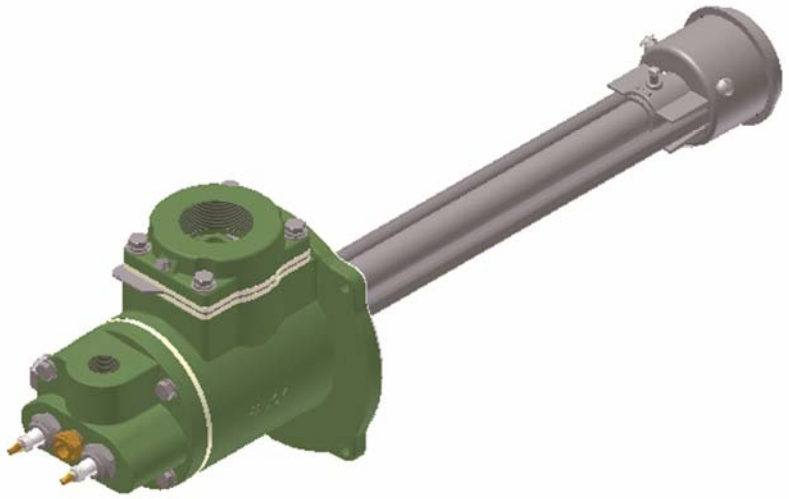
RFG RADIFLAME GAS BURNER



WARNING

These instructions are intended for use only by experienced, qualified combustion start-up personnel. Adjustment of this equipment and its components by unqualified personnel can result in fire, explosion, severe personal injury, or even death.

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WARNING

This equipment is potentially dangerous with the possibility of serious personal injury and property damage. Hauck Manufacturing Company recommends the use of flame supervisory equipment and fuel safety shutoff valves. Furthermore, Hauck urges rigid adherence to National Fire Protection Association (NFPA) standards and insurance underwriter's requirements. Operation and regular preventative maintenance of this equipment should be performed only by properly trained and qualified personnel. Annual review and upgrading of safety equipment is recommended.

A. GENERAL INFORMATION

The Hauck RFG Radiant Tube Burners provide improved flame stability and uniform heat distribution in all types of radiant tube applications. The RFG Series Burners fire any clean industrial gas and will accommodate preheated air up to 800°F (425°C).

RFG burners typically operate with automatic control systems. The burners are capable of cross-connected ratio, high/low, or high/off control over their entire capacity range. If the maximum firing rate does not allow a high turndown, high/low or high/off control may be more appropriate.

RFG burners use an air-cooled igniter and are designed to accommodate an air cooled flame rod. UV flame supervision is also available.

B. RECEIVING AND INSPECTION

Upon receipt, check each item on the bill of lading and/or invoice to determine that all equipment has been received. A careful examination of all parts should be made to ascertain if there has been any damage in shipment.

IMPORTANT

If the installation is delayed and the equipment is stored outside, provide adequate protection as dictated by climate and period of exposure. Special care should be given to all motors and bearings, if applicable, to protect them from rain or excessive moisture.

C. BURNER CAPACITIES

NATURAL GAS, AMBIENT COMBUSTION AIR OPERATION

SPECIFICATIONS		BURNER MODEL			
		120B	220B	125B	225B
Maximum Capacity(10% Excess Air)	**(BTU/hr)**	**500,000**	**500,000**	**880,000**	**880,000**
	(kW)	**130**	**130**	**230**	**230**
Air Capacity	(scfh)	5,180	5,180	9,100	9,100
	(nm^3/hr)	139	139	244	244
Air Inlet Pressure	(in.w.c.)	27.7	13.9	27.7	18.7
	(mbar)	68.9	34.5	68.9	46.5
Gas Inlet Pressure	(in.w.c.)	3.5	3.5	8.5	8.5
	(mbar)	8.7	8.7	21.1	21.1
Flame Length	(in)	120	120	132	132
	(m)	3.0	3.0	3.4	3.4
Operating Limits	(Excess Air)	450%	450%	325%	325%
	(λ)	5.5	5.5	4.3	4.3

NATURAL GAS, 800°F/425°C PREHEATED COMBUSTION AIR OPERATION

SPECIFICATIONS		BURNER MODEL			
		120B	220B	125B	225B
Maximum Capacity(10% Excess Air)	**(BTU/hr)**	**320,000**	**320,000**	**560,000**	**560,000**
	(kW)	**80**	**80**	**150**	**150**
Air Capacity	(scfh)	3,330	3,330	5,855	5,855
	(nm^3/hr)	89	89	157	157
Air Inlet Pressure	(in.w.c.)	27.7	13.9	27.7	18.7
	(mbar)	68.9	34.5	68.9	46.5
Gas Inlet Pressure	(in.w.c.)	2.7	2.7	6.4	6.4
	(mbar)	6.7	6.7	15.9	15.9
Flame Length	(in)	90	90	100	100
	(m)	2.3	2.3	2.5	2.5
Operating Limits	(Excess Air)	360%	360%	260%	260%
	(λ)	4.6	4.6	3.6	3.6

NOTES:

1. Capacities based on Natural Gas with HHV of 1034 BTU/ft^3 (Standard), and LHV of 10.21 kWh/nm3 (Metric), 0.59 S.G., and a stoichiometric ratio of 9.74:1 with burner firing into chamber under no pressure. At less than 25% of maximum capacity, 100% excess air operation is recommended and above 25% of maximum capacity, 10% excess air operation in recommended.
2. Air and fuel flows based on STP operating conditions at sea level and industry standard air and gas piping practices.
3. Gas inlet pressure given for reference only and should not be used for measuring fuel flow to the burner.
4. Flame lengths measured from end of the ignition nozzle and are affected by tube diameter, tube geometry and operating conditions.
5. Flame detection via UV scanner or flame ionization rod.
6. Ignition limits are established with direct spark igniter, metered air and fuel flows and 5kV/15mA spark ignition transformer; for limits listed as "N/R" ignition is Not Recommended at this capacity.
7. Burner is suitable for use on gaseous fuels other than Natural Gas, including propane gas, liquid petroleum gas and coke oven gas.
8. Burner is suitable for use on push, push-pull or pull through type systems.
9. Maximum tube diameter 7.5 Inches (190 mm) for RFG_20 and 9.25 Inches (235mm) for RFG_25. For tubes exceeding these diameters, an auxilliary tube is required; consult Hauck.

Table 1. Burner Capacities

D. DIMENSIONS

See appropriate Dimension sheet for detailed dimensional information.

E. INSTALLATION

1. Typical mounting arrangements for the RFG burners are shown in Figure 1. The arrangement used will depend on the relationship between the mounting plate and the diameter of the tube.

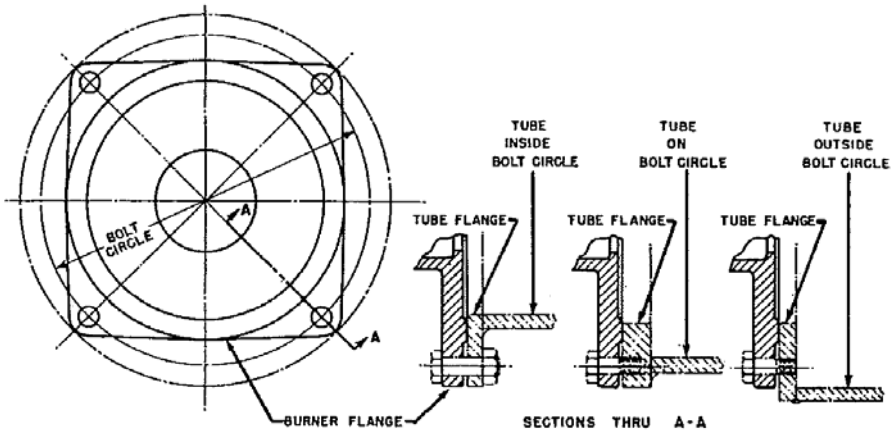

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Figure 1. Three Typical Flange Mounting Arrangements

2. The RFG burners must be properly centered in either the tube or an auxiliary air sleeve to ensure that the ignition nozzle to tube or sleeve gap is properly maintained. There are three adjusting screws (25) on the ignition nozzle (see Figure 3). **These screws must be adjusted to equal lengths** so that the OD formed by the heads of the screws allows the burner to slide snugly into and against the ID of the tube or auxiliary air sleeve. To adjust the screws, loosen the locking nuts (24). After all screws have been properly adjusted, tighten the locking nuts.

3. When the actual tube ID (dimension 'I') is exceeded, an auxiliary air sleeve must be inserted into the tube. The auxiliary sleeve fits inside the radiant tube and must be utilized as the area between the ignition nozzle and the tube meters the flow of burner combustion air. If the tube ID exceeds the maximum dimension, the auxiliary sleeve must be specified on the order. Be sure the actual installation corresponds to the original specification.

4. Prepare the end of the tube to accept the mounting bolts of the RFG burner mounting flange.

5. Make sure that the burner gas and air inlets are properly aligned to meet the piping requirements. The gas inlet may be located in any position. To rotate the gas inlet (refer to Figure 3):

   A. Loosen cooling air connections to the burner. (15)
   B. Loosen the four screws holding on the burner backplate (20).
   C. Rotate the gas inlet assembly to the desired position.
   D. Inspect the backplate gasket (17) to ensure that it is in good condition.
   E. Tighten the burner backplate screws and cooling air connections.

6. Insert the RFG burner with flange gasket into the end of the tube and securely bolt it into place.

7. Connect the fuel and air supply lines to the appropriate connections on the burner, and connect a clean, unheated air source to the 1/8 NPT (DN3) purge connection located on the burner body to cool the spark igniter (identified with an “I”) and the flame safety device being used (flame rod or UV scanner, identified with an “F”). Cooling air flow should be no less than 100 scfh (2.7 nm^3/hr).

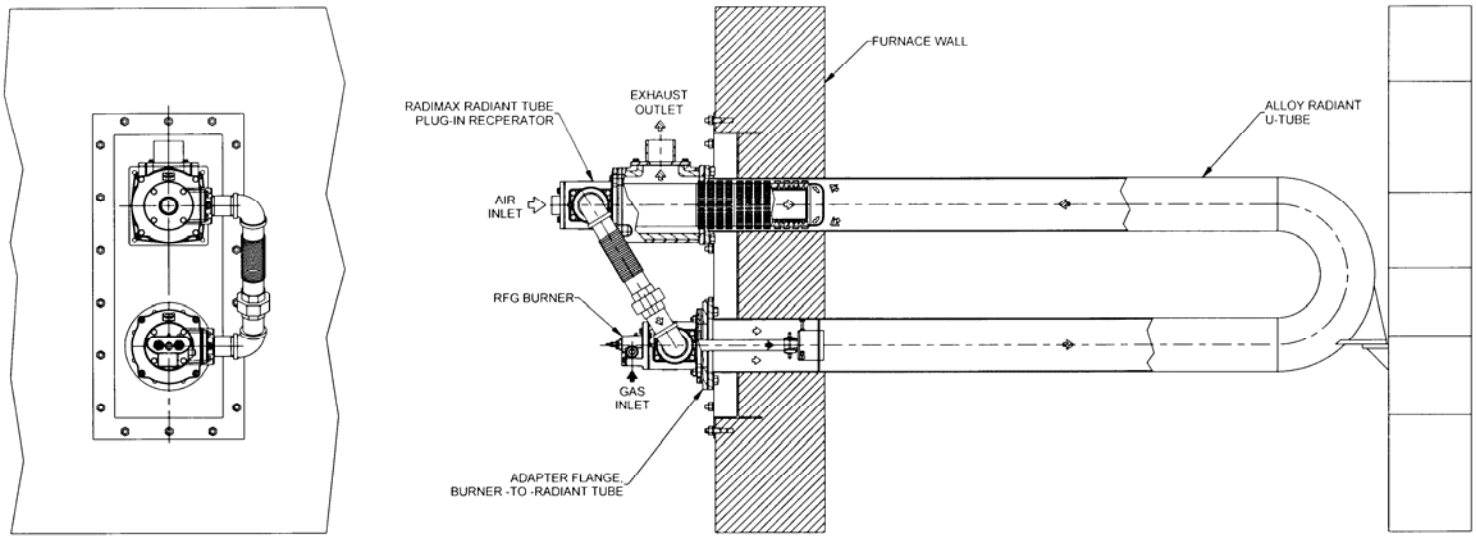
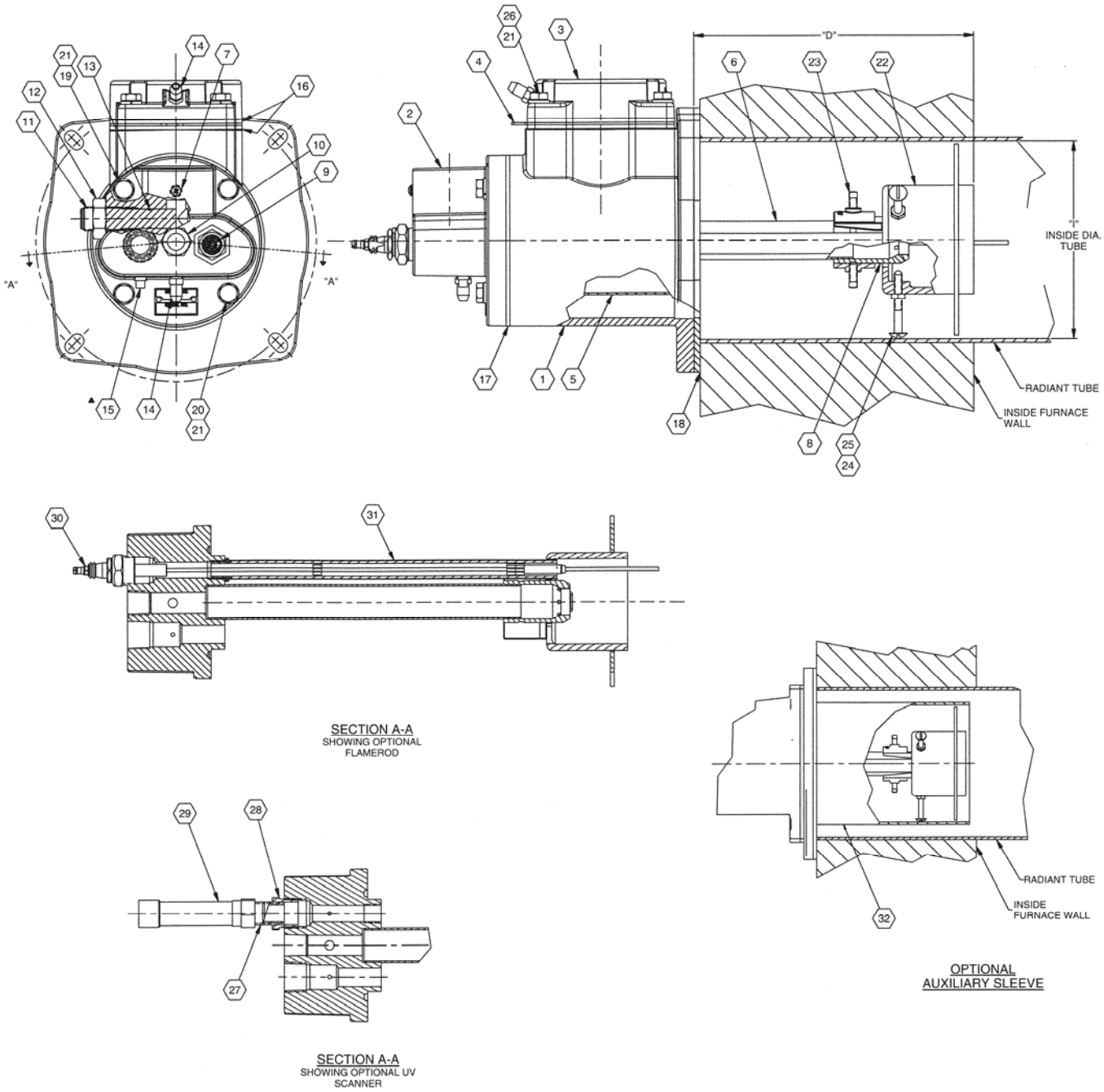


Figure 2. Typical Installation Radimax Plug-In Recuperator W/RADiflame Gas Burner



NOTES
1. DIMENSIONS "D" & "I" MUST BE SPECIFIED WHEN ORDERING REPLACEMENT PARTS
2. ▲ - PLUG ONLY REQUIRED LESS FLAMEROD AND SCANNER OPTION

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Figure 3. Components

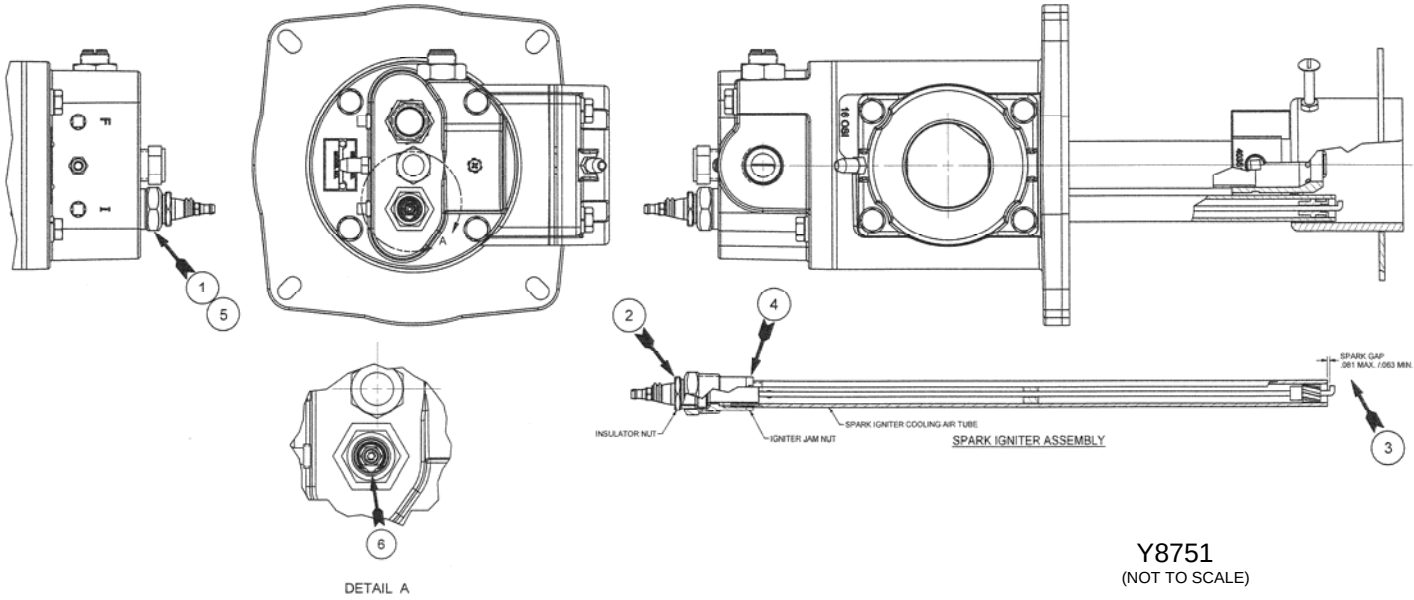
WARNING

Adjustment of this equipment by unqualified personnel can result in fire, explosion, severe personal injury, or even death.

F. IGNITION

Ignition of the RFG burner can be accomplished by a direct spark igniter. A 5000/6000 volt standard coil type ignition transformer or a half-wave "spark blind" solid state type transformer can be utilized. Both transformers yield satisfactory results, however, the standard coil type transformer provides reliable ignition over a wider range of air/fuel ratios than the half-wave type.

1. The RFG burner incorporates a self-contained, fully removable, air-cooled spark igniter assembly for reliable spark ignition. The air-cooled spark igniter is cooled directly through the burner body via a 1/8 NPT (DN3) connection allowing at least 100 scfh (2.7nm^3/hr) at a pressure of 10-100 "wc (2.5 – 25 kPa). Proper orientation of the spark igniter is shown in Figure 4.



SPARK IGNITER REPLACEMENT & ADJUSTMENT INSTRUCTIONS

1. UN-SCREW AND REMOVE SPARK IGNITER ASSEMBLY FROM BURNER BACKPLATE ASSEMBLY.
2. FOR SPARK PLUG REPLACEMENT LOOSEN INSULATOR NUT SO OLD SPARK PLUG CAN BE REPLACED WITH NEW SPARK PLUG. IF ONLY FOR ADJUSTMENT SKIP TO STEP 4.
3. AFTER RE-INSTALLING NEW SPARK PLUG ASSEMBLY CHECK SPARK GAP.
4. IF SPARK GAP IS NOT WITHIN TOLERANCE, LOOSEN IGNITER JAM NUT AND ADJUST SPARK IGNITER COOLING AIR TUBE. TURN AIR TUBE CLOCKWISE TO INCREASE SPARK GAP AND COUNTERCLOCKWISE TO DECREASE GAP.
5. AFTER SPARK GAP IS ACHEIVED RE-TIGHTEN SPARK IGNITER JAM NUT & RE-INSERT SPARK IGNITER ASSEMBLY BACK IN IGNITER PORT MARKED WITH "I" DESIGNATION AND SECURE.
6. NOTE: AFTER IGNITER IS SECURE MAKE SURE FLAT ON INSULATOR FACES AWAY FROM CENTER OF BURNER. IF FLAT IS NOT IN PROPER ORIENTATION LOOSEN INSULATOR NUT AND ADJUST INSULATOR TO CORRECT POSITION. RETIGHTEN INSULATOR NUT, BUT DO NOT OVERTIGHTEN OR INSULATOR WILL CRACK.

Figure 4. Spark Igniter Replacement & Adjustment Instructions

CAUTION
Assembly may be HOT and should be allowed to cool before handling! All electrical devices should be de-energized to prevent electrical shock!

WARNING

If standard coil ignition transformer is used, provisions must be made to eliminate the ignition spark falsely satisfying the “flame on” UV sensor. Hauck designed flame supervisory panels accomplish this by “timing out” the spark transformer after a short (10 seconds for most applications) trial for ignition.

G. INITIAL SET-UP

RFG burners typically operate with automatic control systems. The burners are capable of cross-connected ratio control over their entire capacity range, or high/low or high/off control if required by the specific application. In a typical system, ignition will be preceded by a series of steps:

NOTE

For safety reasons, it is recommended that the burner be ignited under low fire conditions for the initial set-up.

1. Once installed, the burner is ready for initial set-up. The specific operation of the burner will depend on the individual system components in the entire combustion system. Refer to the instruction sheets that accompany the individual components.

2. Combustion air pressure should be set by the combustion air control valve. Typical settings will be specific to the application. Hauck recommends that the combustion air settings remain at minimum until the burner has been ignited (refer to the burner capacities in Section C for burner air flows at low fire conditions).

3. Adjust the integral limiting orifice valve in the backplate of the burner to the required opening. (Readjustment of the limiting orifice may be necessary for final burner set-up).

4. Refer to Section F for spark igniter set-up.

5. Once the spark igniter is set and the initial gas and air adjustments are made, the burner can be ignited. When all burners are ignited, increase the combustion air to the high fire position (refer to burner capacities in Section C for burner air flows at high fire conditions).

6. Once the high fire combustion air is set, adjust the limiting gas orifice valve to achieve the desired gas flow at high fire.

7. Verify air/gas ratio using orifice meters in the air and gas lines.

8. Drive the burner to the low fire position and verify that low fire air and gas flows are set as desired. Repeat steps 6 and 7 as necessary until high and low fire settings remain consistent.

9. To shut down the burner system:
   A. Return the burner to low fire position.
   B. Close all fuel shutoff valves.
   C. To prevent damage to the burner and other components, allow the furnace to cool to below 800°F (425°C) before shutting off the combustion air.

H. OPERATION

Once properly installed, ignited and fired, the burner is ready for operation. The operation of the burner will depend on the specific items in the combustion control system and the application of the burners. Refer to the instruction sheet that accompanies each item. When the burner is operating, the spark igniter can be shut off since the burner is designed to maintain ignition of the air/gas mixture. In any case, cooling air should remain constant to assure optimum igniter and flame safety service life.

If using preheated combustion air, there are restrictions to operation. The maximum preheated combustion air temperature should not exceed 800°F (425°C). Low fire performance of certain recuperators can raise the preheated combustion air temperature dramatically. This occurs because as the burner capacity drops for low fire, the recuperator becomes oversized for the lower capacity. The preheated combustion air temperature at low fire should be determined prior to use. If air temperatures exceed the maximum of 800°F (425°C), one of the following options must be used:

1. Increasing the air/fuel ratio at reduced flows (excess air operation).
2. Adding dilution air to the hot combustion air before it enters the burner.

A burner using hot combustion air should not be insulated. This allows the burner body to maintain an acceptable equilibrium temperature. Suitable notice and protection must be provided around the burner to prevent accidental operator contact.

When using hot combustion air, cooling air to the spark igniter, flame rod, or UV scanner, and air to any pilot must be provided at ambient air temperature.

Shutdown of a burner using preheated combustion air is accomplished by first returning the burner to low fire, closing all fuel shutoff valves, and allowing the furnace to cool to approximately 800°F (425°C) before stopping flow of combustion air. While cooling down the furnace, ambient cooling air must be supplied to the spark igniter and flame supervision components.

NOTE

If a loud, roaring noise occurs, it could be resonance, gradually restrict the exhaust outlet leg of the tube until the resonance is eliminated. This can be done with a stainless steel plate. **Do not attempt to restrict the tube while the burner is firing.** Shut down the burner, place the restriction on the tube then resume firing the burner. **Never completely restrict the end of the tube.** When minimum noise is reached, the plate can be welded to the tube.

I. MAINTENANCE

The RFG burner design and use of clean fuel gas makes the system virtually maintenance free. For long life and optimum operation, however, it is recommended that the burner be periodically removed for cleaning.

Periodically check the air/gas ratio to ensure the burner is operating at peak efficiency. Flue gas analysis can be performed with any commercially available flue gas analyzer.

J. RECOMMENDED SPARE PARTS LIST

Item	Qty.	Part Number	Description
1	1	See Parts List	Air Cooled Spark Igniter Assembly (If Applicable)
2	1	See Parts List	UV Scanner (If Applicable)
3	1	See Parts List	Flame Rod Assembly (If Applicable)

Table 2. Recommended Spare Parts