CG/SERIES

Installation,
Operation,
Service,
and
Parts Manual

Industrial Combustion, LLC

⚠ WARNING

ONLY FACTORY AUTHORIZED BURNER SERVICE PERSONNEL SHOULD START- UP, ADJUST, OR SERVICE THIS EQUIPMENT.

IC-1004
2/09

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PARTS MANUAL

OPERATING PRECAUTIONS

This operating manual presents information that will help to properly operate and care for the equipment. Study its contents carefully. The unit will provide good service and continued operation if proper operating and maintenance instructions are followed. No attempt should be made to operate the unit until the principles of operation and all of the components are thoroughly understood. Only trained and authorized personnel should be allowed to operate, adjust or repair this equipment.

If you are operating a burner(s), it is your responsibility to ensure that such operation is in full accordance with all applicable safety requirements and codes.

Placed on all Industrial Combustion burners are warning or caution labels designed to inform the operator of potential hazards and stress important information.

These symbols and their meanings are as follows:

⚠ WARNING

FAILURE TO INSTALL AND OPERATE THIS EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDED INSTRUCTIONS AND INDUSTRY STANDARDS AND PRACTICES CAN RESULT IN FIRE, EXPLOSION, PROPERTY DAMAGE AND/OR PERSONAL INJURY !! READ THIS MANUAL IN IT'S ENTIRIETY PRIOR TO ANY ATTEMPT TO COMMISSION THIS EQUIPMENT. INSTALLATION, STARTUP, OPERATION AND MAINTENANCE OF THIS EQUIPMENT MUST BE PERFORMED ONLY BY FACTORY AUTHORIZED, EXPERIENCED AND QUALIFIED PERSONNEL.

⚠ WARNING

HAZARD OF ELECTRIC SHOCK !!! MORE THAN ONE DISCONNECT MAY BE REQUIRED TO DISCONNECT ALL POWER TO THIS PANEL. SERIOUS PERSONAL INJURY OR DEATH MAY RESULT.

⚠ WARNING

READ PRODUCT MANUAL AND FULLY UNDERSTAND ITS CONTENTS BEFORE ATTEMPTING TO OPERATE THIS EQUIPMENT. SERIOUS PERSONAL INJURY OR DEATH MAY RESULT.

⚠ WARNING

TO AVOID PERSONAL INJURY FROM MOVING PARTS, SHUT OFF ALL ELECTRICAL POWER BEFORE SERVICING THIS EQUIPMENT.

CAUTION

PROVIDE SUPPORT FOR THIS PANEL TO PREVENT DAMAGE TO THE ELECTRICAL COMPONENTS.

CAUTION

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CAUTION

AFTER FINAL FUEL INPUT ADJUSTMENTS ARE MADE, VERIFY FUEL INPUT BY METER IF POSSIBLE.

Further warning and caution references have been made in this manual and should be adhered to for smooth operation of the burner.

WARNING This symbol precedes information which, if disregarded, may result in injury to the user of the burner or to others.

CAUTION This symbol precedes information which, if disregarded, may result in damage to the burner.

NOTE This symbol precedes information which is vital to the operation or maintenance of the burner.

Model designations are based on the type of fuel(s) to be fired and the amount of furnace pressure to be overcome. Burner size is based on firing rate (rated input in BTU/HR).

MODEL	FUEL
CG	GAS

EXAMPLE: Model number on nameplate is CG-42, indicating it is a Gas burner with input rated at 4,200 MBTU per hour, against furnace pressures up to 0.50" W.C.

RATED BURNER INPUT	
SIZE	**MBTU/HR**
6	600
9	900
12.5	1250
17	1700
23	2300
30	3000
36	3600
42	4200

* Gas input based on natural Gas at 1,000 Btu/cu.ft. and 0.60 specific gravity.

** Refer to burner nameplate data for correct manifold pressures.

THE INSTALLATION OF A BURNER SHALL BE IN ACCORDANCE WITH THE REGULATIONS OF AUTHORITIES HAVING JURISDICTION. THE EQUIPMENT MUST BE INSTALLED IN ACCORDANCE WITH APPLICABLE LOCAL, STATE OR PROVINCIAL INSTALLATION REQUIREMENTS INCLUDING THE NATIONAL ELECTRICAL CODE (NEC) AND ASSOCIATED INSURANCE UNDERWRITERS.

GAS BURNING EQUIPMENTS SHALL BE CONNECTED TO FLUES HAVING SUFFICIENT DRAFT AT ALL TIMES, TO ASSURE SAFE AND PROPER OPERATION OF THE BURNER.

SECTION 1
INTRODUCTION

A. GENERAL INFORMATION

Industrial Combustion CG/Series burners are assembled, wired and tested at the factory. They are listed by the Underwriters Laboratory, cUL, CSD-1, GAP, F.M., and other regulatory agency control options are available.

The operator of this equipment must be familiar with the individual functioning of all controls to understand the operations and procedures described in this manual, and supplementary instructions provided with optional controls. Identify and locate each item in the illustrations as they are described in the following sections.

CAUTION

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B. DESCRIPTION

The Industrial Combustion CG/Series burners are designed to operate with gas. The burners are designed for automatic, unattended operation except for periodic inspection and maintenance. The control panel components require little attention except for occasional cleaning.

The burners are available in the following configuration:

CG6-9	On-Off
CG12.5-23	Low-High-Off
(Optional: Low-High-Low, Full Modulation)	
CG30-42	Full Modulation

C. OPERATING CONTROLS - PANEL

The control panel contains a flame safeguard programming control, motor relays (starters), and terminal strips mounted internally on a panel subbase. Lights, switches, and a control circuit breaker are mounted externally on the panel as indicated below.

1. **ON-OFF BURNER SWITCH**

2. **CONTROL CIRCUIT BREAKER**
   Supplementary low overcurrent protection only. No larger than 15 amps.

3. **AUTO-MANUAL MODULATION SELECTOR SWITCH**
   Auto Position: Selects boiler modulation control. In this position, the burner will operate automatically in response to load demand.
   Manual Position: Selects 135 ohm potentiometer for manual modulating control.

4. **MANUAL MODULATING CONTROL** 135 ohm
   (For full modulation burners only) Increases or decreases the burner firing rate manually.

5. **SIGNAL LAMPS.**
   a. POWER ON (white) illuminates when the control circuit is energized (powered).
   b. IGNITION (amber) illuminates when the ignition transformer is powered, and pilot valve is energized (opened).
   c. MAIN FUEL (green) illuminates when the main fuel valve or valves are energized (open).
   d. FLAME FAILURE (red) illuminates when the flame safeguard system fails to detect pilot or main flame.

6. **MODULATING MOTOR (OPTIONAL)**
   Operates the air damper and fuel rate valves through a linkage system to adjust air-fuel ratios under all load conditions.

7. **IGNITION TRANSFORMER**
   Provides high voltage spark for ignition of gas pilot or main flame direct spark models.

D. FLAME SAFEGUARD CONTROLS

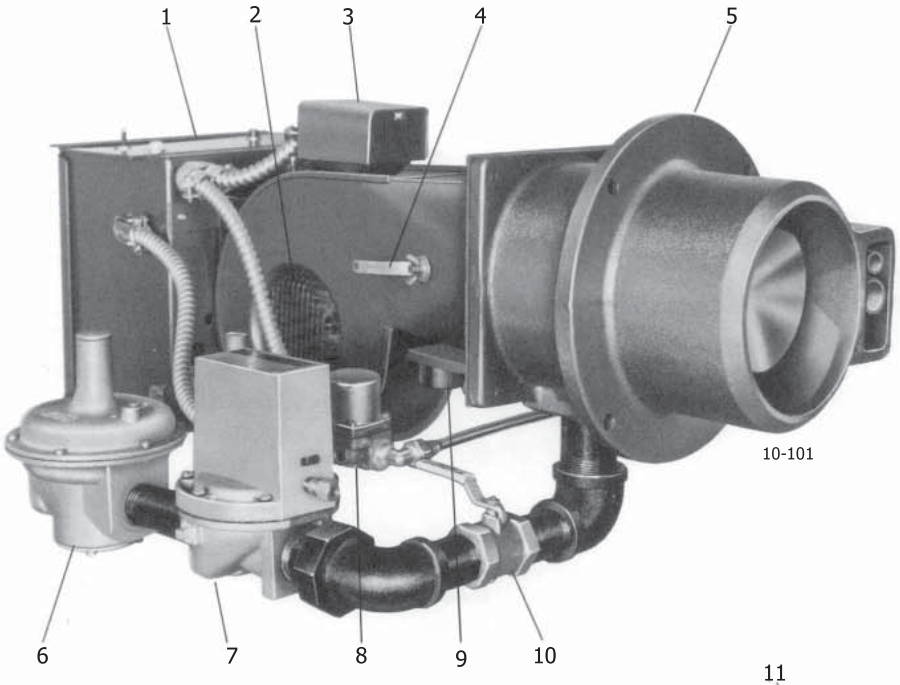
The flame safeguard controls the operating sequence of the combustion system (prepurge, pilot, firing and shutdown). The flame safeguard programmer incorporates a flame sensing cell (scanner) to shut down the burner in the event of pilot flame or main flame failure. Other safety controls shut down the burner based on sequence of operation as shown in the manufacturers flame safeguard manual.

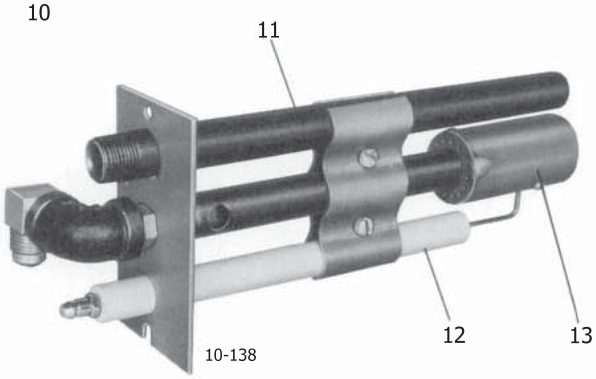
FLAME SCANNER

Monitors gas pilot flame and energizes the programmer's flame relay in response to a flame. It monitors main flame (oil or gas) after termination of pilot proving period.

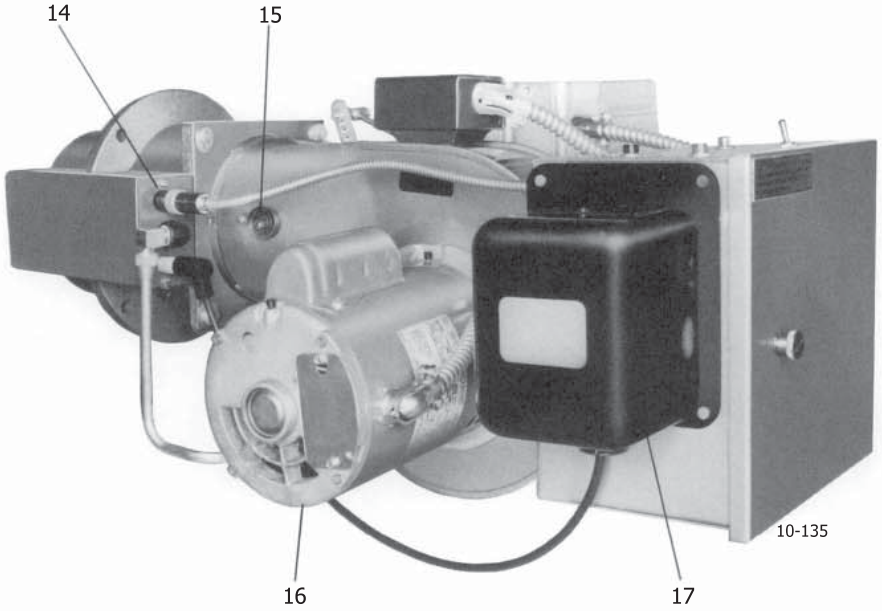
MOTOR

Drives blower fan and fuel unit at 3450 rpm.

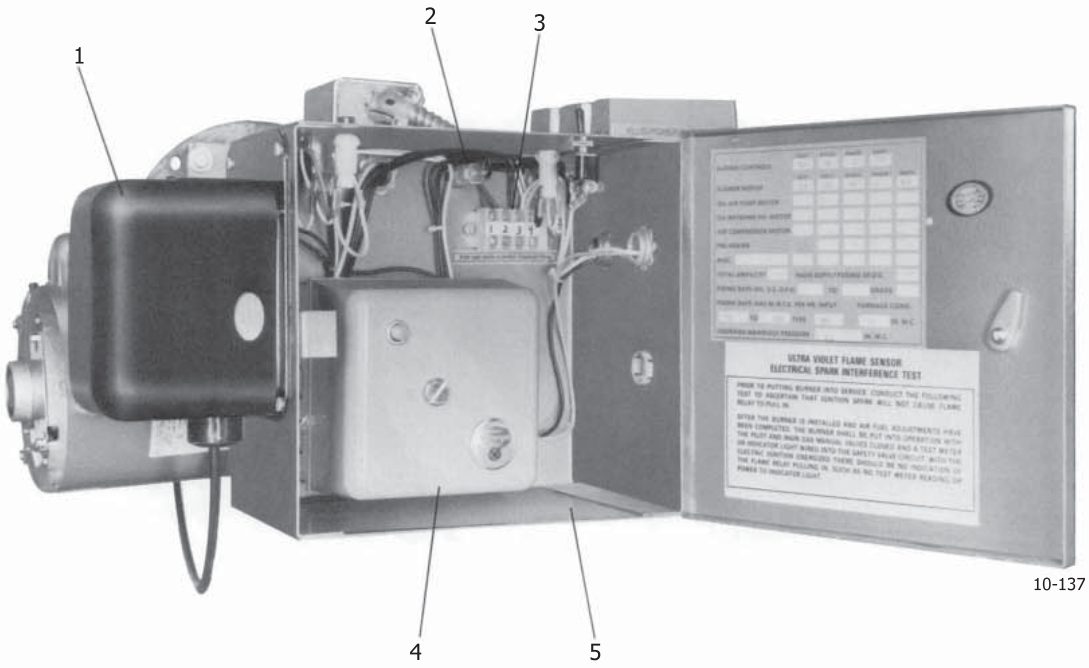




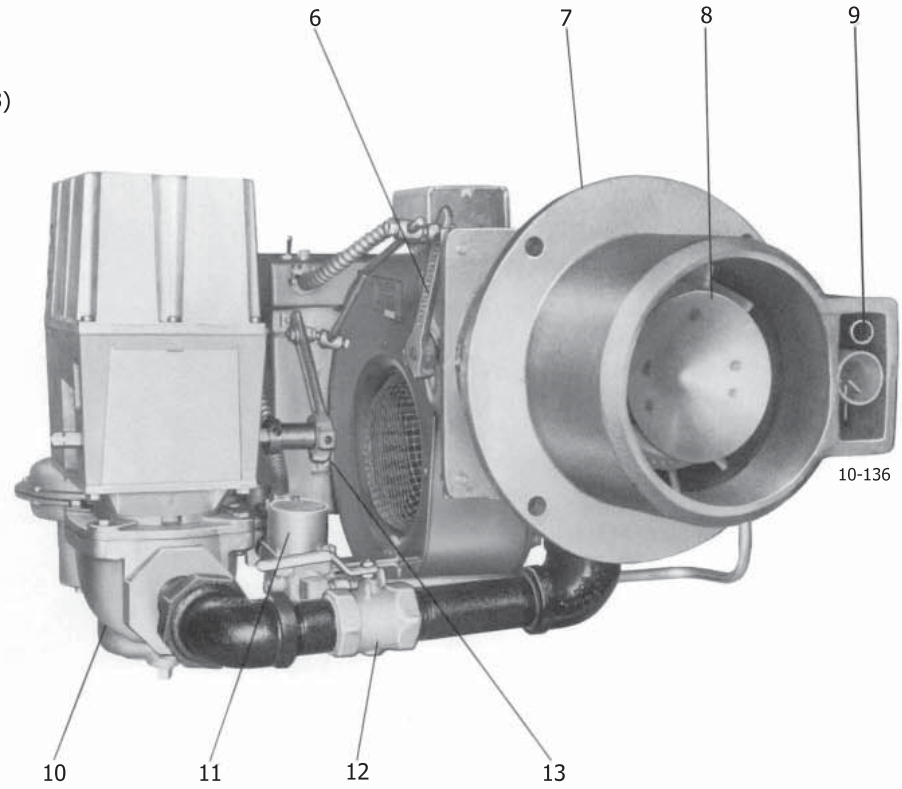
1. Control Panel
2. Combustion Air Inlet
3. Combustion Air Proving Switch
4. Air Damper Adjustment Lever
5. Cast Iron Blast Tube and Flange
6. Pressure Regulator
7. Diaphragm Gas Valve (Models 6-9)
8. Pilot Solenoid Valve
9. Burner Support Bracket
10. Manual Shutoff Cock
11. Scanner Sight Tube
12. Ignition Electrode
13. Gas Pilot
14. Drawer Assembly Access Plate
15. Damper Return Spring (Models 12.5-23)
16. Blower Motor
17. Ignition Transformer



TYPICAL CG6-23 Figure 1-1

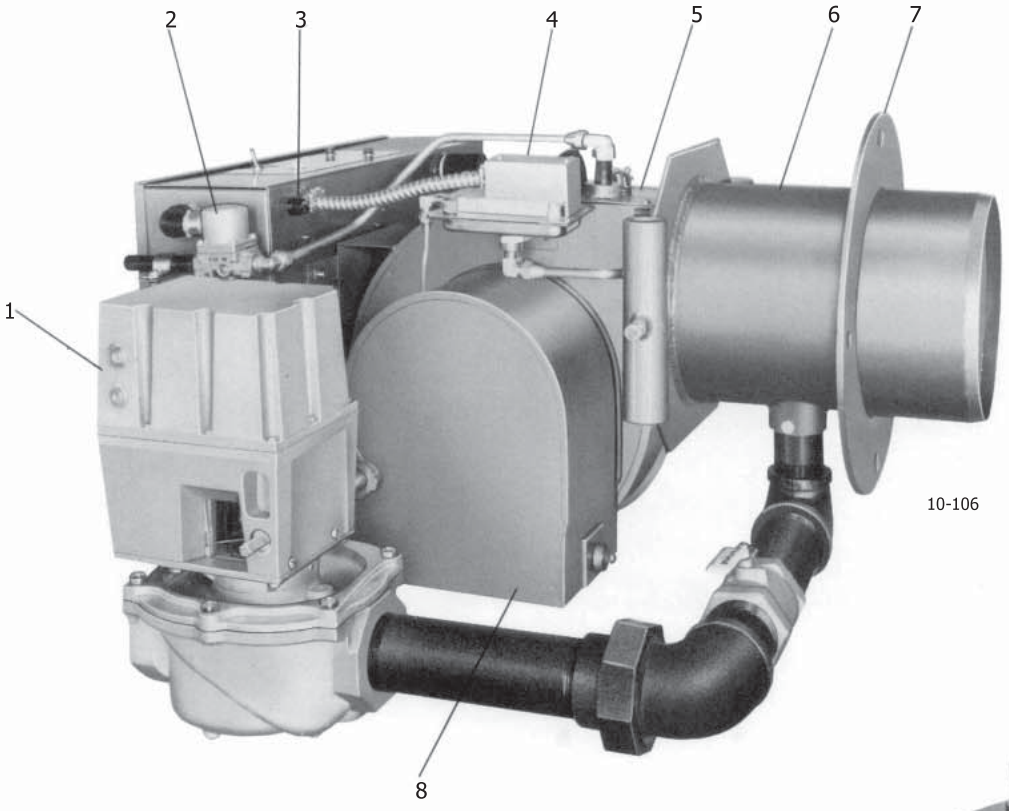


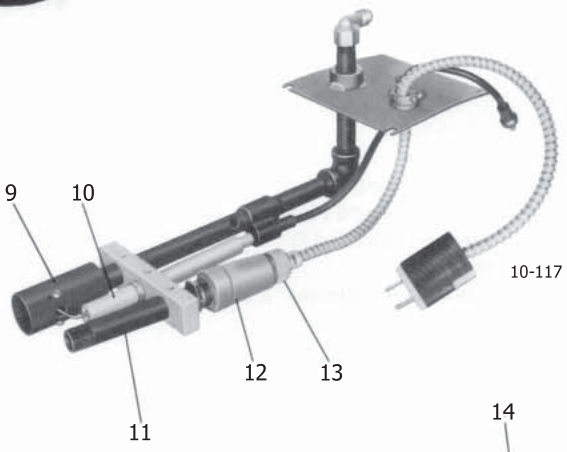
1. Ignition Transformer
2. Control Circuit Breaker
3. Terminal Strip
4. Programming and Flame Safeguard Control
5. Control Panel Box
6. Combustion Air Linkage
7. Cast Iron Blast Tube and Flange
8. Air Mixer Plate (Models 6-7)
9. Drawer Assembly
10. Motorized Gas Valve (Models 12.5-23)
11. Pilot Solenoid Valve
12. Manual Shutoff Cock
13. Gas Valve Actuating Linkage



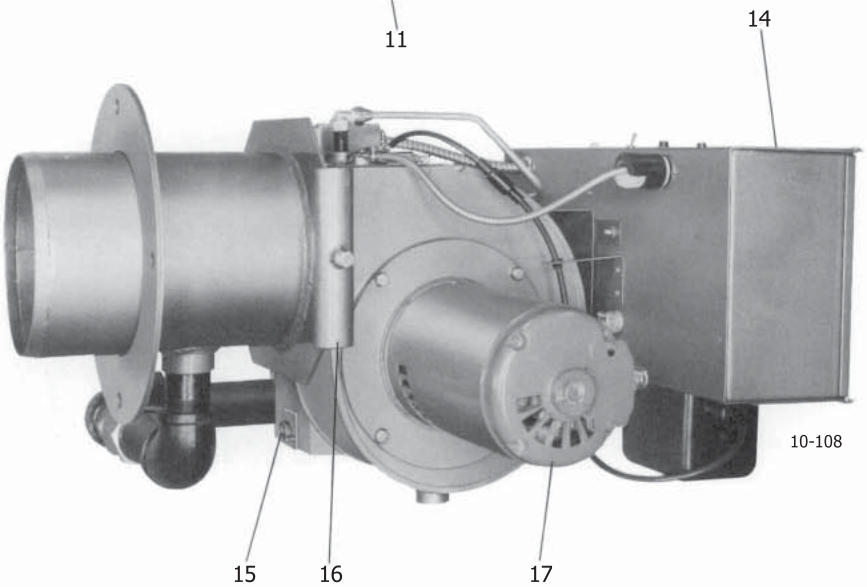
TYPICAL CG6-23

Figure 1-2



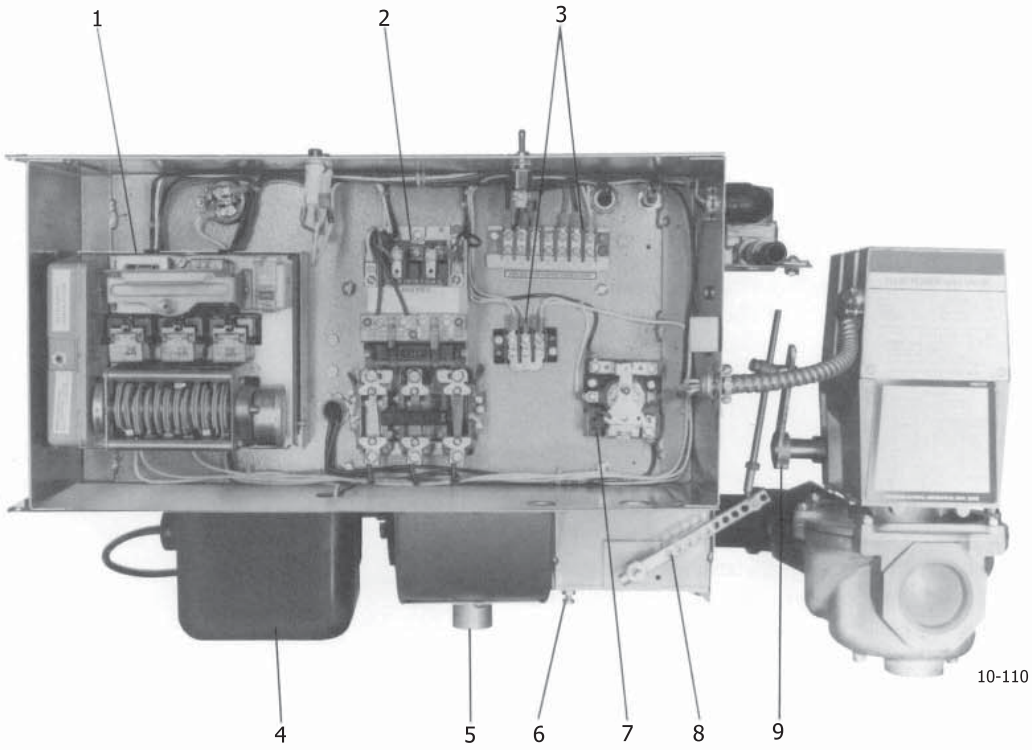


1. Motorized Gas Valve
2. Pilot Solenoid Valve
3. Control Circuit Breaker
4. Combustion Air Proving Switch
5. Removable Drawer Assembly
6. Blast Tube
7. Mounting Flange
8. Combustion Air Inlet
9. Gas Pilot
10. Ignition Electrode
11. Scanner Sight Tube
12. Heat Block
13. Flame Detector
14. Control Panel
15. Air Damper Return Spring
16. Pipe Support Bracket
17. Blower Motor

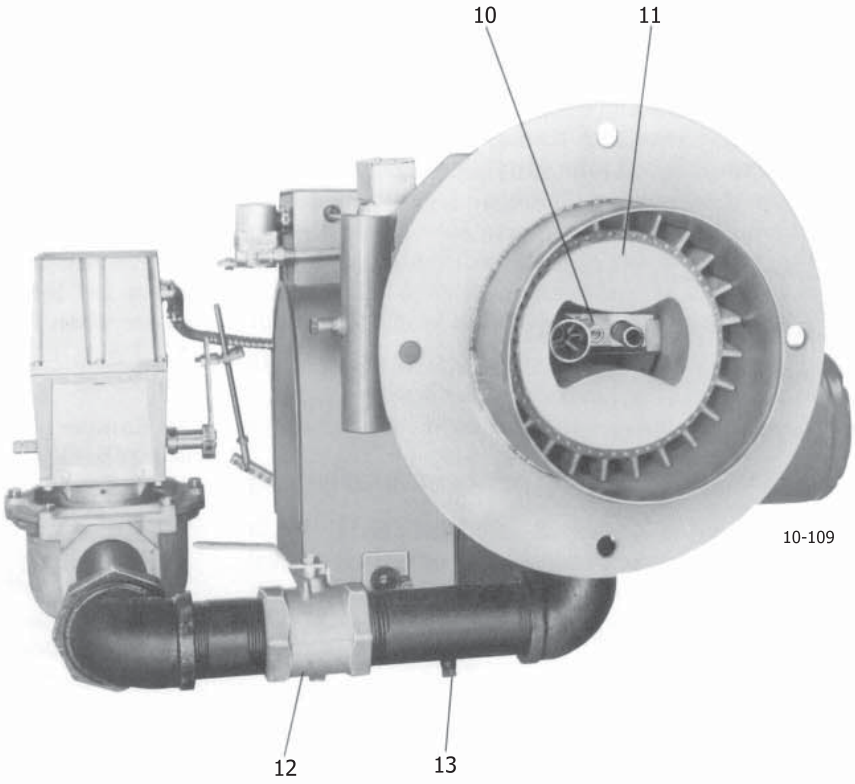


TYPICAL CG30-42

Figure 1-3



1. Programming and Flame Safeguard Control
2. Motor Starter
3. Terminal Strip
4. Ignition Transformer
5. Burner Support Bracket
6. Damper Low Fire Stop Screw
7. Relay
8. Combustion Air Linkage
9. Gas Valve Actuating Linkage
10. Drawer Assembly
11. Gas Manifold
12. Manual Shutoff Valve
13. Pressure Tap



TYPICAL CG30-42

Figure 1-4

E. COMBUSTION AIR HANDLING SYSTEM

MOTOR AND BLOWER - Motor driven squirrel cage type blower fan for forced draft combustion air supply.

AIR VOLUME REGULATOR

CG6-9 - Air damper plate is located in fan housing. Air adjustments is set for fixed fire operation with levers and lock nuts.

CG-12.5-23 - Air damper plate is located in the fan housing. Damper is mechanically interlocked and actuated by main gas valve for low-high-off operation and by modulating motor when in full modulation.

CG-30-42 - Air damper plate is located in the air scoop housing. Damper is mechanically linked and actuated by the main gas valve for low-high-off operation and by modulating motor when in full modulation.

3. **COMBUSTION AIR PROVING SWITCH -** A pressure sensitive switch actuated by air pressure created by the blower fan. Contacts close to prove combustion air flow.

F. GAS SYSTEM (Figure 1-7)

Depending upon the requirements of the regulating authority, the gas control system and gas train may consist of some, or all, of the following items:

MAIN GAS TRAIN COMPONENTS

1. **MAIN GAS VALVES** - Electrically operated safety shutoff valve(s) that open to admit gas to the burner. Standard U.L. burners include:
   - -Models: 6-9; One diaphragm gas valve
   - -Models: 12.5-23; One motorized gas valve
   - -Models: 30-42; One motorized gas valve and one solenoid valve

2. **MAIN GAS REGULATOR -** Regulates gas train pressure to specified pressure reqiured at inlet to gas train. Input is set by main gas pressure regulator adjustment.

3. **MAIN GAS COCKS -** Used for manual shutoff of the gas supply upstream of the pressure regulator. A second shutoff cock downstream of the main gas valve(s) provides a means of testing for leakage through the gas valve(s).

4. **HIGH GAS PRESSURE SWITCH** (Models 30-42)
A pressure actuated switch that remains closed when gas pressure is below a selected setting. Should the pressure rise above the setting, the switch contacts will open causing main gas valve(s) to close. This switch requires manual reset after being tripped.

5. **LOW GAS PRESSURE SWITCH** (Models 30-42)
A pressure actuated switch that remains closed when gas pressure is above a selected setting. Should the pressure drop below this setting, the switch contacts will open, causing main gas valve(s) to close. This switch requires manual reset after being tripped.

6. **GAS VOLUME VALVE (OPTIONAL)**
When full modulation is provided, the butterfly type valve is positioned by linkage from the modulating motor.

NOTE

PILOT GAS SUPPLY CONNECTION MUST BE UPSTREAM OF MAIN GAS PRESSURE REGULATOR.

G. PILOT GAS TRAIN

GAS PILOT VALVE

A solenoid valve that opens during the ignition period to admit fuel to the pilot. It closes after the main flame is established.

GAS PRESSURE REGULATOR

Regulates gas pressure to that required by the pilot**.**

GAS PILOT SHUT-OFF COCK

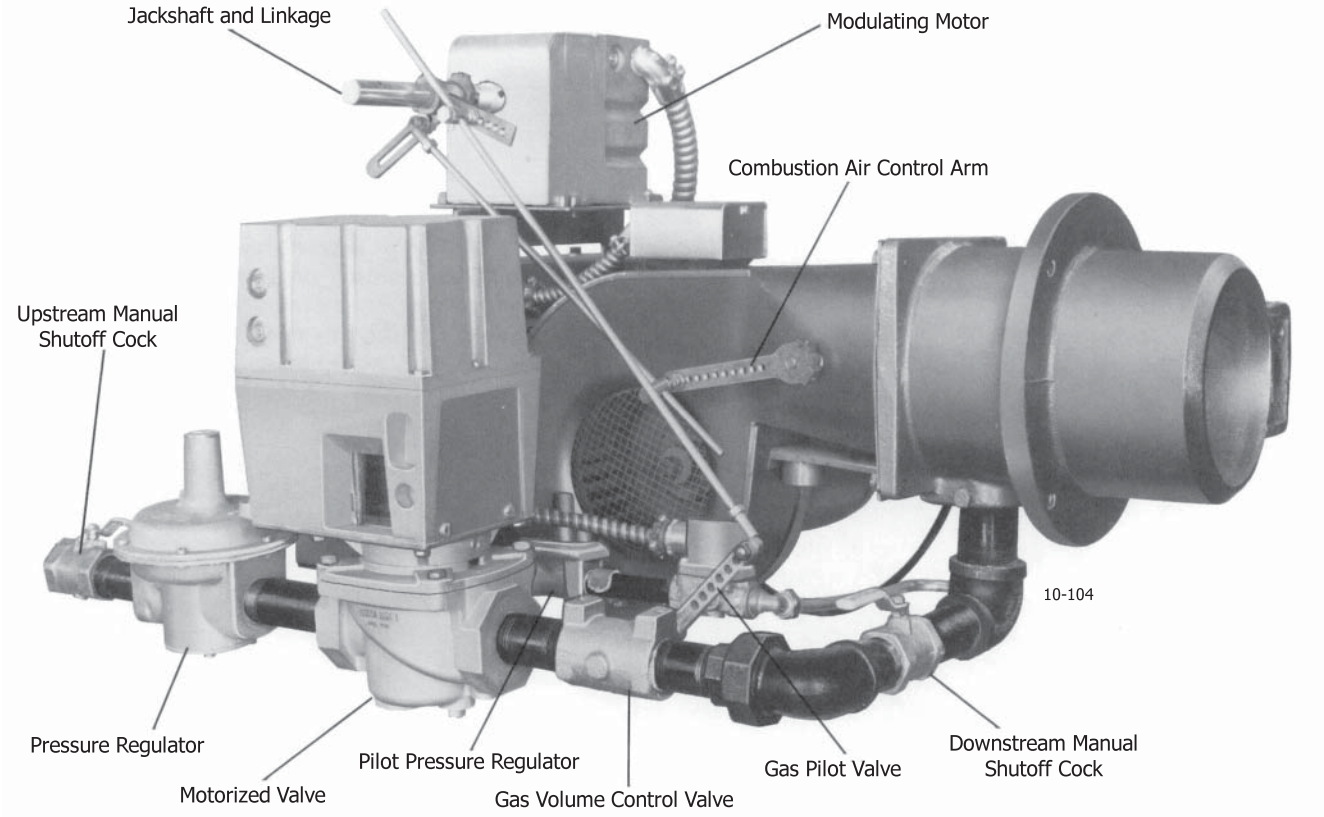
For manually closing the pilot gas supply.

H. GAS MANIFOLD

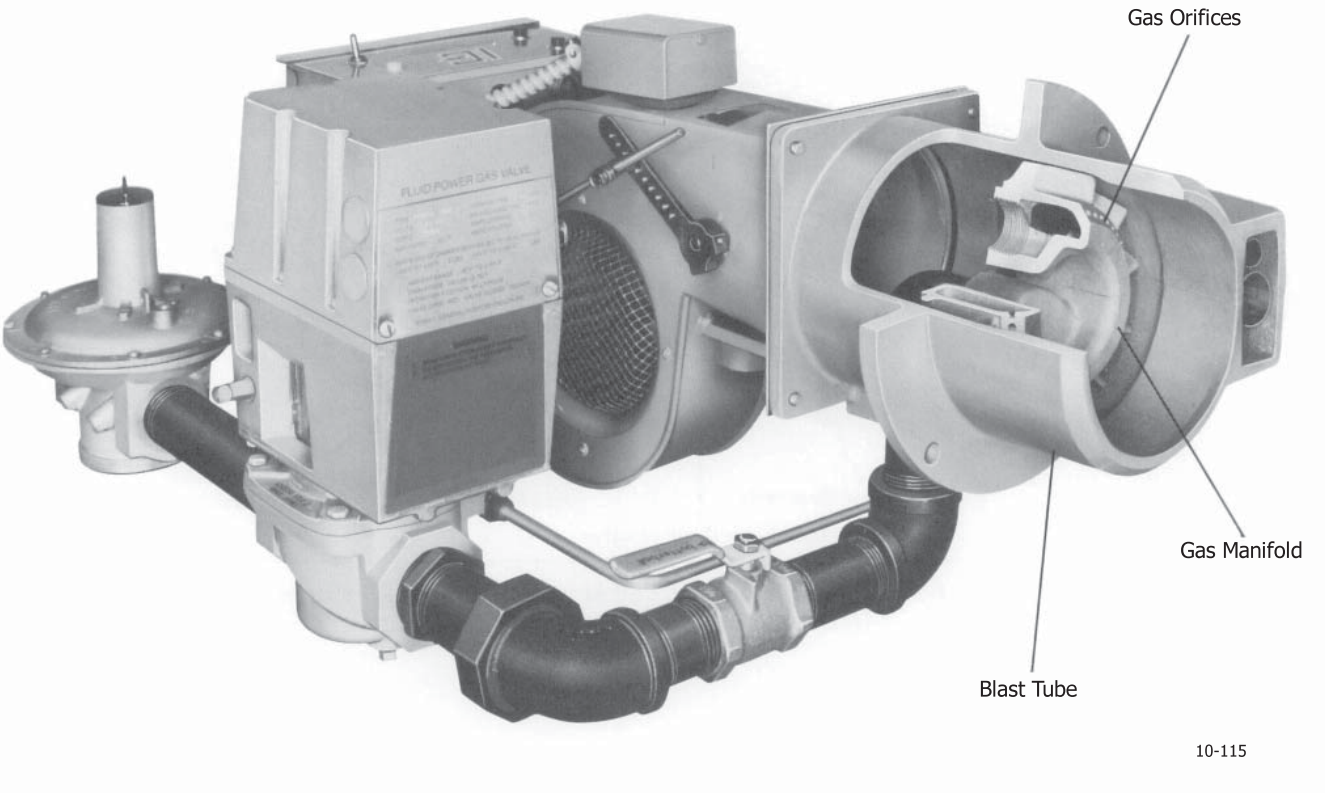
The gas manifold is a cast aluminum housing which distributes gas through orifices in the combustion air stream. Figure 1-8 shows construction features of the gas manifold.

I. AIR MIXER PLATE (Models 6-17)

Stabilizes flame front.



U.L. GAS TRAIN AND FULL MODULATION ON CG17 BURNER Figure 1-5



CUTAWAY VIEW OF BLAST TUBE AND GAS MANIFOLD. CG17 SHOWN. Figure 1-6

SECTION 2
INSTALLATION

A. DRAFT CONDITIONS

A boiler or other heating vessel fired with an CG/Series burner does not depend on chimney draft for proper combustion air. Combustion air is supplied by the burner forced draft blower providing adequate air for any normal combustion condition.

Since draft control is essential to maximum efficiency, a draft regulator may be required when the vessel is connected to a tall stack or where wind conditions may cause erratic draft. Excessive furnace draft contributes to inefficient burner operation.

Sealed boilers may be operated under positive firebox pressure within the capability of the burner.

B. COMBUSTION AIR SUPPLY

The space in which a burner operates must be supplied with adequate fresh air for combustion and ventilation purposes. Fresh air supply must meet or exceed all code requirements. Consult with insurance carrier and/or local authorities for specific regulations.

WARNING

THE BOILER ROOM PRESSURE MUST BE AT LEAST EQUAL TO THE OUTDOOR ATMOSPHERIC PRESSURE. WHERE FAN VENTILATION IS USED, AIR MUST BE FORCED INTO THE BOILER ROOM. NEVER EXHAUST AIR FROM THE BOILER ROOM. ADJOINING AREAS HAVING EXHAUST FANS MUST BE POSITIVILY ISOLATED FROM THE BOILER ROOM.

C. COMBUSTION CHAMBER DESIGN

It is not possible to include a complete design and construction combustion chamber manual in this section, but the following may be helpful in arranging burner applications in typical boilers. Combustion chambers are of three basic types:

1. Completely water enclosed as in Scotch type boilers.
2. Conventional “dry bottom” firebox boilers having a refractory floor and full water walls.
3. Full refractory combustion chambers in “ash pit” type installations where a complete firebox is required below the level of the boiler water walls.

The CG/Series burners are of the forced draft flame retention type. Refractory is required only to protect surfaces not adequately protected by free circulating water. Four basic objectives are:

1. Provide adequate combustion space.
2. Avoid flame impingement.
3. Protect surfaces not adequately water cooled.
4. Seal openings.

Suggested minimum combustion chamber dimensions in Figure 2-1 are based on the rated capactiy of the burner.

BURNER	COMBUSTION CHAMBER		
MODEL	LENGTH	WIDTH	CL HEIGHT
6	23	15	7
9	25	18	8 1/2
12.5	28	18	10
17	34	21	11
23	46	24	12
30	56	22	10
36	58	26	11
42	60	28	12

Figure 2-1

While these dimensions are typical for good practice, satisfactory results may be achieved with modifications to suit some conditions. Factors such as fuel properties, total combustion volume, and length of flame travel often make fixed requirements impractical. When in doubt, consult the factory.

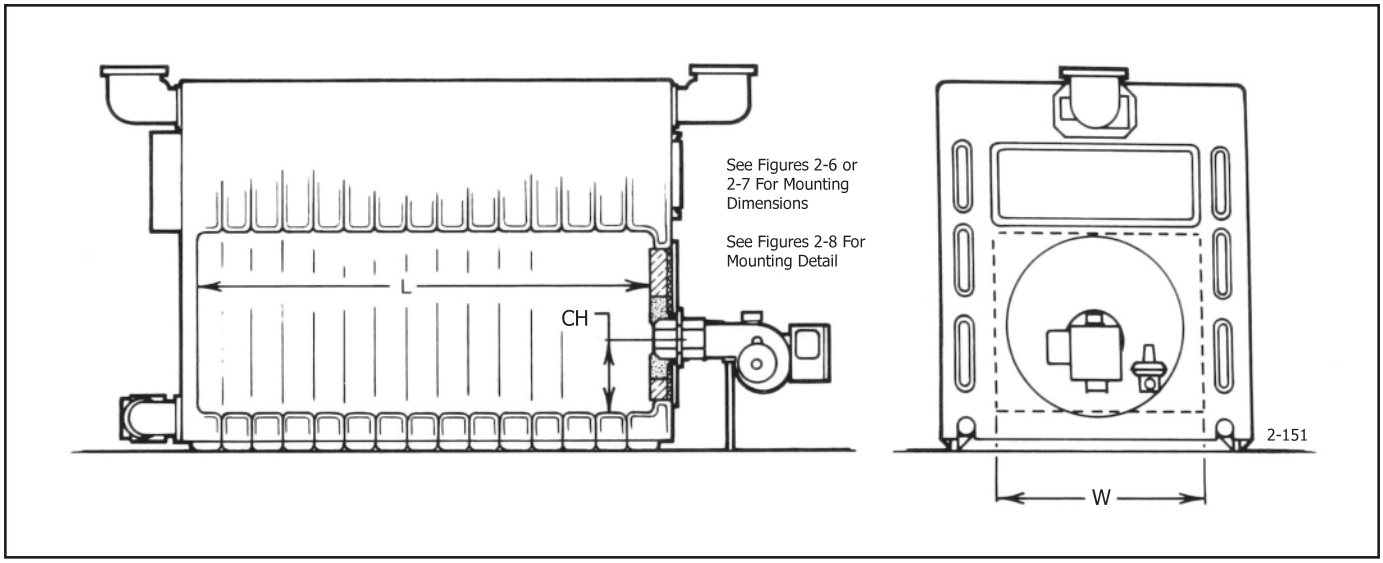
Figure 2-2 shows a typical installation for cast iron sectional type boilers. Refer to Figure 2-1 for dimensions.

Figure 2-3 shows a typical firebox boiler base installation. Combustion chamber firebrick walls should extend a minimum of 4” above the water leg of the boiler.

Insulation should be provided between the refractory and the boiler base. Mineral wool, or other material not likely to settle is preferred. The chamber front wall may be constructed of firebrick or insulating firebrick. Insulation should be used between refractory and front plate. Firebrick, or insulating firebrick should be set in high temperature bonding mortar with provision for expansion.

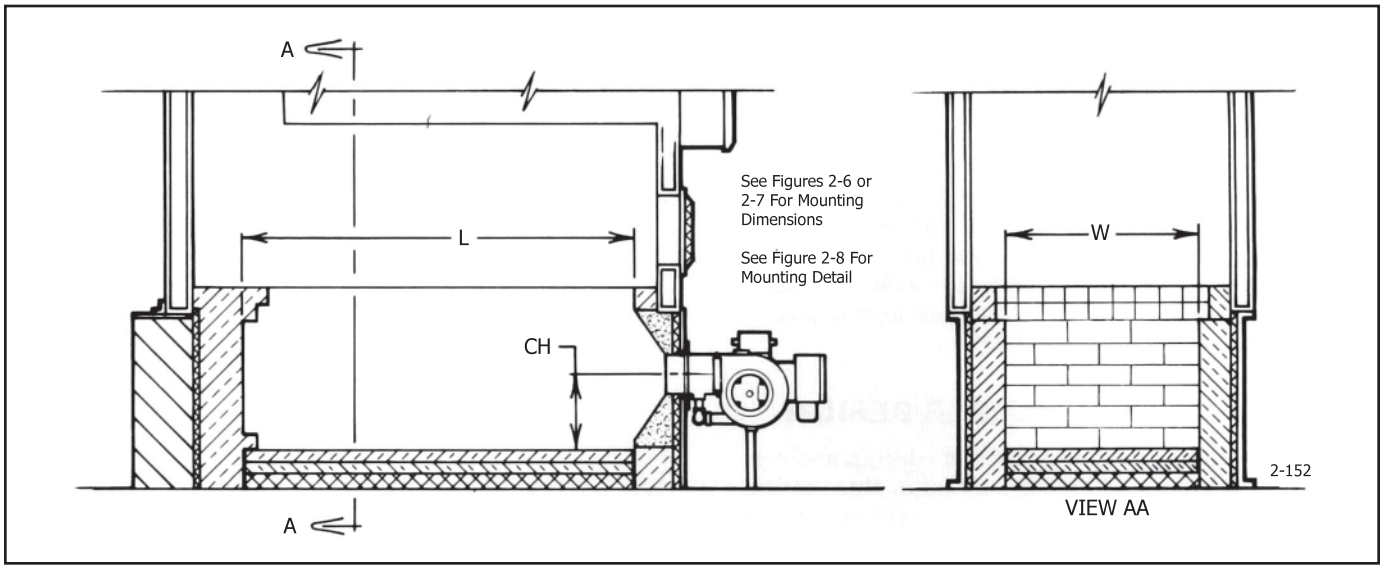
Figure 2-4 shows a typical fire door type installation in a sealed base firebox boiler. Where combustion volume is adequate and boiler design permits, fire door installations are acceptable. A suitable hearth can be made by filling the base with rubble and covering with insulation and loose or cast refractory.

Figure 2-5 shows a typical installation for Scotch type boilers.



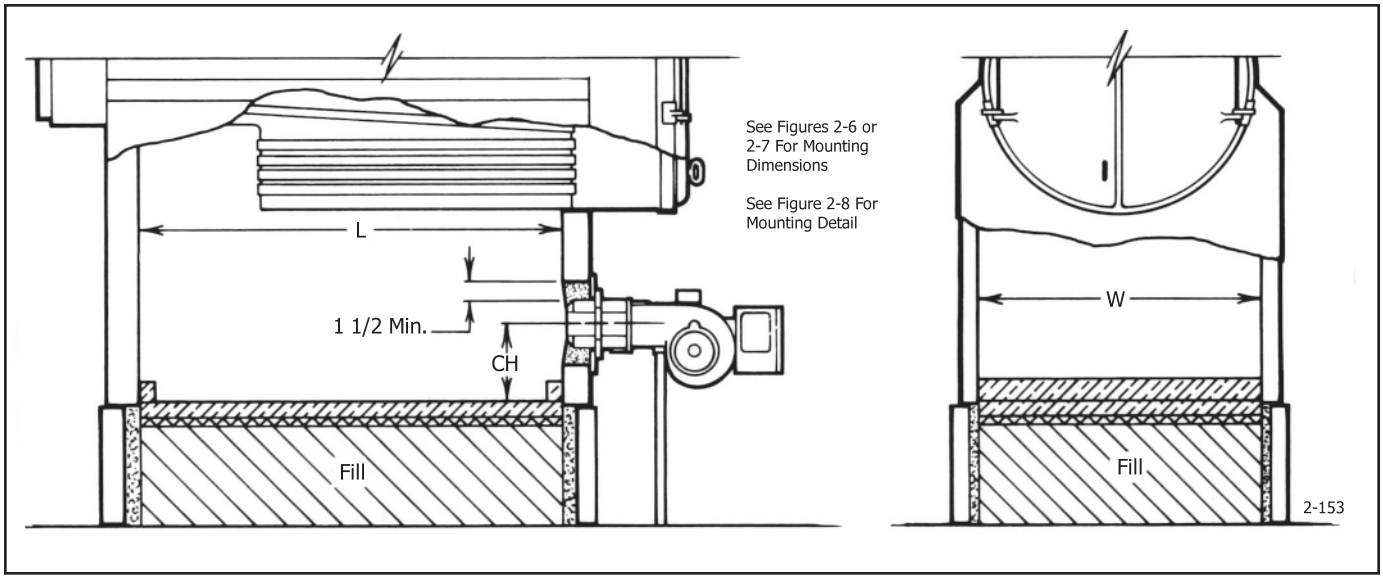
TYPICAL APPLICATION TO CAST IRON SECTIONAL BOILER

Figure 2-2



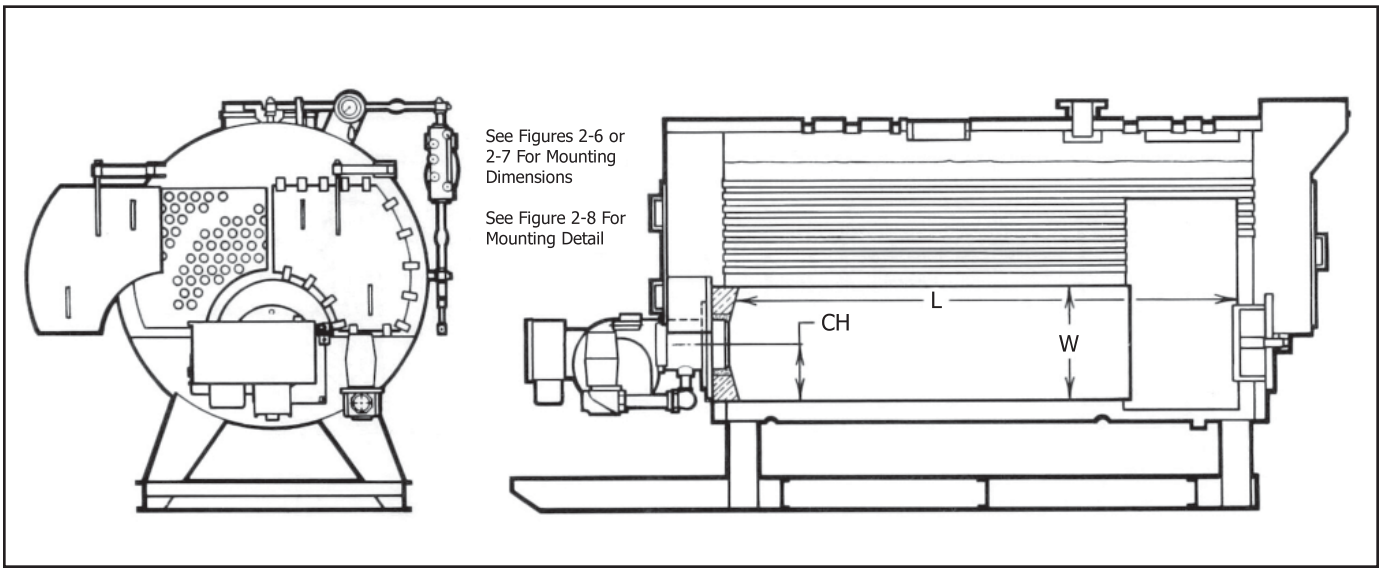
TYPICAL APPLICATION TO FIREBOX BOILER

Figure 2-3



TYPICAL FIRE DOOR APPLICATION

Figure 2-4



TYPICAL APPLICATION TO SCOTCH TYPE BOILER Figure 2-5

D. BURNER INSTALLATION

Prepare the boiler front plate as follows:

1. Determine burner mounting height. Locate and scribe a level horizontal centerline across the mounting face.

2. Locate and scribe vertical centerline. Be sure stud locations line up where studs will have full support. If they don't or if opening is too large, a steel adapter plate, 3/8" minimum may be welded or bolted in place. Suitable anchors should be provided to hold refractory in place. Adapter plate must be properly sealed (use insulating rope gasket to prevent leakage of combustion gases.

3. Refer to Figures 2-6 and 2-7 for bolt circle and cut out dimensions.

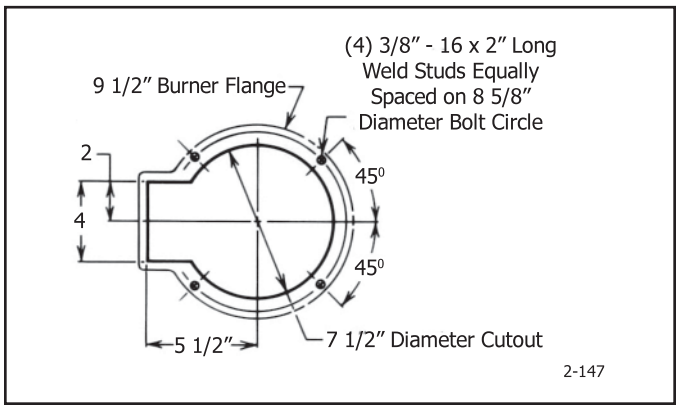
MOUNTING BURNER (SEE FIGURE 2-8)

4. Using insulating rope gasket, wrap rope on the inside of the bolt circle, looping rope around the four mounting studs.

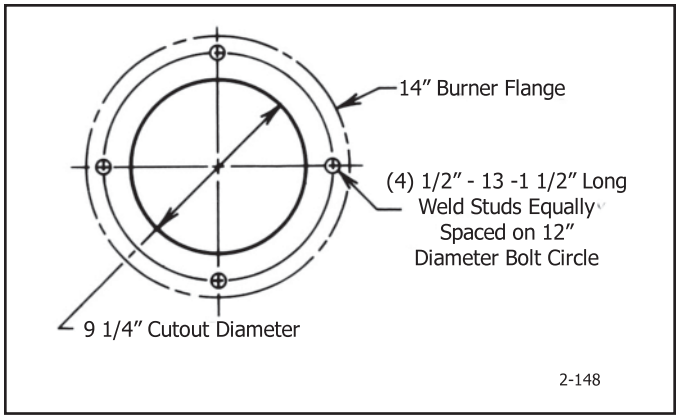
5. Set burner into position for mounting and tighten into place.

6. Permanently support the burner using the pipe support connections

7. The space between the boiler refractory, water leg, or fire tube and outside diameter of the blast tube must be packed with plastic refractory, Kaiser Refractory Mono T-Air Set or equal. Ram plastic refractory from front to rear, parallel to outside surface of blast tube. In Scotch type boilers, the refractory should extend past the tube sheet a minimum of 2 1/2". In firebox boilers, the refractory should be flush or set back from the firebrick.



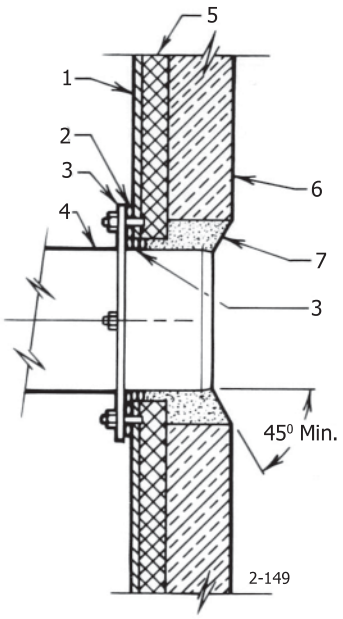
MOUNTING DIMENSIONS CG6-23 Figure 2-6



MOUNTING DIMENSIONS CG30-42 Figure 2-7

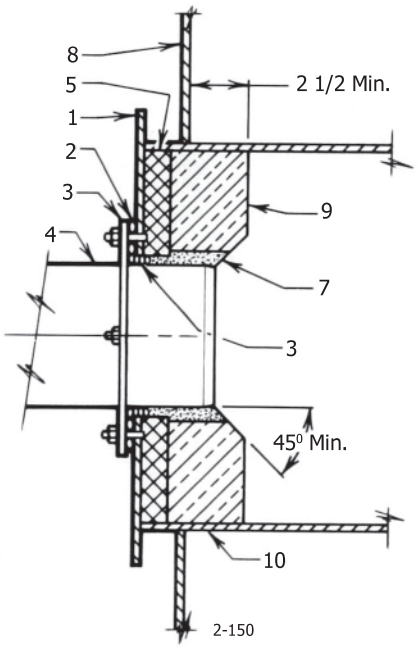
CAUTION

GASKET MUST BE RESILIENT TO SEAL ANY UNEVEN AREAS BETWEEN THE BURNER FLANGE AND THE BOILER FRONT PLATE TO PREVENT LEAKAGE OF COMBUSTION GASES.



FIRE BOX

1. Boiler Front Plate
2. Insulating Rope Gasket
3. Burner Flange
4. Burner Blast Tube
5. Block Insulation
6. Firebrick
7. Pack with Plastic Refractory. (Kaiser Mono T-9 Air Set or Equal Ram From Front to Rear)
8. Tube Sheet
9. Cast or Plastic Refractory
10. Firetube



SCOTCH MARINE

MOUNTING DETAIL Figure 2-8

E. GAS PIPING

Gas service and house piping must supply the quantity of gas demanded by the unit at the pressure required at the burner gas train inlet.

All piping must be in strict accordance with applicable codes, ordinances and regulations of the supplying utility. In the absence of other codes, piping should be in accordance with the following standards: "National Fuel Gas Code" NFPA No. 54, ANSI No. Z223-1.

Gas train components that are shipped loose should be mounted as close to the burner as practical. See Figure 2-9 or 2-10 for component arrangement.

Arrange gas piping at the burner so that the burner is accessible for servicing without disassembly.

The gas pilot supply line must be connected upstream of the main gas regulator. If a reducing bushing is required between the house piping and the burner piping, it should be close to the burner shut-off valve.

The gas piping must be internally clean and free of foreign material. Before using in service, a leak test must be performed.

F. INSTALLATION CHECKLIST

1. All burners are carefully assembled and tested at the factory, but before being placed in service all connectors should again be checked for looseness caused during shipment.

Check:

a. Electrical terminals in the control panel and on all electrical comoponents

b. Pipe fittings and unions.

c. Tubing connections.

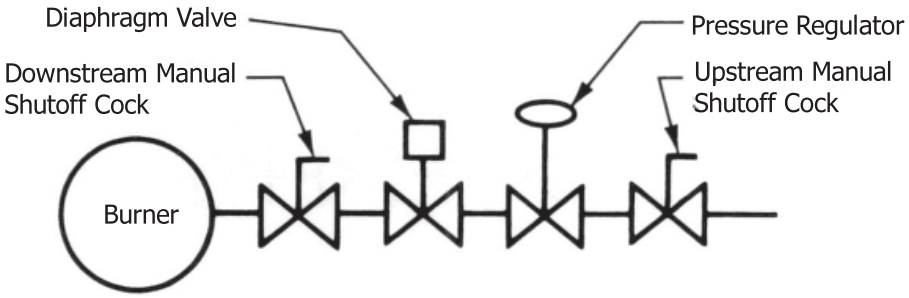
d. Nuts, bolts, screws.

2. Before connecting electrical current to any component, be sure the supply voltage is the same as that specified on the component nameplate.

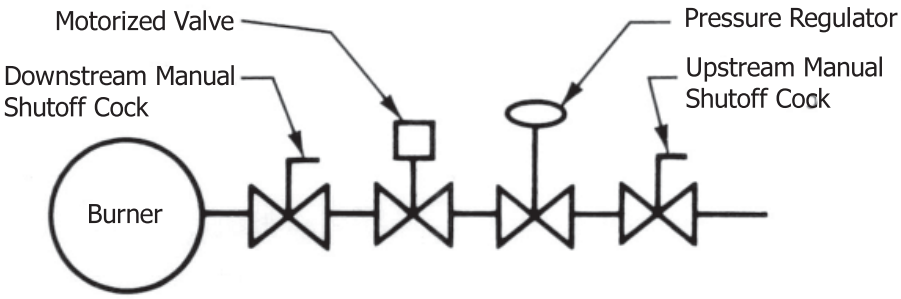
3. Before burner operation, be sure all motors are rotating in the proper direction.

4. Before firing, make sure the burner firing head and dry areas of the boiler are protected with refractory. The burner mounting flange must be properly sealed against the vessel front plate.

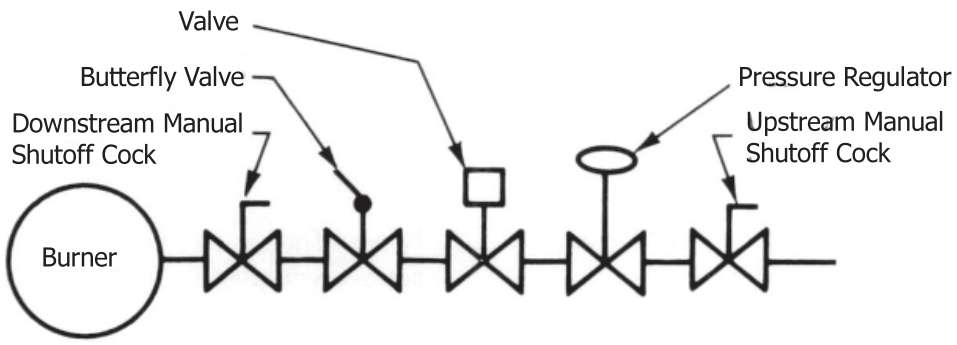
5. Make certain that the operator in charge is properly instructed in operation and maintenance procedures.



MODELS 6-9, ON-OFF



MODELS 12.5-23, LO-HI-OFF, LO-HI-LO

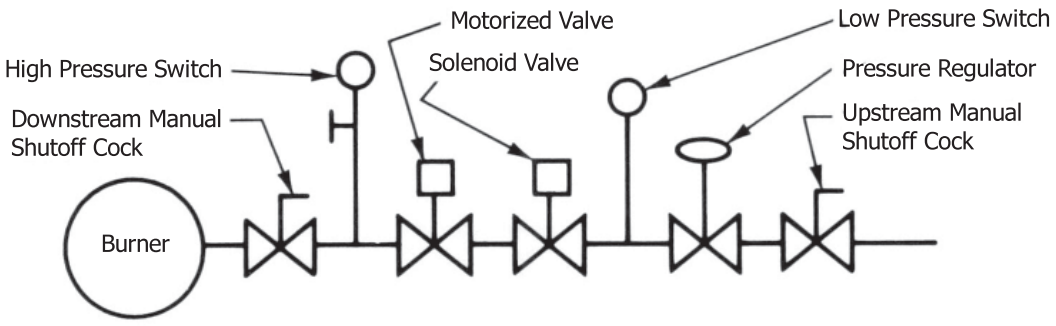


MODELS 12.5-23, FULL MODULATION

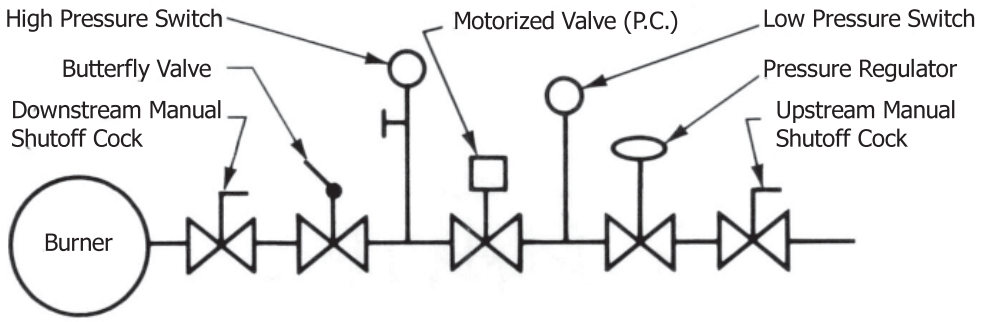
29-110

GAS PIPING, TYPICAL U.L. ARRANGEMENT CG6-23

Figure 2-9



MODELS 30-42, LO-HI-OFF, AND LO-HI-LO



MODELS 30-42, FULL MODULATION

10-111

GAS PIPING, TYPICAL U.L. ARRANGEMENT CG30-42 Figure 2-10

SECTION 3
STARTING UP AND OPERATION

A. PREPARATION FOR INITIAL START-UP

When the installation is complete and all electrical, fuel, water and vent stack connections are made, make certain said connections are tight. The operator should become familiar with the burner, boiler controls and components. To identify controls and components refer to drawings and contents of Section 1. Adjustment procedures given in Section 4 should be reviewed prior to firing. The wiring diagram should also be studied along with the operating sequence of burner programmer. Check the electrical power supply for accordance with the nameplate specifications for all motors and controls.

Read and understand starting instructions before attempting to operate the burner. The following checks must be made:

BOILER.

Check boiler water level. Be sure all boiler valves are installed correctly and positioned properly. Set the high limit control slightly above the operating control. Set operating control at the desired temperature or pressure.

BURNER.

For protection in shipment, the flame safeguard control chassis is shipped unmounted. Check all screw connections before attaching flame safeguard chassis to base. Screw must be secure to assure low resistance connections. The relay chassis is mounted on the subbase with a screw which, when tightened, completes the connection between the subbase and chassis contacts. Press manual reset button to be sure safety switch contacts are closed.

Check fuses in main panel and in burner control cabinet. Check wiring to the burner control cabinet for compliance with the wiring diagram and local codes. The control cabinet components are 120 volt. If a control transformer is supplied, ensure that the supply voltage matches its primary voltage.

Check motor rotation by momentarily closing the starter or relay. Blower rotation is clockwise when viewed from the drive end.

Check the pilot electrode setting. Refer to the ADJUSTMENT section.

Check control linkage for proper movement of the air volume damper and fuel metering components. This can be done by loosening the linkage at the actuator lever and manipulating by hand.

Check the air shutter and adjust low fire setting. Refer to the ADJUSTMENT section.

B. FIRING PREPARATIONS

Check to make certain that all plugs, connections, linkages etc., are tight. Prior to initial firing, oil flow and pressure should be verified.

GAS BURNERS

A representative of the gas utility should turn on the gas. Determine by a test gauge upstream of the burner regulator that sufficient pressure exists at the entrance to the gas train. The gas pressure regulator must be adjusted to the pressure required and the pressure setting recorded.

On combination fuel models, set the selector switch to gas. On initial start-up it is recommended that the main gas shutoff cock remain closed until the programmer has cycled through pre-purge and pilot sequences to determine that the main gas valve opens. Turn the burner switch “OFF” and let programmer finish its cycle. Check to see that gas valve closes tightly.

On burners equipped with high and low gas pressure switches, set switch pressure actuating levels and record settings for future service reference.

See the burner specification nameplate inside the control panel door for minimum and maximum input rate and required manifold pressure.

When the conditions covered above and in Section 2 are assured, the burner is ready for firing. Refer to Letter E for starting and operating information.

C. SEQUENCE OF OPERATION

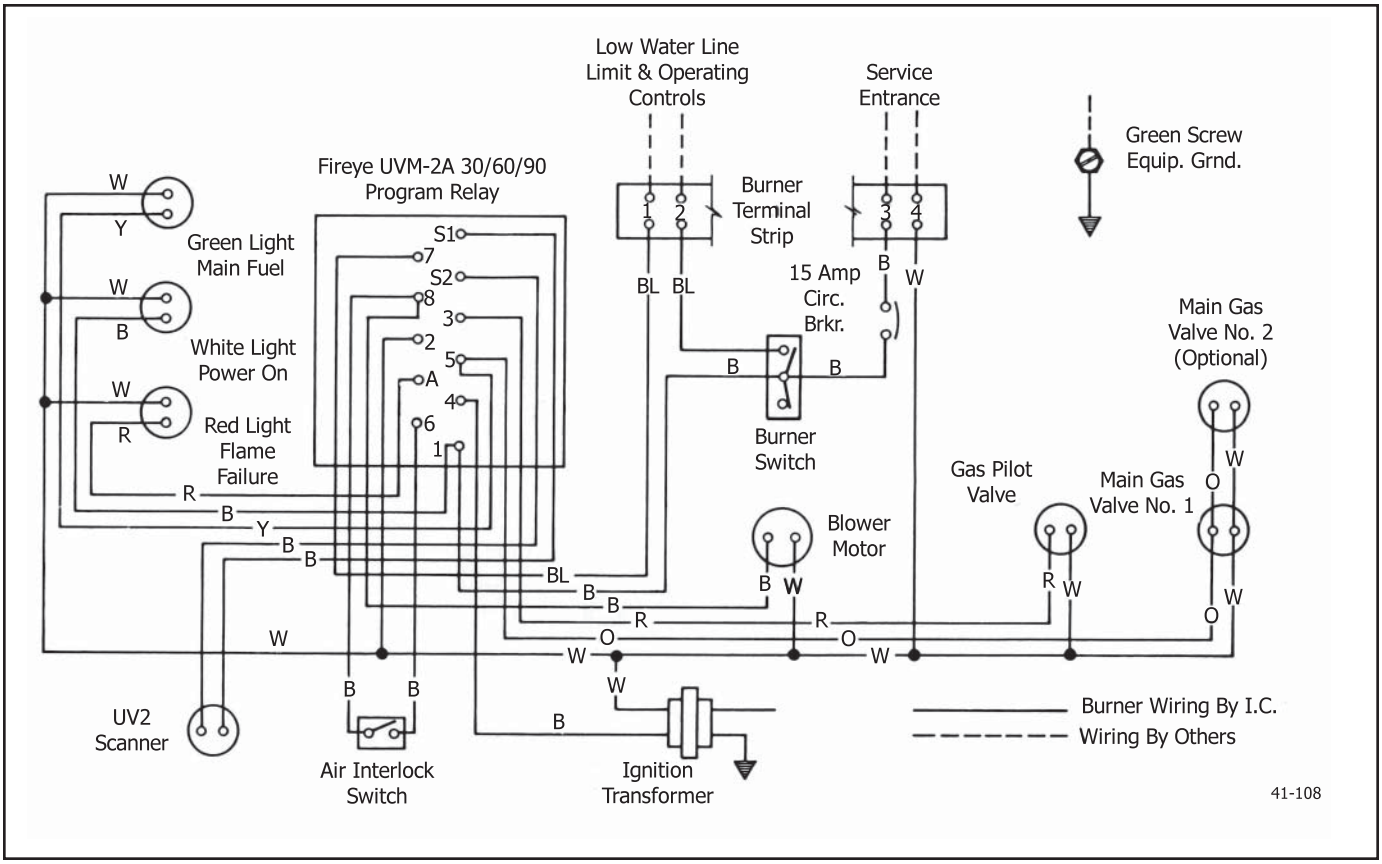
The programming control sequences the operation of all controls and components through the starting, ignition, firing, and shutdown cycle. The burner and control system are in starting condition when: a. The operating and high limit control (temperature or pressure) are below their cutoff setting; b. All power supply switches are closed; c. Power is present at the control panel.

Refer to the manufacturer’s literature on programming controls and burner wiring diagrams for detailed information.

SEQUENCE OF OPERATION
MODELS: CG6-23, ON-OFF, LO-HI-OFF
CONTROLLER: FIREYE UVM-2 (SEE FIG. 3-1):

Starting:

1. 115/60/1 service entrance supplies power to burner terminal #4 (ground) which picks up all grounds and UVM-2 terminal #2. Burner terminal #3 (hot) provides power through 15 amp. circuit breaker to common of burner switch UVM-2 terminal #1 and to white power on light.



U.L. STANDARD WIRING DIAGRAM - CG6-23, ON-OFF, LO-HI-OFF

Figure 3-1

2. With burner switch in the "ON" position, control power continues to burner terminal #2, through low water line limit and operating controls to burner terminal #1 and UVM-2 terminal #7.

3. With power to UVM-2, terminal #7 blower motor terminal #8 becomes energized. After blower motor is in operation, the air interlock switch closes and completes air flow circuit between UVM-2 terminals #8 and 6, which allows perpurge to start.

4. Following prepurge, UVM-2 terminals #3 (pilot) and #4 (spark ignition) are energized. When pilot flame is detected (by the UV-2 scanner connected to UVM-2 terminals S1 and S2), UVM-2 terminal #5 and green main fuel light are energized (opening main fuel valve), and UVM-2 terminal #4 is de-energized. UVM-2 terminal #3 remains energized through firing cycle.

Shutdown:

5. Burner will continue to fire until operating control opens (in the limit circuit). The entire system will then de-energize, and the unit is ready to start over when operating control closes.

Flame Failure:

6. In the event of pilot flame failure before the end of trial for ignition, UVM-2 terminals #3 and 4 are de-energized. A safety lockout occurs which de-energizes the blower motor and energizes the UVM-2 alarm terminal letter "A" and red flame failure light.

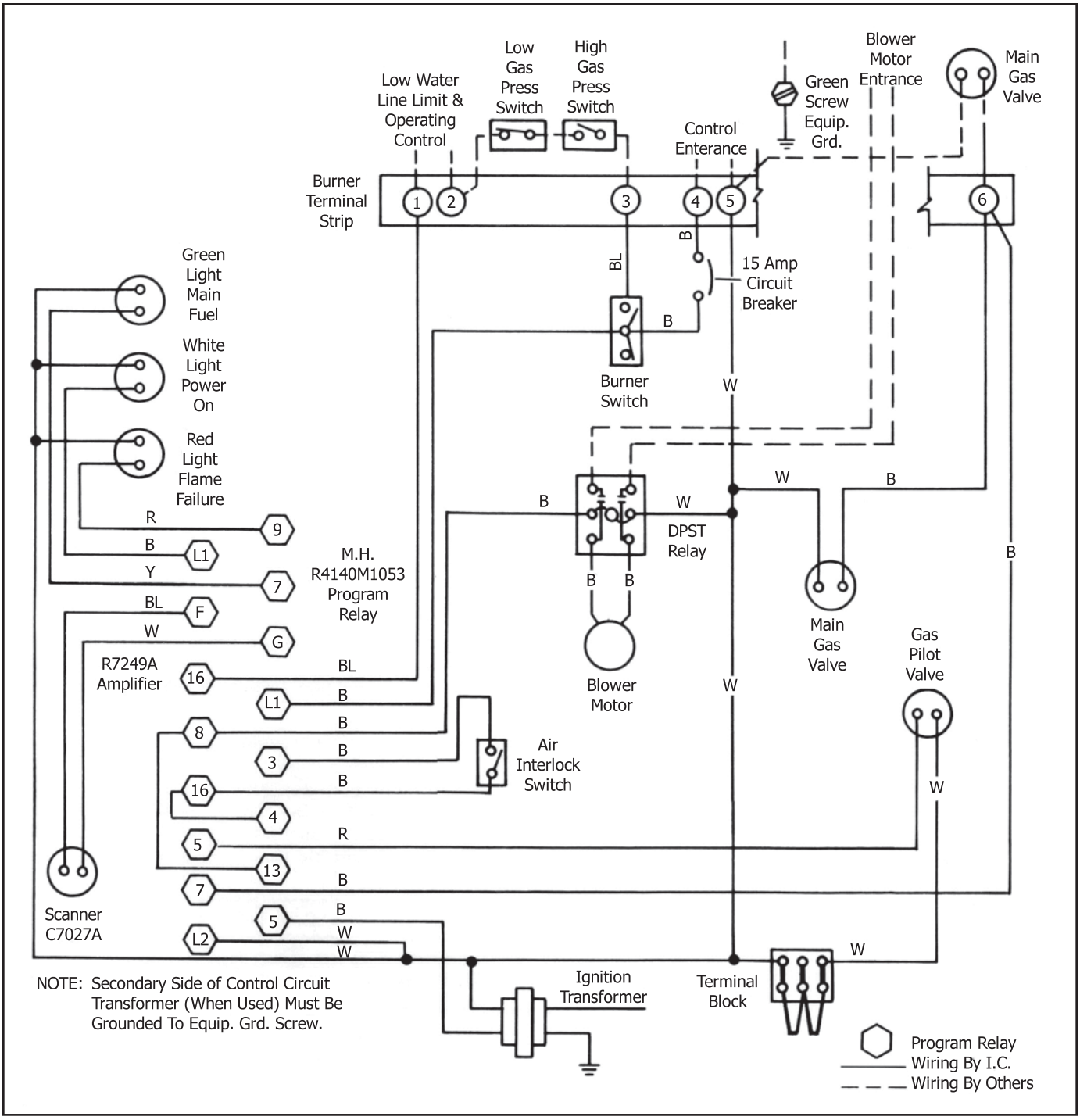
7. In the event of main flame failure, UVM-2 terminals #3 and 5 are de-energized. With proven air flow, the UVM-2 will recycle, UVM-2 terminals #3 and 4 are re-energized, and trial for ignition is initiated. If pilot flame id detected, UVM-2 terminal #5 is energized, and UVM-2 terminal #4 is de-energized. If the pilot flame is not detected during trial for ignition, UVM-2 terminals #3 and 4 are de-energized and a safety lock-out occurs which de-energizes the blower motor and energizes the UVM-2 alarm terminal letter "A" and red flame failure light. Manual reset is required following any safety lock-out.

SEQUENCE OF OPERATION
MODELS: CG30-36, LO-HI-OFF
CONTROLLER: M.H. R4140M1053 (SEE FIG. 3-2):

Starting:

1. 115-240/60/1 blower motor entrance supplies power to D.P.S.T. relay and through relay to blower motor.

2. 115/60/1 control entrance supplies power to control circuit by the way of terminal #5 (ground) which picks up all grounds and M.H. R4140M1053 terminal L2. Burner terminal #4 supplies power through 15 amp. circuit breaker to common of burner switch, to R4140M terminal L1, and



U.L. STANDARD WIRING DIAGRAM - CG30-36, LO-HI-OFF Figure 3-2

to white power on light.

3. With burner switch in the “ON” position, control power continues to burner terminal #3 through high and low gas pressure switches to burner terminal #2. From burner terminal #2 through low water line limit and operating controls to burner terminal #1 and R4140M terminal #16. With the main fuel valve closed interlock circuit jumpered out, between R4140M terminals #16 to 4, blower motor terminal #8 on R4140M and the coil of blower motor D.P.S.T. relay are energized. R4140M 96 sec. prepurge is initiated.

4. As the blower is energized, the running interlock circuit between R4140M terminals #16 to #3 must be proven in the first 17 seconds by way of the air interlock switch. The running interlock circuit must remain closed all through the firing period.

5. At the end of prepurge, the low fire proving circuit between R4140M terminals #8 to 3 is made by way of a jumper. R4140M terminals #5 (ignition and pilot valve) is energized. If pilot flame is proven before the end of trial for ignition by C7027A scanner (connected to R4140M

terminals F and G). R4140M terminal #7 (main fuel valves) and the green main fuel light are energized.

6. With R4140M terminal #7 energized, the burner will be driven to the high fire position by the downstream main gas valve. The burner will remain in the high fir position until the operating control (in the limit circuit) opens.

Shutdown:

7. When the operating control opens (in the limit circuit) the entire system will then de-energize and the burner is ready to restart when the operating control closes.

Flame Failure:

8. If pilot or main flame fails during trial for ignition or firing cycle, R4140M terminal #7 will de-energize and the R4140M will lock-out on safety energizing the red flame failure light. Manual reset is required following any safety lock-out.

SEQUENCE OF OPERATION
MODELS: CG42, LO-HI-OFF
CONTROLLER: M.H. R4140M1053 (SEE FIG. 3-3):

Starting:

1. 115-240/60/1 blower motor entrance supplies power to line side (L1 and L2) of blower motor starter. Out load side (T1 and T2) of starter to blower motor.

2. 115/60/1 control entrance supplies power to control circuit by the way of terminal #5 (ground) which picks up all grounds and M.H. R4140M1053 terminal L2. Burner terminal #4 supplies power through 15 amp. circuit breaker to common of burner switch, to R4140M terminal L1, and to white power on light.

3. With burner switch in the “ON” position, control power continues to burner terminal #2 through high and low gas pressure switches to burner terminal #2. From burner terminal #2 through low water line limit and operating controls to burner terminal #1 and R4140M terminal #16. With the main fuel valve closed interlock circuit jumpered out, between R4140M terminals #16 to 4. Blower motor terminal #8 on R4140M and terminal C9 of blower motor starter are energized. R4140M 96 sec. prepurge is initiated.

4. As the blower motor is energized, the running interlock circuit between R4140M terminals #16 to 3 must be proven in the first 17 seconds by way of the air interlock switch, and terminals C2 to C3 of blower motor starter. The running interlock circuit must remain closed all through the firing period.

5. At the end of prepurge, the low fire proving circuit between R4140M terminals #8 to 3 is made by way of a jumper. R4140M terminal #5 (ignition and pilot valve) is energized. If pilot flame is proven before the end of trial for ignition by C7027A scanner (connected to R4140M terminals F and G), R4140M terminal #7 (main fuel valves) and the green main fuel light are energized.

6. With R4140M terminal #7 energized, the burner will be driven to the high fire position by the downstream main gas valve. The burner will remain in the high fire position until the operating control (in the limit circuit) opens.

Shutdown:

7. When the operating control opens (in the limit circuit) the entire system will then de-energize and the burner is ready to restart when the operating control closes.

Flame Failure:

8. If pilot or main flame fails during trial for ignition or firing cycle, R4140M terminal #7 will de-energize and the R4140M will lock-out on safety energizing the red flame failure light. Manual reset is required following any safety lock-out.

⚠ WARNING

READ THE FLAME SAFEGUARD MANUAL AND FULLY UNDERSTAND ITS CONTENT BEFORE ATTEMPTING TO OPERATE THIS EQUIPMENT.. SERIOUS PERSONAL INJURY OR DEATH MAY RESULT.

⚠ WARNING

SHOULD A STARTING FAILURE OCCUR FOR ANY REASON, COMBUSTIBLE FUMES MAY FILL THE COMBUSTION CHAMBER. NEVER ATTEMPT TO RE-LIGHT THE BURNER UNDER THESE CONDITIONS WITHOUT FIRST PURGING

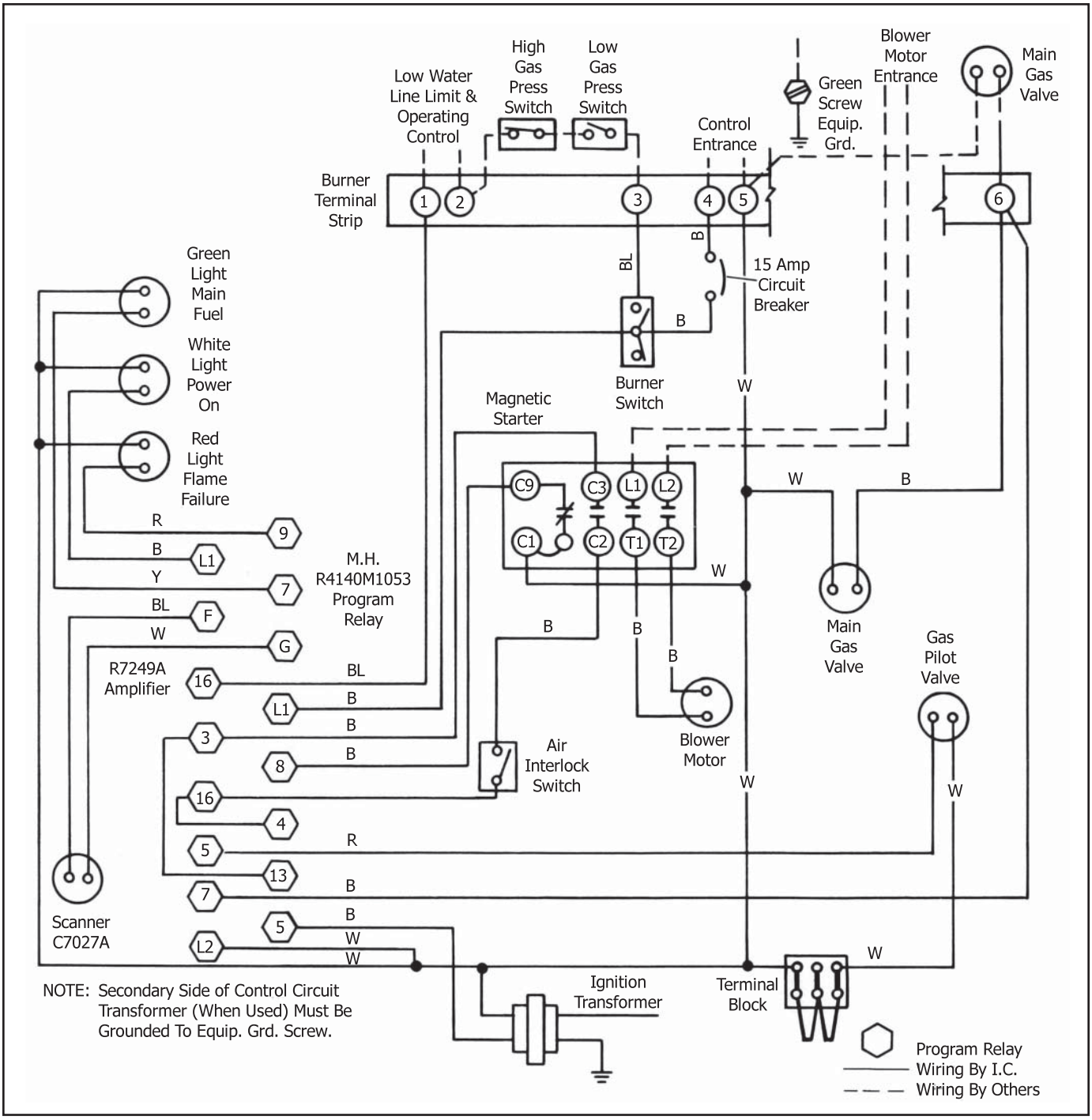
D. ELECTRICAL INTERFERENCE TEST

Prior to putting the burner into service, conduct the following test to ascertain that ignition spark will not cause the flame relay to pull in.

GAS FIRED

Close the pilot and main line manual gas valves. Start the burner and at time of pilot trial with just the electrical ignition system energized. The flame relay should not pull in (i.e. should not be energized).

Upon completion of successful test, proceed with start-up procedures.



U.L. STANDARD WIRING DIAGRAM - CG42, LO-HI-OFF

Figure 3-3

E. START-UP AND OPERATING

GAS BURNERS:

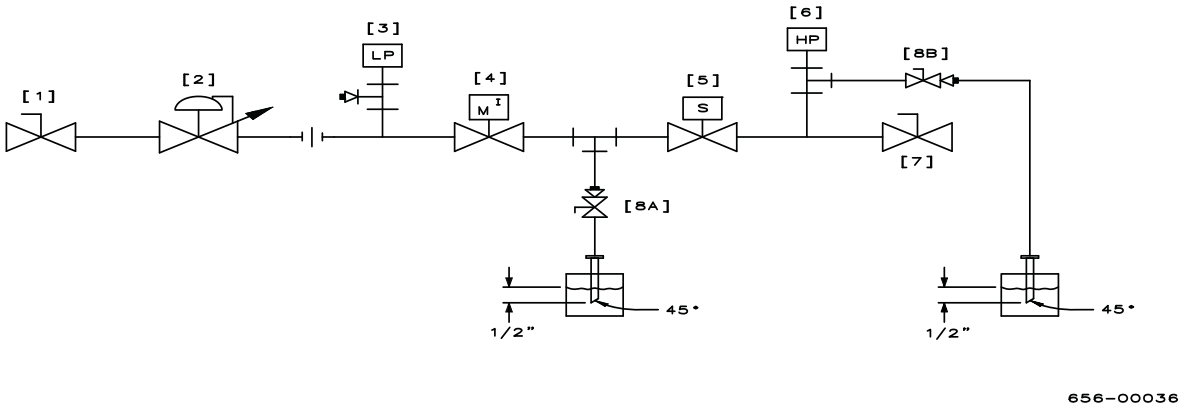
Performing A Gas Valve Leak Test (Bubble Test)

A gas valve leak-test must also be performed on the automatic safety shutoff valves located in the main gas train prior to any initial commissioning or subsequent maintenance of the burner and gas train systems – where automatic valve proving systems interlocked with the main burner safety control are not provided. This test should be performed periodically to ensure no leakage of valves in their closed or de-energized position.

Refer to the diagram below when following this procedure. The unit should be taken out of service if the unit fails any of the following tests. Any defective part must be replaced prior to putting the equipment back into service.

⚠ WARNING

FAILURE TO FOLLOW THIS PROCEDURE MAY RESULT IN EXPLOSION, FIRE, PROPERTY DAMAGE AND PERSONAL INJURY. THIS PROCEDURE MUST BE PERFORMED ONLY BY AUTHORIZED AND QUALIFED PERSONNEL.



- Close (or shut off) manual valve [7] downstream of the automatic safety shutoff valves, trapping gas pressure between the safety shutoff valves and manual valve and causing a flame failure. This should close the auxiliary safety shutoff valve [4] and main gas safety shutoff valve [5]. If both or either valve fails to close, do not proceed further until you correct the problem.

- Release gas pressure at the leak test cock [8B] between manual valve [7] and main gas safety shutoff valve [5], then conduct a bubble test for leak through blocking valve [5]. If no leak, close the test cock.

- Release gas pressure at test cock [8A] and bubble test for leak through auxiliary safety shutoff valve [4]. If you do not observe a leak, close test cock and go to next step. If either valve leaks, correct the problem and retest 10 times before proceeding.

- When there are no valve leaks, open manual valve [7] and relight the burners. Then close manual valve [1]. The safety shutoff and blocking valve should close due to low gas pressure.

- Relight the burners. Reduce the high gas pressure switch [6] setpoint setting until it reaches the operating gas pressure, which should cause the auxiliary and main gas safety shutoff valves to close from high gas pressure. Return the setpoint to its original position before proceeding.

- Shut off the combustion air blower. This should cause a failure due to low air pressure and cause the safety valves to close.

- Reset all manual valves to their normal setting for operation. Make sure all electric valves are operating normally. Make sure all test cocks are closed before resuming normal operation.

Close the downstream main and pilot gas cocks. Make sure the “ON-OFF” switch is in the “OFF” position. Actuate the manual reset button of the flame safeguard control to close the safety switch contacts. Open the gas pilot cock.

Set the “ON-OFF” switch to “ON”. The burner will start and prepurge. After prepurge, the ignition transformer and the gas pilot solenoid are energized. Before proceeding further, conduct pilot turndown tests. Refer to Chapter 4, Section C.

On initial start-up it is recommended that the main gas shutoff cock remain closed until the programmer has cycled through prepurge and pilot sequences. Then determine that main gas valve opens. When this is confirmed, turn the burner switch “OFF” and let programmer finish its cycle. Check to see that gas valve has closed tightly.

CAUTION

IF IGNITION DOES NOT OCCUR, TURN THE BURNER SWITCH “OFF” AND ALLOW PROGRAMMER TO RECYCLE FOR A NEW IGNITION TRIAL.

⚠ WARNING

DO NOT REPEAT UNSUCCESSFUL LIGHT OFF ATTEMPS WITHOUT RECHECKING BURNER AND PILOT ADJUSTMENT. VENT FUEL VAPORS FROM THE COMBUSTION CHAMBER AFTER EACH UNSUCCESSFUL LIGHT OFF ATTEMPT.

CG6-9 ON-OFF FIRING

Turn burner "ON" and after pilot ignition when the flame relay pulls in, the main gas diaphragm valve begins to open. A bleed valve incorporated into the diaphragm valve determines the opening speed.

Slowly open the downstream manual shutoff cock. Main flame should ignite at this time. Adjust the air damper so a proper air-gas mixture is obtained.

CG12.5-42 LOW-HIGH-OFF FIRING

Turn burner "ON" and after pilot ignition when the flame relay pulls in, the slow opening, motorized, main gas valve is energized. Slowly open the downstream manual shutoff gas cock. Main flame should ignite at this time. The gas valve and air damper continue advancing until high fire is reached.

CG12.5-42 OPTIONAL LOW-HIGH-LOW OR FULL MODULATION FIRING

Set the "HI-LO" switch in the "LO" position or the "MANUAL-AUTO" switch in the "MANUAL" position. If a manual modulating control is provided, set in low fire position.

Set the "ON-OFF" switch to "ON". The burner will start and prepurge. After prepurge, the ignition transformer and the gas pilot are energized. After pilot ignition, slowly open the downstream manual shutoff gas cock. Main flame should ignite at this time.

Set the gas low fire rate by adjusting valve actuator or butterfly valve and air linkage.

When low fire is adjusted, shut down burner. Restart several times to be sure the low fire setting is stable. Readjust if necessary.

After combustion adjustments are satisfactorily set, allow the heating vessel to slowly reach normal operating pressure or temperature.

Check high fire at this point using combustion instruments.

Do not disturb established low fire adjustment. Allow the burner to return to low fire position before adjusting high or intermediate settings.

F. NORMAL OPERATION

Normal operation must be with the "MANUAL-AUTO" switch selector at "AUTO".

In automatic operation, the operating cycle always proceeds sequentially through pre-purge, pilot ignition, main flame ignition, run and post-purge. The length of purge and ignition trial vary according to the type of programmer used.

During the run cycle, burner input is regulated to the load demand by the modulating pressure or temperature control on the boiler. The burner will continue to modulate until the operating pressure or temperature is reached.

Programmer control operation should be tested when the burner is initially placed into service, when a control is replaced, and at scheduled intervals in the maintenance program.

Refer to adjustments procedures and maintenance instructions given in Sections 4 and 5.

G. SHUTDOWN

When the operating limit control setting is reached or the burner switch is turned "OFF", the following sequence occurs:

The fuel valve(s) de-energize and flame extinguishes. The blower motor continues running during post-purge (if so equipped with post-purge feature).

At the end of the post-purge the blower motor is de-energized. The programmer returns to its starting position and stops. Unit is ready to restart.

Abnormal shutdown might result from motor overload, flame outage, low water, current or fuel supply interruption, combustion or atomizing air pressure below minimum level, tripped circuit breakers, blown fuses, or other interlock devices. Check for cause and correct before restarting burner.

Safety shutdown caused by ignition or flame failure will actuate a red indicator light and energize an audible alarm (if so equipped). If the programmer has a non-recycling interlock circuit, any interruption in this circuit during the pre-purge or firing cycle will cause a safety shutdown. This type of shutdown requires manual reset of the programming control and must be corrected before operation can be resumed.

SECTION 4
ADJUSTMENTS

A. GENERAL

While each burner is tested at the factory for correct operation before shipment, variable conditions such as burning characteristics of the fuel used and operating load conditions may require further adjustment after installation to assure maximum operating efficiency.

Prior to placing the boiler into initial service, a complete inspection should be made of all controls, connecting piping, wiring, and all fastenings such as nuts, bolts and setscrews to be sure that no damage or misadjustments occurred during shipment and installation.

A combustion efficiency analysis made during the initial start-up will help to determine what additional adjustments are required in a particular installation.

B. COMBUSTION ADJUSTMENT

Efficient combustion cannot be properly judged by flame appearance, although it may help in making preliminary settings.

The proper settings of air-fuel ratios must be determined by flue gas analysis. Combustion gas analysis indicates the air to fuel ratio and the degree of complete combustion. Instruments are available to measure carbon dioxide (CO2), oxygen (02), and carbon monoxide (CO). At no time should CO2 measurements alone be used to indicate proper excess air levels. Only O2 measurement can definitively show whether sufficient air has been provided for combustion.

STACK TEMPERATURE

Net stack temperature is obtained by subtracting the ambient temperature from the flue gas temperature. A high net stack temperature indicates wasted heat. Decreasing either the temperature or the volume of the flue gas, or both can reduce stack heat loss. Flue gas temperature is reduced by improving heat transfer or by reducing excess combustion air. A certain amount of excess air is necessary to complete combustion. More efficient burners require minimum excess air.

SMOKE MEASUREMENT

Smoke measurements can be made using a variety of different methods. The standards will vary somewhat according to the equipment used, and instructions accompanying the instrument should be followed.

Smoky combustion can result from: Improper air delivery, insufficient draft, improper fuel viscosity, improper fuel-air ratio, excessive air leaks in the combustion chamber, or improper fuel oil temperature.

TEST EQUIPMENT

The following test equipment should be used to set-up and adjust the burner correctly:

1. Combustion analyzer for O2 or CO2 indicator.
2. U-Tube manometer, or pressure gauge, to measure gas pressures (Main and Pilot), Vacuum and pressure gauges for oil.
3. Inclined manometer to measure draft pressures.
4. Smoke spot tester for oil burners and CO analyzer for gas fired units.
5. Voltmeter / Ammeter
6. Stack Thermometer and Thermocouples.

GAS ADJUSTMENTS

Low-fire combustion analysis typically is 7 to 9 percent CO2 and less than .04 percent CO (400 ppm). High-fire reading typically is 9 to 10.5 percent O2 and less than .04 percent CO.

NOTE

CHECK FOR CO THROUGH ENTIRE FIRING RANGE.

NOTE

SOME CONDITIONS MAY MAKE IT IMPOSSIBLE TO ATTAIN ACCURATE COMBUSTION ANALYSIS. AIR INFILTRATION THROUGH THE BOILER AT ANY POINT WILL DILUTE FLUE GAS.

C. GAS SYSTEM

GAS PRESSURE

Gas must be supplied at a pressure high enough to over come the pressure loss in the burner gas train and furnace pressure while running at full input.

GAS FLOW

The volume of gas is measured in cubic feet as determined by a meter reading. The gas flow rate required depends on the heating value (Btu/cu ft). The supplying utility can provide this information as well as pressure correction factors. To determine the required number of cubic feet per hour of gas, divide burner input (Btu/hr) by the heating value (Btu/cu ft.).

NOTE

WHEN CHECKING THE INPUT RATE, MAKE SURE NO OTHER EQUIPMENT IS OPERATING ON THE SAME METER.

Model Size	Gas Input Btu (000)					Minimum Gas Pressure Required at Train Inlet ("W.C.)			Gas Pressure @ Manifold "WC (at Full Input & Zero Furnace Pressure)		Gas Manifold Orifice Size/No.				Gas Train Size	
	Minimum		Maximum								Natural		L.P.			
	On-Off Lo-Hi-Off Operation		Furnace Pressure			Natural	L.P.		Natural	L.P.					Natural	L.P.
			+0.00	+0.20	+0.50		On-Off Lo-Hi-Off	W/Full Mod.			Size	No.	Size	No.		
6	350	-	600	600	-	5.0	4.0*	-	2.0	2.0	#34	25	#40	12	3/4	3/4
9	350	-	900	900	-	6.0	4.0*	-	4.5	4.5	#34	25	#40	12	1	1
12.5	750	550	1250	1250	-	5.0	4.0	3.0	1.3	1.0	11/64"	50	#40	25	1	1
17	750	600	1700	1550	-	5.0	6.0	5.0	2.0	1.2	11/64"	50	#40	25	1 1/2	1
23	1550	600	2300	2000	-	6.5	8.0	7.0	3.1	1.4	11/64"[1]	50	#40	25	1 1/2	1
30	-	900	3000	3000	3000	6.0	7.0	4.5	2.7	1.7	#17	56	#17	56	2	1 1/2
36	-	1000	3600	3600	3600	8.5	9.0	5.0	3.5	2.3	#17	56	#17	56	2	1 1/2
42	-	1160	4200	4200	4200	11.0	13.0	6.5	4.0	2.6	#13	56	#17	56	2	1 1/2

*A 5/16"orifice is installed between the faces of the union downstream of the main gas valve.
[1] .201 drill orifice size used on full modulation models.

GAS PRESSURE REQUIREMENTS

Figure 4-1

GAS PILOT FLAME ADJUSTMENT

The gas pilot flame is regulated by adjusting the pressure setting of the pilot regulator. Normal setting is 3" to 6" W.C. when the pilot is burning. The flame must be sufficient to be proven by the flame detector and ignite the main flame.

Although it is possible to visibly adjust the size of the pilot flame, obtain a proper DC volt or microamp reading of the flame signal.

The flame safeguard amplifier has a meter jack for this purpose. At initial start-up and during planned maintenance, test the pilot flame signal, pilot turndown, and safety switch lockout.

⚠ WARNING

AN ULTRA-VIOLET FLAME SENSOR ELECTRICAL SPARK INTERFERENCE TEST MUST BE PERFORMED AFTER FINAL ADJUSTMENT. SEE SECTION 3 OF THIS MANUAL FOR ADDITIONAL INFORMATION.

An ultra-violet flame sensor electrical spark interference test is conducted to determine if the sensor is picking up ignition spark. To test; close the manual valves in the main and pilot gas lines. Turn the burner on. With the electric ignition energized there should not be any signal on the test meter. If spark interference is encountered, the position of the UV sight tube may be out of place, in which case adjustment is necessary.

The various flame safeguard system manufacturer's literature describes detailed check-out and measurement procedures.

GAS DIAPHRAGM VALVE (CG6-9)

Adjust diaphragm valve bleed screw during normal burner cycling to obtain proper opening speed.

MOTORIZED GAS VALVE (CG12.5-42)

Upon being energized, the motorized gas valve has a damper positioning arm which controls the air damper.

OPTIONAL MOTORIZED GAS VALVE (CG12.5-42) (LO-HI-LO FIRING)

This two position gas valve opens to low fire position when power is supplied to the actuator. Low fire position is adjustable on the actuator. (Refer to manufacturer's literature for adjustment procedure.) Actuator opens valve to high fire when firing rate controller contacts are made. When the firing rate controller is satisfied, the actuator will drive the valve to the low fire position. The valve will close when the limit control is satisfied, shutting down the burner.

The combustion air damper is positioned by the actuator shaft to drive the damper at the same speed the valve opens. See Section D and F of this chapter for additional information on damper and linkage adjustment.

MAIN GAS PRESSURE REGULATOR

The gas pressure required at the burner manifold is the pressure that is required to fire the burner at its rated capacity. The gas pressure regulator must be adjusted to achieve this pressure to assure full input. Refer to manufacturer's literature for regulator adjustment.

LOW GAS PRESSURE SWITCH (MODELS 30-42)

Turn adjusting screw until indicator moves to a pressure setting slightly below the operating gas pressure. The control will break a circuit if pressure is below this set point. The control should be finally adjusted to prevent operation with low gas pressure, but not at a pressure so close to normal operating pressure that unnecessary shutdowns occur.

The switch must be manually reset after tripping. To reset, allow gas pressure to rise and press the manual reset button.

HIGH GAS PRESSURE SWITCH (MODELS 30-42)

Turn adjusting screw until indicator moves to a pressure setting slightly above the maximum operating gas pressure. The control will break a circuit if pressure exceeds this value. The control should be adjusted to prevent operation with excessive gas pressure, but not at a pressure so close to normal operating pressure that unnecessary shutdowns occur.

This switch must be manually reset after tripping. To reset, allow gas pressure to drop and press the manual reset button.

D. LINKAGE ADJUSTMENTS (CG12.5-42)

The linkage consists of levers, rod(s) and ball joints that transmit motion from the gas valve actuator damper crank to the air damper on LO-HI-OFF or LO-HI-LO firing models or from the optional modulating motor to the air damper and gas rate butterfly valve on full modulation models.

When properly adjusted, coordinated movement of the air damper and gas valve or gas rate butterfly valve provides proper fuel/air ratios for reliable ignition, low and high fire or through the firing range on full modulation burners.

Settings are adjusted by the length of the linkage rods, length of lever arms, and the angular positions of the levers on the shafts. Refer to figures 4-2 and 4-3. The most rapid rod travel occurs when the lever is perpendicular to the rod. The closer the rod comes to parallel with the lever, the slower the rod moves.

The angles of the driven levers on the jackshaft can be adjusted to vary the rate of change. The closer the rod to the hub of the lever, the less distance it will travel.

Increasing the lever length on the damper, metering unit, and valve(s) decreases the flow rate.

E. MODULATING MOTOR (OPTIONAL)

The modulating motor, through a linkage arrangement, positions the air damper and the butterfly gas valve to maintain proper air/fuel ratio throughout the firing range.

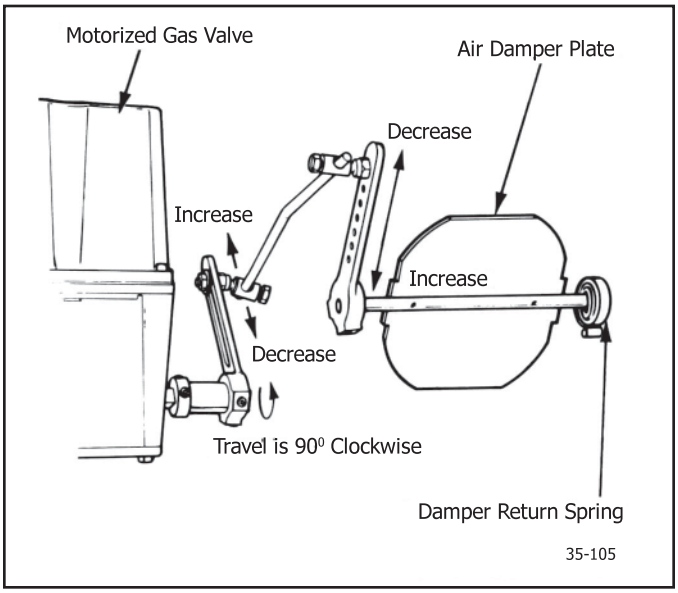
The motor is controlled by either a temperature or pressure actuated modulating control. During normal operation, the motor moves in either direction or stops at any position within a 90° range to follow load demand.

If a modulating motor is replaced, verify the 90° stroke before installing.

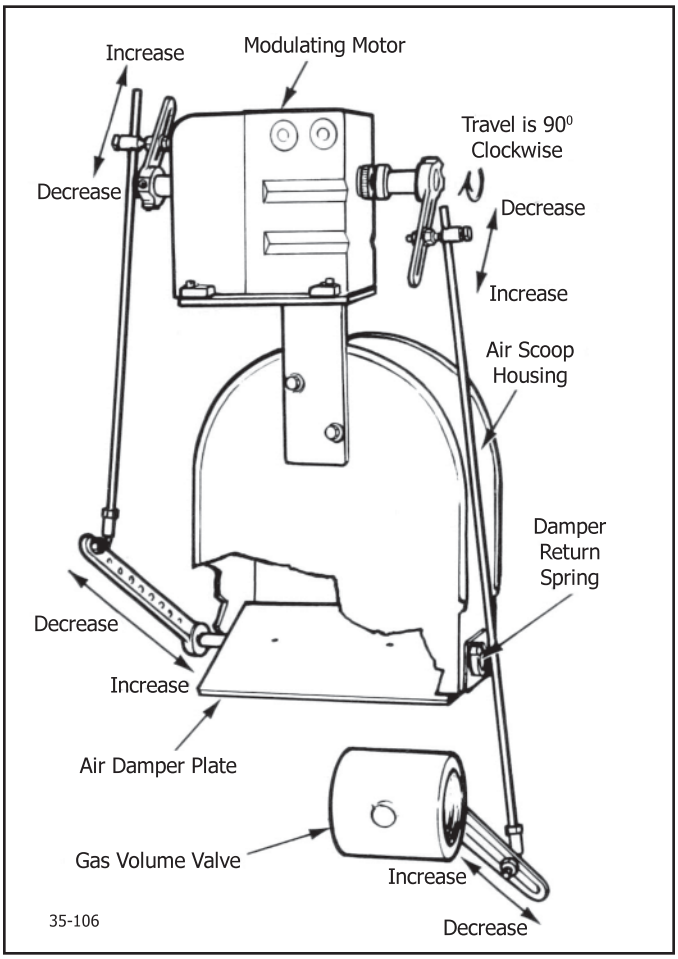
The flame safeguard programmer holds the modulating motor in low fire during ignition and until the main flame is established. A low fire switch, integral to the motor or damper mounted, is actuated by the rotation of the motor. This switch must be closed to prove that the damper and fuel metering units are in low fire position before ignition. During this time, neither the manual potentiometer nor modulating control have any effect on the damper motor.

Some burners have a second integral switch to prove the motor has driven the damper to an open position during prepurge. This switch closes at the high fire position to allow continuation of the programming cycle.

Refer to manufacturer's literature for adjusting the modulating motor switch.



AIR ADJUSTMENTS - LO-HI-OFF / LO-HI-LO FIRING
Figure 4-2



AIR/FUEL ADJUSTMENTS - FULL MOD
Figure 4-3

F. COMBUSTION AIR DAMPER

The damper regulates the combustion air volume.

CG6-9 - The adjustable blade type damper is set in a fixed position for ON-OFF firing. The blade damper is adjusted by levers and locked in place by wing nuts. Blade damper position should be set according to combustion results as described in Section G.

CG12.5-42 - The air damper is positioned by the gas valve actuator damper crank or the modulating motor. The damper must be set as low as possible for trouble free ignition operation while still allowing for efficient combustion at low fire. At high fire, adjustment is made for high efficiency at the desired input rate.

G. COMBUSTION ADJUSTMENT PROCEDURE

Basically, gas adjustments are made with the gas pressure regulator which controls the pressure and indirectly the rate of flow. On full modulation models the butterfly gas valve directly controls the rate of flow. The low fire light-off setting should be regarded as preliminary until proper gas pressure for high fire operation is established.

Determine the actual gas flow from a meter reading at high fire. With the gas valve or butterfly valve open and with regulated gas pressure set, the actual flow rate should be quite close to the required input. If corrections are necessary, increase or decrease the gas pressure by adjusting the gas pressure regulator, following manufacturer's directions for regulator adjustment.

When proper gas flow is obtained take a flue gas analysis reading.

With the high fire air/fuel established the gas pressure regulator needs no further adjusting.

After making certain that the air damper and its linkage are correctly adjusted to provide the proper amount of combustion air and after adjusting the gas pressure regulator, final adjustment can be made.

SECTION 5
MAINTENANCE

A. GENERAL

A maintenance program avoids unnecessary down time, costly repairs, and promotes safety. It is recommended that a record be maintained of daily, weekly, monthly, and yearly maintenance activities.

Electrical and mechanical devices require systematic and periodic inspection and maintenance. Any "automatic" features do not relieve the operator from responsibility, but rather free him from certain repetitive chores, providing time for upkeep and maintenance.

Unusual noise, improper gauge reading, leak, sign of overheating, etc., can indicate a developing malfunction, requiring corrective action.

⚠ WARNING

ONLY FACTORY AUTHORIZED BURNER SERVICE PERSONNEL SHOULD START-UP, ADJUST, OR SERVICE THIS EQUIPMENT

CAUTION

Any cover plates, enclosures, or guards anchored to the burner, or any burner related equipment, must remain in position at all times. Only during maintenance and service shutdown can these cover plates, enclosures, or guards be allowed to be removed. They must be replaced, and securely anchored before testing, adjusting, or running the burner or burner related equipment.

B. CONTROL SYSTEM

Most operating controls require very little maintenance beyond regular inspection. Examine electrical connections. Keep the controls clean. Remove any dust from the interior of the control. Covers should be left on controls at all times. Keep the control cabinet doors closed. Dust and dirt can damage motor starters and relay contacts. Starter contacts are plated with silver and are not harmed by discoloration. Never use files or abrasive materials such as sandpaper on contact points.

⚠ WARNING

WHEN REPLACING A CONTROL OR CLEANING CONTACTS, BE SURE TO DISCONNECT THE MAIN POWER SUPPLY SINCE THE CONTROL IS ENERGIZED EVEN THOUGH THE BURNER SWITCH IS OFF. MORE THAN ONE DISCONNECT SWITCH MAY BE REQUIRED TO DISCONNECT ALL POWER.

PROGRAMMING CONTROL

This control requires no adjustment, nor should any attempt be made to alter contact settings or timing logic. Those programmers with contacts may require occasional cleaning. If so, follow instructions given in the manufacturer's bulletin. Never use abrasive materials. The manufacturer's bulletin also contains troubleshooting information. The flame detector lens should be cleaned as often as conditions demand.

A periodic safety check procedure should be established to test the complete safeguard system. Tests should verify safety shutdown with a safety lock out upon failure to ignite the pilot or the main flame, and upon loss of flame. Each of these conditions should be checked on a scheduled basis. The safety check procedures are contained in the manufacturer's bulletin.

MOTORS

Supply voltage to the motor must not vary more than 10 percent from nameplate ratings. At initial start-up and regularly thereafter, check the motor current with an ammeter while the burner is in high fire position. If the reading exceeds the nameplate rating plus service factor, determine the cause and correct it. In dusty locations, clean the motor regularly to assure adequate cooling. Lubricate in accordance with the manufacturer's instructions.

C. GAS SYSTEM

Check the gas train for leaks. Check the gas valves and verify the low and high gas pressure settings.

MOTORIZED MAIN GAS VALVES

Should the valve fail to operate, check for voltage at the valve. Make certain that the main shut-off cock is closed prior to testing. The actuator is not field repairable nor should it be disassembled. Replace the actuator if valve fails to operate.

After replacement, cycle the valve with the fuel shut off to determine that it opens and closes. If the valve has a visual indicator, observe its position for correct operation.

CAUTION

ALL POWER MUST BE DISCONNECTED BEFORE SERVICING VALVES

DIAPHRAGM VALVES: MAIN AND PILOT

Should the valve fail to open, check that there is voltage at the valve actuator. If there is no voltage at actuator, check for loose wiring connections.

If there is proper voltage at actuatgor and the valve does not open, check that gas pressure is normal and that bleed line is not obstructed. After proving that the pressure is adequate and bleed line is clear the valve still does not

open, replace the coil assembly (refer to manufacturer's specifications and instructions for proper procedure).

If after replacing the coil assembly and valve still does not open, replace the valve assembly.

Be sure valve is installed so gas flows in direction of arrow on valve body.

Test for gas leaks and check valve action several times to ensure proper operation before attempting to relight the burner.

D. DRAWER ASSEMBLY

The gas pilot, ignition electrode and flame scanner are held in place by a support bracket and mounting plate. Refer to Figures 5-1 and 5-2 for drawer assembly dimensions.

Defective or cracked porcelain requires replacement. A gradual wearing away of the electrode tip(s) and/or grounding screws may require they be respaced or replaced. Thoroughly clean and adjust the porcelain insulated electrode. Correct all variations from the clearance dimentions.

NOTE

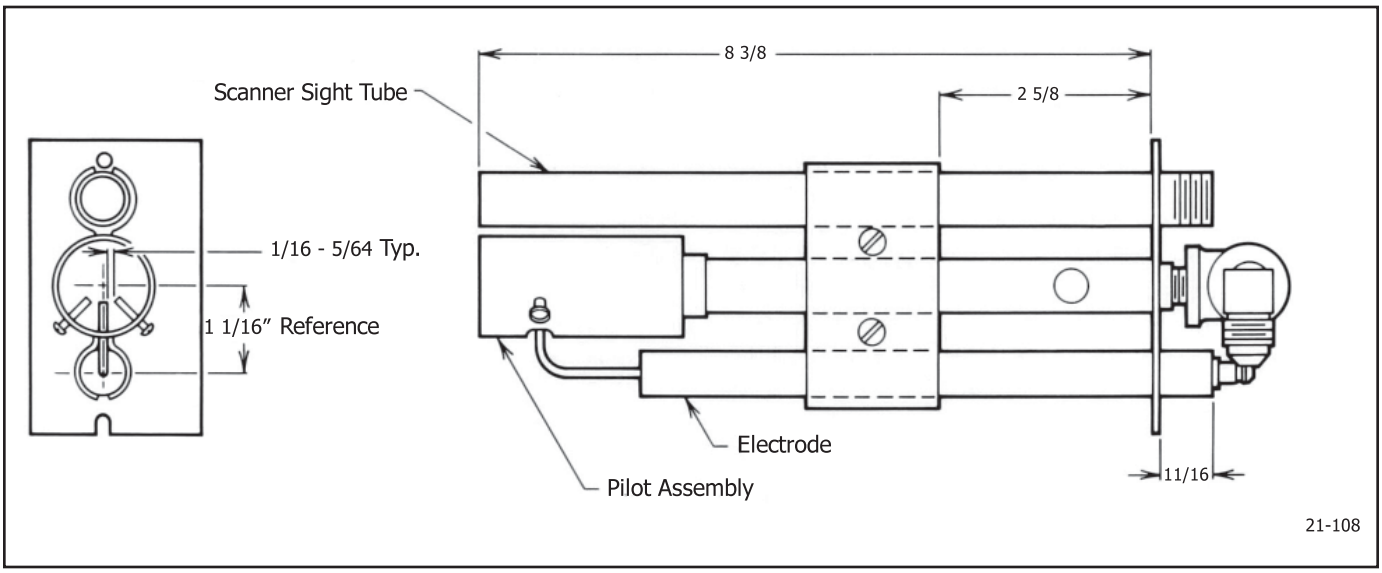
GROUND SCREWS ARE STAINLESS STEEL; REPLACE WITH SAME.

if the insulation on the high voltage cable becomes cracked or charred, install a new cable. Ignition cable should not be exposed to moisture, abrasion or rough handling. See that the connectors are in proper contact with the cable ends. Unscrewing the snap portion of the connector will show whether this is ture. Do not allow this cable to be located close to the scanner wiring.

The flame scanner must be clean. Even a small amount of contamination will reduce the flame signal. Wipe the scanner lens with a clean soft cloth. If proper scanner signal cannot be obtained, replace the cell.

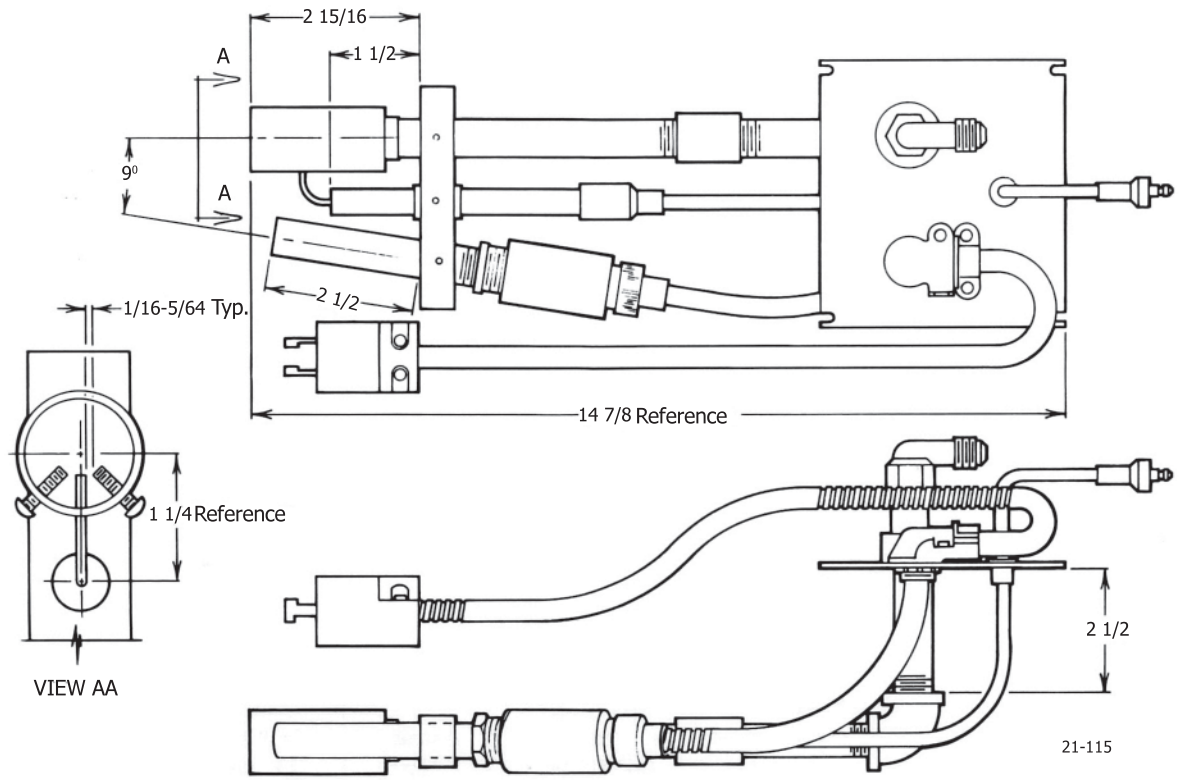
E. BURNER MOUNTING INSPECTION

The seal between the burner flange, refractory oven flange, and furnace front plate must not permit combustion gases to escape. Periodic inspection is important. If leakage occurs, refer to Chapter 2, Section D for proper sealing procedure.



DRAWER AND PILOT ASSEMBLY, CG6-23

Figure 5-1



Note: End of gas pilot tube must be flush with the face of the gas manifold. Gas pilot tube must fit tight against the inside of the manifold, Slots are provided on the drawer mounting bracket for this adjustment.

DRAWER AND PILOT ASSEMBLY, CG30-42 Figure 5-2

F. MAINTENANCE FLOW CHART RECOMMENDED TEST SCHEDULE

ITEM	SERVICE BY	REMARKS
		DAILY
Gauges, Monitors, and Indicators	Operator	Make visual inspection and record readings in log.
Instrument and Equipment Settings	Operator	Make visual check against recommended specifications.
Low water, Fuel cut-off and Alarms	Operator	Refer to instructions.
		WEEKLY
Firing rate control	Operator	Verify factory settings
Igniter	Operator	Make visual inspection. Check flame signal strength.
Pilot and Main Fuel Valves	Operator	Open limit switch. Make audible and visual check. Check valve position indicators, and check fuel meters.
Flame Failure Controls	Operator	Close manual fuel supply for (1) pilot and (2) main fuel cock and/or valve(s). Check safety shutdown timing. Record in log.
Flame Signal Strength Controls	Operator	Read and log the flame signal for both pilot and main flame. Notify Service if readings are very high, very low, or fluctuating.
Linkages	Operator	Check all burner linkages for tightness. Tighten if required.
		MONTHLY
Low Fan Pressure Interlock	Operator	Manually adjust until switch opens.
High and Low Gas Pressure Interlocks	Operator	Refer to instructions. Manually adjust until switch opens.
Scanner and Diffuser	Operator	Check, inspect and clean for soot buildup.
Pilot Assembly	Operator	Check for loosening of components, erosion or carbon buildup.
		ANNUALLY
Strainer (Oil units)	Operator	Replace or clean the oil strainer element.
Impeller	Operator	Inspect and clean the combustion impeller.
Combustion Test	Service Technician	Perform a complete combustion test. Adjust burner if necessary. Read and Log data.
Pilot turndown Test	Service Technician	Required after any adjustment to flame, scanner, or pilot adjustment
Operating Controls	Service Technician	Refer to instructions.

SECTION 6
TROUBLE SHOOTING

PROBLEM	SOLUTION
BURNER DOES NOT START	1. No voltage at program relay power input terminals. a. Main disconnect switch open. b. Blown control circuit fuse. c. Loose or broken electrical connection.
	2. Program relay safety switch requires resetting.
	3. Limit circuit not completed - no voltage at end of limit circuit program relay terminal. a. Pressure or temperature is above setting of operation control. b. Water below required level. Low-water light (and alarm horn) should indicate this condition. Check manual reset button, if provided, on low -water control. c. Fuel pressure must be within settings of low pressure and high pressure switches. d. Check burner air proving switch and high fire limit switch.
	4. High or Low gas pressure - investigate and repair.
NO IGNITION	1. Lack of spark. a. Electrode grounded or porcelain cracked. b. Improper electrode setting. c. Loose terminal on ignition cable; cable shorted. d. Inoperative ignition transformer. e. Insufficient or no voltage at pilot ignition circuit terminal.
	2. Spark but no flame. a. Lack of fuel - no gas pressure, closed fuel valve, empty tank, broken line b. Too much air flow. c. No voltage to pilot solenoid. d. Defective pilot solenoid. e. Improperly positioned electrode (Direct spark models).
	3. Low fire switch open in low fire proving circuit. a. Damper motor not closed, slipped cam, defective switch. b. Damper jammed or linkage binding.
	4. Running interlock circuit not completed. a. Combustion proving switches defective or not properly set. b. Motor starter interlock contact not closed.
	5. Flame detector defective, sight tube obstructed, or lens dirty.

TROUBLE SHOOTING

PROBLEM	SOLUTION
PILOT FLAME, BUT NO MAIN FLAME	1. Insufficient pilot flame.
	2. Gas fired unit. a. Manual gas cock closed. b. Main gas valve inoperative. c. Gas pressure regulator inoperative.
	3. Oil fired unit. a. Oil supply cut off by obstruction, closed valve, or loss of suction. b. Supply pump inoperative. c. No fuel. Broken, loose or missing oil pump coupling. d. Main oil valve inoperative. e. Check oil nozzle, gun and lines.
	4. Flame detector defective, sight tube obstructed or lens dirty.
	5. Insufficient or no voltage at main fuel valve circuit terminal.

BURNER STAYS IN LOW FIRE	1. Pressure or temperature above modulating control setting.
	2. Manual-automatic switch in wrong position.
	3. Inoperative modulating motor.
	4. Defective modulating control.
	5. Binding or loose linkages, cams, setscrews etc.

SHUTDOWN OCCURS DURING FIRING	1. Loss or stoppage of fuel supply.
	2. Defective fuel valve; loose electrical connection.
	3. Flame detector weak or defective.
	4. Scanner lens dirty or sight tube obstructed.
	5. If the programmer lockout switch has not tripped, check the limit circuit for an opened safety control.

TROUBLE SHOOTING

PROBLEM	SOLUTION
SHUTDOWN OCCURS DURING FIRING (cont).	6. If the programmer lockout switch has tripped. a. Check fuel lines and valves. b. Check flame detector. c. Check for open circuit in running interlock circuit. d. The flame failure light is energized by ignition failure, main flame failure, inadequate flame signal, or open control in the running interlock circuit.
	7. Improper air/fuel ratio. a. Slipping linkage. b. Damper stuck open. c. Fluctuating fuel supply. Temporary obstruction in the fuel line. Temporary drop in gas pressure.
	8. Interlock device inoperative or defective.
	9. Air in the oil lines. Bleed lines.

MODULATING MOTOR DOES NOT OPERATE	1. Manual-automatic switch in wrong position.
	2. Linkage loose or jammed.
	3. Motor does not drive to open or close during pre-purge or close on burner shutdown. a. Motor defective. b. Loose electrical connection. c. Damper motor transformer defective.
	4. Motor does not operate on demand. a. Manual/automatic switch in wrong position. b. Modulating control improperly set or inoperative. c. Motor defective. d. Loose electrical connection. e. Damper motor transformer defective.

warranty policy

A. LIMITED WARRANTY

The Company warrants that at the time of shipment, the equipment manufactured by it shall be merchantable, free from defects in material and workmanship and shall possess the characteristics represented in writing by the Company. The Company's warranty is conditioned upon the equipment being properly installed and maintained and operated within the equipment's capacity under normal load conditions with competent supervised operators. Equipment, accessories and other parts and components not manufactured by the Company are warranted only to the extent of and by the original manufacture's warranty to the Company; In no event shall such other manufacturer's warranty create any more extensive warranty obligations of the Company to the Buyer than the Company's warranty covering equipment manufactured by the Company.

B. EXCLUSIONS FROM WARRANTY

(I) THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES, ORAL OR EXPRESS OR IMPLIED, INCLUDING ANY WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION OF THE EQUIPMENT. THERE ARE NO EXPRESS WARRANTIES OTHER THAN THOSE CONTAINED HEREIN TO THE EXTENT PERMITTED BY THE LAW. THERE ARE NO IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. THE PROVISIONS AS TO DURATION, WARRANTY ADJUSTMENT AND LIMITATION OF LIABILITY SHALL BE THE SAME FOR BOTH IMPLIED WARRANTIES (IF ANY) AND EXPRESSED WARRANTIES.

(II) The Company's warranty is solely as stated in (a) above and does not apply or extend, for example, to: expendable item; ordinary wear and tear; altered units; units repaired by persons not expressly approved by the Company; materials not of the Company's manufacture; or damage caused by accident, the elements, abuse, misuse, temporary heat, overloading, or by erosive or corrosive substances or by the alien presence of oil, grease, scale, deposits or other contaminants in the equipment.

C. WARRANTY ADJUSTMENT

Buyer must make claim of any breach of any warranty by written notice to the Company's home office within thirty (30) days of the discovery of any defect. The Company agrees at its option to repair or replace, BUT NOT INSTALL, F.O.B. Company's plant, any part or parts of the equipment which within twelve (12) months from the date of initial operation but no more than eighteen (18) months from date of shipment shall prove the Company's satisfaction (including return to the Company's plant, transportation prepaid, for inspection, if required by the Company) to be defective within the above warranty. Any warranty adjustments made by the Company shall not extend the initial warranty period set forth above. Expenses incurred by Buyer in replacing or repairing or returning the equipment or any part or parts will not be reimbursed by the Company.

D. SPARE AND REPLACEMENT PARTS WARRANTY ADJUSTMENT

The Company sells spare and replacement parts. This subparagraph (d) is the warranty adjustment for such parts. Buyer must make claim of any breach of any spare or replacement parts by written notice to the Company's home office within thirty (30) days of the discovery of any alleged defect for all such parts manufactured by the company. The Company agrees at its option to repair or replace, BUT NOT INSTALL, F.O.B. Company's plant, any part or parts or material it manufacture which, within one (1) year from the date of shipment shall prove to Company's satisfaction (including return to the Company's plant, transportation prepaid, for inspection, if required by the Company) to be defective within this part warranty. The warranty and warranty period for spare and replacement parts not manufactured by the company (purchased by the Company, from third party suppliers) shall be limited to the warranty and warranty adjustment extended to the Company by the original manufacturer of such parts; In no event shall such other manufacturer's warranty create any more extensive warranty obligations of the Company to the Buyer for such parts than the Company's warranty adjustment covering part manufactured by the Company as set forth in this subparagraph (d). Expenses incurred by Buyer in replacing or repairing or returning the spare or replacement parts will not be reimbursed by the Company.

E. LIMITATION OF LIABILITY

The above warranty adjustment set forth Buyer's exclusive remedy and the extent of the Company's liability for breach of implied (if any) and express warranties, representations, instructions or defects from any cause in connection with the sale or use of the equipment. THE COMPANY SHALL NOT BE LIABLE FOR ANY SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES OR FOR LOSS, DAMAGE OR EXPENSE, DIRECTLY OR INDIRECTLY ARISING FROM THE USE OF THE EQUIPMENT OR FROM ANY OTHER CAUSE WHETHER BASED ON WARRANTY (EXPRESS OR IMPLIED) OR TORT OR CONTRACT, and regardless of any advices or recommendations that may have been rendered concerning the purchase, installation, or use of the equipment.

START-UP / SERVICE REPORT

The following information should be filled in by the service technician at start-up or after any adjustment to the burner.

A copy of the start-up report MUST be returned to IC in order to validate the warranty of the burner.

Burner Model _____ Serial Number _____ Start-up Date _____

Test Conducted	GAS			OIL		
	Low	50%	High	Low	50%	High
Firing Rate MMBtu / gph						
Stack Temp (Gross) ^{O}F						
Room Temp ^{O}F						
O2%						
CO2%						
CO (PPM)						
NOx (PPM)						
Smoke (Bacharach)						
Combustion Eff.%						
Stack Draft "W.C.						
Furnace Pressure "W.C.						
Blast tube Pressure "W.C.						
Steam Pressure PSIG						
Water Temperature ^{O}F						
Supply oil pressure PSIG						
Return oil pressure PSIG						
Vacuum oil pump "HG						
Oil Temperature						
Atom. air pressure						
Gas Pressure @ Burner Manifold "W.C.	Inner Manifold					
	Outer Manifold					
Center Gas pressure "W.C.						
Gas Pressure @ Regulator Inlet PSIG						
Gas Pressure @ Regulator Outlet PSIG						
Pilot Gas Pressure @ Regulator Outlet "W.C.						
Flame Signal Main	Low		50%		High	

Control Checks	Test	Set Point
Low Water Cut Off		
Aux. LWCO		
High Water Cut Off		
Operating Limit		
High Limit		
Operating Control		
Stack Temp Interlock		
Flame Failure		
Combustion Air Switch		
High Purge Switch		
Low Fire Interlock		
Oil Pressure Switch		
Oil Valve with P.O.C. Interlock		
High Gas Pressure Switch		
Low Gas Pressure Switch		
Gas Valve P.O.C. Interlock		
Pilot Turndown Test		
Flame Signal Pilot		

(For Low NOx Burners)

Blast Tube Temp. Interlock		
FGR Line Purge Switch		
FGR Valve P.O.C. Switch		

Electric Motors	Voltage			Amperage		
	L1	L2	L3	L1	L2	L3
Control Voltage						
Blower Motor						
Air Compressor						
Air-Oil or Metering						

Adjusted by:

Date:

Accepted by:

(Signature Required)

PRODUCT SATISFACTION SURVEY

Burner Model _____ Serial Number _____

As a requirement of our ISO certification, please fill-in this form and return to Industrial Combustion.
Please rate your satisfaction with the following:

	Poor	Good	Excellent
Delivery time			
Apperance of equipment after delivery			
Piping and tubing			
Wiring			
All components arrived with equipment			
Ease of start-up			
Performance of equipment			
Quality of information provided			
Sales			
Engineering			
Service			
Parts			
Overall way any problems were handled			

Comments:

Date: _____ By: _____

CG/SERIES

Parts Manual

Industrial Combustion, LLC

CG /SERIES PARTS SECTION

INSTRUCTIONS FOR THE USE OF THIS PART BOOK
WHEN ORDERING REPAIR PARTS, PLEASE INCLUDE PART NUMBER, THE BURNER SERIAL NUMBER, MODEL, SIZE, AND VOLTAGE. THE INFORMATION CAN BE OBTAINED FROM THE BURNER NAMEPLATE AND THE VOLTAGE FROM THE DATA LABEL ON THE PANEL DOOR.

WHEN ORDERING FAN WHEELS, GIVE THE OVERALL DIAMETER, WIDTH, BORE, MANUFACTURER, AND MOTOR HP.

THIS PARTS BOOK DOES NOT INCLUDE SUCH COMMON HARDWARE ITEMS AS NUTS, WASHERS, ELECTRICAL PARTS, COPPER TUBING, FLARE FITTINGS, AND PIPE. ITEMS SUCH AS THESE CAN BE READILY PURCHASED LOCALLY.

THE FOLLOWING PARTS ARE SOLD ON EXCHANGE BASIS:

OIL-AIR METERING PUMPS, OIL AND AIR PUMPS, BEARING ASSEMBLY, AIR MODULATORS, AND RELIEF VALVES.

PARTS SHIPPING POLICY
ALL ORDERS FOR STOCKED ITEMS WILL BE PROCESSED AND READY FOR SHIPMENT WITHIN (24) HOURS OF ITS RECEIPT.

AIR SHIPMENTS (U.P.S. OR OTHERWISE) WILL BE SHIPPED THE SAME DAY IF ORDER IS RECEIVED BEFORE 2:30 P.M. (WEATHER PERMITTING).

GROUND SHIPMENTS TO WISCONSIN AND BORDERING STATES WILL BE SHIPPED THE SAME DAY UPON REQUEST.

ALL PARTS ORDERS AND EXHCNAGE PARTS MUST BE SENT TO:

INDUSTRIAL COMBUSTION
351 -21st STREET
MONROE, WISCONSIN 53566

PLANT PHONE: (608) 325-3141
FAX: (608) 325-4379

PARTS DIRECT: (608) 325-5003
FAX: (608) 329-3190

RETURN GOODS PROCEDURES (CREDIT OR REPLACEMENT PARTS)

Defective WARRANTY PARTS OR PARTS to be repaired are not to be returned to the PARTS DEPARTMENT without calling for a RETURN GOODS AUTHORIZATION NUMBER.

1) Before any item is RETURNED, PLEASE CALL THE PARTS DEPARTMENT TO OBTAIN AN **RGA** (RETURN GOODS AUTHORIZATION) NUMBER. PLEASE HAVE THE FOLLOWING INFORMATION AVAILABLE WHEN CALLING:

   A) PART NUMBER OF ITEM
   B) DESCRIPTION OF ITEM
   C) REASON FOR THE RETURN WITH A FULL DESCRIPTION OF THE DEFECT(S)
   D) PARTS ORDER OR SALES ORDER ITEM WAS PURCHASED ON
   E) NAME, ADDRESS, AND DATE OF INSTALLATION
   F) DO YOU WANT CREDIT OR REPLACEMENT BEING ISSUED

2) Once an **RGA** number HAS BEEN ISSUED, THE ITEM MAY BE RETURNED. YOU WILL HAVE THIRTY (30) DAYS TO RETURN THE ITEM FROM THE DATE OF THE **RGA** BEING ISSUED OR THERE WILL BE A 10% HANDLING CHARGE.

3) RETURNED GOODS MUST HAVE THE **RGA** NUMBER APPEARING ON THE ADDRESS LABEL ATTACHED TO THE OUTSIDE OF THE BOX BEING RETURNED. IF THE **RGA** NUMBER IS NOT ON THE LABEL, YOUR CREDIT MAY BE DELAYED AND THERE WILL BE A $50.00 SERVICE CHARGE FOR PAPERWORK. ALL NEW PARTS RETURNED TO THE FACTORY WILL BE CHARGED WITH A 25% RESTOCKING FEE.

PLEASE NOTE:
FAILURE TO PROVIDE COMPLETE AND CORRECT INFORMATION MAY RESULT IN DELAYED OR CREDIT REFUSAL.

RETURN OF WARRANTY PARTS: WARRANTY PARTS MUST BE RETURNED TO THE FACTORY FREIGHT PREPAID, WITHIN THIRTY (30) DAYS AFTER A NEW PART HAS BEEN RECEIVED OR THERE WILL BE A 10% HANDLING CHARGE.

SHIPPING CHARGES: ON A WARRANTY PART, WE WILL ASSUME STANDARD SHIPPING CHARGES. THIS DOES NOT INCLUDE SPECIAL HANDLING SUCH AS AIR FREIGHT, U.P.S. NEXT DAY AIR SERVICE, OR U.P.S. SECOND DAY AIR SERVICE, ETC.

MOTOR WARRANTY POLICY:
THE FOLLOWING PROCEDURE MUST BE USED FOR PROPER REPLACEMENT AND/OR REPAIR OF ELECTRIC MOTORS THAT HAVE FAILED UNDER WARRANTY.

1) Remove motor from unit and take motor to a **MANUFACTURER AUTHORIZED SERVICE STATION.**

2) The service station will determine the warranty status by **INSTALLATION DATE OF THE UNIT, AND DATE OF FAILURE,** along with the age of the motor, determined by the **CODE DATE.**

3) If the unit is within warranty, the unit will be inspected for cause of failure and repair requirements.

4) If the unit is within warranty limitations, the service station will repair on a **"NO CHARGE"** basis.

5) If the repairs are extensive, the service station will contact the motor manufacturer warranty manager to decide if the motor is to be repaired or replaced.

EXCEPTION TO THE ABOVE PROCEDURE:
EMERGENCY SITUATIONS MAY DICTATE THAT BECAUSE OF THE DISTANCE BETWEEN USER AND AUTHORIZED SERVICE STATIONS, SEVERE DAMAGE OR INTERRUPTIONS MAY RESULT.

THE FOLLOWING PROCEDURE SHOULD BE USED:

1) SELECT A KNOWLEDGEABLE MOTOR REPAIR SHOP.

2) REPAIR SHOP TO CONTACT MOTOR MANUFACTURER WARRANTY REPAIR MANAGER, DETAILING REPAIRS NECESSARY ALONG WITH THE COMPLETE NAMEPLATE DATA BEFORE ANY REPAIRS ARE MADE.

3) IF ANY PROBLEMS OCCUR, THE INDUSTRIAL COMBUSTION PARTS DEPT. WILL PROVIDE ASSISTANCE.

FAILURE TO FOLLOW THE NEXT PROCEDURE WILL RESULT IN REPAIRS BEING MADE AT THE CUSTOMERS EXPENSE.

***MARATHON ELECTRIC - ELECTRIC MOTORS WARRANTY REPAIR PROCEDURE**

THE FOLLOWING PROCEDURE MUST BE USED FOR PROPER REPLACEMENT AND/R REPAIR OF MARATHON ELECTRIC MOTORS THAT HAVE FAILED UNDER WARRANTY.

1) END USER WILL REMOVE MOTOR FROM UNIT AND TAKE FAILED MOTOR TO MARATHON ELECTRIC AUTHORIZED SERVICE STATION.

2) SERVICE STATION WILL DETERMINE WARRANTY STATUS BY INSTALLATION DATE OF UNIT AND DATE OF FAILURE ALONG WITH AGE OF MOTOR DETERMINED BY DATE CODE.

3) IF WINTHIN WARRANTY LIMITATIONS, UNIT WILL BE INSPECTED FOR CAUSE OF FAILURE AND REPAIR REQUIREMENTS. DETERMINATION WILL BE MADE THAT FAILURE WAS CAUSED BY DEFECT IN MATERIALS OR WORKMANSHIP AND NOT BY MISUSE, ABUSE, ACCIDENT, OR OTHER EXCLUSIONS LISTED IN OUR WARRANTY.

4) IF MINOR REPAIR IS REUIRED, SERVICE STATION WILL REPAIR MOTOR AND RETURN TO USER ON A "NO CHARGE" BASIS.

5) IF MAJOR REPAIR (REWIND) IS REQUIRED, SERVICE STATION MAY:

   A) REWIND MOTOR AND RETURN TO USER ON A "NO CHARGE" BASIS IF USER REQUIREMENT IS NOT AN EMERGENCY AND REPAIR CAN BE MADE WITHIN MARATHON ELECTRIC PRICE GUIDELINES, OR

   B) NAMEPLATE WILL BE REMOVED AND ALONG WITH A REPORT OF CAUSE OF FAILURE WILL BE GIVEN TO THE USER.

6) USER WILL PRESENT NAMEPLATE AND REPORT TO DISTRIBUTOR.

7) DISTRIBUTOR WILL FURNISH USER WITH A NEW MOTOR, NO CHARGE, EITHER FROM HIS INVENTORY OR SECURE REPLACEMENT UNIT DIRECT FROM PARENT ORGANIZTION.

*MARATHON ELECTRIC
WARRANTY REPAIR PROCEDURE, DPN-79-113
ELECTRIC MOTORS, 48-215 FRAME

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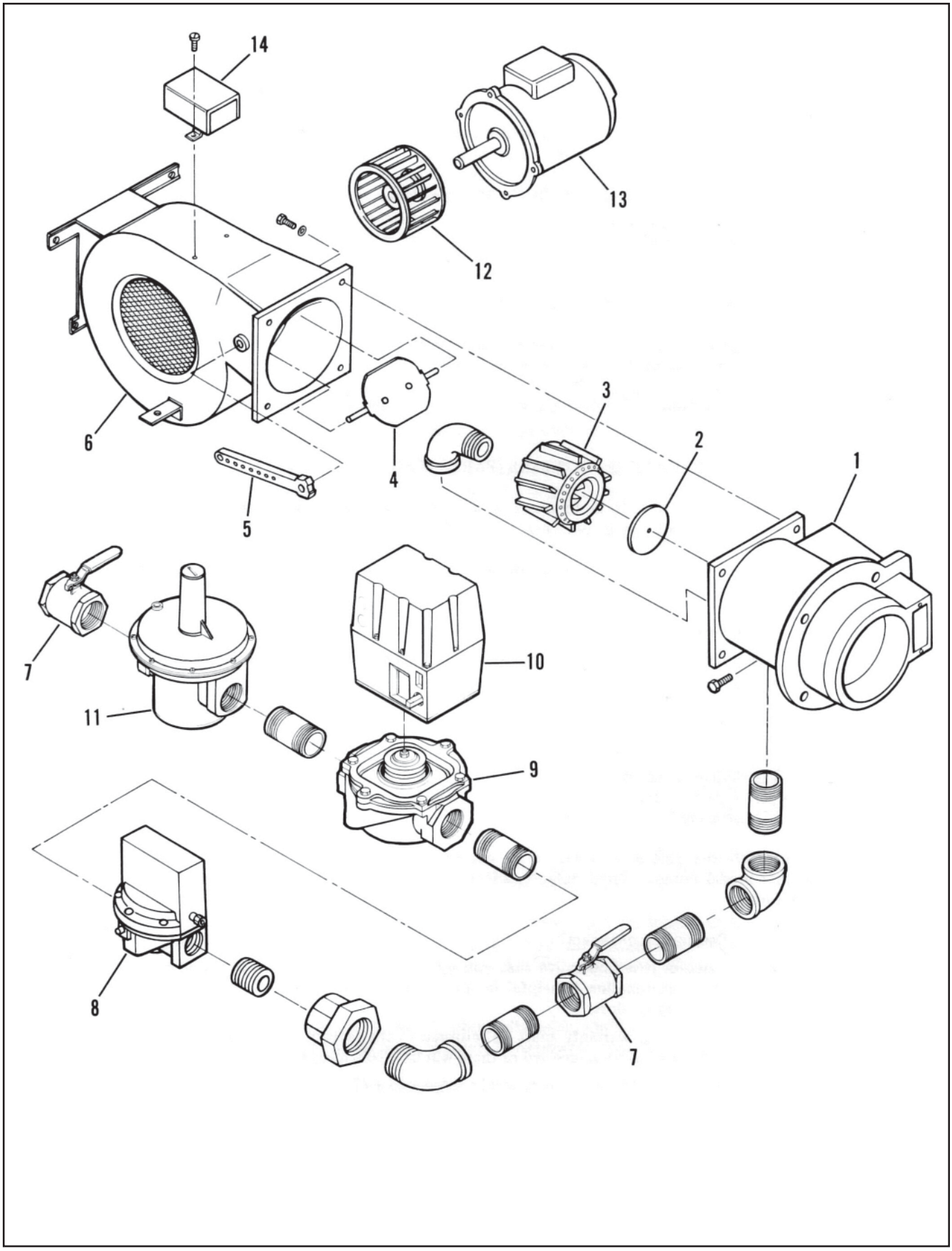

FIGURE 1. BLAST TUBE, BLOWER HOUSING, GAS TRAIN ASSEMBLIES CG6-23

BLAST TUBE, BLOWER HOUSING, GAS TRAIN ASS'Y			QUANTITY							
ITEM NO.	PART NO.	DESCRIPTION	6	9	12.5	17	23	30	36	42
1	90-221	BLAST TUBE	1	1	1	1	1			
2	59-1056	AIR MIXER PLATE	1	1	1	1				
3	132-398	GAS MANIFOLD	1	1						
	132-399	GAS MANIFOLD			1	1				
	132-431	GAS MANIFOLD					1			
4	22-142	AIR DAMPER PLATE	1	1	1	1				
	22-148	AIR DAMPER PLATE					1			
	67-241	AIR DAMPER SHAFT	1	1	1	1	1			
5	108-52	ADJUSTING ARM	2	2						
	108-53	ADJUSTING ARM			1	1	1			
6	40-244	HOUSING, FAN	1	1						
	40-225	HOUSING, FAN			1	1				
	40-235	HOUSING, FAN					1			
7	941-562	SHUT-OFF COCK, 3/4"	2							
	941-594	SHUT-OFF COCK, 1"		2	2					
	941-584	SHUT-OFF COCK, 1-1/4"				2				
	941-127	SHUT-OFF COCK, 1-1/2"					2			
8	940-1293	VALVE, GAS DIAPHRAGM, 3/4"	1							
	940-1103	VALVE, GAS DIAPHRAGM, 1"		1						
9	940-1263	VALVE BODY, 1"			1					
	940-1288	VALVE BODY, 1-1/2"				1	1			
10	945-125	ACTUATOR, (LOW-HIGH-OFF)			1	1	1			
	945-136	ACTUATOR, (LOW-HIGH-OFF)			1	1	1			
11	817-582	GAS PRESSURE REGULATOR RV60, 1"	1	1	1					
	817-622	GAS PRESSURE REGULATOR RV81, 1-1/2"				1	1			
12	951-97	WHEEL, BLOWER, 5" X 2-1/2"	1	1						
	951-93	WHEEL, BLOWER, 6-1/4" X 2-1/2"			1	1				
	951-116	WHEEL, BLOWER, 6-1/4" X 3-1/2"					1			
13	894-1016	MOTOR, 115/60/1/3450, 1/8 HP	1	1						
	894-1013	MOTOR, 115/60/1/3450, 1/3 HP			1	1	1			
14	817-581	SWITCH, AIR	1	1	1	1	1			

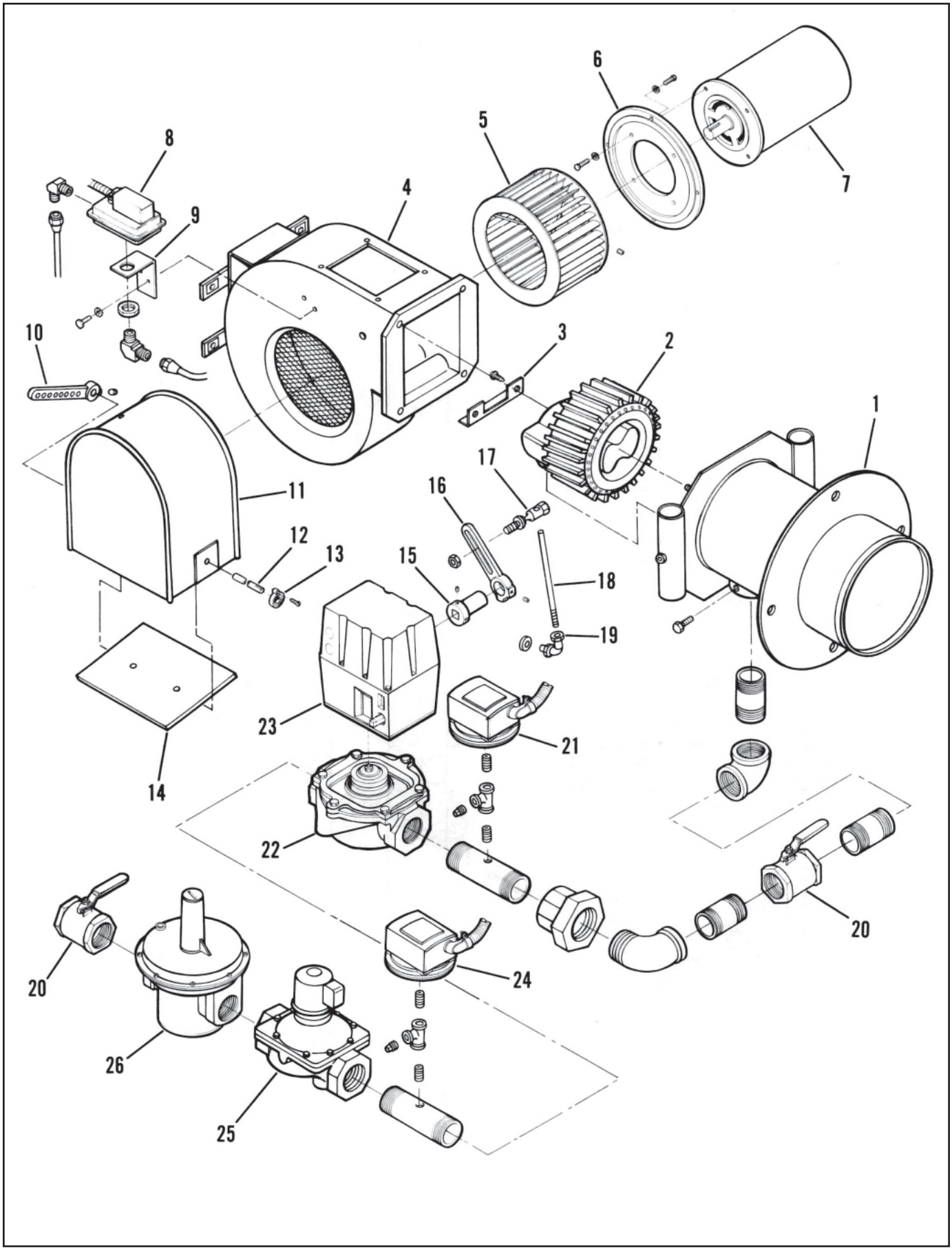

FIGURE 2. BLAST TUBE, BLOWER HOUSING, GAS TRAIN ASSEMBLIES CG30-42

BLAST TUBE, BLOWER HOUSING, GAS TRAIN ASS'Y			QUANTITY							
ITEM NO.	PART NO.	DESCRIPTION	6	9	12.5	17	23	30	36	42
1	90-354	BLAST TUBE ASSEMBLY						1	1	1
2	132-449	GAS MANIFOLD						1	1	
	132-448	GAS MANIFOLD								1
3	8-1311	BRACKET, DRAWER ASSEMBLY MOUNTING						1	1	
	8-133	BRACKET, DRAWER ASSEMBLY MOUNTING								1
4	40-298	HOUSING, FAN						1	1	1
5	951-147	WHEEL, BLOWER, 8-3/8 X 1-1/2						1		
	951-148	WHEEL, BLOWER, 8-3/8 X 2							1	
	951-149	WHEEL, BLOWER, 8-3/8 X 4								1
6	29-937	FLANGE, MOTOR MOUNTING						1	1	1
7	894-885	MOTOR, 115-230/1/60, 1 HP						1		
	894-928	MOTOR, 208-220/440/3/60, 1 HP						1		
	894-1231	MOTOR, 115-230/1/60, 1 HP							1	
	894-1290	MOTOR, 208-230/460/3/60, 2 HP							1	1
	894-1293	MOTOR, 115-230/1/60, 2 HP								1
8	836-366	SWITCH, AIR						1	1	1
9	8-1307	BRACKET, AIR SWITCH						1	1	1
10	2-13	ARM, ADJUSTING						1	1	1
11	40-297	HOUSING, AIR SCOOP						1	1	1
12	74-499	SHAFT, DAMPER						1	1	1
13	82-140	SPRING, DAMPER RETURN						1	1	1
14	59-1084	PLATE, AIR DAMPER						1	1	1
15	10-295	BUSHING						1	1	1
16	2-14	ARM, ACTUATING						1	1	1
17	883-8	BALL JOINT, 1/4 X STAIGHT						1	1	1
18	67-304	ROD, BRASS, 1/4 DIA. X 5-1/2"						1	1	1
19	883-11	BALL JOINT, 1/4 X 90°						1	1	1
20	991-128	SHUT-OFF COCK						2	2	2
21	817-571	SWITCH, GAS PRESSURE, HIGH						1	1	1
22	940-1289	VALVE, BODY, 2"						1	1	1
23	945-136	ACTUATOR						1	1	1
24	817-570	SWITCH, GAS PRESSURE, LOW						1	1	1
25	940-1096	VALVE, SOLENOID, K3E, 2"						1	1	1
26	817-617	REGULATOR, GAS PRESSURE						1	1	1

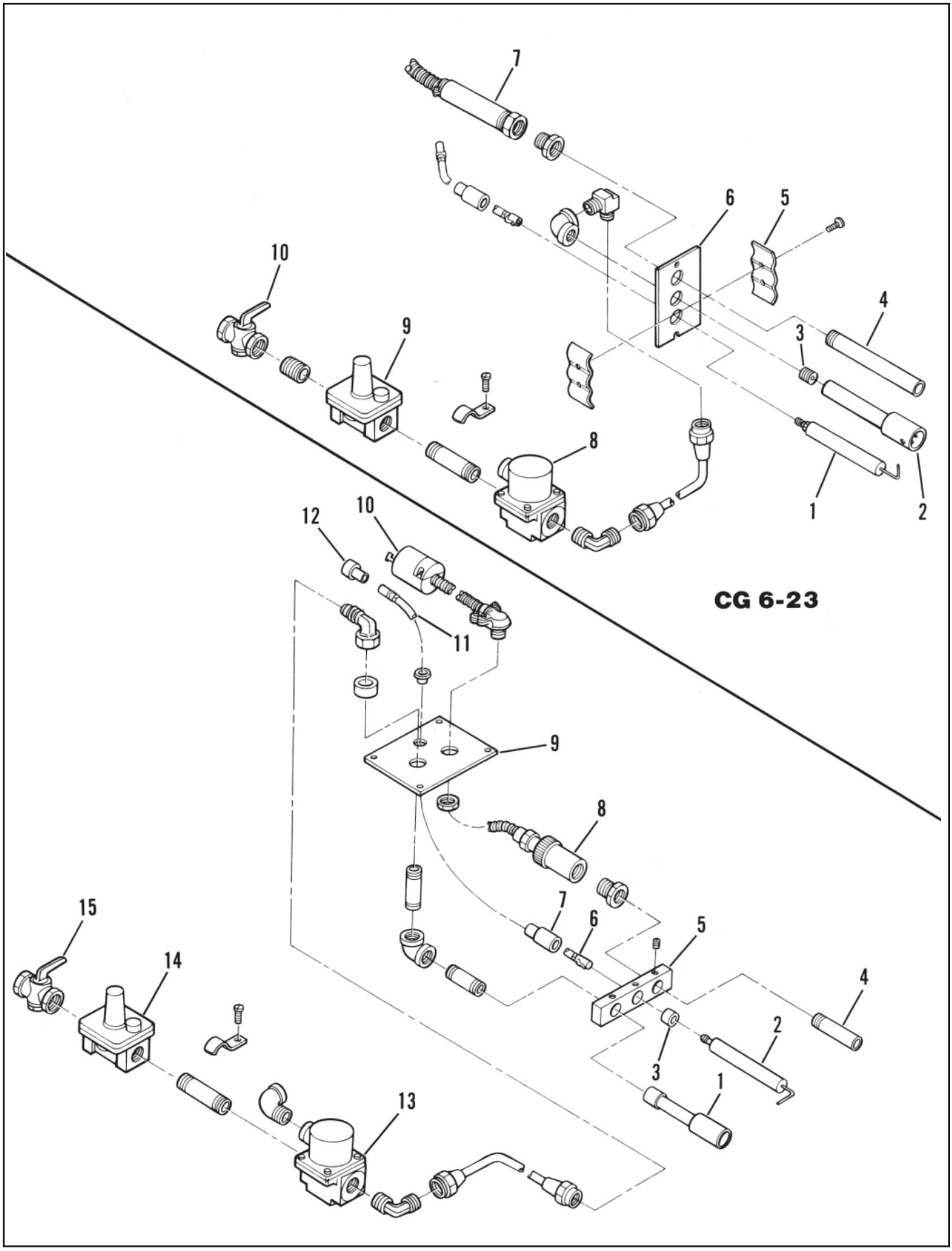

FIGURE 3. DRAWER AND GAS PILOT ASSEMBLIES CG30-42

DRAWER AND GAS PILOT ASSEMBLIES			QUANTITY							
ITEM NO.	PART NO.	DESCRIPTION	6	9	12.5	17	23	30	36	42
	429-636	DRAWER ASSEMBLY	1	1	1	1	1			
1	875-85	ELECTRODE	1	1	1	1	1			
2	48-135	PILOT, SUB-ASSEMBLY	1	1	1	1	1			
3	284-59	PILOT INSPIRATING HEAD	1	1	1	1	1			
4	57-106	UV SIGHT TUBE	1	1	1	1	1			
5	8-942	BRACKET	1	1	1	1	1			
6	13-119	BACK CAP	1	1	1	1	1			
7	817-614	SCANNER, UV1A FIREYE	1	1	1	1	1			
	817-613	SCANNER, UV M.H.			1	1	1			
8	940-1123	VALVE, GAS PILOT, 3/8”	1	1	1	1	1			
9	817-150	REGULATOR, GAS PRESSURE, PILOT, 3/8”	1	1	1	1	1			
10	825-136	COCK, SHUTOFF, 3/8”	1	1	1	1	1			
	429-623	DRAWER ASSEMBLY						1	1	1
1	48-109	PILOT, SUB-ASSEMBLY						1	1	1
2	873-85	ELECTRODE						1	1	1
3	10-1050	BUSHING, ELECTRODE						1	1	1
4	857-146	U.V. SIGHT TUBE						1	1	1
5	8-1304	BRACKET, DRAWER ASSEMBLY						1	1	1
6	848-157	TERMINAL						2	2	2
7	848-166	CONNECTOR, GTO						1	1	1
8	817-613	SCANNER, UV M.H.						1	1	1
	817-614	SCANNER, UV FIREYE						1	1	1
9	19-439	COVER, DRAWER ASSEMBLY HOLDER						1	1	1
10	848-347	TWIST CAP						1	1	1
11	826-40	IGNITION CABLE, 13”						1	1	1
12	848-167	CONNECTOR, GTO						1	1	1
13	940-1123	VALVE, GAS PILOT, 3/8”						1	1	1
14	817-150	REGULATOR, GAS PRESSURE, PILOT 3/8”						1	1	1
15	825-136	COCK, SHUTOFF, 3/8”						1	1	1

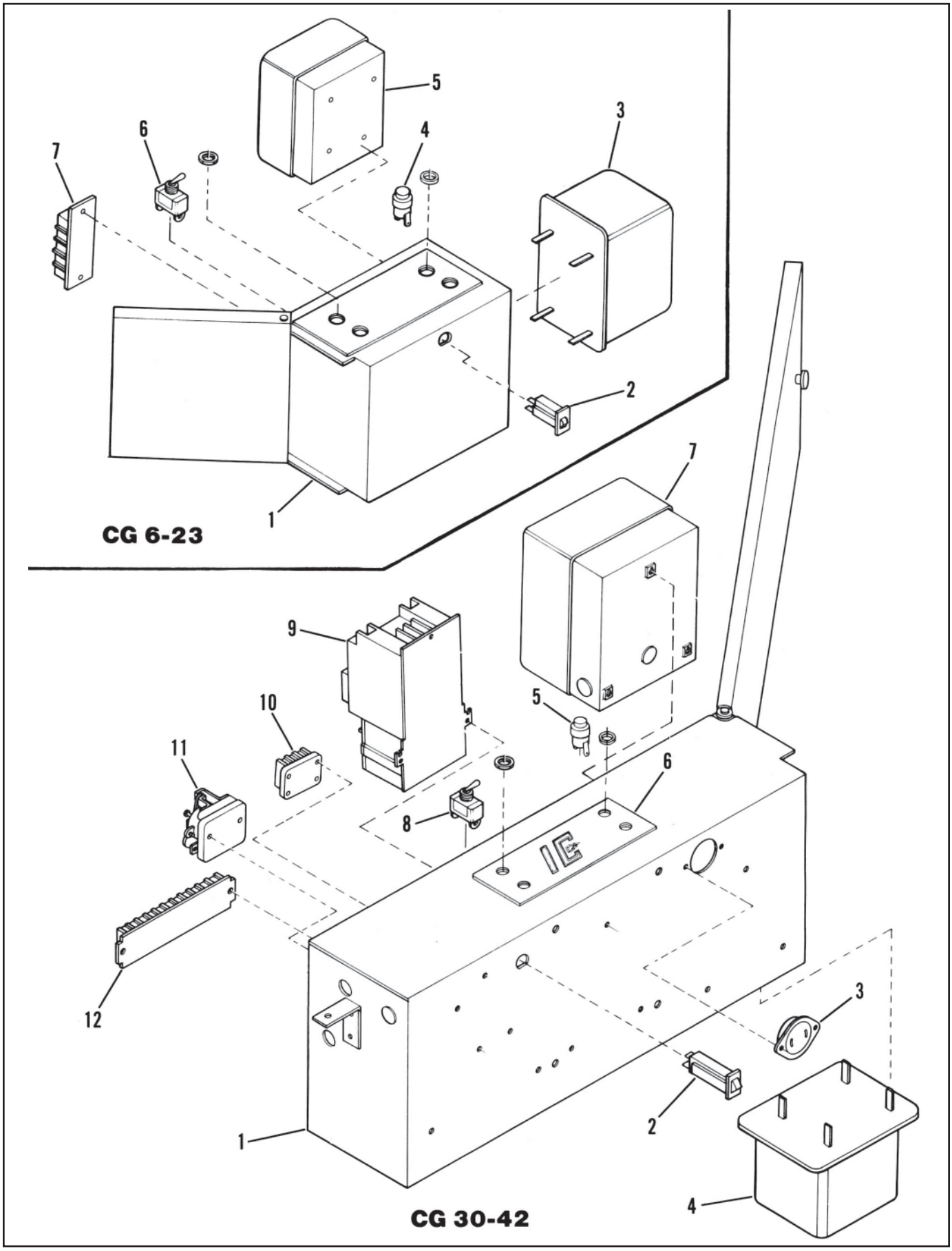

FIGURE 4. PANEL BOX & CONTROL SYSTEM

PANEL BOX & CONTROL SYSTEM			QUANTITY							
ITEM NO.	PART NO.	DESCRIPTION	6	9	12.5	17	23	30	36	42
		CG6-23								
1	119-312	PANEL, CONTROL, 9 X 9 X 6	1	1	1	1	1			
2	832-648	FUSE, 15 AMP.	1	1	1	1	1			
	832-71	FUSE, HOLDER	1	1	1	1	1			
3	832-107	TRANSFORMER, IGNITION	1	1	1	1	1			
4	881-136	LAMP, NATURAL	1	1	1	1	1			
	881-137	LAMP, RED	1	1	1	1	1			
	881-138	LAMP, GREEN	1	1	1	1	1			
5		SEE CHART	1	1	1	1	1			
6	836-264	SWITCH, TOGGLE, SPDT, ON-OFF	1	1	1	1	1			
7	832-653	TERMINAL BLOCK, 1 PAIR	4	4	4	4	4			
	832-654	TERMINAL BLOCK, END	1	1	1	1	1			
		CG30-42								
1	119-313	PANEL, CONTROL, 10 X 20 X 6						1	1	1
2	832-648	FUSE, 15 AMP						1	1	1
	832-713	FUSE, HOLDER						1	1	1
3	848-375	RECEPTACLE						1	1	1
4	832-102	TRANSFORMER, IGNITION						1	1	1
5	881-136	LAMP, NATURAL						1	1	1
	881-137	LAMP, RED						1	1	1
	881-138	LAMP, GREEN						1	1	1
6	118-687	NAMEPLATE, “CG”						1	1	1
7		SEE CHART						1	1	1
8	836-380	SWITCH, TOGGLE, SPDT, ON-OFF						1	1	1
9		SEE CHART						1	1	1
10	832-638	TERMINAL BLOCK, 3 PAIR						1	1	1
11	833-830	RELAY, 115, SPDT, 3 PH						1	1	1
	833-589	RELAY, 115, DPDT, 1 PH						1	1	1
12	832-829	TERMINAL BLOCK, 1 PAIR						8	8	8
	832-827	TERMINAL BLOCK, END						2	2	2

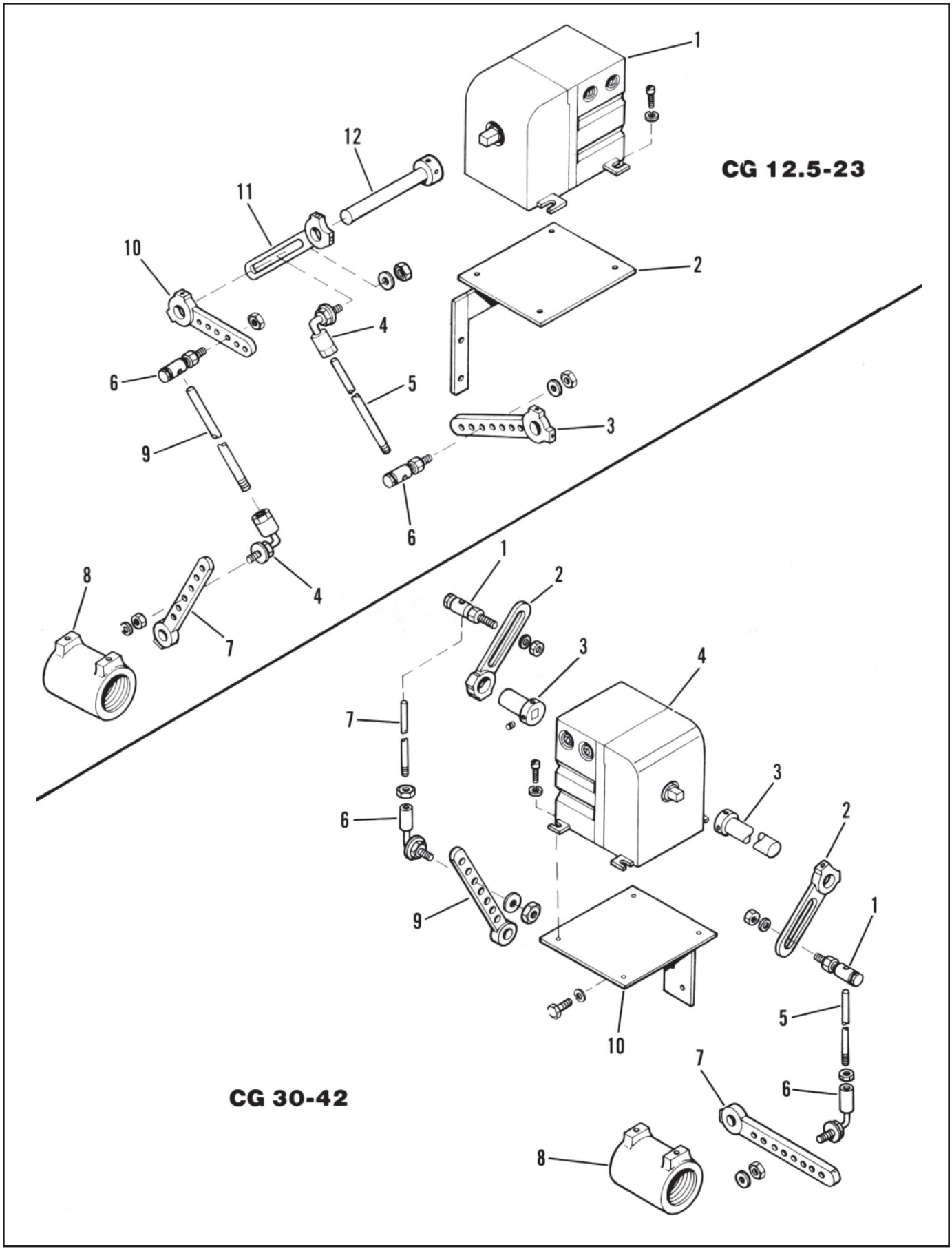

FIGURE 5. MODULATING MOTOR & LINKAGE (OPTIONAL)

MODULATING MOTOR & LINKAGE (OPTIONAL)			QUANTITY							
ITEM NO.	PART NO.	DESCRIPTION	6	9	12.5	17	23	30	36	42
		CG12.5-23								
1	894-1288	MOD MOTOR, 90°			1	1	1			
2	8-1315	BRACKET, MOD MOTOR			1	1	1			
3	2-101	ARM, ACTUATING			1	1	1			
4	883-11	BALL JOINT, 1/4" X 90°			2	2	2			
5	67-240	ROD, BRASS, 1/4" DIA. X 16" LONG			1	1	1			
6	883-8	BALL JOINT, 1/4" X STRAIGHT			2	2	2			
7	2-142	ARM, ACTUATING			1	1	1			
8	940-1129	VALVE, BUTTERFLY, 1"			1					
	940-1255	VALVE, BUTTERFLY, 1-1/4"				1				
	940-1256	VALVE, BUTTERFLY, 1-1/2"					1			
9	67-308	ROD, BRASS, 1/4" DIA. X 20" LONG			1	1	1			
10	2-30	ARM, ACTUATING			1	1	1			
11	2-14	ARM, ACTUATING			1	1	1			
12	10-305	BUSHING			1	1	1			
		CG30-42								
1	883-8	BALL JOINT, 1/4" X 90°						2	2	2
2	2-14	ARM, ACTUATING						2	2	2
3	10-295	BUSHING						2	2	2
4	894-1288	MOD MOTOR, 90°						1	1	1
5	67-130	ROD, BRASS, 1/4" X 18" LONG						1	1	1
6	883-11	BALL JOINT, 1/4" X 90°						2	2	2
7	2-103	ARM, ACTUATING						1	1	1
8	940-1192	VALVE, BUTTERFLY, 2"						1	1	1
9	2-142	ARM, ACTUATING						1	1	1
10	8-1320	BRACKET, MOD MOTOR						1	1	1

MOTOR STARTERS						
CG BURNER	BLOWER MOTOR	PART NO. 833 -				
		1 PHASE		3 PHASE		
SIZE	HP	115	230	208	230	460
6	1/8	*	589	-	-	-
9	1/8	*	589	-	-	-
12.5	1/3	*	589	-	-	-
17	1/3	*	589	-	-	-
23	1/3	*	589	-	-	-
30	1	589	589	1071	1071	1071
36	1**	589	589	1071	1071	1071
42	2	1006	1004	1004	1004	1071

FLAME SAFEGUARD CONTROLS							
BURNER SIZE	FIREYE IC PACKAGE NO.				HONEYWELL IC PACKAGE NO.		
	ON-OFF	LOW-HI-OFF	LO-HI-LO	FULL MOD	LO-HI-OFF	LO-HI-LO	FULL MOD
6	108	-	-	-	-	-	-
9	108	-	-	-	-	-	-
12.5	-	111	111	91	-	-	103
17	-	111	111	91	-	-	103
23	-	111	111	91	-	-	103
30	-	87	87	91	100	100	103
36	-	87	87	91	100	100	103
42	-	87	87	91	100	100	103

FLAME SAFEGUARD CONTROL COMPONENTS

Control Package No. 87 (Fireye)

833-1022	Controller D30-5063 (Assy.)
833-1074	Controller 70D30
932-789	Amplifier 72DUV1
832-793	Timer 71D90 (90 Sec.)
817-614	Scanner UV-2 UV1A
833-1018	Base (Open Bottom std.)

Control Package No. 100 (Honeywell)

833-1061	Controller R4140M1053
817-613	Scanner C7027A UV
833-986	Base
832-766	Amplifier R7249A1003

Control Package No. 108 (Fireye)

833-981	Controller UVM-30 (Assy.)
833-1080	Controller UVM-2
832-796	Timing Card MT3010
817-672	Scanner UV-2
833-963	Base

Control Package No. 91 (Fireye)
Full Modulation

833-1035	Controller D20-5066 (Assy.)
833-1073	Controller 70D20
832-789	Amplifier 72DUV1
832-792	Timer 71D60 (60 sec.)
817-614	Scanner UV1A
833-1018	Base (Open bottom std.)

Control Package No. 103 (Honeywell)
Full Modulation

833-1062	Controller R4140G1106
817-613	Scanner C7027A UV
833-986	Base
832-766	Amplifier R7249A1003

Control Package No. 111 (Fireye)

833-960	Controller UVM-90 (Assy.)
833-1080	Controller UVM-2
832-830	Timing Card MT9010
817-672	Scanner UV-2
833-963	Base