ProFire XL
Burner
Gas Only
Installation
Operation
Maintenance

Manual Part No. 750-276 05/2011
ProFire XL SERIES

Installation, Operation, and Service Manual

Manual Number: 750-276

Release Date: May 2011
PREFACE

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 ProFire burners are warning or caution lables designed to inform the operator of potential hazards and stress important information.

These symbols and their meanings are as follows:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>⚠️ Warning</td>
<td></td>
</tr>
</tbody>
</table>

Failure to install and operate this equipment in accordance with the manufacturer’s recommended instructions and industry standards and practices can result in fire, explosion, property damage, and/or personal injury. Read this manual in its entirety 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

To avoid personal injury from moving parts, shut off all electrical power before servicing this equipment.

⚠️ Warning

Read product manual and fully understand its contents before attempting to operate this equipment. IF these instructions are not followed, serious personal injury or death may result.
Further warning and caution references have been made in this manual and should be adhered to for smooth operation of the burner.

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide support for this panel to prevent damage to electrical components.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Only factory authorized berner service personnel should startup, adjust, or service this equipment.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>After final fuel input adjustments are made, verify fuel input by meter, if possible.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>This symbol precedes information which, if disregarded, may result in injury to the user of the burner or others.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>This symbol precedes information which, if disregarded, may result in damage to the burner.</td>
</tr>
</tbody>
</table>

**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).

<table>
<thead>
<tr>
<th>Standard Model</th>
<th>Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>XLG</td>
<td>Gas</td>
</tr>
</tbody>
</table>

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. Where applicable, the Canadian Gas Association (CGA) B149 and Canadian Standard Association (CSA) B140 and B139 (for oil burners) codes shall prevail.

Gas burning equipment shall be connected to flues having sufficient draft at all times to assure safe and proper operation of the burner.
The XL Series burners are designed to burn natural gas only. Gas input ratings shown below.

<table>
<thead>
<tr>
<th>Burner Size</th>
<th>Maximum Burner Gas Input MBTU/HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>672</td>
<td>67,200,000</td>
</tr>
<tr>
<td>756</td>
<td>75,600,000</td>
</tr>
<tr>
<td>840</td>
<td>84,000,000</td>
</tr>
<tr>
<td>924</td>
<td>92,400,000</td>
</tr>
</tbody>
</table>

Gas input based on natural gas at 1,000 Btu/cu. ft. and 0.60 specific gravity.
ProFire XL Series

Table of Contents

CHAPTER 1  Introduction 1-1
  1.1 — Overview 1-1
  1.2 — Description 1-1
  1.3 — Operating Controls 1-1
  1.4 — Flame Safeguard Controls 1-2
  1.5 — Combustion Air Handling System 1-3
  1.6 — Firing Rate Controls 1-3
  1.7 — Firing Head 1-3
  1.8 — Gas System 1-4
    1.8.1 — Operation 1-5

CHAPTER 2  Installation 2-1
  2.1 — Application 2-1
  2.2 — Installation 2-1
  2.3 — Packing Plastic Refractory Around Oven 2-1
  2.4 — Gas Piping 2-1
  2.5 — Installation Checklist 2-2
CHAPTER 3  Operation  1

3.1 — Preparations for Starting  3-1
   3.1.1 — Firing Preparations for Gas Burners  3-1

3.2 — Electrical Interference Test  3-2
   3.2.1 — Gas Fired  3-2

3.3 — Gas Pilot Flame Adjustment  3-2

3.4 — Startup Sequence  3-2

3.5 — Automatic Shutdown  3-3

3.6 — Manual Shutdown  3-4

3.7 — Safety Shutdown  3-4

3.8 — Startup and Operating  3-4

3.9 — Normal Operation  3-5

3.10 — Shutdown  3-5

CHAPTER 4  Adjustments  4-1

4.1 — Overview  4-1

4.2 — Combustion Adjustment on Gas and Oil  4-1
   4.2.1 — Stack Temperature  4-1
   4.2.2 — Smoke Measurement  4-2
   4.2.3 — Gas Adjustments  4-2
   4.2.4 — Fuel Oil Adjustments  4-2

4.3 — Gas System  4-2
   4.3.1 — Gas Pressure  4-2
   4.3.2 — Gas Flow  4-2
   4.3.3 — Gas Pilot Flame Adjustment  4-2
   4.3.4 — Main Gas Pressure Regulator  4-3
   4.3.5 — Low Gas Pressure Switch  4-3
   4.3.6 — High Gas Pressure Switch  4-3
   4.3.7 — Gas Combustion Adjustment  4-3
CHAPTER 5  

**Maintenance**  5-1  

5.1 — Overview  5-1  

5.2 — Control System  5-1  

5.3 — Programming Control  5-2  

5.4 — Firing Head Inspection  5-2  

5.5 — Pilot and Ignition Electrode  5-2  

5.6 — Flame Scanner  5-3  

5.7 — Fan Removal  5-3  
   5.7.1 — To Remove Wheel  5-3  
   5.7.2 — Motor Shaft Seal  5-4  

5.8 — Diffuser  5-6  

5.9 — Firing Rate Controls  5-7  

5.10 — Burner Mounting Inspection  5-7  

5.11 — Gas System  5-7  
   5.11.1 — Motorized Main Gas Valves  5-7  
   5.11.2 — Solenoid Valves  5-7  

5.12 — Electrical System  5-8  
   5.12.1 — Electric Motors  5-8  

5.13 — Extended Shutdown  5-8  

5.14 — Maintenance Flow Chart Recommended Test Schedule  5-9
CHAPTER 6  

Troubleshooting  6-1

6.1 — Awareness  6-1

6.2 — Emergency Shutdown  6-2

6.3 — Troubleshooting  6-3

WARRANTY POLICY

STARTUP/SERVICE REPORT
CHAPTER 1  Introduction

1.1 — Overview

ProFire XL Series burners are assembled, wired, and tested at the factory. They are listed by the Underwriters Laboratory, CSD-1, NFPA-85, XL-GAP, F.M., including the National Electrical Code (NEC) and associated insurance underwriters. Where applicable, the Canadian Gas Association (CGA) B149 and Canadian Standards Association (CSA) B140 codes shall prevail. Other regulatory agency control options are available.

Caution

Only factory authorized burner service personnel should startup, adjust, or service this equipment.

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

1.2 — Description

The ProFire XL Series gas burners are of the peripheral mix type. All burners feature ignition by spark-ignited gas pilot flame. The burner operates with full modulation. A switch permits changeover from automatic fully modulated firing to manually set firing at any desired rate between minimum and maximum. Additional safeguards assure that the burner always returns to minimum firing position for ignition.

XL Series burners are designed for automatic, unattended operation except for periodic inspection and maintenance. After selecting the proper overload settings for the starter, the rest of the control panel components require little attention except for occasional cleaning.

1.3 — Operating Controls

The burner is supplied with a remote control panel and with a burner mounted junction box.
Control Panel

The control panel contains a flame safeguard programming control, motor starters, relays, time delays, and terminal strips mounted internally on a panel subbase. Lights, switches, potentiometers, a control circuit breaker, and flame safeguard displays are mounted externally on the panel.

<table>
<thead>
<tr>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Off Burner Switch</td>
<td>To manually turn the burner on or off.</td>
</tr>
<tr>
<td>Control Circuit Breaker</td>
<td>Supplementary low overcurrent protection only. No larger than 15 amps.</td>
</tr>
</tbody>
</table>
<pre><code>                                  | Manual position: Selects 4-20 mA potentiometer for manual modulating control.|
</code></pre>
<p>| Manual Modulating Control 135 ohm | Increases or decreases the burner firing rate manually.                      |</p>
| Signal Lamps                      | a) LOAD DEMAND (white)  
                                      | b) FUEL VALVE OPEN (white)  
                                      | c) LOW WATER (red)  
                                      | d) FLAME FAILURE (red) |

1.4 — Flame Safeguard Controls

**Warning**

Read the flame safeguard manual and fully understand its contents before attempting to operate this equipment. If this instruction is not followed, serious personal injury or death may result.

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 manufacturer’s flame safeguard manual.

1.5 — Combustion Air Handling System

The combustion air handling system consists of two major components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Damper Assembly</td>
<td>A multi-blade damper regulates the combustion air volume and is positioned by an actuator. The damper is normally almost closed in the low-fire position and opens as the burner drives toward the high-fire position.</td>
</tr>
<tr>
<td>Motor Driven Impeller</td>
<td>The diameter of the impeller determines available air pressure and the width determines air capacity in cubic feet per minute. Alternate motor-impeller combinations are available for 50 cycle or 60 cycle power and for firing against either moderate or high furnace pressure. For higher altitudes and higher furnace pressures, motor and impeller combinations are determined at the factory.</td>
</tr>
</tbody>
</table>
1.6 — Firing Rate Controls

Burner input is fully modulated between low-fire and high-fire on boiler demand. The firing rate is controlled by a parallel positioning system utilizing electric actuators.

1.7 — Firing Head

Access to the firing head is provided by a hinged rear access door and removable side access covers on the burner housing.

![FIGURE 1-1. Access Cover Location](image)

1.8 — Gas System

Gas is introduced into the combustion zone from a circular manifold through multiple ports in the blast tube, and through a pre-mix zone. Firing rate is determined by the size and number of ports, by manifold pressure, and by combustion zone pressure. The firing rate is regulated by a rotary, butterfly type throttling valve at the manifold inlet. Depending upon specific requirements, one or two safety shutoff, motorized main gas valves are provided for installation in the gas train upstream of the butterfly valves. Safety shutoff gas valves are wired into the programming control to automatically open and close at the proper time in the operating sequence.
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:

<table>
<thead>
<tr>
<th>Main Gas Train Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Volume Valve</td>
<td>The butterfly type valves are positioned by actuators and control the rate of gas flow.</td>
</tr>
<tr>
<td>Main Gas Valves</td>
<td>Electrically operated safety shutoff valve(s) that open to admit gas to the burner. Standard U.L. burners include two motorized gas valves w/closure interlock.</td>
</tr>
<tr>
<td>Main Gas Regulator</td>
<td>Regulates gas train pressure to specified pressure required at inlet to the gas train. Input is set by main gas pressure regulator adjustment.</td>
</tr>
<tr>
<td>Main Gas Cocks</td>
<td>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).</td>
</tr>
</tbody>
</table>
1.8 — Gas System

<table>
<thead>
<tr>
<th>Main Gas Train Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Gas Pressure Switch</td>
<td>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 the main gas valve(s) to close. This switch requires manual reset after being tripped.</td>
</tr>
<tr>
<td>Low Gas Pressure Switch</td>
<td>A pressure actuated switch that remains closed when gas pressure is above a pre-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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pilot Gas Train Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas Pilot Valve</td>
<td>Solenoid valve(s) that open during the ignition period to admit fuel to the pilot. They close after main flame is established.</td>
</tr>
<tr>
<td>Gas Pressure Regulator</td>
<td>Reduces gas pressure to that required by the pilot.</td>
</tr>
<tr>
<td>Gas Pilot Shutoff Cock</td>
<td>For manually closing the pilot gas supply.</td>
</tr>
</tbody>
</table>

FIGURE 1-3. Typical Gas Train

1.8.1 — Operation

Metered gas flows through the main gas shutoff cock, through the pressure regulator to the automatic gas valves and butterfly valve to the gas manifold.

The butterfly gas valve(s) modulate flow to burner input demand. The butterfly valve(s) are positioned by actuators. The air control damper is also positioned simultaneously by actuators. The automatic gas valve(s) cannot be energized unless the combustion air proving switch is closed. The low and high gas pressure switches must be closed to prove proper gas pressure.
A normally open vent valve, if required, is located between the two automatic gas valves. This valve is shut when the automatic gas valves are open. When the automatic valves are closed, the vent valve is open for venting gas to the outside, should any be present.
CHAPTER 2  Installation

2.1 — Application

Electrical power available is usually 230/460 volt, 3-phase, 50 cycle. Control circuit is 115 volt, single-phase, 60 cycle or 115 volt, single-phase, 50 cycle. Refer to the electrical schematic diagram shipped with the burner. Power connections are made at the control panel. The burner is furnished with a burner mounted junction box and remote control panel. Wiring from the burner junction box to remote panel, panel to boiler controls, low water controls, remote compressor motor, and remotely located fuel valves is furnished by the installer.

2.2 — Installation

Locate the burner properly. The burner is designed for operation with the blast tube level. Do not tilt the burner up or excessively downward. Securely support the burner pedestal on the floor or foundation. The face of the boiler and burner flange must be sealed with a gasket. Carefully place the gasket over the dry oven bolts before it is mounted onto the burner flange. The I.D. of the dry oven is slightly larger than the blast tube I.D. Make sure the dry oven and burner blast tube are concentric. Due to bolt hole tolerances, the dry oven may have to be shifted to accomplish this. After the dry oven nuts are properly tightened, the burner and dry oven assembly can then be mounted into the boiler.

2.3 — Packing Plastic Refractory Around Oven

The area between the outside circumference of the dry oven and existing refractory should be packed with Kaiser Refractory Mono T-9 Airset or equivalent within two hours after coating the dry oven with Trowleze. From inside the furnace, ram plastic refractory from the front to the rear parallel to the outside surface of the dry oven.

2.4 — Gas Piping

Gas service an 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.
For Canada: The Canadian Gas Association (CGA) B149 and Canadian Standards Association (CSA) B140 codes shall prevail.

Unless specified otherwise, gas train components upstream of the butterfly valve are shipped loose. These components should be mounted by the installer as close to the butterfly valve as practical. Normally, the control train is ordered to suit a particular code or insurance regulation - such as Underwriters Laboratories, Inc., CGA, Factory Mutual, or Industrial Risk Insurance.

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 shutoff valve.

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

2.5 — Installation Checklist

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:
1. Electrical terminals in the control panel and on all electrical components.
2. Pipe fittings and unions.
3. Tubing connections.

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

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

Before firing, make sure that the refractory flame cone is properly sealed to the burner mounting flange and the boiler front plate.

Make certain that the operator in charge is properly instructed in the operation and maintenance procedures.
FIGURE 2-1. Burner Mounting Details for Scotch Marine Boilers

NOTES
1. LAY THE DRY OVEN ON THE FLOOR WITH THE MOUNTING STUDS FACED UP, CAREFULLY PRESS THE BURNER SUPPLIED GASKET OVER THE Threaded STUDS.
2. LIFT THE DRY OVEN ONTO THE BURNER FLANGE AND GENTLY TIGHTEN THE BOLTS.
3. MAKE SURE THE DRY OVEN IS CENTERED ON THE BURNER FLANGE SO THAT THE SPACE IS EQUAL ALL AROUND THE BURNER'S BLAST TUBE.
4. ENSURE THAT NONE OF THE GASKET IS PROTRUDING INTO THE BURNER BLAST TUBE AIR STREAM. FULLY TIGHTEN THE DRY OVEN MOUNTING NUTS.
5. WRAP THE DRY OVEN WITH TROWELZE COATED KAO-WOOL, THEN LIFT THE BURNER/DRY OVEN ASSEMBLY ONTO THE BOILER MOUNTING PLATE STUDS AND SECURE IN PLACE.
6. FINISH REFRACTORY WORK INSIDE FURNACE.
FIGURE 2-2. Burner Mounting Details for Scotch Marine Boilers

NOTES:
1. Lay the dry oven on the floor with the mounting studs up. Carefully press the gasket over the mounting studs.
2. Lift the dry oven onto the burner mounting flange and gently tighten the hex nuts securing the dry oven to the burner.
3. Make sure the dry oven is centered on the burner flange, so the space is equal all around the burner blast tube.
4. Ensure that none of the gasket is protruding into the air stream. Tighten the hex nuts to secure the dry oven in place.
5. Wrap the dry oven with troweled Kao-Wool, then lift the burner onto the burner mounting studs and bolt securely in place.
6. Finish refractory work inside the boiler as shown herein.
FIGURE 2-3. Mounting Details
Before opening the gas shutoff valves, read the regulator instructions carefully. Open the shutoff valve slowly to allow inlet pressure to build-up slowly in the regulator until it is fully pressurized. Opening the shutoff valve quickly will damage the regulator. Do not exceed the regulator pressure ratings.
3.1 — Preparations for Starting

When the installation is complete and all electrical, fuel, water, and vent stack connections are made, make certain these connections are tight. The operator should become familiar with the burner, boiler controls, and components. To identify controls and components, refer to Chapter 1. Adjustment procedures given in Chapter 4 should be reviewed prior to firing. The wiring diagram should also be studied along with the operating sequence of the burner programmer.

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

<table>
<thead>
<tr>
<th>Component</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler</td>
<td>• Check boiler water level. Be sure all boiler valves are installed correctly and positioned properly. Set the high limit control slightly above the desired temperature or pressure. Set the modulating controls at the desired temperature or pressure.</td>
</tr>
</tbody>
</table>
| Burner    | • Check the electrical power supply to the burner in accordance with the nameplate voltage on all motors and the control circuit.  
  • Check the direction or rotation of the motors.  
  • Open the housing to check the electrode setting.  
  • Check the gas pilot pressure at the pilot gas regulator. A normal setting is 18” to 20” W.C.  
  • For protection in shipment, the flame safeguard control chassis is shipped unmounted. Check all screw connections before attaching the flame safeguard chassis to the base. The 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 the manual reset button to be sure safety switch contacts are closed.  
  • Check control actuators for proper movement of the air volume damper and fuel metering components. |

3.1.1 — Firing Preparations for 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 startup, 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 the programmer finish its cycle. Check to see that the gas valve closes tightly. Set the high and low gas pressure switches.

Check for leaks and determine there is adequate gas pressure available at the burner for operating at full capacity. Check with the local utility if necessary. Check gas pressure at the pilot and main burner. Close the manual gas valve.

3.2 — Electrical Interference Test

“Spark Pickup”

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

3.2.1 — Gas Fired

1. Close the pilot and the main line manual gas valves.
2. Start the burner and at the time of the pilot trial with just the electrical ignition system energized, the flame relay should not pull in (be energized).
3. Upon completion of a successful test, proceed with startup procedures.

3.3 — Gas Pilot Flame Adjustment

The gas pilot flame is regulated by adjusting the pressure setting of the pilot regulator. A normal setting is 18” to 20” 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 startup and during planned maintenance, test the pilot flame signal, pilot turndown, and safety switch lockout.

3.4 — Startup Sequence

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:

• The operating and high limit control (temperature or pressure) are below their cutoff setting.
• All power supply switches are closed.
• Power is present at the control panel.
3.5 — Automatic Shutdown

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

1. Begin the starting sequence, with the burner switch off, and with all manual valves closed. Switch the main power on.
2. Firing on gas, open the main manual gas valve.
3. Firing on gas, manually reset the high and low gas pressure switches.
4. Place the selector switch to the “GAS” position. With all limit and operating controls calling for heat, the burner will follow the Flame Safeguard Sequence below.
5. When the burner motor starts, open the gas cock.
6. Firing on gas, when the main fuel lamp lights indicating pilot flame proven, open the manual leak test valve.

<table>
<thead>
<tr>
<th>Time in Seconds</th>
<th>External Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Provided the fuel valve is proven closed, the burner motor and flame safeguard timer will start.</td>
</tr>
<tr>
<td>7</td>
<td>Air flow must be proven before ignition, or the flame safeguard will lockout. If the interlock circuit opens during a firing period, the burner will shut off and the flame safeguard will lockout.</td>
</tr>
<tr>
<td>60</td>
<td>Firing on gas and providing the air flow and low-fire have been proven, the pilot ignition transformer and ignition lamp are energized and the gas pilot valve opens to ignite the pilot.</td>
</tr>
<tr>
<td>70</td>
<td>On gas, the main valve opens to ignite the burner at low-fire.</td>
</tr>
<tr>
<td>80</td>
<td>The pilot ignition transformer is de-energized, the main safety shutoff pilot valve closes, and the scanner proves the main flame only. If the “LOW/AUTO” switch is in the “AUTO” position, the following will occur: • On gas, the butterfly valve and the burner air louvre moves to the low-fire position.</td>
</tr>
<tr>
<td>100</td>
<td>“Normal” run position. Burner continues.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time in Seconds</th>
<th>External Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>Fuel valves close. The main fuel lamp goes off. The flame safeguard timer starts.</td>
</tr>
<tr>
<td>115</td>
<td>The flame safeguard timer and burner motor stop. The burner is ready for startup on the next call for heat.</td>
</tr>
</tbody>
</table>
3.6 — Manual Shutdown

1. Turn the “GAS/OFF” selector switch “OFF.” The burner shuts down in “Automatic Shutdown” as in Section 3.5.
2. When the burner motor stops, close all manual valve.

3.7 — Safety Shutdown

1. If at any time during the operating cycle a flame failure occurs, the burner shuts down as in Automatic Shutdown, with an additional post-purge, and the flame failure lamp is energized.
   a. The lockout switch on the flame safeguard control must be manually reset before the burner will fire again.
2. If a low water condition occurs, the burner shuts down as in Automatic Shutdown.
3. If a high or low gas pressure condition occurs while firing on gas, the burner shuts down as in Automatic Shutdown.
   a. Condition must be corrected and the respective gas pressure switch manually reset before the burner will fire again on gas.

3.8 — Startup and Operating

**GAS BURNERS**

1. Close the main and pilot gas cocks. Make sure the “ON/OFF” switch is in the “OFF” position and the selector switch is set to “GAS.”
2. Actuate the manual reset button of the flame safeguard control to close the safety switch contacts.
3. Set the “MANUAL/AUTO” switch to the “MANUAL” position.
4. Set the manual potentiometer in the low-fire position.
5. Open the gas pilot cock.
6. On initial startup it is recommended that the main gas shutoff cock remain closed until the programmer has cycled through the pre-purge and pilot sequence. Then determine that the main gas valve opens. When this is confirmed, turn the burner switch “OFF” and let the programmer complete its cycle. Check to see that the gas valve has closed tightly. If ignition does not occur, turn the burner switch “OFF” and allow the programmer to recycle for a new ignition trial.
7. Turn the burner “ON” and after pilot ignition, when the flame relay pulls in, the slow-opening, motorized, main gas valve is energized.
8. 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.
9. So not repeat unsuccessful light off attempts without rechecking burner and pilot adjustment. Vent fuel vapors from the combustion chamber after each unsuccessful light off attempt. Set the gas low-fire rate by adjusting the butterfly valve and air linkage.
10. When low-fire is adjusted, shut down the burner.
11. Restart several times to be sure the low-fire setting is suitable. Readjust, if necessary. Never start the burner with fuel vapor in the furnace. In case of emergency, open the main power switches and close all fuel valves.
12. After combustion adjustments are satisfactorily set, allow the heating vessel to slowly reach normal operating pressure or temperature.
13. turn the potentiometer switch to the high-fire position. Check high-fire at this point using combustion instruments.

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

High-fire combustion analysis is typically 9% to 10.5% CO₂. When conditions covered above are assured, refer to Sections 3.9 and 3.10.

3.9 — Normal Operation

Normal operation must be with the “MANUAL/AUTO” switch selector on “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 adjustment procedures and maintenance instructions given in Chapters 4 and 5.

3.10 — Shutdown

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

1. The fuel valve(s) de-energizes and the flame extinguishes.
2. The blower motor continues running during post-purge.
3. At the end of post-purge, the blower motor is de-energized.
4. The programmer returns to its starting position and stops.
5. The 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 the cause and correct it before restarting the 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 dur-
ing 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.

---

## Warning

An ultraviolet flame sensor electrical spark interference test must be performed after final adjustment. See Section 3.2 for additional information.
CHAPTER 4 Adjustments

4.1 — Overview

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 mis-adjustments occurred during shipping and installation.

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

4.2 — Combustion Adjustment

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

The proper setting 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 (O₂), and carbon monoxide (CO).

4.2.1 — 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. Stack temperature should be as low as possible without causing flue gas condensation.

Stack heat loss can be reduced by decreasing either the temperature or the volume of the flue gas, or both. 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.
4.2.2 — 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-air ratio
- excessive air leaks in the combustion chamber

4.2.3 — Gas Adjustments
Low-fire combustion analysis typically is 7% to 9% CO₂ and less than .04% CO (400 ppm). A high-fire reading typically is 9% to 10.5% CO₂ and less than .04% CO. Typically, these burners are capable of operating at CO levels less than 50 ppm.

4.3 — Gas System

4.3.1 — Gas Pressure
Gas must be supplied at a pressure high enough to overcome the pressure loss in the burner gas train and furnace pressure while running at full input. Refer to the nameplate inside the control panel for gas pressure requirements at the train inlet and manifold. The pressures listed are based on nominal 1000 Btu/cu ft natural gas at elevations up to 2000 feet above sea level.

4.3.2 — 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/cu ft) by the heating value (Btu/cu ft).

**NOTE:** When checking the input rate, make sure no other equipment is operating on the same meter.

4.3.3 — Gas Pilot Flame Adjustment
The gas pilot flame is regulated by adjusting the pressure setting of the pilot regulator. A normal setting is 18” to 20” 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 startup and during planned maintenance, test the pilot flame signal, pilot turndown, and safety switch lockout.
4.3.4 — 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.

<table>
<thead>
<tr>
<th>Warning</th>
</tr>
</thead>
<tbody>
<tr>
<td>An ultra-violet flame sensor electrical spark interference test must be performed after final adjustment. See Section 4.3 for additional information.</td>
</tr>
</tbody>
</table>

4.3.5 — Low Gas Pressure Switch
Turn the adjusting screw until the 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.

4.3.6 — High Gas Pressure Switch
Turn the adjusting screw until the 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.

4.3.7 — Gas Combustion Adjustment
After operating for a sufficient period of time to assure a warm boiler, make adjustments for most efficient combustion. 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 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 ratio established, the gas pressure regulator needs no further adjusting.

Recheck low-fire and adjust, if necessary.

Proper setting of the air-fuel ratios at all rates must be determined by combustion analysis.
4.3.8 — Valves Adjustment

The secondary valve feeds gas to the inner spuds. A slot in the valve stem in relationship to the shut/open scale on the valve indicates the blade position. Both low- and high-fire positions are approximate. The primary valve which feeds the outer spuds should be adjusted as normal.

![Diagram of Gas Butterfly Valve](image)

**FIGURE 4-1. Gas Butterfly Valve**

4.4 — Actuators

Refer to the original manufacturer’s control package manual that was originally sent with the burner.

4.5 — Firing Rate Controls

Firing rate adjustments are made with the actuators on the combustion air inlet damper, oil metering valve, and main gas butterfly valve. Settings are determined by the operating length of the levers and the angular position...
on the shafts. Increasing the lever lengths on damper, pump, or valve decreases the flow rate. Normally, the air control damper will be almost closed in low-fire position. For best pilot operation, the damper should be set as low as possible. Excessive opening in low-fire can cause pilot ignition problems. Air to the pilot is supplied under pressure to compensate for variations in furnace pressure, but the damper must be in low-fire position for reliable ignition.

FIGURE 4-2. Air Damper Blades
FIGURE 4-3. Damper Blade Linkages

NOTES
1 - ENSURE ALL LINKAGE HARDWARE IS SECURELY FASTENED.
2 - FINAL LINKAGE CONFIGURATION MAY VARY FROM THAT DEPICTED HEREIN.
CHAPTER 5  

Maintenance

5.1 — Overview

A maintenance program avoids unnecessary downtime, 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.

5.2 — 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.

5.3 — 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 lockout 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.

5.4 — Firing Head Inspection

Disconnect the damper linkage, release the impeller housing latch, and swing the housing open for access to the firing head. Inspect the flame scanner lens to be sure it is clean and the support tube is in proper position to sight the flame through the hole in the diffuser. Inspect the lead wire to the ignition electrode. It must be firmly attached and the insulation should be clean and free of cracks.

5.5 — Pilot and Ignition Electrode

The ignition transformer requires little attention other than making sure the ignition wire is firmly attached to the transformer and the electrode. Be sure the wire insulation is in good condition and not grounded. Failure to keep the ignition electrode clean and properly set can cause faulty operation. Refer to Figure 5-1 for electrode gap setting and position. The pilot assembly is supported by a collar in the diffuser and gas inlet tube. No adjustment is required except proper positioning of the electrode wire.

![FIGURE 5-1. Ignition Pilot Electrode Setting](image)
5.6 — Flame Scanner

The scanner must be clean. Even a small amount of contamination will reduce the flame signal. Wipe the scanner lens with a clean soft cloth.

5.7 — Fan Removal

To access the fan wheel, first remove the inlet windbox. Support the weight of the air inlet housing using the lifting eye attached to the housing. If moving the air inlet housing far away from the fan housing, or if the conduit attached to the air damper actuator is too short, detaching the actuator first may be required. Remove all of the bolts holding the air inlet housing to the fan housing.

Remove the air inlet cone by removing all perimeter bolts and pull away from the fan housing.

5.7.1 — To Remove Wheel

The Chicago Blower wheel has a taper lock hub that attaches to the shaft. To remove the wheel, remove the three bolts on the front of the hub. Insert two of the bolts in the threaded holes on the front of the taper lock hub (refer to the Chicago Blower maintenance bulletin for details).
5.7.2 — Motor Shaft Seal

A brass (motor shaft) seal plate is screwed to the fan hosing to help block air from escaping through the motor shaft hole. No lubrication at this plate is required. This plate should be inspected periodically for abnormal wear.

FIGURE 5-3. Inlet Cone/Impeller Overlap Detail

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QTY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>MOTOR, ELECTRIC</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>HOUSING-WELDMENT, FAN</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>PLATE, SEAL</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>WHEEL, IMPELLER</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>RING-WELDMENT, EXTENSION</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>CONE, INLET, AIR</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>WINDBOX-ASSEMBLY, DAMPER, AIR</td>
</tr>
</tbody>
</table>
FIGURE 5-4. Drawer Assemblies
5.8 — Diffuser

The diffuser is factory set and does not require attention under normal operating conditions. If fouled with carbon, the diffuser should be removed for cleaning. First remove the electrode and scanner leads and the gas pilot.
assembly before attempting to remove the diffuser. Mark the diffuser relative position to the blast tube with a scribed or pencil line where the three mounting screws are located, to insure that the diffuser is placed back in the same position. Remove the three screws holding the diffuser to the blast tube and slowly pull the diffuser along the blast tube towards the firing head. Keep the diffuser as parallel as possible. If it should become stuck or tight, do not apply any tool which would distort the shape or blade configuration. A small wooden block tapped gently against the diffusers outer edge will help expedite its removal. Clean all carbon from the diffuser vanes and reinstall in reverse order or disassembly, aligning the diffuser with the scribed marks. Do not attempt to drive the diffuser back along the blast tube with anything other than a small block of wood tapped against the diffuser’s outer edge. When reinstalling, be sure the diffuser is centered.

5.9 — Firing Rate Controls

Check all actuator couplings for tightness. Check all damper rods and linkages. Make sure all connections are tight. Adjust if necessary. Perform a combustion test as per Chapter 4, and readjust the burner if necessary.

5.10 — Burner Mounting Inspection

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

5.11 — Gas System

5.11.1 — Motorized Main Gas Valves

Should the valve fail to operate, check for voltage at the valve. Make certain that the main shutoff cock is closed prior to testing. The actuator is not field repairable nor should it be disassembled. Replace the actuator if the valve fails to operate. After replacement, cycle the valve with the fuel shutoff to determine that it opens and closes. If the valve has a visual indicator, observe its position for correct operation.

5.11.2 — Solenoid Valves

A slight hum from the solenoid is normal when the coil is energized. Should the valve fail to operate, check that there is voltage at the valve coil. If there is not voltage at the coil, check for loose wiring connections. If there is proper voltage at the valve coil and the valve still fails to open, replace the coil. Refer to the manufacturer’s bulletin for correct procedure in coil replacement.

Should it become necessary to replace the complete valve, be sure that the flow is in the direction of the arrow on the body.

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

⚠️ Caution

All power must be disconnected before servicing the valves.
5.12 — Electrical System

Because of the many types of flame safeguard systems applicable to this equipment, complete descriptions of all XL Series burner electrical systems are beyond the scope of this manual. An individual electrical schematic drawing is shipped with each burner and complete operation and troubleshooting instructions are available from the various flame safeguard system manufacturers.

5.12.1 — Electric Motors

Motor supply voltage must not vary more than 10% from the nameplate ratings. At initial startup and at least once a year thereafter, check the motor current with a meter while the burner is in high-fire position. If the reading exceeds the nameplate rating plus service factor, determine the cause and correct it immediately. In dusty locations, clean the motor regularly to assure adequate cooling. Lubricate in accordance with the manufacturer’s instructions.

5.13 — Extended Shutdown

When shutting down the burner for an extended period of time, the operator should use the following general guidelines to protect the burner from its surrounding elements. This will add to the operating life of the burner.

1. Turn the burner’s main electrical disconnect switch to the “OFF” position.
2. Close all main fuel valves.
3. If the burner operates in a damp environment, cover it with plastic to protect all electrical components from moisture. Remove the flame safeguard control and store in a dry atmosphere.
## 5.14 — Maintenance Flow Chart Recommended Test Schedule

<table>
<thead>
<tr>
<th>ITEM</th>
<th>SERVICE BY</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DAILY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gauges, Monitors, Indicators</td>
<td>Operator</td>
<td>Make visual inspection and record readings in log.</td>
</tr>
<tr>
<td>Instrument and Equipment Settings</td>
<td>Operator</td>
<td>Make visual check against recommended specifications.</td>
</tr>
<tr>
<td>Low Water, Fuel Cutoff, Alarms</td>
<td>Operator</td>
<td>Refer to instructions.</td>
</tr>
<tr>
<td><strong>WEEKLY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firing Rate Control</td>
<td>Operator</td>
<td>Verify factory settings.</td>
</tr>
<tr>
<td>Igniter</td>
<td>Operator</td>
<td>Make visual inspection. Check flame signal strength.</td>
</tr>
<tr>
<td>Pilot and Main Fuel Valves</td>
<td>Operator</td>
<td>Open limit switch. Make audible and visual check. Check valve position indicators, and check fuel meters.</td>
</tr>
<tr>
<td>Flame Failure Controls</td>
<td>Operator</td>
<td>Close manual fuel supply for (1) pilot and (2) main fuel cock and/or valve(s). Check safety shutdown timing. Record in log.</td>
</tr>
<tr>
<td>Flame Signal Strength Controls</td>
<td>Operator</td>
<td>Read and log the flame signal for both pilot and main flame. Notify Service if readings are very high, very low, or fluctuating.</td>
</tr>
<tr>
<td>Linkages</td>
<td>Operator</td>
<td>Check all damper linkages for tightness. Tighten if required.</td>
</tr>
<tr>
<td><strong>MONTHLY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low Fan Pressure Interlock</td>
<td>Operator</td>
<td>Manually adjust until switch opens.</td>
</tr>
<tr>
<td>High and Low Gas Pressure Interlocks</td>
<td>Operator</td>
<td>Refer to instructions. Manually adjust until switch opens.</td>
</tr>
<tr>
<td>Scanner and Diffuser</td>
<td>Operator</td>
<td>Check, inspect, and clean for soot buildup.</td>
</tr>
<tr>
<td>Pilot Assembly</td>
<td>Operator</td>
<td>Check for loosening of components, erosion or carbon buildup.</td>
</tr>
<tr>
<td><strong>ANNUALLY</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impeller</td>
<td>Operator</td>
<td>Inspect and clean the combustion impeller.</td>
</tr>
<tr>
<td>Combustion Test</td>
<td>Service Tech</td>
<td>Perform a complete combustion test. Adjust burner if necessary. Read and log data.</td>
</tr>
<tr>
<td>Pilot Turndown Test</td>
<td>Service Tech</td>
<td>Required after any adjustment to flame, scanner, or pilot adjustment.</td>
</tr>
<tr>
<td>Operating Controls</td>
<td>Service Tech</td>
<td>Refer to instructions.</td>
</tr>
</tbody>
</table>
CHAPTER 6  Troubleshooting

6.1 — Awareness

This Chapter assumes that:
1. The unit in question has been properly installed and that it has been running for some time.
2. The operator has become thoroughly familiar with both the burner and the manual by this time.

The points set forth under each heading are brief, possible causes, suggestions or clues to simplify locating the source of the trouble. Methods of correcting the trouble, once it has been identified, may be found elsewhere in this manual.

If the burner will not start or operate properly, the Troubleshooting Section should be referred to for assistance in pinpointing problems that may not be readily apparent.

The program relay has the capability to self-diagnose and to display a code or message that indicates the failure condition. Refer to the control bulletin for specifics and suggested remedies.

**Warning**

Troubleshooting should be performed only by personnel who are familiar with the equipment and who have read and understood the contents of this manual. Failure to follow these instructions could result in serious personal injury or death.

**Warning**

Disconnect and lockout the main power supply in order to avoid the hazard of electrical shock. Failure to follow these instructions could result in serious personal injury or death.
Familiarity with the programmer and other controls in the system may be obtained by studying the contents of this manual. Knowledge of the system and its controls will make troubleshooting that much easier. Costly downtime or delays can be prevented by systematic checks of actual operation against the normal sequence to determine the stage at which performance deviates from normal. Following a set routine may possibly eliminate overlooking an obvious condition, often one that is relatively simple to correct.

If an obvious condition is not apparent, check each continuity of each circuit with a voltmeter or test lamp. Each circuit can be checked and the fault isolated and corrected. In most cases, circuit checking can be accomplished between appropriate terminals on the terminal boards in the control cabinet or entrance box. Refer to the wiring schematic supplied for terminal identification.

### Caution

Never attempt to circumvent any of the safety features.

### Warning

The cause for loss of flame or any other unusual condition should be investigated and corrected before attempting to restart. Failure to do so may result in serious personal injury or death.

### Warning

Do not repeat unsuccessful lighting attempts without rechecking the burner and pilot adjustments. Failure to follow these instructions may result in damage to the boiler or serious personal injury or death.

### Warning

Do not re-light the pilot or attempt to start the main burner if the combustion chamber is hot and/or if gas vapor combustion gases are present in the furnace or flue passages or when excess oil has accumulated promptly correct any conditions causing leakage. Failure to follow these instructions could result in serious personal injury or death.

#### 6.2 — Emergency Shutdown

In case of emergency, shut down the burner by turning the “ON-OFF” switch to the “OFF” position. Turn the fuel selector switch to the “OFF” position. Shut off the main manual fuel shutoff valves on the fuel supply line. The unit can also be shut down with the main electrical power disconnect. Inspect the burner carefully and troubleshoot before restarting the unit. Follow the instructions in Chapter 3 for starting and operating.
### 6.3 — Troubleshooting

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burner Does Not Start</td>
<td>1. No voltage at the program relay power input terminals.</td>
</tr>
<tr>
<td></td>
<td>a. Main disconnect switch open.</td>
</tr>
<tr>
<td></td>
<td>b. Blown control circuit fuse.</td>
</tr>
<tr>
<td></td>
<td>c. Loose or broken electrical connection.</td>
</tr>
<tr>
<td></td>
<td>2. Program relay safety switch requires resetting.</td>
</tr>
<tr>
<td></td>
<td>3. Limit circuit not completed - no voltage at end of limit circuit program relay terminal.</td>
</tr>
<tr>
<td></td>
<td>a. Pressure or temperature is above setting of operation control</td>
</tr>
<tr>
<td></td>
<td>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.</td>
</tr>
<tr>
<td></td>
<td>c. Fuel pressure must be within settings of low pressure and high pressure switches.</td>
</tr>
<tr>
<td></td>
<td>d. Check burner air proving switch and high-fire limit switch.</td>
</tr>
<tr>
<td></td>
<td>4. Fuel valve interlock circuit not completed.</td>
</tr>
<tr>
<td></td>
<td>a. Fuel valve auxiliary switch not closed.</td>
</tr>
<tr>
<td>No Ignition</td>
<td>1. Lack of spark.</td>
</tr>
<tr>
<td></td>
<td>a. Electrode grounded or porcelain cracked.</td>
</tr>
<tr>
<td></td>
<td>b. Improper electrode setting.</td>
</tr>
<tr>
<td></td>
<td>c. Loose terminal on ignition cable, cable shorted.</td>
</tr>
<tr>
<td></td>
<td>d. Inoperative ignition transformer.</td>
</tr>
<tr>
<td></td>
<td>e. Insufficient or no voltage at pilot ignition circuit terminal.</td>
</tr>
<tr>
<td></td>
<td>2. Spark but no flame.</td>
</tr>
<tr>
<td></td>
<td>a. Lack of fuel - no gas pressure, closed valve, empty tank, broken line, etc.</td>
</tr>
<tr>
<td></td>
<td>3. Low-fire switch open in low-fire proving circuit.</td>
</tr>
<tr>
<td></td>
<td>a. Damper motor not closed, slipped cam, defective switch.</td>
</tr>
<tr>
<td></td>
<td>b. Damper jammed or linkage binding.</td>
</tr>
<tr>
<td></td>
<td>4. Running interlock circuit not completed.</td>
</tr>
<tr>
<td></td>
<td>a. Combustion air proving switches defective or not properly set.</td>
</tr>
<tr>
<td></td>
<td>b. Motor starter interlock contact not closed.</td>
</tr>
</tbody>
</table>
## Troubleshooting

**Problem** | **Possible Causes**
--- | ---
Pilot Flame, but No Main Flame | 1. Insufficient pilot flame.
 | 3. Main gas valve inoperative.
 | 4. Gas pressure regulator inoperative.
 | 5. Flame detector defective, sight tube obstructed or lens dirty.
 | 6. Insufficient or no voltage at main fuel valve circuit terminal.
Burner Stays in Low-Fire | 1. Pressure or temperature above modulating control setting.
 | 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.
 | 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 (lean fire).
  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.
Warranty Policy

**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 manufacturer'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.

**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.

**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.

**Spare and Replacement Parts Warranty Adjustment:** The Company sells spare and replacement parts. This subparagraph (10.4) 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.
(10.4). Expenses incurred by Buyer in replacing or repairing or returning the spare or replacement parts will not be reimbursed by the Company.

**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 advice or recommendations that may have been rendered concerning the purchase, installation, or use of the equipment.
Startup/Service Report

The following information should be filled in by the service technician at startup or after any adjustment to the burner. A copy of the startup report MUST be forwarded to Cleaver-Brooks in order to validate the warranty of the burner.

Burner Model _______________     Serial Number_______________     Startup Date_______________

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<thead>
<tr>
<th>Electric Motors</th>
<th>Voltage</th>
<th>Amperage</th>
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<tbody>
<tr>
<td></td>
<td>L1</td>
<td>L2</td>
</tr>
<tr>
<td>Control Voltage</td>
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<tr>
<td>Blower Motor</td>
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<tr>
<td>Air Compressor</td>
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<tr>
<td>Air-Oil or Metering</td>
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<thead>
<tr>
<th>Test Conducted</th>
<th>Gas</th>
<th>Oil</th>
<th>Control Check</th>
<th>Test</th>
<th>Set Point</th>
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<tbody>
<tr>
<td></td>
<td>Low</td>
<td>50%</td>
<td>High Low</td>
<td>50%</td>
<td>High</td>
</tr>
<tr>
<td>Firing Rate MMBtu/gph</td>
<td></td>
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<tr>
<td>Stack Temp (gross) ° F</td>
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<tr>
<td>Room Temp ° F</td>
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<td>O2%</td>
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<td>CO%</td>
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<td>CO (PPM)</td>
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<tr>
<td>NOx (PPM)</td>
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<tr>
<td>Smoke (Bacharach)</td>
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<td>Combustion Eff. %</td>
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<tr>
<td>Stack Draft &quot; W.C.</td>
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<tr>
<td>Furnace Pressure &quot; W.C.</td>
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<td>Blast Tube Pressure &quot; W.C.</td>
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<td>Steam Pressure PSIG</td>
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<td>Water Temp ° F</td>
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<td>Supply Oil Pressure PSIG</td>
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<td>Vacuum Oil Pump &quot; HG</td>
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<td>Atom. Air Pressure</td>
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<td>Gas Pressure @ Burner</td>
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<td>Manifold &quot; W.C.</td>
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<td>Center Gas Pressure &quot; W.C.</td>
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<td>Gas Pressure @ Regulator Inlet PSIG</td>
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</tr>
<tr>
<td>Gas Pressure @ Regulator Outlet PSIG</td>
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<tr>
<td>Pilot Gas Pressure @ Regulator Outlet &quot; W.C.</td>
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<td>High</td>
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</table>

Adjusted by:

Date:

Accepted by:

(Signature Required)