

Instruction Manual



WARNING

Except where specifically stated otherwise, this manual must be used only by a qualified service technician.

In the state of Massachusetts, this product must be installed by a licensed Plumber or Gas Fitter.

Failure to comply with the above or other requirements in this manual could result in severe personal injury, death or substantial property damage.

WARNING

USER — Refer only to User care and maintenance on back page for information regarding operation of this burner. The burner Instruction Manual is intended only for your service technician. The burner and heat exchanger must be inspected and started at least annually by your service technician.

NOTICE

Check burner cartons carefully. The Model 702GAS combination gas burner was assembled and tested at the factory before shipment. If the burner was ordered with a completed assembled gas train, the train was pressure tested and electrically checked for proper operation. Where possible, the gas train or components were shipped in the same carton as the burner. Check your packing slip for the number of cartons shipped from the factory.

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PLEASE read this first . . .

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Special attention flags . . .

Please pay particular attention to the following when you see them throughout this manual.

DANGER Notifies you of hazards that WILL cause severe personal injury, death or substantial property damage.

WARNING Notifies you of hazards that CAN cause severe personal injury, death or substantial property damage.

CAUTION Notifies you of hazards that WILL or CAN cause minor personal injury or property damage.

NOTICE Notifies you of special instructions on installation, operation or maintenance that are important, but are not normally related to injury or property damage hazards.

Before installing or servicing:

WARNING (1) Shut off the oil and gas supplies to the burner.
(2) DO NOT shut off the control switch to the boiler circulator or the burner.

WARNING Follow the guidelines below to avoid potential severe personal injury, death or substantial property damage.

Installer/service technician . . .

- Read all instructions before proceeding. Perform all procedures, and in the order given to avoid potential of severe personal injury, death or substantial property damage.
- Before leaving the site after startup or service, review the User care and maintenance page with the user. Make the user aware of all potential hazards and perform the training outlined below.

Installer/service technician — Train the user . . .

- To properly operate the burner/appliance per this manual and the appliance instructions. See User care and maintenance.
- To keep this manual at or near the burner/appliance for ready access by the user and service technician.
- To keep the appliance space free of flammable liquids or vapors and other combustible materials.
- To never use laundry products, paints, varnishes or other chemicals in the room occupied by the burner/appliance.
- To contact the service technician at least annually for startup and burner/appliance service.

When servicing the burner . . .

- DISCONNECT ELECTRICAL SUPPLY and all other electrical connections to burner before attempting to service to avoid electrical shock or possible injury from moving parts.
- Burner and appliance components can be extremely hot. Allow all parts to cool before attempting to handle or service to avoid potential of severe burns.

General information

Burner applications

Follow all instructions in this manual, the primary control data sheet and the appliance manual.

Adjust the nozzle selection/firing rate if necessary due to positive overfire pressure and/or altitudes more than 2,000 feet above sea level. See the NOTICE under the Ratings information at right. Where appliance application information is available, the recommended firing rate and burner information will include appropriate adjustments for positive overfire pressure and recommendations for high altitudes. Follow the appliance manual guidelines when available.

Damage or shortage claims

The consignee of the shipment must file damage or shortage claims immediately against the transportation company. See the NOTICE on page 1 for burner carton information.

When calling or writing about the burner:

Please provide us with the UL serial number and burner model number to assist us in locating information. This information can be helpful when troubleshooting or obtaining replacement parts.

Codes and standards

Certification

702GAS burners are U.L. listed for the U.S., certified to comply with:

- UL 795, for use with natural gas or propane.
- CUL certified CSA B140.2.1.10, CGA3.4-1973
- Burner labels list compliance, when required, with special local, state or provincial approvals.
- 702GAS burners can be configured for local code compliance.

United States installations

Burner/appliance installations in the United States must comply with the latest editions of:

- Installation of Domestic Gas Conversion Burners, ANSI Z21.8.
- National Fuel Gas Code, ANSI Z223.1/NFPA 54.
- National Electrical Code, ANSI/NFPA 70.
- All additional applicable national, state and local codes. Regulations of these authorities take precedence over the general instructions provided in this manual.

Ratings

Altitude 2,000 feet max. (see NOTICE below)

Gas Input

.....High fire: 840 to 1,600 MBH

Fuels

.....Natural gas or propane

Gas Train (available in straight or angled configuration)

.....(2) Main gas valves & RV-61 or RV-81 regulator

.....Butterfly gas valve for input regulation

.... 1" gas train standard; 1 1/4", 1 1/2" or 2" gas train available

Electrical

Power 120V/60 Hz/1-Phase

Limit circuit input (RM7895C or RM7897C) 120 vac/60 hz

Control circuit load (120 vac).....1.2 amps

Motor 1/2 hp, 3450 rpm, 48-frame, "N" flange

..... 115 / 208-230 vac/60 hz/1-ph, 8.4 / 3.8-4.2 amps

Gas valve power..... 120 vac/60 hz

Damper motor Siemens SQN71

Ignition & Primary Control

.....Carlin Model 41800 solid state electronic ignitor

Ignition voltage 9,000 volts

Primary control Honeywell RM7897C

Agencies

.....UL Listed (US)

NOTICE

Reduce nozzle/firing rate when required – Maximum burner capacity is reduced when overfire pressure is positive and for altitudes above 2,000 feet. See below, and adjust firing rate/nozzle selection if necessary.

702GAS — Maximum firing rate for positive overfire pressure and high altitude	
Overfire pressure (Inches w.c.)	Gas – MBH
0.00	1,600
0.10	1,530
0.20	1,500
0.30	1,480
0.40	1,440
0.50	1,430
0.60	1,390

Altitudes: For altitudes more than 2,000 feet above sea level, reduce the above capacities an additional 4% per 1,000 feet higher than 2,000 feet above sea level.

1. The Carlin Model 702GAS burner

702GAS overview

The Model 702GAS burner is a low-high-low (step modulating) burner that utilizes a damper motor to control air (and gas fuel rate).

See the next page for gas train component locations.

Operation

Ignition for main flame is accomplished by a proved gas pilot of approximately 70,000 Btu/h. Pilot gas is introduced and ignited by a Carlin 9,000-volt electronic ignitor wired to the electrode. After the pilot flame is proven, the two main gas safety valves open. The pilot gas valve closes after a time delay to allow main flame to establish. Flame is monitored both for pilot flame and main flame with a UV scanner positioned in the mounting flange. The burner main flame begins at low fire. If additional input is required, the damper motor opens the gas butterfly valve and air damper to their high fire positions.

Gas is introduced into the burner through a manifold around the air tube. The gas then circulates through a set of four orifice spuds into the air stream, upstream of the retention ring. The spin of the air flow at the retention ring thoroughly mixes the gas/air before it reaches the combustion zone.

Firing rate adjustment

- Then gas flow is adjusted to match the air flow at low and high fire rates. NOTE: High Fire must be set before Low Fire.
- See the "Starting and operating" section on page 12 of this manual for the complete description of the adjustment process. The following is a brief summary only.
- High-fire air is set by adjusting the combustion head position (to control air flow through and around the retention ring).
- Low-fire air is then adjusted by altering the position of the low fire adjusting screw.

Gas pressure requirements

Standard gas train requirements for the 702GAS burner requires a minimum w.c. inlet of 5" under flow conditions (maximum 14"). Systems with high pressure (above 14" w.c.) require a line pressure regulator upstream.

2. Pre-fire inspection • preparation

Vent system

Vent/chimney sizing

1. Follow all local codes when sizing the vent and chimney.
2. Refer to the appliance manufacturer's manual, when available, for venting recommendations.

Combustion air/ventilation openings

Combustion air/ventilation opening checklist

- Verify that air openings are unobstructed.
- Verify that appliance space and air source spaces are free of:
 - Gasoline or other flammable liquids or vapors.
 - Combustible materials.
 - Air contaminants, such as laundry products, paint, thinner, varnish, etc.
- Confirm with user that the area will be kept free of these materials at all times.
- All air from inside building (building must be well-ventilated):
Size air openings for a free area (after louver deduction) of at least 1 square inch per 1,000 Btuh input of all appliances in the space.
- All air through openings directly from outside the building through an adjacent outside wall:
If air openings connect directly to outside, provide two openings, one within 12 inches of the ceiling, the other within 12 inches of the floor. Each opening must have a free area (after louver deduction) of:
 - If directly through side wall: 1 square inch for each 4,000 Btuh of all appliances in the space.
 - If through vertical ducts: 1 square inch for each 4,000 Btuh of all appliances in the space.
 - If through horizontal ducts: 1 square inch for each 2,000 Btuh of all appliances in the space.

WARNING

Do not install or operate the burner if any component is damaged or if burner does not comply with other guidelines of this manual and the appliance manual.

Inspect, repair and/or replace vent system

WARNING

Do not install this burner unless you have verified the entire vent system and the appliance are in good condition and comply with all applicable codes. And . . .

The vent and chimney must be sized and constructed in accordance with all applicable codes for gas firing.

The vent system must not be pressurized unless the vent piping and vent system are designed accordingly. The vent must provide draft at all times (negative pressure in vent).

Do not install or use an existing manual damper in the vent connector or vent.

Do not connect the appliance vent connector to a chimney or vent serving a fireplace, incinerator or solid-fuel-burning apparatus.

In a cold climate, do not vent into a masonry chimney that has one or more sides exposed to the outside. Install a listed stainless steel liner to vent the flue products.

A defective vent system could result in severe personal injury, death or substantial property damage.

Mount burner in appliance

1. Verify the bolt pattern on the appliance chamber matches the flange pattern.
2. Verify the insertion depth (UTL) matches the depth of the appliance opening (so the end of the air tube is flush with, or slightly short of, the inside surface of the combustion chamber).
3. Place gasket onto boiler front plate.
4. Slide the end of the air tube into the opening and secure the flange to the boiler front plate.

2. Pre-fire inspection • preparation (continued)

Prepare vent/chimney

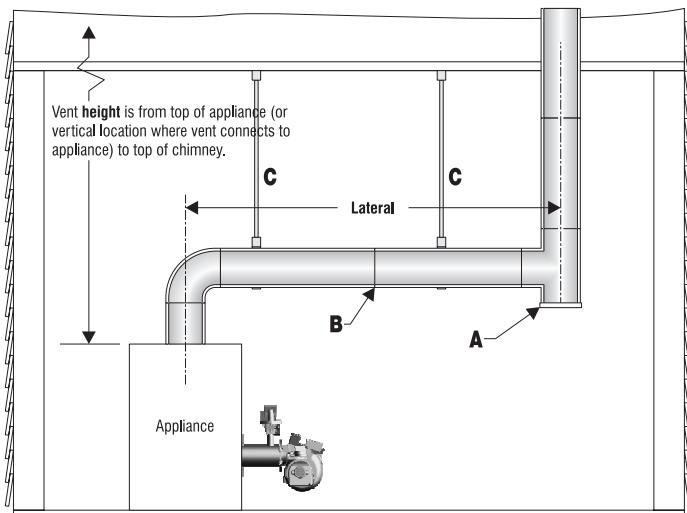
1. Secure all metal vent joints with screws, following the vent manufacturer's instructions. Seal all joints in the vent system and chimney. Repair masonry chimney lining and repair all mortar joints as needed.
2. Where draft fluctuations are likely, install a double-acting barometric draft regulator in the vent piping. (The damper must be located in the same space as the appliance.) Install a manual reset spill switch per manufacturer's instructions. Wire the switch into the appliance limit circuit to shut off the appliance/burner if sustained downdraft should occur. Refer to the appliance manufacturer's instruction manual for recommendations regarding the need for a barometric draft regulator.
3. Provide support for the vent piping. Do not rest the weight of any of the vent piping on the appliance flue outlet.

Clearances

Check codes, standards and the equipment manual

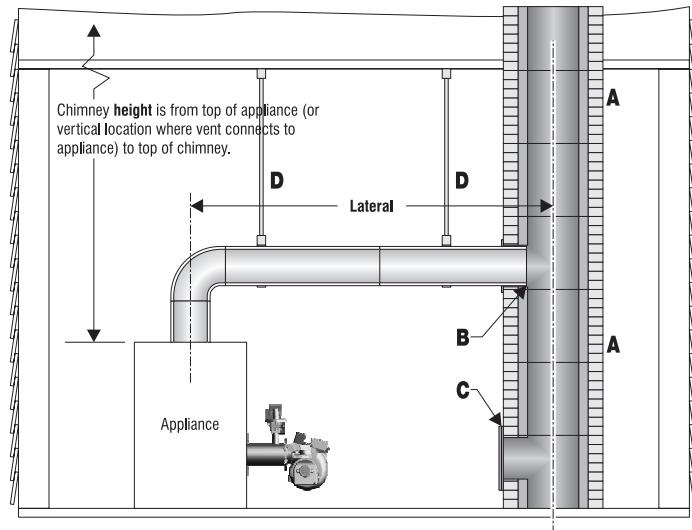
- Verify that the burner/appliance will maintain all clearances to combustible walls or floor and all clearances required for service/maintenance as required in the appliance manual and applicable codes.

Figure 1 Vent and vent connector installations, typical



Metal vent application

- A** Connect to vertical with tee, if possible, to provide inspection/cleanout opening in vent.
- B** Seal all joints and access openings tightly to prevent draft loss.
- C** Support vent pipe so no weight of vent connector rests on appliance.



Masonry chimney application

- A** Tile-lined interior masonry chimney only; with all tile and joints in good condition.
- B** Vent pipe should be almost flush, but *not extending into*, inside surface of liner.
- C** Seal all access openings tightly to prevent draft loss.
- D** Support vent pipe so no weight of vent connector rests on appliance.

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2. Pre-fire inspection • preparation (continued)

Combustion air/ventilation openings

Sizing air openings

Follow all applicable codes and the appliance instruction manual (when available) to size combustion air openings. Use the following guidelines when appliance instructions are not available.

- All air from inside building (building must be well-ventilated):
Size air openings for a free area (after louver deduction) of at least 1 square inch per 1,000 Btuh input of all appliances in the space.
- All air through openings directly from outside the building through an adjacent outside wall:
If air openings connect directly to outside, provide two openings, one within 12 inches of the ceiling, the other within 12 inches of the floor. Each opening must have a free area (after louver deduction) of:
 - If directly through side wall: 1 square inch for each 4,000 Btuh of all appliances in the space.
 - If through vertical ducts: 1 square inch for each 4,000 Btuh of all appliances in the space.
 - If through horizontal ducts: 1 square inch for each 2,000 Btuh of all appliances in the space.

Locating air openings

Follow all applicable codes and the appliance instruction manual (when available) to size combustion air openings. Refer to Figure 2 when appliance instructions are not available.

Estimating free area

When specific information on the free area of louvers is not available, estimate free area as follows:

1. Wood louvers — free area = area times 0.25.
2. Metal louvers or grilles — free area = area times 0.60.
3. Screens, when used must be no smaller than 1/4 inch mesh.

Motorized vent dampers

Wire the vent damper end switch to prevent operation of the burner until the air opening louvers are fully open.

Combustion air/ventilation opening checklist

- Verify that air openings are unobstructed.
- Verify that appliance space and air source spaces are free of:
 - Gasoline or other flammable liquids or vapors.
 - Combustible materials.
 - Air contaminants, such as laundry products, paint, thinner, varnish, etc.
- Confirm with user that the area will be kept free of these materials at all times.

WARNING

Installing the burner/appliance in a space that does not provide enough air for combustion and ventilation can result in severe personal injury, death or substantial property damage. Follow all applicable codes and guidelines below to ensure space has sufficient air openings.

WARNING

Exhaust fans and negative pressure conditions — Isolate the boiler room from areas subject to negative pressure. Size combustion air openings to ensure neutral air pressure in the boiler room whenever the burner operates.

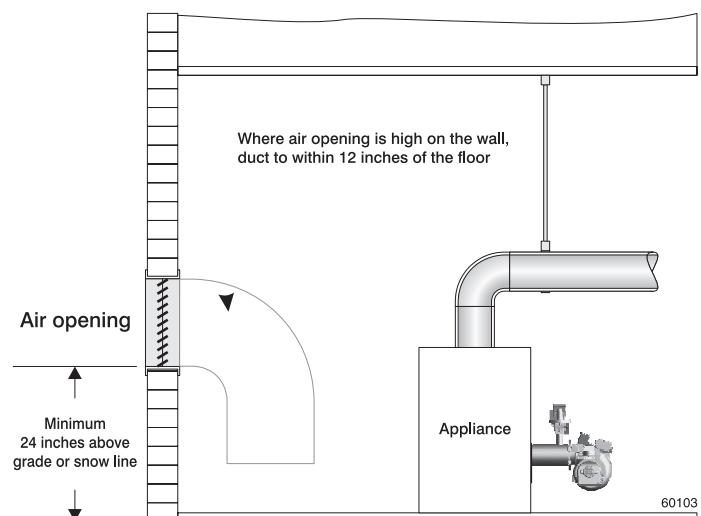
WARNING

Make sure the space provides enough ventilation to prevent overheating of the appliance, burner and controls. If there is risk of overheating, you must install ventilation air openings sized large enough to provide air for cooling the equipment. Failure to provide ventilation can result in severe personal injury, death or substantial property damage.

WARNING

The space and combustion air supply must not contain corrosive contaminants, such as laundry products, paints, varnishes or other chemicals.

Figure 2 Locating combustion air/ventilation openings



2. Pre-fire inspection • preparation (continued)

Prepare the appliance

WARNING

Burner input: Install a burner sized for the normal input rating of the appliance. Do not install a burner with a higher firing rate than the appliance rating. Do not install a burner with a firing rate more than 10% lower than the appliance rating. The appliance and vent system could be damaged due to condensation.

Clean the appliance: Clean the appliance thoroughly. Test all electrical components and verify the relief valve works (boilers only).

Seal the appliance: Seal all flue-gas containing joints. Seal all connections to the vent piping or breeching.

Verify combustion chamber dimensions comply with the minimum dimensions recommended on page 9. Install or replace chamber liner if required by the appliance manufacturer. The burner must not extend into the combustion chamber. The end of the burner air tube must be with 1/4" of the inside face of the chamber. If the space around the burner air tube is more than 1/4", wrap the burner air tube with minimum 2300-°F-rated ceramic fiber blanket to seal off the gap.

Repair or replace damaged appliance components. Inspect the appliance thoroughly. Follow appliance manufacturer's guidelines for repair or replacement of any component found defective.

When cleaning the appliance or working with ceramic fiber refractories or fiberglass insulation, see **WARNING** on this page.

Failure to comply with the above could result in severe personal injury, death or substantial property damage.

Prepare appliance for burner mounting

WARNING

Positive overfire pressure applications: When firing with positive overfire pressure, do not exceed the pressure specified in the appliance manual.

Positive overfire pressure reduces maximum burner capacity. See Page 3 for estimated reduction in burner capacity with pressurized firing and high altitude applications.

Failure to comply could result in severe personal injury, death or substantial property damage.

Ceramic fiber or Fiberglass insulation

WARNING

Ceramic fiber materials, such as chamber liners, may contain carcinogenic particles (chrysotile asbestos) after exposure to heat. Airborne particles from fiberglass or ceramic fiber components have been listed as potentially carcinogenic by the State of California. Take the following precautions when removing, replacing and handling these items.

Avoid breathing dust and avoid contact with skin or eyes. Wear long-sleeved, loose-fitting clothing, gloves and eye protection. Use a NIOSH N95 certified respirator. This respirator meets requirements for protection from chrysotile asbestos. Actual job requirements or NIOSH regulations may require other or additional protection. For information, refer to the NIOSH website, <http://www.cdc.gov/niosh/homepage.html>.

Ceramic fiber removal: To prevent airborne dust, thoroughly wet ceramic fiber with water before handling. Place ceramic fiber materials in a plastic bag and seal to dispose.

Avoid blowing, tearing, sawing or spraying fiberglass or ceramic fiber materials. If such operations are necessary, wear extra protection to prevent breathing dust.

Wash work clothes separately from other laundry. Rinse clothes washer thoroughly afterwards to prevent contamination of other clothing.

NIOSH First aid procedures:

Eye exposure — irrigate immediately

Breathing — fresh air.

2. Pre-fire inspection • preparation (continued)

Prepare burner and components

WARNING

Do not install or operate the burner if any component is damaged or if burner does not comply with the specifications of Table 2 and other guidelines in this manual.

Combustion chamber minimum dimensions

- For applications that have not been specifically tested (OEM applications), verify that the combustion chamber provides the minimum dimensions shown in Table 2 and Figure 3. For specific OEM applications, the appliance testing ensures suitability of the chamber.
- Chamber dimensions may be larger than listed in Table 2, but should not be excessively large.

WARNING

Combustion chambers should be sized as recommended in Table 2. They should be constructed of refractory materials with the capacity to withstand 2600°F or higher.

It is difficult to include all possible chamber constructions in this manual. Therefore, you should use the information presented in this manual combined with commonly practiced techniques when determining chamber design. If certain conditions are in question, consult the factory.

Using chamber linings

- When using refractory liners or lightweight chambers, use insulating-type refractory rated 2600°F minimum, or as specified by the appliance manufacturer.
- You must install a target wall liner if flame length is close to the length of the chamber.
- Use a floor liner when possible. The floor liner will improve firing in most applications. Extend floor liner 3 to 4 inches up the side walls.
- Target wall liners — Extend target wall liners at least 3 to 4 inches above the center of the flame corbel the top 1½ to 2½ inches deep.
- Use preformed chamber liners when available. Lining the floor and target wall water-backed combustion chambers with lightweight insulating refractory will accomplish the same.
- When converting coal-fired units, install a combustion chamber in the ashpit area, or fill the ashpit with sand up to 2 inches above the "mud ring" of the boiler (firing through the door). Install a lightweight refractory liner on the target wall.

Air tube insertion length (UTL)

- Usable air tube length (UTL) is the distance from mounting flange to end of air tube. Verify that the end of the air tube will be flush with, or no more than 1/4 inch short of, the inside of the appliance combustion chamber front wall when the burner is mounted. See Figure 3 for further information.

NOTE: A flange spacer is available for appliances with less than 4" UTL.

Figure 3 Chamber dimensions & tube configurations

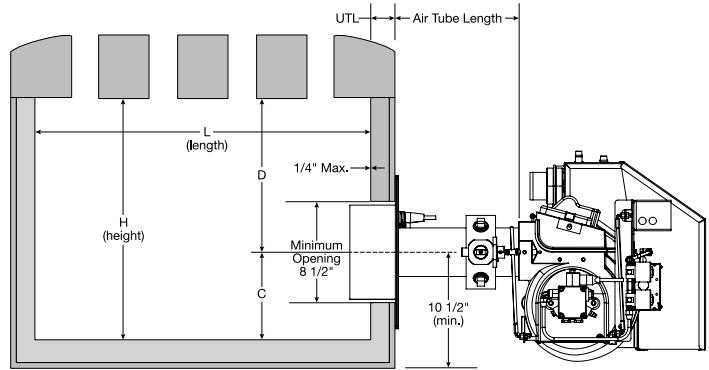


Table 2 Minimum combustion chamber dimensions (see Figure 3)

High fire input	Refractory combustion chamber applications (all dimensions in inches)			
	"L"	"W"	"C"	"H"
Gas-MBH				
840	21	15.0	7.5	15
910	23	15.5	8.0	16
966	25	16.0	8.0	16
1092	28	17.0	8.5	17
1218	31	17.5	9.0	18
1330	34	18.0	9.0	18
1456	38	19.0	9.5	19
1568	43	20.0	10.0	20

High fire input	Refractory combustion chamber applications (all dimensions in inches)				
	"L" W/target	"L" No target	"W"	"C"	"D"
Gas-MBH					
840	21	25	17.0	8.5	10.5
910	23	27	17.5	9.0	11.0
966	25	29	18.0	9.0	11.0
1092	28	32	19.0	9.5	11.5
1218	31	35	19.5	10.0	12.0
1330	34	38	20.0	10.0	12.0
1456	38	42	21.0	10.5	12.5
1568	43	47	22.0	11.0	13.0

2. Pre-fire inspection • preparation (continued)

Mount burner in appliance

1. Welded-flange burners
2. Verify the bolt pattern on the appliance chamber matches the flange pattern.
3. Verify the insertion depth (UTL) matches the depth of the appliance opening (so the end of the air tube is flush with, or slightly short of, the inside surface of the combustion chamber).
4. Place gasket onto boiler front plate.
5. Slide the end of the air tube into the opening and secure the flange to the boiler front plate.

Inspect components and wiring

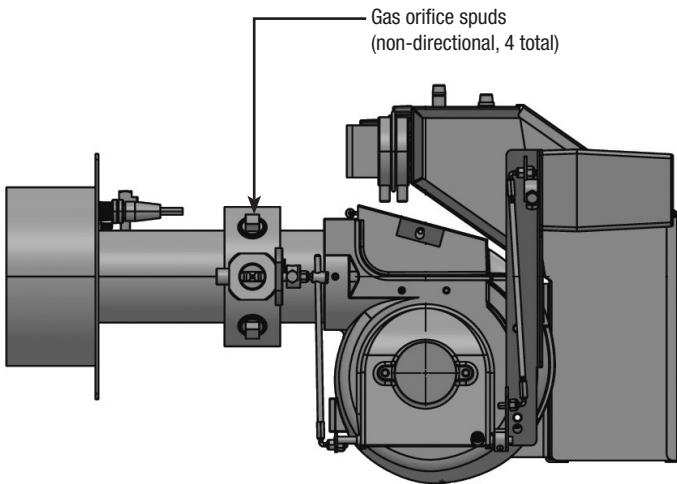
- Visually inspect all burner components and wiring.
- Verify that wiring is intact and leads are securely connected.
- Verify that all burner components are in good condition.

2. Pre-fire inspection • preparation (continued)

Removing the combustion head assembly

1. Shut off the burner.
2. Remove the four gas orifice spuds from the manifold (Figure 4).
3. Remove the two housing cover locking screws and swing the housing open.
4. Remove the combustion head assembly and inspect as needed.

Figure 4 Gas orifice location



WARNING

Installing the burner/appliance in a space that does not provide enough air for combustion and ventilation can result in severe personal injury, death or substantial property damage. Follow all applicable codes and guidelines below to ensure space has sufficient air openings.

WARNING

Exhaust fans and negative pressure conditions — Isolate the boiler room from areas subject to negative pressure. Size combustion air openings to ensure neutral air pressure in the boiler room whenever the burner operates.

WARNING

Make sure the space provides enough ventilation to prevent overheating of the appliance, burner and controls. If there is risk of overheating, you must install ventilation air openings sized large enough to provide air for cooling the equipment. Failure to provide ventilation can result in severe personal injury, death or substantial property damage.

WARNING

The space and combustion air supply must not contain corrosive contaminants, such as laundry products, paints, varnishes or other chemicals.

2. Pre-fire inspection • preparation (continued)

Install gas train on burner

1. The standard burner gas train is shipped fully assembled, with the piping disconnected at the gas train unions. See separate instructions if installing an optional knocked down gas train. The gas train is available in either an angled (standard) or straight (optional) configuration.
2. Connect the main trains at the unions (Figure 5).

WARNING To avoid damage to gas train components, do not hold components with a pipe wrench or overtighten. Use only a crescent wrench or other means. Failure to comply could result in severe personal injury, death or substantial property damage.

3. Connect the flexible conduit, pre-attached to the burner J-box, to the gas train J-box, and attach the wires to the terminal strip inside the gas train J-box.
 - a. Match wire colors of the incoming wires to those pre-wired to the terminal strip inside the gas train J-box.
 - b. See the label in the burner junction box included

NOTICE

Gas valve vent opening — The V48 diaphragm gas valve is NOT fitted with a vent limiting orifice in the vent connection. If local codes require, install piping from the vent connection to outside, sized and installed as required by codes. Because this is a diaphragm-assisted solenoid valve, a small amount of gas will exit from the vent orifice each time the valve opens.

Figure 5 Gas train installation (shown with straight gas train)

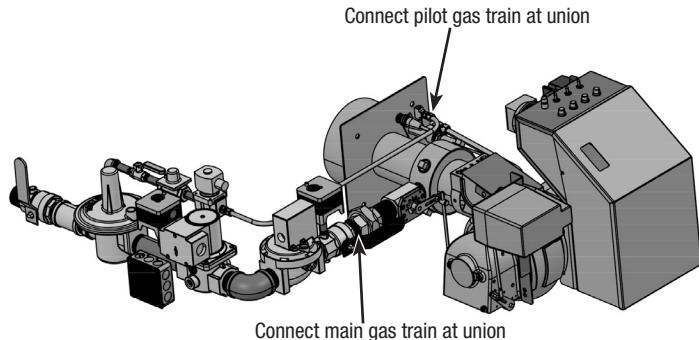
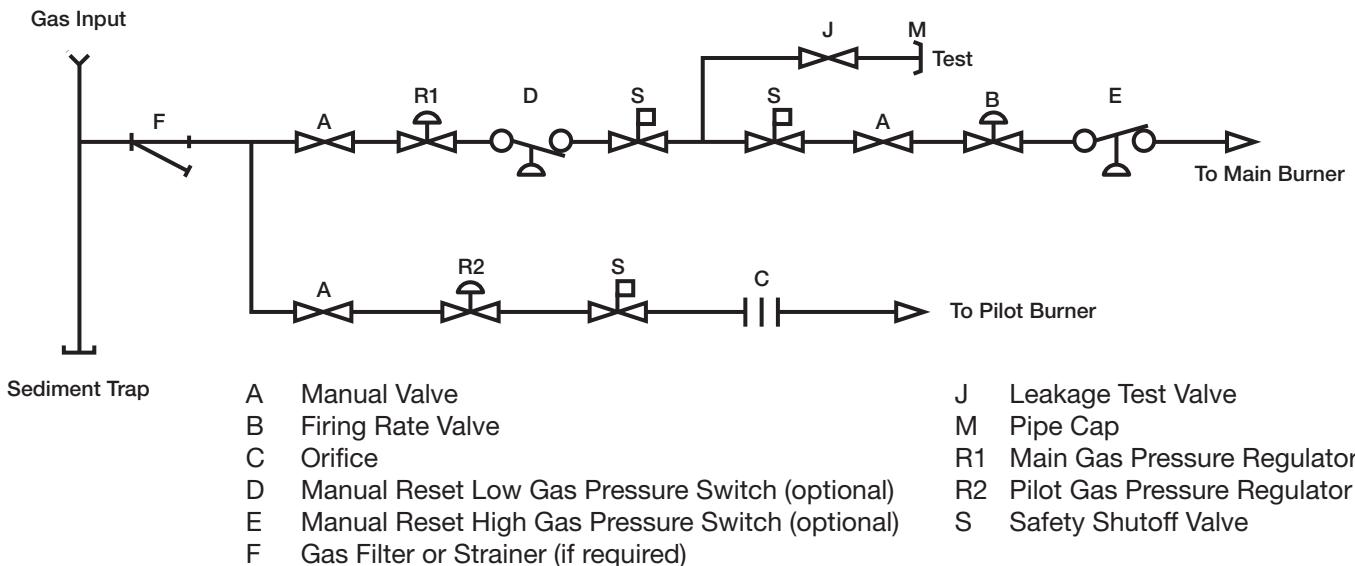


Figure 5A Gas piping schematic

GAS FUEL TRAIN



3. Install gas piping

WARNING

Connect from the gas supply to the burner gas train inlet using new, clean black iron pipe and malleable iron fittings only. Do not use copper, brass, cast iron or galvanized pipe or fittings.

Provide support for gas piping. Do not rest the weight of the gas piping on burner gas train.

Provide a support for the burner gas train.

Apply pipe dope sparingly at all joints. Use only pipe dope listed for use with propane gas. Do not use pipe sealing tape.

Do not hold the gas valve with pipe wrench. Use crescent wrench or other smooth-jawed device. Do not overtighten.

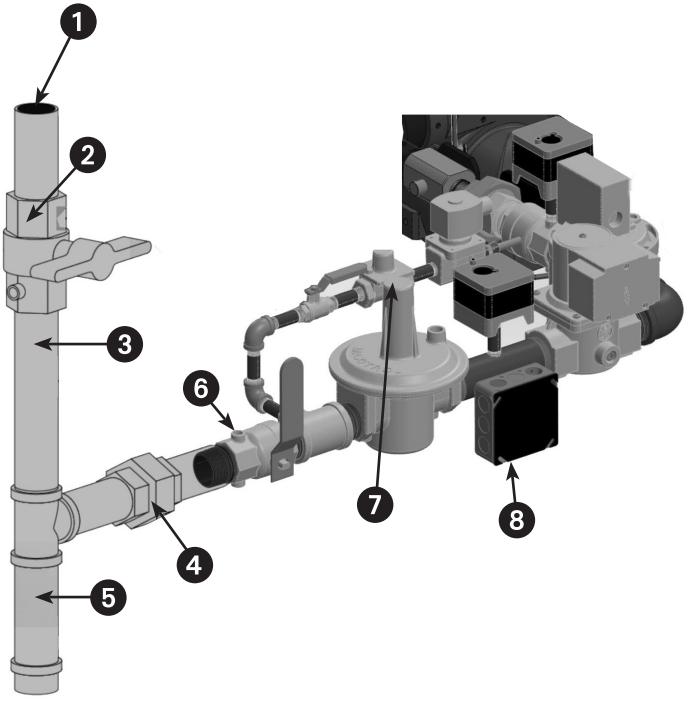
Failure to comply with above could result in severe personal injury, death or substantial property damage.

WARNING

Do not expose the gas train to gas pressure in excess of 14 inches water column. Higher pressure could damage the valve seat, resulting in potentially hazardous condition. When pressure testing piping at higher pressures, disconnect burner from gas line before testing.

If the gas supply pressure can exceed 14 inches water column at any time, you must install a lockup type gas pressure regulator in the gas supply piping, ahead of the main manual gas valve installed at the burner.

Figure 5A Connecting gas supply piping to burner (shown with angled gas train)



1	Pipe to meter or branch	6	Pressure tap, 1/4" (upstream shown, outlet not shown)
2	T-handle main manual gas valve	7	Gas regulator access screw (the regulator spring is located under the adjusting screw)
3	Use clean, burr-free black iron pipe and malleable iron fittings	8	Gas train wire junction box
4	Ground joint union		
5	Sediment leg		

Piping from gas meter to burner

1. Verify the gas train on the burner is correctly sized. The gas train pressure drop must not be more than the gas pressure at the burner gas train entrance minus 3.4" w.c. (pressure required at entrance to butterfly valve). See Figure 6 for gas train pressure drop information. The standard gas train is 1 inch.
2. If possible, install a new gas line directly from the gas meter. If you are using an existing gas line, verify it is clean and in good condition, and verify it is large enough to handle the load of all connected appliances.
3. When branching from a common gas line, do not tap off from the bottom of horizontal sections – only from the side or top.
4. Install a main manual shutoff valve, sediment trap and ground joint union near the burner gas train connection as shown in Figure 5A.
5. If the burner is installed inside an appliance jacket, install the main manual gas valve and sediment trap external to the jacket.
6. Size piping (or verify size) using Table 3. You will find additional information on gas line sizing in the National Fuel Gas Code, ANSI Z223.1.

Gas supply pressure – **natural gas or propane** Maximum supply pressure: **14 inches w.c.**

Minimum supply pressure: **5 inches w.c.**

Test and purge gas line

Read WARNING above.

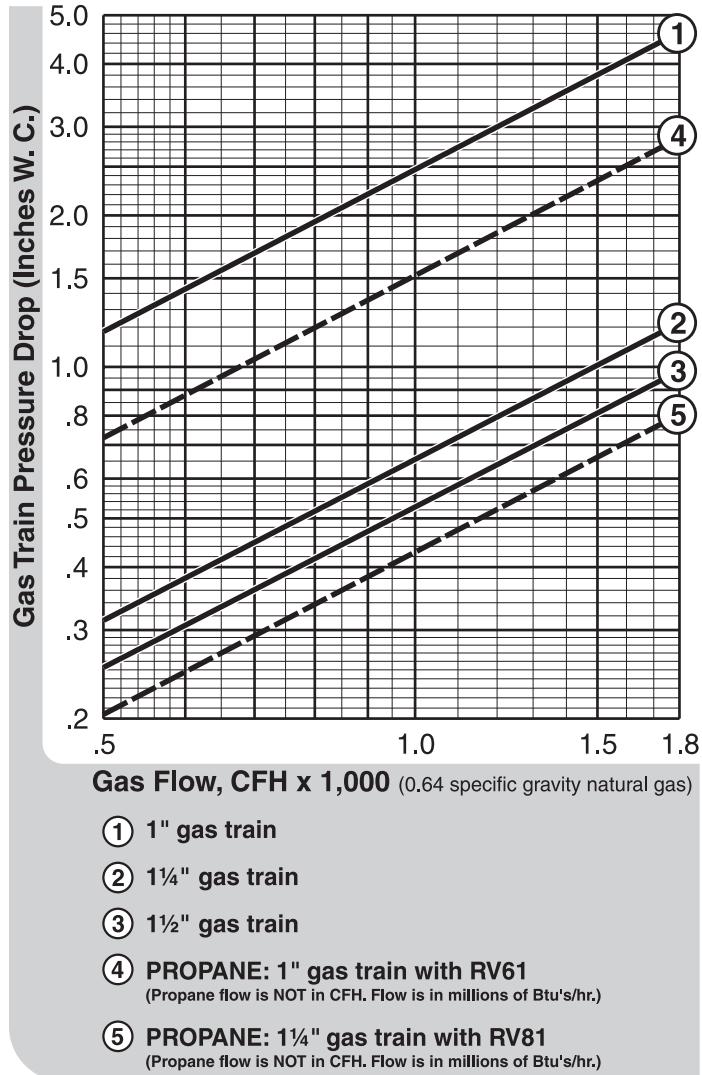
Pressure test and purge the line. Pressure testing should be done by the gas supplier or utility, following all applicable codes.

3. Install gas piping (continued)

Table 3 Capacities of black iron pipe, cubic feet gas/hour

NATURAL GAS						
Capacities in Cubic feet per hour for Schedule 40 metal pipe						
Pipe size (inches)	Total length of gas piping, from meter to burner connection (feet)					
	20	40	60	80	100	
Natural gas @ .60 specific gravity, pressure drop 0.3 in. w.c. (note 1)						
1 1/4	730	500	400	350	305	
1 1/2	1,100	760	610	530	460	
2	2,100	1,450	1,150	990	870	
2 1/2	3,300	2,300	1,850	1,600	1,400	
Natural gas @ .60 specific gravity, pressure drop 0.5 in. w.c. (note 1)						
1 1/4	950	660	530	460	400	
1 1/2	1,460	990	810	690	620	
2	2,750	1,900	1,520	1,300	1,150	
2 1/2	4,350	3,000	2,400	2,050	1,850	
Note 1 For natural gas with specific gravity other than 0.60, consult National Fuel Gas Code for correction factor.						
PROPANE GAS						
Capacities in Btuh for Schedule 40 metal pipe						
Propane gas @ 1.5 specific gravity, pressure drop 1 psi						
1/2	1,839	1,264	1,015	869	770	
3/4	3,845	2,643	2,122	1,816	1,610	
1	7,243	4,978	3,998	3,422	3,033	
Propane gas @ 1.5 specific gravity, pressure drop 0.5 in. w.c.						
1	787	541	434	372	330	
1 1/4	1,616	1,111	892	677	543	
1 1/2	2,422	1,664	1,337	1,114	1,014	

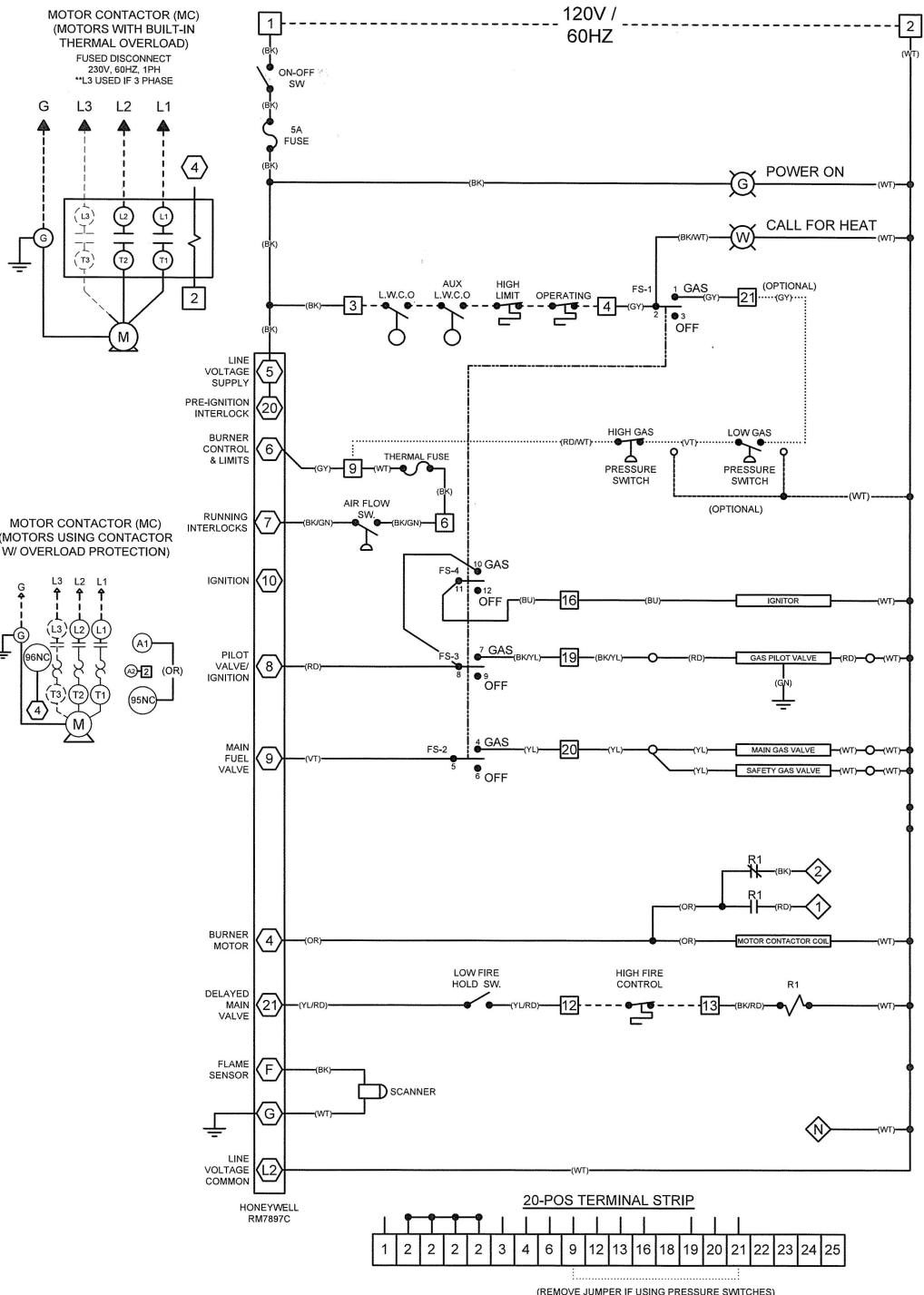
Figure 6 Gas train pressure drop



4. Wire the burner — RM7897C primary control

WARNING Turn off power to appliance when servicing burner. Failure to comply could result in severe personal injury, death or substantial property damage.

Figure 7
702GAS burner wiring
using Honeywell
RM7897C primary
control (see appliance
manual or separate
wiring information for
burner equipped with
a primary control not
covered in this manual);
see Figure 7A for a
legend to callouts.



4. Wire the burner — RM7897C primary control (continued)

WARNING

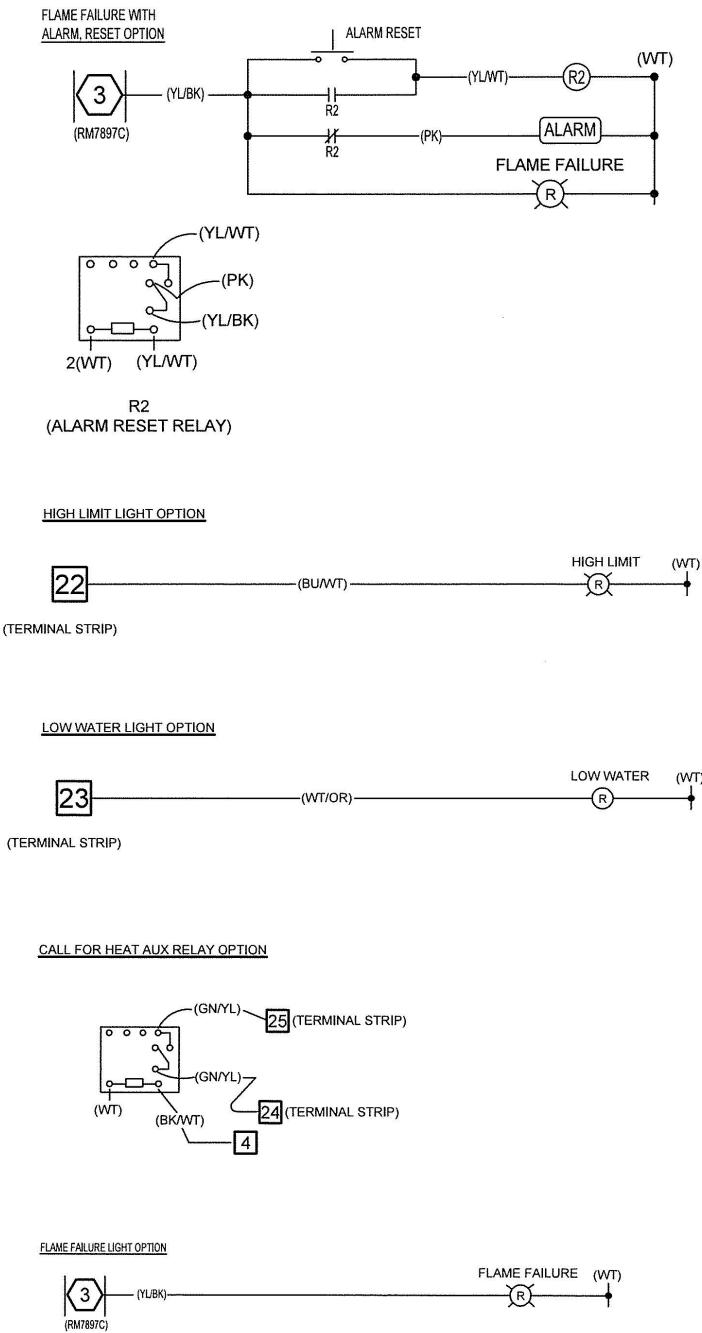
Turn off power to appliance when servicing burner. Failure to comply could result in severe personal injury, death or substantial property damage.

Low-High-Low step modulation

1. To take advantage of the energy-saving potential of the Model 701GAS burner, it should be wired to operate at low-high-low cycles. The firing cycle can be much longer using low-high-low firing, because the burner can cycle to low fire as demand decreases. This keeps the burner on longer, reducing cyclic losses.

Figure 8

*CONTINUED: 702GAS
burner wiring using
Honeywell RM7897C
primary control (see
appliance manual or
separate wiring
information for burner
equipped with a primary
control not covered in this
manual); see Figure 7A
(page 15) for a legend to
callouts.*



2. The appliance must be equipped with a high fire, break on rise control. (either temperature [water boiler] or pressure [steam boiler]. Read the appliance manual for the location of the high fire control, when used. See Figures 7 and 8 to connect the high fire control to the burner firing rate circuit.
3. The burner includes a pre-wired manual high-fire switch. Close this switch to hold the burner in high fire mode. Open the switch to hold the burner in low fire mode.

5. Checkout procedure — before starting the burner

Before firing the burner . . .

WARNING

Should overheating or an emergency occur, immediately do the following:

- Shut off gas supply valves.
- Under some circumstances power should remain on for water pumps or blowers. Determine proper response before attempting start-up.
- If burner fails ignition on several attempts, use burner blower to purge appliance chamber before restart.

WARNING

If burner is running on natural gas only, coupling must be removed.

- Gas lines in good condition, sized and designed correctly?
- Gas line connections and fittings tight?
- Burner, appliance and all components inspected and in good condition?
- Appliance limit and operating controls properly installed, wired and adjusted?
- Boiler water supply, feed pumps, automatic feeders, and low water cut-offs properly piped and wired?
- Breeching, draft regulator, draft inducer (if required) properly installed and operational?
- Gas train piping and components correctly installed, tested and verified gas tight?
- Vent lines installed when required?
- Gas lines purged?
- Sufficient gas line pressure present?

Checklist before firing . . .

- Burner and appliance installed per this manual and appliance instruction manual?
- Burner/appliance installed per all applicable codes?
- Installation site has adequate combustion/ventilation air openings and vent system?
- Are voltages correct? Burner, appliance and motor correctly wired per burner and appliance manuals and wiring diagrams?
- Gas manifold spud orifices sealed with pipe dope and tight?

WARNING

Follow the procedures on the following pages to ensure the burner is correctly adjusted.

You must perform the adjustments in the sequence given in this manual.

Failure to follow the correct procedures could result in severe personal injury, death or substantial property damage.

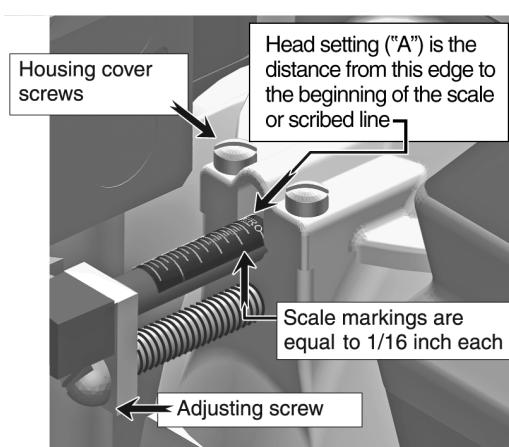
6. Set burner initial head and damper positions

Before firing the burner . . .

Set combustion head (Dimension "A")

1. The combustion head adjusting screw is used to set the spacing between the retention ring and throttle ring (or air cone), regulating how much air passes around the retention ring.
2. See Figure 9. Loosen the two housing cover screws. Then rotate the head adjusting screw until the distance from the housing detent to the beginning of the scale or scribed line on combustion head equals the value given in Table 5 (Dimension "A"). Tighten the housing cover screws.

Figure 9 Set initial combustion head position



6. Set burner initial head and damper positions (continued)

Set air damper (low fire position)

See Figure 10. Adjust the blue cam on damper motor until the air opening between the damper blade and the damper housing equals the initial low-fire opening in Table 5.

Set air damper linkage

Make sure Air Damper Linkage is set at $\frac{3}{4}$ " from the top of the Damper Motor and the bottom of the linkage screw (see Figure 10A). If your settings are off, loosen the two hex head screws found on the linkage arm bosses at the top and bottom of the Air Damper Linkage. Adjust the linkage accordingly, then tighten screws to set position.

Figure 10 Set initial low fire air damper setting

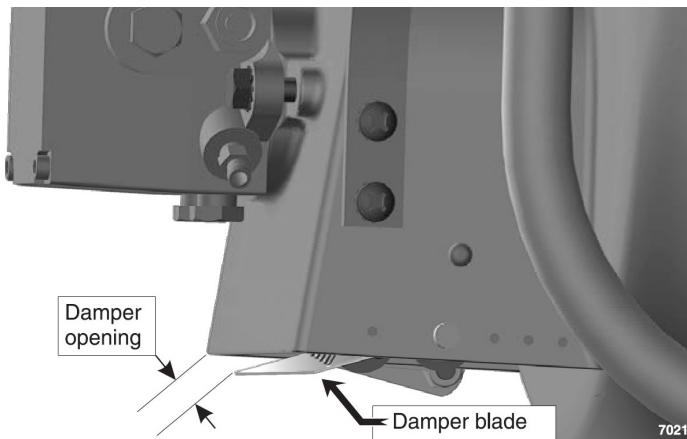
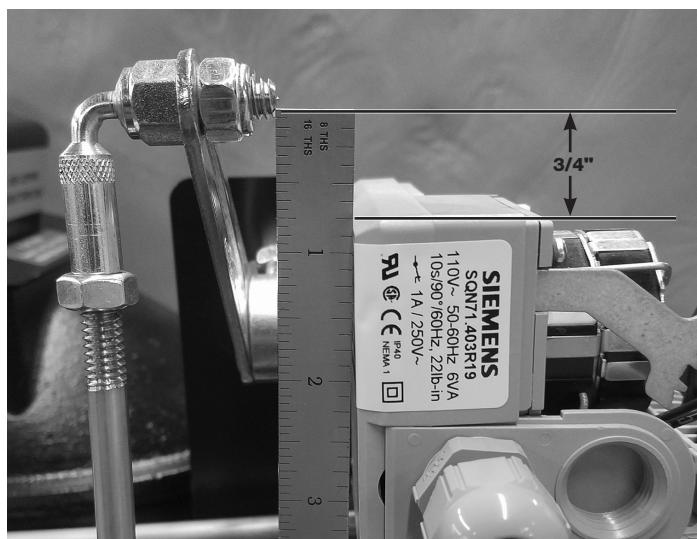


Figure 10A Set air damper linkage



Determining final adjustments

The burner is now adjusted to the approximate air settings for the firing rate used. Follow the procedures on the following pages to **use test instruments** and make final burner adjustments.

Table 5 Initial burner settings (see the pages 18 through 22 for final adjustments using test instruments)

Natural Gas MBH		Combustion head position Dimension "A" Inches (approximately)	Air damper low-fire opening Inches (approximately)	Siemens Blue Cam Setting	Butterfly valve open – low fire (factory set) % (approximately)
Low-fire Input	High-Fire Input				
490	840	0	3/8	25	30
525	910	1/16	3/8	25	30
560	966	1/8	7/16	27	30
630	1092	3/16	7/16	27	30
700	1218	3/8	1/2	30	30
770	1330	5/8	1/2	30	30
840	1456	1-1/8	9/16	35	30
910	1568	1-3/8	9/16	35	30

7. Adjust the burner using test instruments

WARNING

The settings given in Section 6 are initial settings only. **You must use test instruments** to check combustion, and adjust the burner as necessary, following the procedures given in the following pages of this manual. Failure to properly adjust the burner can result in severe personal injury, death or substantial property damage.

Adjustment procedure, summary

- Step 1:** Set gas pilot operation. See details following.
- Step 2:** Set high-fire gas flow to match high-fire air. See details following.
- Step 3:** Adjust the butterfly valve linkage to match low-fire gas to low-fire air. See details following.
- Step 4:** Verify operation of burner, appliance, and controls.

Use test instruments

1. Use combustion test equipment and an accurate manometer or draft gauge to correctly set the burner as required.
2. Overfire pressure must not exceed the appliance manufacturer's recommendations. The burner must never be fired at an overfire pressure more than 0.60 inches w.c.

NOTICE

When the overfire pressure is positive, the maximum burner firing rate is reduced. The firing rate is also reduced for altitudes higher than 2000 feet above sea level. See page 3 for rating information.

3. Adjust the burner fuel and air settings using the following procedures. When adjustment has been completed, the CO₂ (or O₂) should be within the ranges in Table 6, at both low fire and high fire.

Table 6 Allowable values of CO₂ and O₂

Fuel	CO₂		O₂	
	Minimum	Maximum	Maximum	Minimum
Natural Gas	8.5 %	10.0 %	6.2 %	3.6 %
Propane	9.5 %	11.2 %	6.0 %	3.5 %

7. Adjust the burner using test instruments (continued)

WARNING

Check all joints with a soap suds mixture or electronic gas leak detector to ensure the gas train and all components are tight and leak-free. Shut down the burner and correct any leak immediately. Failure to comply could result in severe personal injury, death or substantial property damage.

Step 1 Check gas pilot operation

NOTICE

The Model 702G/O uses a gas pilot for ignition of the gas main flame. The gas pilot is ignited by the burner electrodes.

1. After completing Steps 1, 2 and 3 on page 21, move the burner fuel selector switch to GAS. Set the low-fire switch to low fire.
2. Make sure the gas line has been completely bled. Then turn the service switch to ON.
3. The pilot will usually light the first time once the combustion head assembly and the low-fire air damper have been set by Steps 1 and 2, and the pilot gas train has been completely purged of air.
4. The pilot flame is approximately 280 MBH, and is large enough to be heard when lit. If the pilot fails to light, be sure the gas line has been bled properly. If it still fails to light, increase the pilot gas pressure to 4 inches w.c. If the primary control is equipped with a pilot test hold switch, it can be used to hold the pilot "on" while adjusting pilot gas pressure.
5. Follow the instructions in the primary control instruction manual to check flame signal. Make sure the flame signal is steady, and greater than the required minimum for the UV sensor.

Step 2 (firing on gas) Set main gas pressure regulator

NOTICE

The butterfly gas valve is factory set to a preliminary setting of 30% open for low fire, and 100% open for high fire. The pilot regulator is set for 3.0 inches w.c. Use manometer in the pilot test port (Figure 12) provided to confirm settings.

1. Leave the low-fire switch in low fire.
2. With the gas pilot operating correctly, and the UV sensor flame signal above minimum required, the primary control will cycle the burner to main gas.

3. Check the flame signal after the pilot has shut down to ensure the signal is still strong with main flame on.
4. Move the burner fuel selector switch to OFF. The burner will shut down.
5. Temporarily install two U-tube manometer connections to check gas pressures. Install connections at the inlet pressure tap of the main manual gas valve and at the downstream pressure tap of the manual gas valve next to the butterfly valve.
6. The gas pressure at the inlet to the gas train must never exceed 14 inches w.c., either when the burner is off or firing on gas.
7. Move the burner fuel selector switch to GAS. The burner should start.
8. With the burner firing in low fire, check the gas pressure at the downstream of the butterfly valve. Adjust the main gas pressure regulator if necessary until the gas pressure reads 1.0 inch w.c. as a starting pressure.
9. Switch the low-fire switch to high fire. **CAUTION:** Be prepared to turn the burner off immediately if it begins to pulsate as it attempts to move to high fire.
10. If the flame pulsates, it is probably too rich. Switch the low-fire switch to low fire and reduce the gas pressure by adjusting the main gas pressure regulator. Then return to 9, above.
11. If the fire is too lean, it will appear small and can even blow out during the swing to high fire. If it blows out, shut off the burner immediately. Switch the low-fire switch to low fire and start the burner again. Adjust the main gas pressure regulator to increase the gas pressure. Return to 9, above.

WARNING

With the burner running in **high fire**, inspect the butterfly valve indicator (Figure 13). The indicator must be at 90°. IF NOT, turn the burner off. Loosen the two hex-head screws securing the valve linkage arm. With the damper motor linkage arm pulled up, use a screwdriver to rotate the butterfly valve slot until it is horizontal. Tighten the two hex head screws while still holding the damper motor linkage arm up. Return to step 9, above. DO NOT proceed with combustion adjustment unless the butterfly valve position has been verified, and corrected if necessary.

7. Adjust the burner using test instruments (continued)

12. With the burner running in **high fire**, adjust the main gas pressure regulator to achieve:

- Natural gas: 9.6% to 10.0% CO₂.
- Propane: 10.7% to 11.2% CO₂.
- Measure the CO content. It should be no greater than 100 PPM.

NOTICE

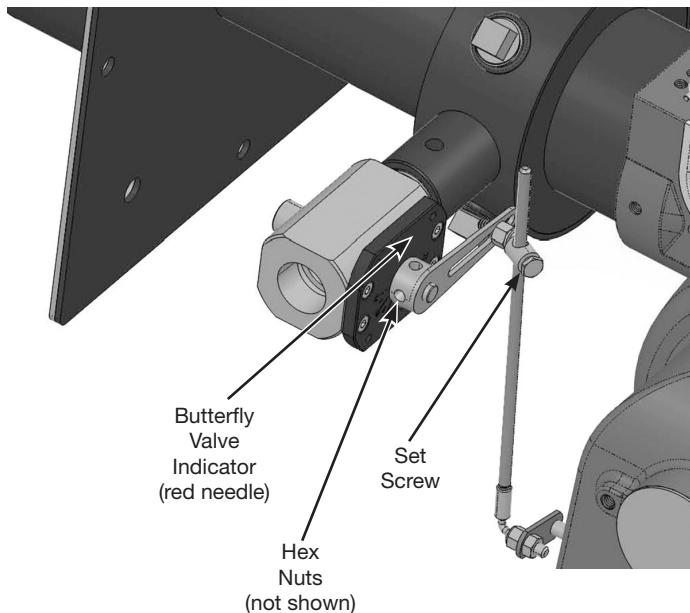
High CO readings may indicate the combustion is on the wrong side of the CO₂ curve. You will know this if a decrease in gas pressure causes an increase in CO₂.

Step 3

Set butterfly gas valve linkage

1. Switch the low-fire hold switch to low fire.
2. Check CO₂ and CO. The CO₂ should be between 9.0% and 10.0% (natural gas) or between 10.0% and 11.2% (propane); with CO less than 100 PPM.
3. To adjust the low-fire air (change CO₂), move the burner fuel selector switch to OFF. Adjust the butterfly gas valve linkage as described in the following to change the low-fire gas flow to the burner head. Do not change the main gas pressure regulator setting.
4. **DO NOT ADJUST THE LOW-FIRE AIR DAMPER SETTING.**
5. See Figure 13 for location of linkage components.

Figure 13 Butterfly gas valve linkage



NOTICE

To adjust the linkage, loosen set screw in the adjustable link in small increments. A 1/8-inch move can cause CO₂ to change as much as 1.5%.

- If more gas is needed (to increase CO₂), slide linkage UP.
- If less gas is needed (to decrease CO₂), slide linkage DOWN.

6. Tighten the set screw in the adjustable link.
7. **The butterfly valve indicator must be at 90°.** IF NOT, turn the burner off. Loosen the two hex-head screws securing the valve linkage arm. Rotate the butterfly valve indicator until it is at 90°. Disengage actuator motor. Rotate linkage to high fire. Tighten the two hex head screws while still holding the motor linkage arm in high fire. Rotate linkage to low fire. Re-engage pin.
8. Tighten the two hex head screws on the butterfly valve linkage arm boss.
9. Restart and repeat as necessary until CO₂ and CO are acceptable.

**IF EQUIPPED WITH LOW-HIGH GAS PRESSURE SWITCH,
PROCEED TO STEP 3A.
OTHERWISE PROCEED TO STEP 4.**

Step 3a

Verify operation

NOTICE

Perform all of the checkout procedures given in Steps 3A-4 of the burner manual. In addition, verify operation of the gas pressure switches as described below.

Verify high gas pressure switch operation

- Cycle the burner off with the appliance controls and turn off power to the appliance/burner.
- Attach a manometer to the manifold-side manual gas valve test port.
- Turn on power and cycle the burner on with the appliance controls.
- Measure the manifold gas pressure with the manometer.
- Set the high gas pressure switch to a pressure less than actual manifold pressure. The high gas pressure switch should shut the burner down. Replace the switch if necessary.
- Turn off power to the appliance/burner; remove the manometer and replace the plug in the gas valve test port. Reset switch.

Verify low gas pressure switch operation

- Cycle the burner off with the appliance controls and turn off power to the appliance/burner.
- Close the main manual gas valve.
- Cycle the burner on.
- The low gas pressure switch should shut the burner down. Replace the switch if necessary.
- Turn off power to the appliance/burner.
- Open the main manual gas valve.
- Reset low gas pressure switch.

7. Adjust the burner using test instruments (continued)

Step 4

Verify operation

Burner/appliance/controls operation

- Test operating and limit controls on appliance as specified in appliance instructions.
- Check operation of the primary control by forcing lockout to occur. For primary controls that enter latch-up after multiple lockouts, force latch-up to occur as well. Reset primary control per control data sheet instructions after each test.
- Start and stop the burner several times, allowing the primary control to sequence through normal operation. Verify correct operation of burner and primary control throughout.
- Confirm and/or adjust overfire combustion pressure. Refer to boiler/furnace manufacturer's recommendations.

Verify vent system operation

- Verify vent is operating correctly and flue products are properly exhausted from building. If the building contains any exhaust fans or conditions that could affect vent performance, check burner/appliance/vent operation with exhaust fans (or other conditions) operating.

Combustion/ventilation air

- Verify combustion/ventilation air openings are not, and will not be obstructed.
- Verify air opening louvers are fully open.
- If louvers are motor-operated, verify motor and end switch are interlocked with appliance/burner wiring to prevent operation of the burner if the air louvers are not fully opened.

Prepare burner for normal operation

- Cycle burner off with appliance controls.
- Turn off power to the appliance.
- Seal the appliance flue test opening.
- Verify all components and wires are in place and burner is ready for operation.
- Restore power to the appliance.

Train the user

- Train the user to operate the burner and appliance under normal conditions.
- Explain the procedure to shut down the burner/appliance when required.
- Review the back cover of this manual (and the appliance manual) with the user.
- Verify the user is aware of all procedures specified in the manuals.
- Verify that the user will not store or use combustible liquids or materials or contaminants in the vicinity of the burner/appliance.

8. Maintenance and service procedures

When servicing the burner . . .

- DISCONNECT ELECTRICAL SUPPLY and all other electrical connections to burner before attempting to service to avoid electrical shock or possible injury from moving parts.
- CLOSE all manual gas valves before disconnecting any portion of fuel lines and before cleaning or removing any parts from the burner or related equipment.
- Burner and appliance components can be extremely hot. Allow all parts to cool before attempting to handle or service to avoid potential of severe burns.

WARNING Turn off power to appliance when servicing burner. After servicing, always operate burner/appliance to verify all components are functioning correctly and that the burner is properly adjusted. Failure to comply could result in severe personal injury, death or substantial property damage.

General maintenance

Cleaning blower wheel

1. The blower wheel accumulates dust and debris from normal operation. You will need to clean the wheel blades periodically to prevent reduction in airflow. Inspect the blower wheel regularly by opening the housing cover.
2. To clean blades, when necessary, remove the bolts securing the motor to the blower housing.
 - a. Slide the motor out and rotate to remove and access blower wheel.
 - b. Use a brush and vacuum to clean each blade and the blower housing interior.
 - c. Install motor/wheel in blower housing and secure with the two bolts.
 - d. Push wire slack back into junction box.

Replacing blower motor or wheel

1. If either the blower wheel or motor must be replaced, remove the bolts securing the motor to housing.
2. Disconnect the motor wires in the burner panel.
3. Loosen the Allen screw securing the blower to the motor shaft and remove the wheel.
4. When assembling the replacement assembly, slide the wheel onto the motor shaft and use feeler gauges to set space between the blower wheel and the motor face. This space must be 3/16 inch.
5. Install the motor/wheel assembly in the housing, wire the motor leads and secure the motor with the two bolts.

Motor maintenance

- Refer to motor manufacturer's instructions for oiling the motor as needed.

Checking ignitor

WARNING Never test an ignitor by placing a screwdriver (or other metallic object) across the high voltage clips. This could cause ignitor damage or severe personal injury.

1. Turn off the power to the burner/appliance.
2. Shut off gas supply to the burner.
3. Remove ignitor from back of panel.
4. Attach the spark plug clamp to the unpainted area of the ignitor plate using the screw from step 3. This grounds the spark plug.
5. Connect the ignitor lead to the spark plug.
6. Reapply power to the burner and, after the pre-purge timing, observe the spark.
7. If there is a spark, verify that the ignitor electrode is in the correct position and not grounded to the diffuser plate. Remove the spark tester and replace the screw and ignitor lead.
8. If there is no spark, verify that there is 120 volts being supplied to the ignitor. If there is not 120 volts supplied, then replace the ignitor.

Thermal fuse

1. When the burner is in a high-overfire draft condition, and not properly adjusted, it is possible that the flame could flash back inside the air tube. If this occurs, the thermal fuse will open in less than two seconds. The fuse must be replaced. (The burner is supplied with spare fuses.)

8. Maintenance and service procedures (continued)

Annual start-up and service

WARNING

This burner must be started and serviced at least annually by a qualified service technician. Failure to properly maintain and service the burner could result in severe personal injury, death or substantial property damage.

- Discuss burner/appliance operation with user to determine any problems that may have occurred during the previous season and to verify user is aware of proper operation and care of the burner/appliance.
- Review proper operation of the appliance/burner unit with the user.
- Turn off power to appliance.

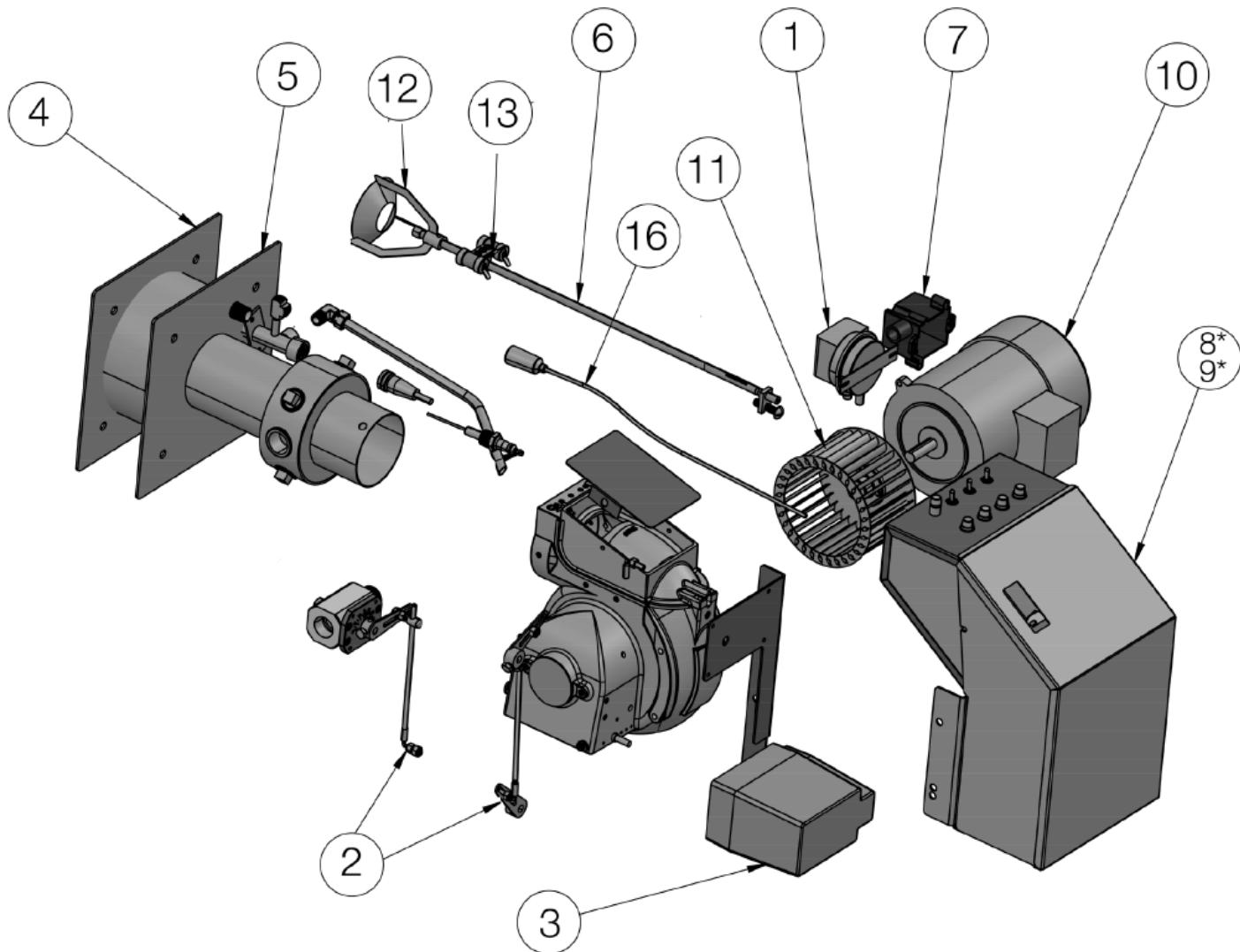
- Remove combustion head assembly to clean and adjust if necessary. (See above.)
- If the inside surface of the air tube and/or retention ring need to be cleaned, clean them with a vacuum cleaner with brush attachment while the combustion head assembly is out of the burner.
- Close the housing cover plate and secure in place.
- Perform the complete checkout procedures of pages 16, including system inspection and checks.
- Inform the user of any problems found.

8. Maintenance and service procedures (continued)

Installation/service certificate				
Installation data				
Burner model	Serial number	Measured gas firing rate, Btuh	Manifold gas pressure, IWC (High fire/Low fire)	Inlet gas pressure, IWC
CO ₂ % Gas Low Fire: _____ Gas High Fire: _____	O ₂ % Gas Low Fire: _____ Gas High Fire: _____	Were limit controls tested?		
Comments about installation/start-up:				
Installer's name:	Company name:	Company address:	Phone:	
Service history				
Date	Technician	Company/address	Describe work performed	

For parts not shown or listed, contact factory and/or check separate documentation supplied with appliance/burner unit.

9. Repair parts — Burner housing and components

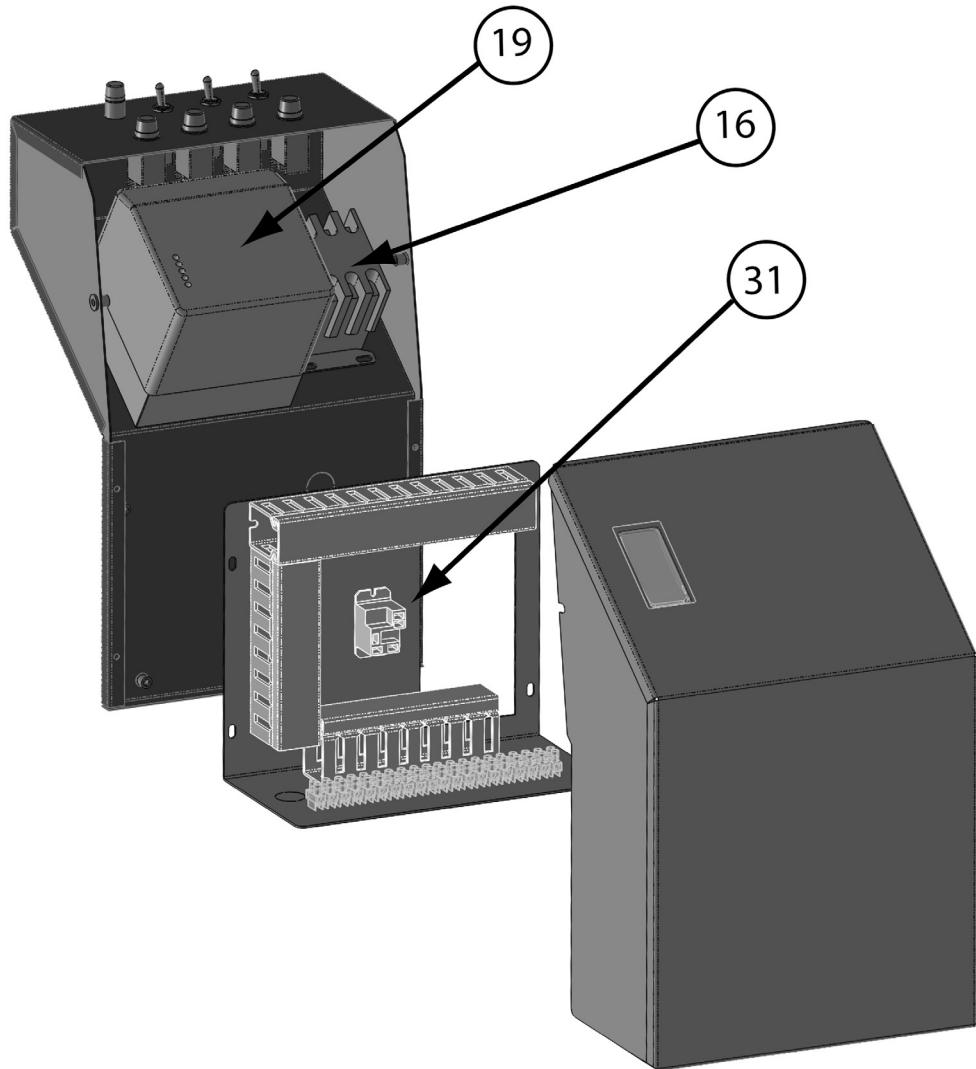


ITEM	PART NO.	DESCRIPTION
1	98522S	Air Flow Switch 120 Volt
2	51542S	Damper Motor Linkage Kit 11"
3	51317S	Damper Motor - SQN71
4	40246S	Gasket
5	99541BLUS	14" Tube with pressurized flange 1" main gas inlet; 1/2" pilot inlet
6	50005S	14" Combustion Head Assembly
7	41000S	Ignitor
8	35840S	Motor Contactor 30 AMP R4243B1004

ITEM	PART NO.	DESCRIPTION
9	35311S	C7027A1023 UV Scanner
	97656S	Q7800B1003 Sub Base
	99766S	RM7897C1000 Programming Control
	97662S	R7849A1023 Amplifier
	97716S	ST7800A1054 Timing Card
	EMX51UVS	EMX51UV KIT includes all of the above
10	27706S	Motor: 1/2 hp, 115/230V, 60HZ, 1 Phase, 3450 rpm
11	98857KITS	Blower Wheel, Coupling, Augmentor, 6-1/2" OD x 3-3/4" W, 1/2" Bore
12	56747S	Retention Ring Assy 702CRD
13	34215S	Thermal Fuse

For parts not shown or listed, contact factory and/or check separate documentation supplied with appliance/burner unit.

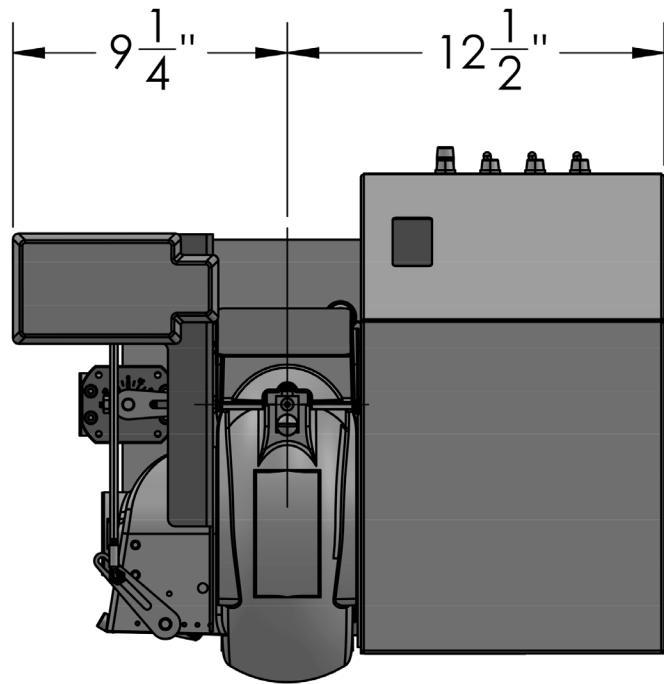
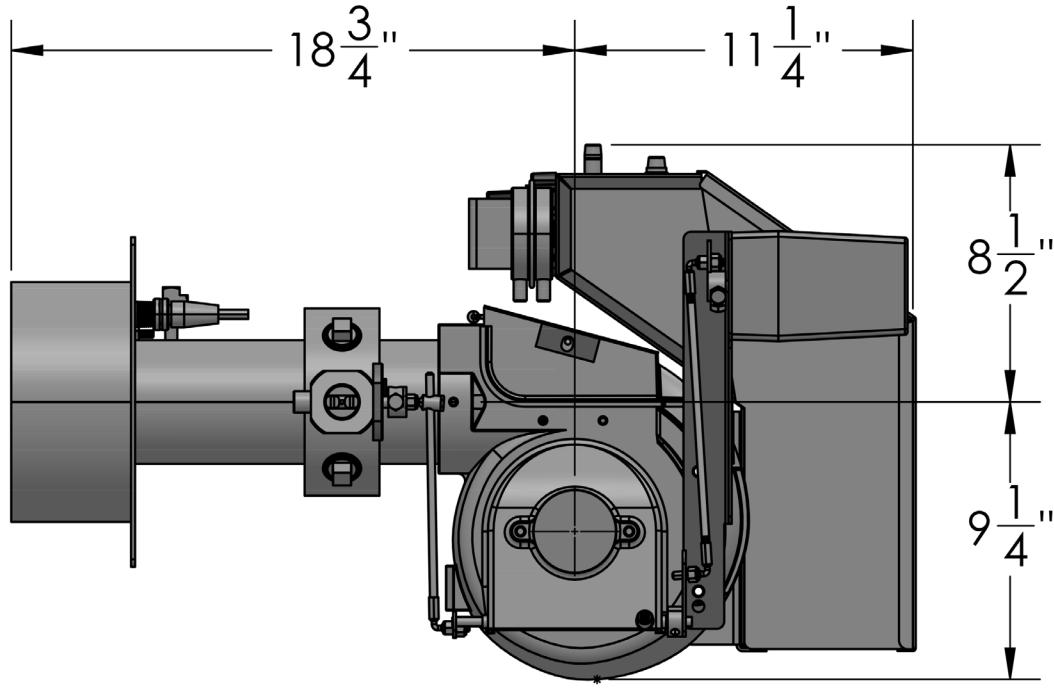
9. Repair parts (continued)



ITEM	PART NO.	DESCRIPTION
16	35824S	Motor Contactor 20 AMP R4242B1005
19	EMX51UVS	EMX51UV KIT includes all of the below
	35311S	C7027A1023 UV Scanner
	97656S	Q7800B1003 Sub Base
	99766S	RM7897C1000 Programming Control
	97662S	R7849A1023 Amplifier
	97716S	ST7800A1054 Timing Card
31	Consult Factory	Relay

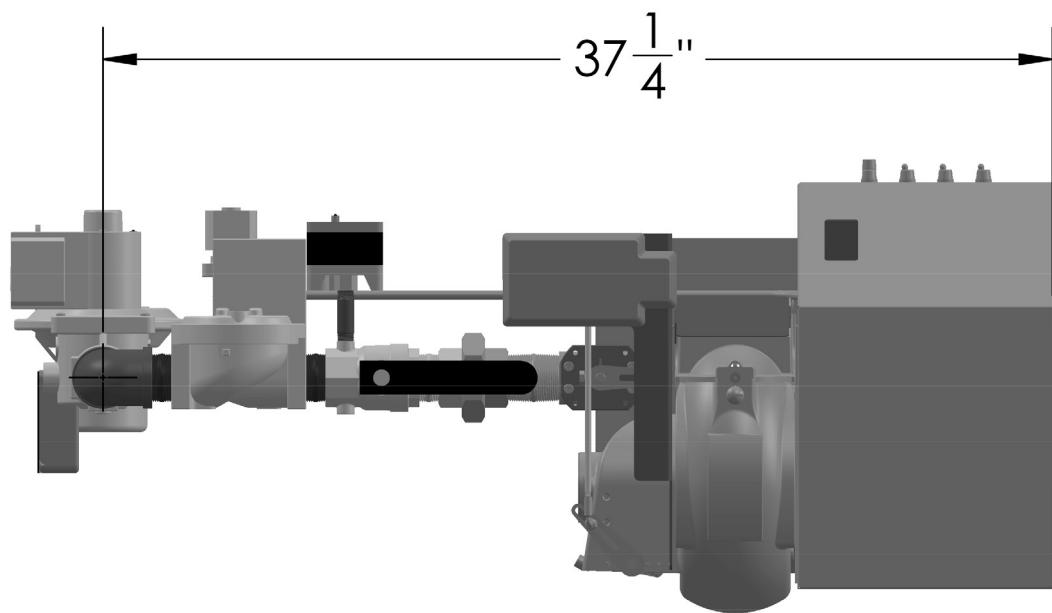
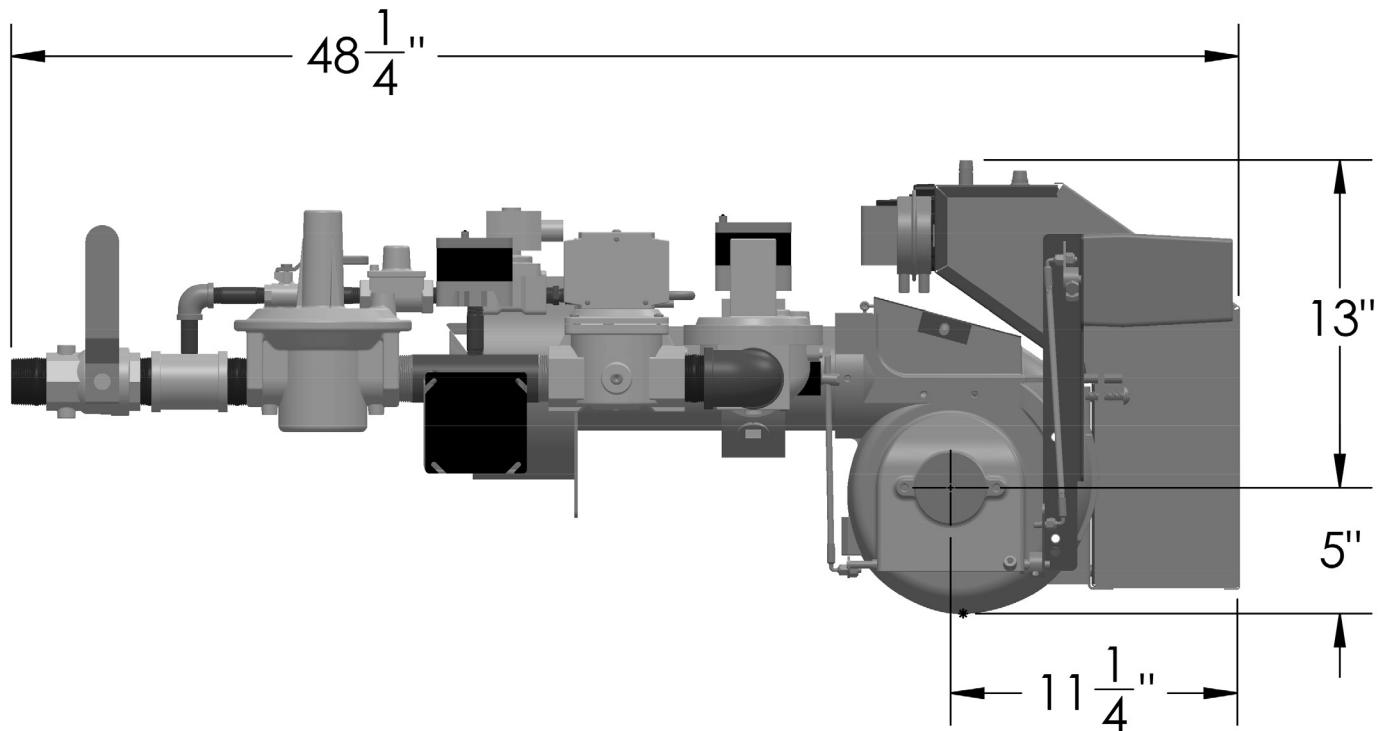
10. Dimensions

Figure 14 Dimensional data



10. Dimensions (continued)

Figure 14A Dimensional data, angled gas train



NOTES



702GAS Burner

User care and maintenance



WARNING Refer only to the information on this page, intended for your use. The remainder of this manual is intended only for your service technician. Failure to comply could result in severe personal injury, death or substantial property damage.

For other than routine maintenance, contact a qualified service company. Perform the following as needed.

- Keep the area around the burner clear and free from combustible vapors and liquids.
- Do not obstruct the flow of combustion and ventilating air.
- Most motors currently used on residential type burners use permanently-lubricated bearings, and do not require field lubrication. Read the label on the motor to determine oiling needs, if any. Do not over-lubricate. This can cause as much trouble as not lubricating at all.

WARNING The burner must be cleaned, tested and adjusted annually by a qualified burner service technician.

Should overheating occur:

- (1) Shut off gas supply to the burner.
- (2) DO NOT shut off the control switch to the circulator or blower.
- (3) Contact your service technician and the fire department (if needed).