER BOARD POT TO THE MINIMUM POSITION IS NECESSARY TO THE ECONOMIZER BOARD.

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:

START-UP, GENERAL

Unit Preparation

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

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 blade are correctly positioned in fan orifice. See Condenser-Fan Adjustment section for more details.
 - b. Make sure that air filter(s) is 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.

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 in 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 check valves) service ports: one on the suction line, and one on the compressor discharge line. 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. 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. If 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 fan and Compressor 1 start. The outdoor fan motor runs continuously while unit is in Stage 1 or Stage 2 cooling. (RGS090 and 120 units have two outdoor fans; both run 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 CO2 sensor is connected to the Economize control, a Demand Controlled Ventilation strategy will operate automatically. As the CO2 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 CO2 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.

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	72 ± 5 in-lbs	8.1 ± 0.6 Nm
Bearing locking collar setscrew	65 to 70 in-lbs	7.3 to 7.9 Nm
Compressor mounting bolts	65 to 75 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 SIGNIFICANCE

MODEL NOMENCLATURE

MODEL SERIES	R	G	S	0	9	0	H	D	A	B	0	A	G	A
Position Number	1	2	3	4	5	6	7	8	9	10	11	12	13	14
R = Rooftop														
A = Air Conditioning (Cooling Only) H = Heat Pump G = Gas/Electric	Type													
S = Standard ASHRAE 90.1-2010 Efficiency	Efficiency													
090 = 90,000 = 7.5 Tons (Two Compressors) 120 = 120,000 = 10 Tons (Two Compressors) 150 = 150,000 = 12.5 Tons (Two Compressors)	Nominal Cooling Capacity													
H = 208/230-3-60 L = 460-3-60 S = 575-3-60	Voltage													
D = Low Heat E = Medium Heat F = High Heat 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 + CO2 Sensor, OA Temp sensor H = Economizer w/Bara-relief, enthalpy sensor L = Economizer w/Bara-relief + CO2 Sensor, enthalpy sensor P = 2-Position damper	Outdoor Air Options / Control													
0A = No Options 4B = Non-Fused Disconnect AT = Non-powered 115v C.O. BR = Supply Air Smoke Detector 7C = Non-Fused Disconnect + Non-Powered 115v C.O. 7K = Non-Fused Disconnect + Non-Powered 115v C.O.+ SA Smoke detector 8A = Non-Fused Disconnect + SA 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 Digit														

APPENDIX II. PHYSICAL DATA

Physical Data

(Cooling)

7.5 – 12.5TONS

		RGS090	RGS120	RGS150
Refrigeration System				
# Circuits / # Comp. / Type		2 / 2 / Scroll	2 / 2 / Scroll	2 / 2 / Scroll
refrig. R-410A charge per circuit A/B (lbs-oz)		4-6 / 4-6	6-0 / 6-0	7-6/8-0
Oil A/B (oz)		42 / 42	42 / 42	56 / 56
Metering Device		Accutrol	Accutrol	Accutrol
High-press. Trip / Reset (psig)		630 / 505	630 / 505	630 / 505
Low-press. Trip / Reset (psig)		54 / 117	54 / 117	54 / 117
Evaporator Coil				
Material		Cu / Al	Cu / Al	Cu / Al
Coil type		3/8" RTPF	3/8" RTPF	3/8" RTPF
Rows / FPI		3 / 15	4 / 15	4 / 15
Total Face Area (ft ²)		8.9	11.1	11.1
Condensate Drain Conn. Size		3/4"	3/4"	3/4"
Evaporator Fan and Motor				
Standard Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	1.7	2.4	2.9*
	RPM Range	489-747	591-838	652-843
	Motor Frame Size	56	56	56
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	15 x 15	15 x 15	15 x 15
Medium Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	2.9*	3.7	3.7
	RPM Range	733-949	838-1084	838-1084
	Motor Frame Size	56	56	56
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	15 x 15	15 x 15	15 x 15
High Static 3 phase	Motor Qty / Drive Type	1 / Belt	1 / Belt	1 / Belt
	Max BHP	4.7	4.7	4.7
	RPM Range	909-1102	1022-1240	1022-1240
	Motor Frame Size	145TY	145TY	145TY
	Fan Qty / Type	1 / Centrifugal	1 / Centrifugal	1 / Centrifugal
	Fan Diameter (in)	15 x 15	15 x 15	15 x 15
Condenser Coil				
Material		Al / Al	Al / Al	Al / Al
Coil type		Micro-channel	Micro-channel	Micro-channel
Rows / FPI		1 / 20	1 / 20	2 / 20
Total Face Area (ft ²)		20.5	25.1	25.1
Condenser fan / motor				
Qty / Motor Drive Type		2 / Direct	2 / Direct	1 / Direct
Motor HP / RPM		1/4 / 1100	1/4 / 1100	1 / 1175
Fan diameter (in)		22	22	30
Filters				
RA Filter # / Size (in)		4 / 16 x 20 x 2	4 / 20 x 20 x 2	4 / 20 x 20 x 2
OA inlet screen # / Size (in)		1 / 20 x 24 x 1	1 / 20 x 24 x 1	1 / 20 x 24 x 1

Al / Al: Aluminum Tube / Aluminum Fin

Cu / Al: Copper Tube / Aluminum Fin

RTPF: Round Tube / Plate Fin

* 575V motor utilizes 3.7 BHP

APPENDIX II. PHYSICAL DATA (cont.)

Physical Data

(Heating)

7.5 – 12.5TONS

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

APPENDIX III. FAN PERFORMANCE

RGS090

3 PHASE

7.5 TON HORIZONTAL SUPPLY

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

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Medium Static Option						High Static Option			
2250	838	1.81	891	2.12	941	2.46	988	2.82	1033	3.19
2438	854	1.96	906	2.28	955	2.63	1001	2.99	1046	3.37
2625	872	2.12	922	2.46	970	2.81	1016	3.17	1060	3.56
2813	890	2.31	940	2.65	986	3.01	1031	3.38	1074	3.77
3000	910	2.51	958	2.86	1004	3.23	1048	3.61	1090	4.01
3188	930	2.74	977	3.10	1022	3.47	1065	3.86	1107	4.26¹
3375	951	2.99	997	3.35	1041	3.74	1083	4.13	1124	4.54
3563	973	3.26	1018	3.63	1061	4.02	1103	4.43	-	-
3750	996	3.55	1040	3.93	1082	4.34	-	-	-	-

NOTE: Boldface indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1175896) and belt (part no. 1178182).

RGS090

3 PHASE

7.5 TON VERTICAL SUPPLY

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

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Medium Static Option						High Static Option			
2250	839	1.86	889	2.18	935	2.52	980	2.87	1022	3.23
2438	858	2.02	907	2.35	953	2.70	997	3.06	1039	3.43
2625	878	2.20	926	2.54	972	2.89	1015	3.26	1056	3.64
2813	899	2.40	946	2.75	991	3.11	1033	3.49	1074	3.88
3000	920	2.62	966	2.98	1010	3.35	1052	3.74	1093	4.14
3188	942	2.86	987	3.23	1031	3.61	1072	4.01	1112	4.42¹
3375	964	3.12	1009	3.50	1052	3.89	1093	4.30	-	-
3563	988	3.41	1032	3.80	1074	4.20	1114	4.61	-	-
3750	1011	3.71	1054	4.11	1096	4.53	-	-	-	-

NOTE: Boldface indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1175896) and belt (part no. 1178182).

RGS120

3 PHASE

10 TON HORIZONTAL SUPPLY

CFM	AVAILABLE EXTERNAL STATIC PRESSURE (in. wg)									
	0.2		0.4		0.6		0.8		1.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Field-Supplied Drive¹		Standard Static Option						Medium Static Option	
3000	579	0.70	660	0.89	732	1.09	799	1.29	860	1.50
3250	613	0.85	690	1.06	760	1.27	823	1.49	883	1.71
3500	648	1.03	721	1.25	788	1.48	850	1.71	907	1.95
3750	683	1.23	753	1.47	817	1.71	877	1.96	933	2.21
4000	719	1.45	786	1.71	848	1.97	905	2.23	959	2.50
4250	756	1.71	819	1.98	879	2.26	934	2.53	987	2.81
4500	792	1.99	853	2.28	910	2.57	964	2.87	1015	3.16
4750	830	2.31	888	2.62	943	2.92	995	3.23	1044	3.54
5000	867	2.66	923	2.98	976	3.30	1026	3.63	1074	3.95

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

NOTE: Boldface indicates field-supplied drive is required.

1. Recommend using field-supplied fan pulley (part no. 1178190) and belt (part no. 1178181).
2. Recommend using field-supplied motor pulley (part no. 1178188).

RGS120

3 PHASE

10 TON VERTICAL SUPPLY

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

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

NOTE: Boldface indicates field-supplied drive is required.

1. Recommend using field-supplied motor pulley (part no. 1178188).

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

CFM	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Medium Static Option					High Static Option				
3438	955	2.12	1007	2.35	1056	2.59	1103	2.83	1148	3.08
3750	985	2.46	1035	2.71	1083	2.97	1129	3.23	1173	3.49
4063	1017	2.84	1066	3.12	1112	3.39	1157	3.67	1200	3.95
4375	1050	3.27	1097	3.56	1142	3.86	1186	4.15	1228	4.45
4688	1084	3.75	1130	4.06	1174	4.37	1216	4.68	1257	5.00
5000	1120	4.28	1164	4.61	-	-	1248	5.27	1288	5.60
5313	-	-	-	-	-	-	-	-	-	-
5625	-	-	-	-	-	-	-	-	-	-
5938	-	-	-	-	-	-	-	-	-	-
6250	-	-	-	-	-	-	-	-	-	-

NOTE: Boldface indicates field-supplied drive is required.

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

CFM	Available External Static Pressure (in. wg)									
	1.2		1.4		1.6		1.8		2.0	
	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
	Medium Static Option					High Static Option				
3438	981	2.23	1032	2.47	1082	2.72	1130	2.97	1177	3.23
3750	1014	2.60	1063	2.86	1111	3.12	1157	3.39	1202	3.66
4063	1049	3.02	1097	3.29	1142	3.57	1186	3.85	1230	4.14
4375	1087	3.49	1132	3.78	1176	4.08	1218	4.37	1260	4.68
4688	1126	4.03	1169	4.33	1211	4.64	-	-	-	-
5000	1167	4.63	-	-	-	-	-	-	-	-
5313	-	-	-	-	-	-	-	-	-	-
5625	-	-	-	-	-	-	-	-	-	-
5938	-	-	-	-	-	-	-	-	-	-
6250	-	-	-	-	-	-	-	-	-	-

NOTE: Boldface indicates field-supplied drive is required.

APPENDIX III. FAN PERFORMANCE (cont.)

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
090	3 phase	Standard Static	747	721	695	670	644	618	592	566	541	515	489
		Medium Static	949	927	906	884	863	841	819	798	776	755	733
		High Static	1102	1083	1063	1044	1025	1006	986	967	948	928	909
120	3 phase	Standard Static	838	813	789	764	739	715	690	665	640	616	591
		Medium Static	1084	1059	1035	1010	986	961	936	912	887	863	838
		High Static	1240	1218	1196	1175	1153	1131	1109	1087	1066	1044	1022
150	3 phase	Standard Static	838	813	789	764	739	715	690	665	640	616	591
		Medium Static	1084	1059	1035	1010	986	961	936	912	887	863	838
		High Static	1240	1218	1196	1175	1153	1131	1109	1087	1066	1044	1022

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

■ – Factory settings

APPENDIX IV. ELECTRICAL INFORMATION

RGS090
2–Stage Cooling
7.5 Tons

V-Ph-Hz	VOLTAGE RANGE		COMP (Cir 1)		COMP (Cir 2)		OFM (ea)		IFM				
	MIN	MAX	RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	Max	Max	EFF at Full Load	FLA
										WATTS	AMP Draw		
208–3–60	187	253	13.6	83	13.6	83	325	1.5	STD	1448	5.5	80%	5.2
									MED	2278	7.9	81%	7.5
									HIGH	4400	15.0	81%	15.0
230–3–60	187	253	13.6	83	13.6	83	325	1.5	STD	1448	5.5	80%	5.2
									MED	2278	7.9	81%	7.5
									HIGH	4400	15.0	81%	15.0
460–3–60	414	506	6.1	41	6.1	41	325	0.8	STD	1448	2.7	80%	2.6
									MED	2278	3.6	81%	3.4
									HIGH	4400	7.4	81%	7.4
575–3–60	518	633	4.2	33	4.2	33	325	0.6	STD	1379	2.5	80%	2.4
									MED	3775	2.9	81%	2.8
									HIGH	4400	5.9	81%	5.6

RGS120
2–Stage Cooling
10 Tons

V-Ph-Hz	VOLTAGE RANGE		COMP (Cir 1)		COMP (Cir 2)		OFM (ea)		IFM				
	MIN	MAX	RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	Max	Max	EFF at Full Load	FLA
										WATTS	AMP Draw		
208–3–60	187	253	15.6	110	15.9	110	325	1.5	STD	2120	5.5	80%	5.2
									MED	3775	10.5	81%	10.0
									HIGH	4400	15.0	81%	15.0
230–3–60	187	253	15.6	110	15.9	110	325	1.5	STD	2120	5.5	80%	5.2
									MED	3775	10.5	81%	10.0
									HIGH	4400	15.0	81%	15.0
460–3–60	414	506	7.7	52	7.7	52	325	0.8	STD	2120	2.7	80%	2.6
									MED	3775	4.6	81%	4.4
									HIGH	4400	7.4	81%	7.4
575–3–60	518	633	5.8	39	5.7	39	325	0.6	STD	1390	2.1	80%	2.0
									MED	3775	2.9	81%	2.8
									HIGH	4400	5.9	81%	5.6

RGS150
2–Stage Cooling
12.5 Tons

V-Ph-Hz	VOLTAGE RANGE		COMP (Cir 1)		COMP (Cir 2)		OFM (ea)		IFM				
	MIN	MAX	RLA	LRA	RLA	LRA	WATTS	FLA	TYPE	Max	Max	EFF at Full Load	FLA
										WATTS	AMP Draw		
208–3–60	187	253	19.0	123	22.4	149	1288	6.2	STD	2615	7.9	81%	7.5
									MED	3775	10.5	81%	10.0
									HIGH	4400	15.0	81%	15.0
230–3–60	187	253	19.0	123	22.4	149	1288	6.2	STD	2615	7.9	81%	7.5
									MED	3775	10.5	81%	10.0
									HIGH	4400	15.0	81%	15.0
460–3–60	414	506	9.7	62	10.6	75	1288	3.1	STD	2615	3.6	81%	3.4
									MED	3775	4.6	81%	4.4
									HIGH	4400	7.4	81%	7.4
575–3–60	518	633	7.4	50	7.7	54	1288	2.5	STD	3775	2.9	81%	2.8
									MED	3775	2.9	81%	2.8
									HIGH	4400	5.9	81%	5.6

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

RGS	NOM. V-Ph-Hz	IFM TYPE	COMBUSTION FAN MOTOR FLA	POWER EXHAUST FLA	NO C.O. or UNPWRD C.O.								
					NO P.E.				w/ P.E. (pwrd fr/ unit)				
					MCA	MOCP	DISC. SIZE		MCA	MOCP	DISC. SIZE		
							FLA	LRA			FLA	LRA	
RGS090	208/230-3-60	STD	0.48	3.8	43.6	50	46	198	47.4	60	51	202	
		MED			45.9	50	49	235	49.7	60	53	239	
		HIGH			53.8	60	58	261	57.6	70	62	265	
	460-3-60	STD	0.25	1.8	20.1	25	21	97	21.9	25	23	99	
		MED			20.9	25	22	116	22.7	25	24	118	
		HIGH			25.3	30	27	129	27.1	30	29	131	
	575-3-60	STD	0.24	3.8	14.8	20	16	79	18.6	20	20	83	
		MED			15.2	20	16	94	19.0	25	21	98	
		HIGH			18.3	20	19	108	22.1	25	24	112	
RGS120	208/230-3-60	STD	0.48	3.8	48.5	60	51	263	52.3	60	56	267	
		MED			53.3	60	57	306	57.1	70	61	310	
		HIGH			58.3	70	62	315	62.1	70	67	319	
	460-3-60	STD	0.25	1.8	23.7	30	25	125	25.5	30	27	127	
		MED			25.5	30	27	147	27.3	30	29	149	
		HIGH			28.5	35	31	151	30.3	35	33	153	
	575-3-60	STD	0.24	3.8	17.9	20	19	95	21.7	25	23	99	
		MED			18.7	25	20	106	22.5	25	24	110	
		HIGH			21.5	25	23	120	25.3	30	27	124	
RGS150	208/230-3-60	STD	0.48	3.8	65.5	80	69	365	69.3	80	73	369	
		MED			68.0	80	72	382	71.8	80	76	386	
		HIGH	Model not available due to high amperage draw.										
	460-3-60	STD	0.25	1.8	31.7	40	33	183	33.5	40	35	185	
		MED			32.7	40	35	192	34.5	45	37	194	
		HIGH			35.7	45	38	196	37.5	45	40	198	
	575-3-60	STD	0.24	3.8	24.0	30	25	144	27.8	30	30	148	
		MED			24.0	30	25	144	27.8	30	30	148	
		HIGH			26.8	30	29	158	30.6	35	33	162	

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.

LEGEND:

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

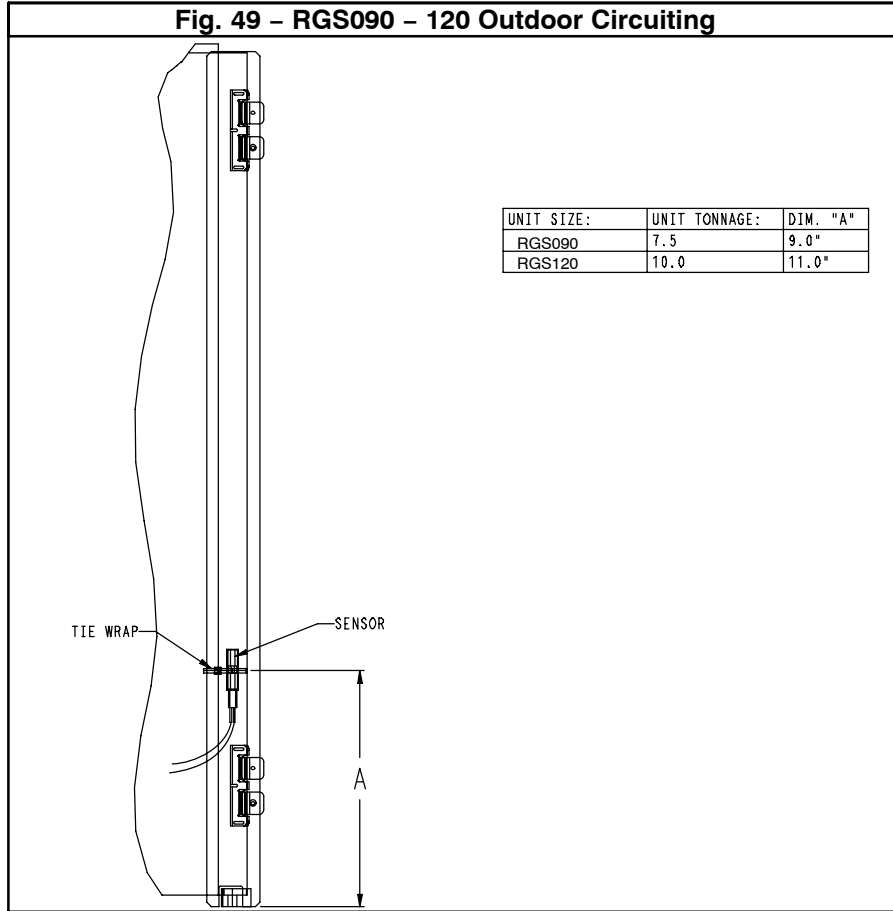


NOTES:

- 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.
- 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.

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

APPENDIX V. MOTORMASTER SENSOR LOCATIONS



NOTE: The low ambient kit for the 12.5 ton unit utilizes a pressure transducer, and therefore there is no Motormaster temperature sensor location for this unit.

UNIT START-UP CHECKLIST

I. PRELIMINARY INFORMATION:

MODEL NO.: _____

TECHNICIAN: _____

DATE: _____

BUILDING LOCATION: _____

SERIAL NO: _____

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

- 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)	_____
REFRIGERANT SUCTION	CIR 1	_____	PSIG
	CIR 2	_____	PSIG
REFRIGERANT DISCHARGE	CIR 1	_____	PSIG
	CIR 2	_____	PSIG
		_____	TEMP °F
		_____	TEMP °F

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