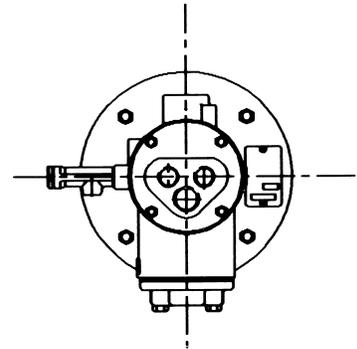


## Installation and Maintenance Instructions

### Air Inlet Arrangement

RAMFIRE® Burners are furnished in standard position illustrated at right. Since burner block is round, the entire burner assembly may be installed and/or rotated when mounting into combustion chamber wall. This will permit matching up to field site piping. Positions which would allow dirt or debris to fall down and block flame supervision port should be avoided.



Air inlet down is standard

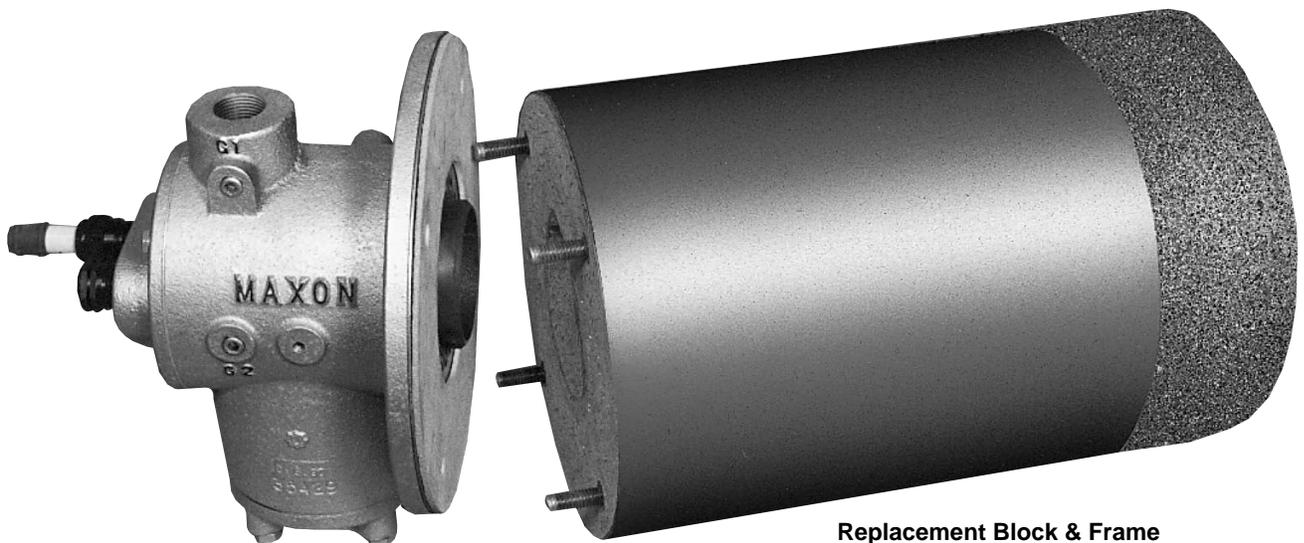
### Burner Block Replacement

If the refractory block of your RAMFIRE® Burner ever requires replacement, Maxon can supply replacement block and frame sub-assemblies.

When ordering refractory block/frame sub-assemblies, identify refractory block material code stamped on the bolt heads of your existing RAMFIRE® Burner.

#### To install a new block sub-assembly:

1. Secure heat processing equipment from operation following manufacturer's instructions.
2. Disconnect piping, etc. and remove RAMFIRE® Burner from installation.
3. Loosen and remove the nuts holding the burner body to the burner block.
4. Remove old block assembly and remount new block assembly. Be sure gasket between block and body is in place between the components.
5. Secure the block to the body by retightening the nuts onto the block studs.
6. Re-install burner, following installation instructions.



Replacement Block & Frame  
Sub-Assembly

## Installation Instructions

### General Instructions

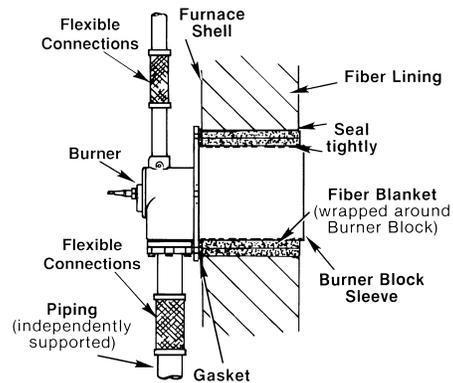
The burner itself is normally only a part of your complete combustion system. Additional pipe train accessories and control components will be required for a complete system installation. The sketch below shows a typical pipe train system as might be used with RAMFIRE® Burners.

**Important: Do not discard packing material until all loose items are accounted for.**

To prevent damage in transit, the control valves, pipe trains, spark ignitor, mounting gaskets, and connecting linkage components may be packed separately and shipped loose with your new Maxon RAMFIRE® Burner.

RAMFIRE® Burners can fire in any direction, but the scanner manufacturer may impose limitations. Avoid orientations which might permit flame supervision ports to collect debris and/or moisture.

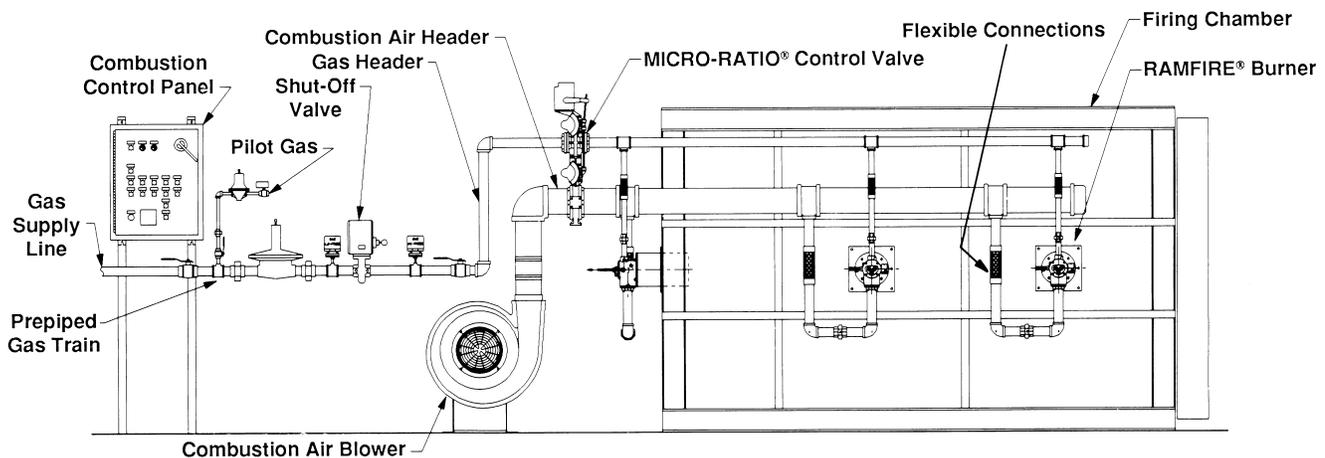
Include observation ports in your combustion chamber design to provide a view of both main and pilot flame area. This will simplify start-up and adjustment procedures.



Burner block and casting failure is frequently the result of external stresses and strains transmitted to the burner through the piping. Flexible connections are recommended in all piping to reduce piping stresses and alignment/shifting problems. Installation of such connectors at certain key spots in the air or gas manifolding can prevent damage to the burners from uneven thermal expansion.

**Gas check valves** should be horizontally installed in multi-burner applications as close as possible to each burner inlet for dependable light-off. (Gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period.)

### Typical installation diagram of RAMFIRE® Burner system



Maxon assumes no responsibility for the use or misuse of the piping layout shown. Specific piping and wiring diagrams should always be submitted to the appropriate agencies for approval on each application.



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**INDUSTRIAL COMBUSTION EQUIPMENT AND VALVES**

## Installation Instructions (continued)

**RAMFIRE® Burner** requires a separate combustion air blower. The nozzle mixing burners serve as their own fuel/air mixing device.

The blower should not be exposed to direct radiant heat or positioned where it might draw in inert gases. If problems exist, consider relocation.

**Electrical service** must match the voltage, phase and cycle of all electrical system components and be compatible with burner nameplate ratings. Insure that all normal control safeguards are satisfied. Combustion air blower should continue to run after shutdown to allow burner to cool.

**Gas supply piping** must be large enough to maintain the required fuel pressures cataloged for the particular burner size used with burner operating at full-rated capacity.

Anything more than minimal distance or piping turns may necessitate oversizing piping runs to keep pressure drops within acceptable ranges.

If multiple burners are fed from a single gas train, care should be taken to minimize pressure drop and give maximum uniformity.

**Clean fuel lines** are essential to prevent blockage of pipe train components or burner gas ports.

**Main shut-off cock** should be upstream of both the main gas regulator and pilot line take-off. Use it to shut off fuel to both pilot and main burner during shut-down periods of more than a few hours.

The fuel throttling MICRO-RATIO® Valve with a Maxon RAMFIRE® Burner is not intended for tight shut-off.

**Main gas regulator** is essential to maintain a uniform system supply pressure. If one pipe train supplies multiple burners, provide a separate regulator in the branch leading to each burner system.

Size the regulator for full system capacity at the required pressure, carefully considering pipe train losses. Follow the instructions attached to the regulator during installation.

**Pilot take-off** should be upstream of the main gas regulator, but downstream of the main gas cock. It should normally include its own pilot gas regulator, a solenoid valve, and shut-off cock. A pilot adjustable orifice at the pilot inlet simplifies adjustment.

**Pilot piping** must be large enough to provide for the full flow and pressures shown in the catalog for your particular burner size.

**Fuel shut-off valves** (when properly connected to a control system) are designed to shut the fuel supply off with a loss of electrical power. **Manual reset valves** require operator attendance each time the system is started up (or restarted after a shut-down).

**Motorized shut-off valves** permit automatic start-restart when used with an appropriate control system.

**Test connections** are essential for burner adjustment. They should be provided immediately upstream of the burner and are included in the burner itself.

**Test connections must be plugged except when readings are being taken.**

**Blower location** must deliver a reasonably clean and cool air supply. Care must be taken to keep air manifold pressure drops to a minimum and to independently support the weight of air piping.

**Gas and air piping** should be located reasonably close to the burner and sized for the pressure and volume requirements of the burner, with supply pressures high enough to permit subsequent regulation at each burner. Gas piping drops should not exceed 10% of initial supply pressure.

**Control systems** should provide all normally recommended interlocks (including operation of fuel shut-off valves). **Sequencing control systems** are available from Maxon that include provision for post-purge pilots during all but emergency shut-downs.

**Control system's circuitry** must not allow main fuel shut-off valve to be opened unless combustion air is on, and must de-energize valve upon loss of combustion air pressure, along with the other usual system interlocks. Motor starter is to be interlocked with valve, along with a combustion air pressure switch.

**Flame sensing is accomplished by UV scanner.** UV scanner should be kept as close to burner as feasible. Heat block, if used, may affect signal strength with some brands of scanners.

**Low fire start** and interrupted pilot are essential to obtain cataloged minimums.

**Burner and pipe manifold support** will be required to support weight of the burner and any connected pipe train components. Air control motors, in particular, require additional support. Maxon connecting base and linkage assemblies are designed to position the control motors to work with the control valve, not to support their weight.

**Multi-burner installations** require special considerations if supplied by a common pipe train and/or air supply. **Air and Gas Balancing Valves** should be used for improved heating uniformity; **Gas Swing Check Valves** may be installed in horizontal pipe and as close as possible to each burner inlet for dependable light-off (gas manifold may otherwise act as a reservoir, preventing light-off during trial-for-ignition period).

## Installation Instructions (continued)

### Burner Mounting

Prepare burner mounting as follows:

**In a refractory wall** (sketch 1), basic burner may be used with castable refractory rammed into the space around burner, supported with angle iron and retained by mastic-coated anchors. The burner block should be coated with a mortar for good adhesion between it and the castable refractory material. The remaining gap should be packed with ceramic fiber insulation.

**In a soft wall** (sketch 2), burner should be specified with optional burner block sleeve and wrapped tightly in fiber blanket. Remaining space should be packed with ceramic fiber insulation.

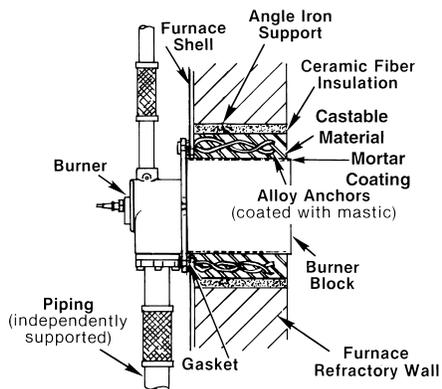
For maximum burner life, burner frame and furnace shell must be protected from hot gas flows. Use high temperature gasketing between burner mounting flange and furnace shell.

Check visually that no obstructions exist in front of the burner, then prepare a shell opening up to 1" larger than burner diameter (2" larger through refractory part of wall). Attach studs to furnace shell or weld angle iron from buckstay to buckstay if additional support is required, checking location carefully for appropriate burner arrangement.

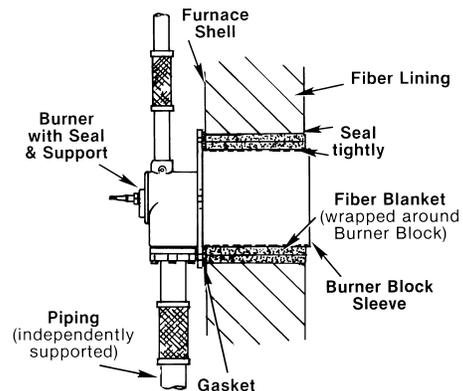
**NOTE: Discharge face of burner should be flush with inner furnace wall for maximum recirculation effectiveness. Entire burner may be rotated about its centerline to mount in any position.**

**Mount burner** in position and draw up mounting bolts to provide support. Overtightening will prevent lateral expansion of the furnace plate and can cause destructive stresses.

1



2



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**INDUSTRIAL COMBUSTION EQUIPMENT AND VALVES**

## Start-Up Instructions

Read complete instructions before proceeding, and familiarize yourself with all the system's equipment components. Verify that your equipment has been installed in accordance with the original manufacturer's current instructions.

**CAUTION: Initial adjustment and light-off should be undertaken only by trained and experienced personnel familiar with combustion systems, with control/safety circuitry, and with knowledge of the overall installation. Instructions provided by the company and/or individuals responsible for the manufacture and/or overall installation of complete system incorporating Maxon burner take precedence over these provided by Maxon. If Maxon instructions conflict with any codes or regulations, contact Maxon Corporation before attempting start-up.**

**NOTE: The following instructions assume use of piloted burners and Standard Cam MICRO-RATIO® Valves:**

The photograph below shows a MICRO-RATIO® Valve assembly consisting of an air butterfly valve to control combustion air flow and an adjustable-gradiant SYNCHRO gas flow control valve. The latter is mechanically linked to the air valve and a series of adjusting screws permits setting of a desired air/fuel ratio throughout the burner firing range. A pneumatic or electric control motor will normally be mounted to this MICRO-RATIO® Valve assembly and establish firing rates in accordance with system demands.

**Additional data on Maxon MICRO-RATIO® Valves is provided in catalog bulletin 7000.**



**Test connections** are essential for burner adjustment. Each RAMFIRE® Burner includes air and fuel test connections but additional connections should be provided (at minimum) downstream of the regulator and MICRO-RATIO® Valve.

Do not attempt to use test connections in pipe elbows or tees, as internal turbulence can give erroneous readings. **Test connections must be plugged except when readings are being taken.**

### For initial system start-up:

1. **Close all burner fuel valves and/or cocks.** Make preliminary adjustments to regulators.
2. **Check all electric circuitry.** Verify that all safety devices and interlocks are operable and functioning within their respective settings/ranges. Be sure all manifolds are tight and that test ports are plugged if not being used.
3. **Check that all duct and chamber dampers are properly positioned** and locked into operating positions.

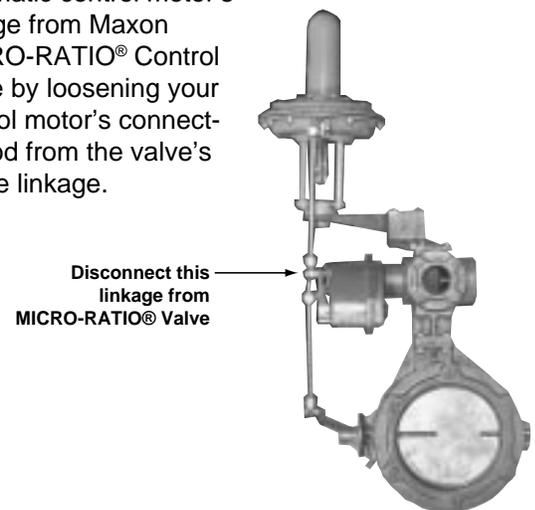
**Vent dampers and pressure controllers should be used to maintain balanced or slightly positive furnace pressures (0.0" to 0.05" wc) for maximum efficiency.** Excessive back pressure can damage furnace and/or reduce burner capacity. Negative pressures allow infiltration of secondary air and can seriously affect efficiency and temperature uniformity.

4. **Start all system-related fans and blowers.** Check for proper motor rotation and impeller direction. Verify that all safety interlocks are working. Allow air handling equipment to run for adequate purge of manifold and combustion chamber plenums.

**CAUTION: Do not by-pass control panel timers typically controlling sequential operations.**

5. **Initial start-up adjustment should only be accomplished during a "manual" control mode.**

Using a 3/16" allen wrench, disconnect the automatic control motor's linkage from Maxon MICRO-RATIO® Control Valve by loosening your control motor's connecting rod from the valve's toggle linkage.

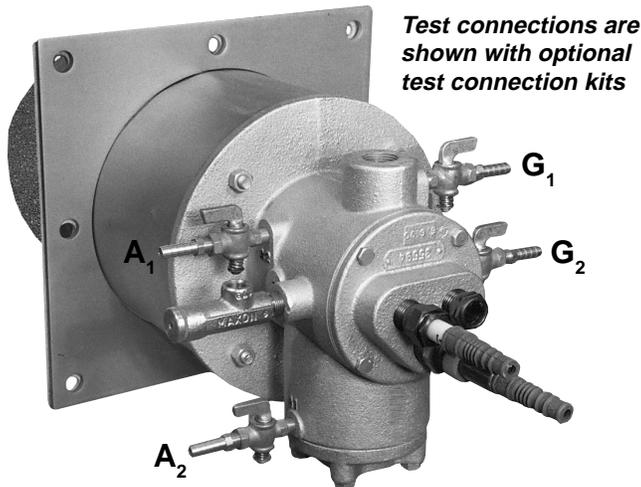


## Start-Up Instructions (continued)

6. Series "G" RAMFIRE® Burners include built-in test connections both upstream and downstream of internal fuel and air orifices. To achieve rated capacities, adjust MICRO-RATIO® Control Valve to give the differential pressures indicated on charts on page 4300-S-9.

**Gas differential pressures** read across burner's built-in gas test connections  $G_1$  and  $G_2$  (shown in photo below) are shown in Chart 1. Note that natural gas flows are in standard cubic feet/hour and are gas differential readings across burner gas test connections (not inlet gas supply) pressure in inches w.c.

**For propane firing**, these differential gas pressure readings would be 40% of these indicated for the equivalent natural gas heat releases.



**Combustion air differential pressures** read across burner's built-in air test connections  $A_1$  and  $A_2$  (shown in photo above) are shown in Chart 2. Note that graph for 2" RAMFIRE® begins at 0.2" wc differential. This is required minimum for 2" size.

Maxon offers a "test connection kit" accessory which provides a convenient means of connecting plastic tubing to the burner test port connections. Kit should be removed after initial start-up and the test ports plugged for normal burner operations.

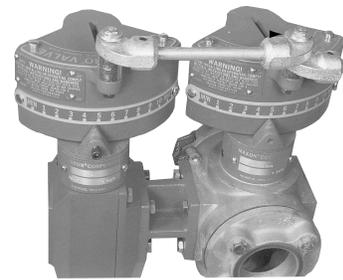
General: To achieve rated capacities, a RAMFIRE® Burner must be adjusted to give the specific air and gas differential pressures as indicated in the charts shown on pages 4300-S-9.

7. **Set minimum air differential pressure at 0.1" w.c.**

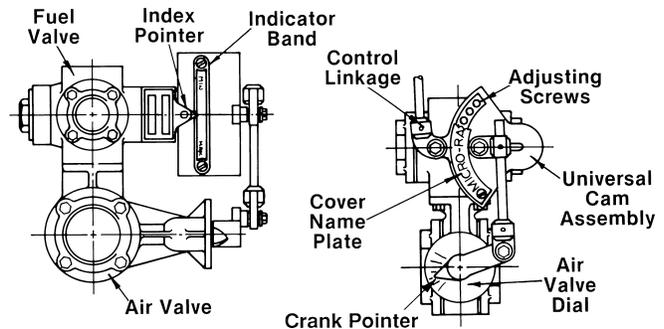
With MICRO-RATIO® Valve combinations of air and fuel valves, the minimum differential setting is initially established with the **air valve only**.

Disconnect the linkage between the air valve and fuel valve(s) on the MICRO-RATIO® Valve assembly.

Loosen to separate air valve movement from fuel valve(s) travel



Rotate the air valve while watching the manometer for the minimum air differential pressure of 0.1" wc. (Note: This is a very small increment on a normal manometer. Readings/settings above 0.1" wc will lessen turndown ratio of burner system.) Then mark red air valve dial (see sketch below) opposite crank pointer.



8. **Establish the maximum combustion air differential pressure** by moving MICRO-RATIO® Valve assembly toward the higher numbered positions until the desired air differential (in accordance with burner specifications) is reached. Again, mark red air valve dial opposite crank pointer (refer to Chart 2 on page 4300-S-9).



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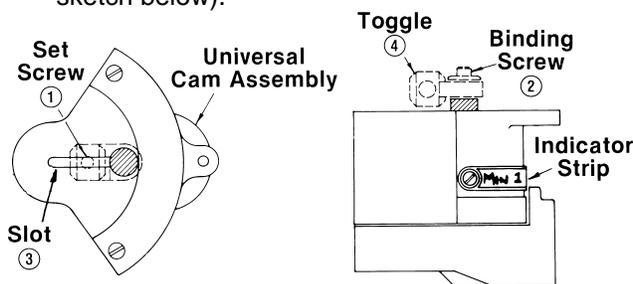
**INDUSTRIAL COMBUSTION EQUIPMENT AND VALVES**

## Start-Up Instructions (continued)

**For example:** A combustion system may need the air valve to only be 15° open for the “minimum” setting and the “maximum” requirements are satisfied with the air valve open to 60°. By marking these points on the air valve’s indicating strip, you are ready to reconnect the SYNCHRO Fuel Valve’s linkage to the air valve.

### 9. Reconnect the SYNCHRO Fuel Valve linkage to the MICRO-RATIO® assembly’s air valve.

Having marked the MICRO-RATIO® air control valve’s settings for both minimum and maximum firing positions, you may adjust the linkage and travel of the SYNCHRO gas valve’s stroke (see sketch below).



Loosen Allen set screw [1] and binding screw [2] in toggle [4]. Move the toggle in universal cam assembly slot towards the center of rotation so that gas valve can rotate from its minimum to maximum position, while the air valve swings between the established (and marked) minimum and maximum settings.

Place air valve on pre-determined “minimum” position and rotate gas valve to its “minimum” setting position. Tighten down set screw [1] and binding screw [2] with both valves set at “minimum”.

Establish set screw [1] as minimum-end adjustment point and binding screw [2] as maximum-end adjustment point. (Note: It doesn’t matter which is maximum or minimum, as long as you identify and keep the same reference points for the next adjustment steps.)

Now rotate MICRO-RATIO® Valve to “maximum” position. The air valve maximum setting was previously determined. Loosen binding screw [2] and adjust pointer and linkage to correct just half of the distance required to make the air valve pointer indicate the maximum air valve setting.

Re-tighten binding screw [2] and return the MICRO-RATIO® Valve to the “minimum” air setting.

This time, loosen set screw [1] and again correct for just half of the distance required to make the air valve pointer indicate the minimum air valve setting.

Re-tighten set screw [1] and again return the MICRO-RATIO® Valve to its maximum position.

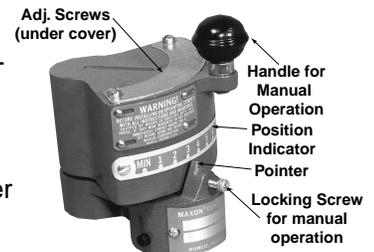
Similarly, correct one half the distance with binding screw [2] for the maximum setting, etc.

**Continue this adjustment procedure until the gas and air valves reach their minimum and maximum positions simultaneously.**

Normally, this is accomplished within seven adjustments.

### 10. To prepare Maxon MICRO-RATIO® Valve for initial fuel firing adjustment:

**Remove cover plate** from screw carrier cam assembly and turn all adjusting screws counter-clockwise until flush with outer surface of casting (new equipment is shipped this way).



**If multiple fuel arrangement**, adjust linkage rods and toggle arrangements between SYNCHRO Fuel Control Valve(s) so that all fuel control valves travel together (from minimum to maximum positions). Leave MICRO-RATIO® Valve(s) at “minimum” position, as shown by pointer on position indicator strip.

11. **To light and adjust gas pilot:** Check to insure combustion air supply is flowing to burner. Pilot gas regulator should initially be set at approximately midpoint of its adjustment range. With pilot gas solenoid closed, open main fuel gas and pilot gas cock. Energize spark ignitor and pilot gas solenoid. Turn pilot gas adjustable orifice screw out (counter-clockwise) several turns from its fully seated position. Observe ignition of pilot gas through sight port of burner assembly and/or by viewing flame signal metered from flame safeguard relay circuit.

## Start-Up Instructions (continued)

Refine pilot gas setting for a hard blue flame (and/or strongest flame signal) by adjusting gas flow through pilot orifice and/or pilot regulator.

Shut off pilot gas cock to extinguish pilot fire. Reopen and confirm easy re-ignition several times. The flame safeguard relays should now power the main fuel shut-off valves.

**Verify all safety interlocks are operational before opening any main and/or individual burner valves.**

12. **To light and adjust RAMFIRE® Burner on gas:** With gas pilot established and flame supervision system operational, opening the main fuel shut-off valve(s) will allow fuel flow to the SYNCHRO Fuel Control Valve of MICRO-RATIO® Valve assembly.
13. **Turn minimum adjusting screw in** (clockwise) to open gas valve until gas is ignited at burners. Several turns of the screw may be necessary. Flame should normally be confined back in the burner block at rated minimums. (Higher minimums might possibly extend flames beyond burner block.)

NOTE: At this point, it is more important to get any kind of a flame as soon as possible. The flame geometry can be adjusted and refined as needed later.

14. **Adjust main gas regulator** (as necessary to maintain required burner differential). Re-adjust minimum screw if necessary.  
If pilots are to be interrupted, shut them off at this point and verify that main flame remains lit and holds in flame detectors. Re-adjust if necessary.
15. **Once your flame is established** and refined at this position, and without advancing the screw carrier quadrant higher, screw all remaining screws down to at least the same level as your first adjusted screw.

NOTE: A preliminary setting can be established with all the remaining adjusting screws. Generally, each succeeding screw needs to be screwed in approximately one full turn deeper than its preceding screw. A smooth "stair-step" gradient pre-set at this point from low to high will simplify the remaining adjustment steps.

16. **With allen wrench engaged in second screw, slowly move MICRO-RATIO® Valve to #1 position**, adjusting as necessary to maintain ignition and the type of flame desired. Flame length should increase slightly, burning with a blue center and yellow tips, and a steady combustion noise.

**If firing into an uncured refractory chamber, allow system to run at this setting for the dryout period recommended by the furnace or refractory manufacturer**, then continue adjustment of the MICRO-RATIO® Valve.

17. **Turn all remaining adjustment screws in slightly further than the second screw**, then with allen wrench inserted in third screw, slowly move MICRO-RATIO® Valve toward #2 position, adjusting as necessary.

**CAUTION: If flame is extinguished, immediately shut off gas and return MICRO-RATIO® Valve to minimum position. Verify that pilots are still burning then reopen gas valve and turn screw last adjusted in slightly further before returning to that firing position. Refine adjustment if necessary.**

18. **Progressively work your way up through each adjusting screw position**, developing a smooth progression slope from your first screw to the "maximum" position.

NOTE: To adjust the flame at any position, you must move the SYNCHRO Valve to the number you desire to adjust. This aligns the adjusting screw directly on top of the fuel valve plunger. A resulting adjustment of the screw is directly applied to the fuel valve plunger and its interconnected valve body linkage.

- If high temperature limit trips before adjustment is completed**, cycle back to minimum and hold there until the system cools down before attempting further adjustment.
19. **Note gas supply pressure while continuing with adjustment.** If it falls off below acceptable range, it may be necessary to re-adjust the regulator. If so, lower firing positions will need rechecked and if necessary, re-adjusted before proceeding.
20. **When all screws have been adjusted**, recheck differential pressures with unit at operating temperature. Refine "high fire" setting if necessary, considering differential pressure, flame length, and appearance.  
Flame should be blue with yellow tails and with a steady combustion noise. Dust or contaminants in the air stream may affect flame appearance.



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## Start-Up Instructions (continued)

The charts at right show specific differential gas (Chart 1) and air (Chart 2) pressure readings at various firing rates. This data may be used to refine your RAMFIRE® Burner adjustments.

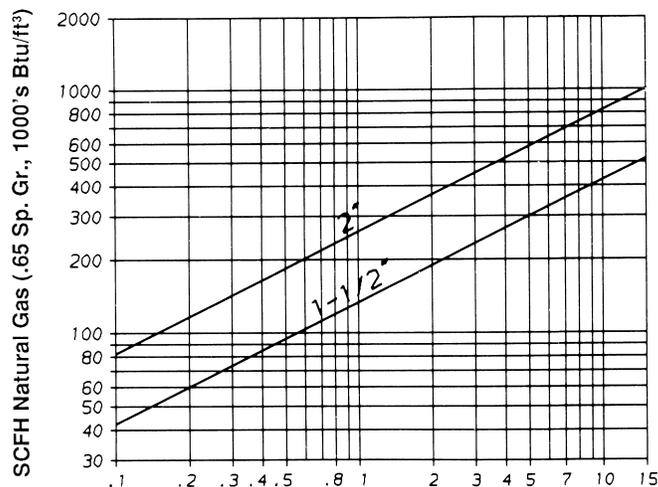
21. **If system will operate with interrupted pilot** (considered good practice), shut pilots off now and cycle MICRO-RATIO® Valve slowly from minimum to maximum and back, with all convection system dampers in operating position or with furnace door closed.
22. **When burner performance is satisfactory** and stable throughout the firing range, reconnect linkage from control motor to MICRO-RATIO® Valve.
23. **Check out overall system operation** on all fuels by cycling through light-off at minimum, interrupting pilot, and allowing temperature control system to cycle burner from minimum to maximum and return. Recheck all safety system interlocks for proper setting and operation.

**CAUTION: Test every UV installation for dangerous spark excitation from ignitors, and other burners, direct or reflected UV radiation.**

24. **Shut system down**, closing all fuel valves and allowing an approved post-purge period before shutting down fans and combustion air blower. Remove test connections and plug openings, then replace all equipment covers and caps and tighten all linkage set screws.
25. **Instruct operator** on proper start-up, operation and shutdown of system. Establish written instructions for reference.

**Chart 1**

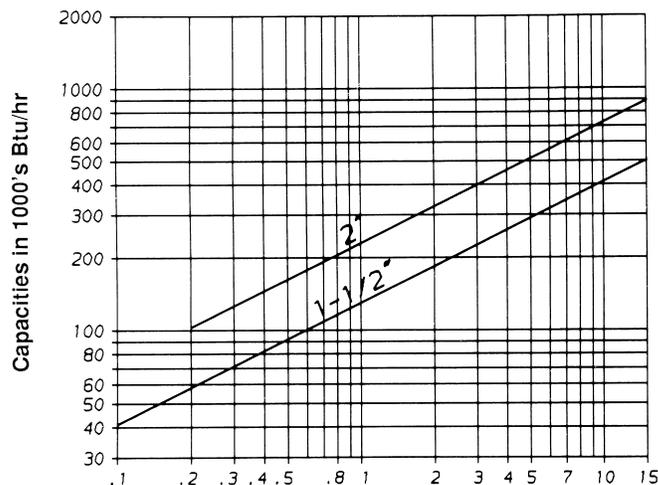
RAMFIRE® Burners  
Differential Gas Pressures



Differential Gas Pressures (measured between gas test ports G<sub>1</sub> and G<sub>2</sub>) in inches w.c.

**Chart 2**

RAMFIRE® Burners  
Differential Air Pressures



Differential Air Pressures (measured between air test ports A<sub>1</sub> and A<sub>2</sub>) in inches w.c.

# Notes



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