Owners Manual

SELLERS ENGINEERING COMPANY

Model 15 Commodore Hot Water Boilers
Model 15 Senior Hot Water Boilers

This manual is supplied to the boiler owner and operator with information regarding installation, startup, operation, and maintenance. It is the ultimate responsibility of the boiler owner to safely and responsibly operate and maintain this equipment.

When received, the boiler should be thoroughly inspected for any damage that could occur in shipping. It is important to note any damage or unusual conditions on the bill of lading. A welded structural steel base is provided for lifting the boiler from underneath. Lifting eyes are provided for lifting the boiler from above. Do not lift the boiler by any other means.

Sellers Horizontal Immersion Hot Water Boilers are delivered completely assembled. Controls are installed on the boiler when practical. Any control not installed on the boiler will be designated on packing lists as “shipped loose”. All wiring to the factory-installed controls is complete. The boiler is supplied with insulation and a sheet metal jacket. The boiler should be placed in a properly designed boiler or mechanical room. The water and gas lines must be properly connected to the boiler and a properly designed electrical power supply should be connected to the boiler at the wiring junction box provided at the hinge of the boiler. The boiler flue gas outlet should be connected and sealed to a properly designed stack or exhaust system.

All Sellers Boilers are factory tested and all operating controls are carefully checked for proper operation before shipment from the factory. The boiler should be installed in accordance with these instructions, properly started, and adjusted in order to obtain optimum performance and trouble free operation.

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EQUIPMENT AND COMPONENT DESCRIPTION

COMPONENT DESCRIPTION AND CROSS REFERENCE

(For cross reference numbers and letters, refer to pages 6-9)

1. Burner Assembly - Delivers and ignites a proper mixture of gas and air to the boiler. (page 6)

2. Blower Motor - Drives blower impeller to provide 100% of the air required for proper combustion to the burner assembly. (page 6)

3. Air Proving Switch - Prevents ignition sequence or shuts off burner under conditions of insufficient combustion air. (automatic reset device) (page 6)

4. Pilot Shutoff Cock - Manually controls pilot gas supply. (page 6)

5. Pilot Gas Pressure Regulator - Provides manual adjustment of gas pressure to the pilot assembly. (page 6)

6. Automatic Pilot Gas Valve - Automatically controls pilot gas supply in response to flame safeguard sequence. (page 6)

7. Main Gas Shutoff Cock - Manually controls main gas supply to the burner assembly. (Installed upstream of main gas train components) (page 6)

8. Main Gas Pressure Regulator - Provides manual adjustment of gas pressure to the main burner. (page 6)

9. Automatic Safety Gas Valve (s) - Automatically controls gas supply to the main burner in response to flame safeguard sequence. (page 6)

10. Low Gas Pressure Switch - Prevents the operation of burner in the event of unsafe low gas supply pressure. (manual reset device) (page 6)

11. High Gas Pressure Switch - Prevents the operation of burner in the event of unsafe high gas supply pressure. (manual reset device) (page 6)

12. Normally Open Vent Valve (if provided) - Provides unrestricted vent to atmosphere between dual main automatic safety gas valves when burner is off. (page 6)

13. Leakage Gas Shutoff Cock - Manually controls main gas supply to the burner assembly. Also allows for manual leak testing of automatic safety gas valves. (Installed down stream of last automatic safety gas valve.) (page 6)

14. Gas Volume Adjusting Tee - Manual adjustment (and lock) for controlling the volume of gas to the main burner. (page 6)

15. Total Air Adjustment - Manual adjustment (and lock) for controlling the total air

pressure to the burner assembly. (page 8)

16. Secondary Air Adjustment(s) - Manual adjustment (and lock) for controlling the secondary air and the combustion chamber pressure. (On smaller boilers, a single adjustment may be mounted on top of the burner assembly.) (page 6)

17. Control Panel - Houses and protects electrical controls and wiring. (page 6)

18. Manufacturers Nameplate - Provides identification and rating information specific to the boiler. (page 6)

19. Flame Safeguard Control - Provides and controls safe sequence of operation for the burner and inter-related operating and safety controls. (page 9)

20. Flame Signal Amplifier - Amplifies the strength of the flame signal from the flame proving electrode to the flame safeguard control. (page 9)

21. Control Circuit Transformer - Converts primary electric supply voltage to 120-60-1 phase for the boiler control circuit. (page 9)

22. Blower Motor Starter - Provides safe on-off control of the blower motor in response to flame safeguard sequence. (page 9)

23. MP Control Timer - Provides extended proved pilot operation for an adjustable time period on demand satisfied condition allowing main burner to re-ignite in safe response to rapid load swing. (Optional on 20 to 125 HP. Standard above 150 HP) (page 9)

24. On-Off Control Switch - Provides manual on-off control of the operating control circuit (sometimes called safe start switch). (page 9)

25. Indicating Lights - Provides visual signal to verify current operating status of boiler. (page 6 & 9)

26. Ignition Transformer - Provides power to ignition electrode for safe pilot ignition. (page 6)

27. Ignition Electrode - Provides spark for safe pilot ignition. (page 8)

28. Pilot Flame Proving Electrode - Senses presence and proper location of the pilot flame for safe main burner ignition. (page 8)

29. Main Flame Proving Electrode - Senses presence of main burner flame in proper position for safe main burner operation. (Not furnished on boilers under 60 HP.) (page 8)

30. Structural Steel Base - Supports entire boiler for handling and rigging, and evenly distributes boiler weight. (page 7)

31. Lifting Eye - Provides convenient location for proper overhead lifting of boiler. (page 7)

32. Electrical Supply Junction Box - Provides convenient primary electrical supply connection to the boiler. (page 7)

33. Operating Temperature Control - Manually adjustable control for selecting temperature at which the burner cycles on and off. (page 7)

34. High Limit Temperature Control - Manually adjustable safety control for selecting temperature at which control system automatically shuts burner off upon a temperature rise above the operating control set point. (page 7)

35. Temperature Gauge - Provides visual verification of boiler operating temperature. (page 7)

36. Pressure Gauge - Provides visual verification of boiler operating pressure. (page 7)

37. Low Water Cutoff - Prevents operation of burner assembly in the event of unsafe water level condition. (page 7)

38. Relief Valve(s) - Relieves internal pressure in boiler in the event component failures allow unsafe pressure condition to develop. (page 7)

39. Stack Outlet - Vents flue gases out of boiler into breeching or stack. (page 7)

40. Explosion Relief Door - Provides adequate relief capacity to prevent boiler damage in the event of unstable combustion. (page 7)

41. Combustion Sight Glass - Provides for visual inspection of pilot and main burner condition. (page 7)

42. Pilot Gas Header – Delivers pilot gas to the runner pilots. (page 8)

43. Runner Pilots – Provides ribbon flame below all main burner nozzles for ignition. (page 8)

44. Secondary Air Screens – Diffuses secondary air in to the combustion chamber to provide positive static pressure and to provide air for the runner pilots. (page 8)

45. Main Burner Nozzles – Flame retention type nozzles deliver pre-mixed air and gas across runner pilots and into the fire tubes for combustion. (page 8)

46. Combustion Air Intake – Screened opening for the introduction of fresh air to the inlet side of the blower assembly. Larger boilers have both bottom and top intakes. (page 8)

47. Motor Control Panel – Houses the motor starter, control circuit transformer and high voltage controls.

STANDARD BOILER OPENINGS

A. Heating Water Supply - Opening from boiler into heating system. (page 7)

B. Heating Water Return - Opening to boiler for return water circulating from the heating system. (page 7)

C. Manual Feed Water Inlet - Opening to boiler for fresh make-up water or manual fill. (page 7)

D. Blowdown/Drain – Opening for blowdown or complete draining of boiler. (page 7)

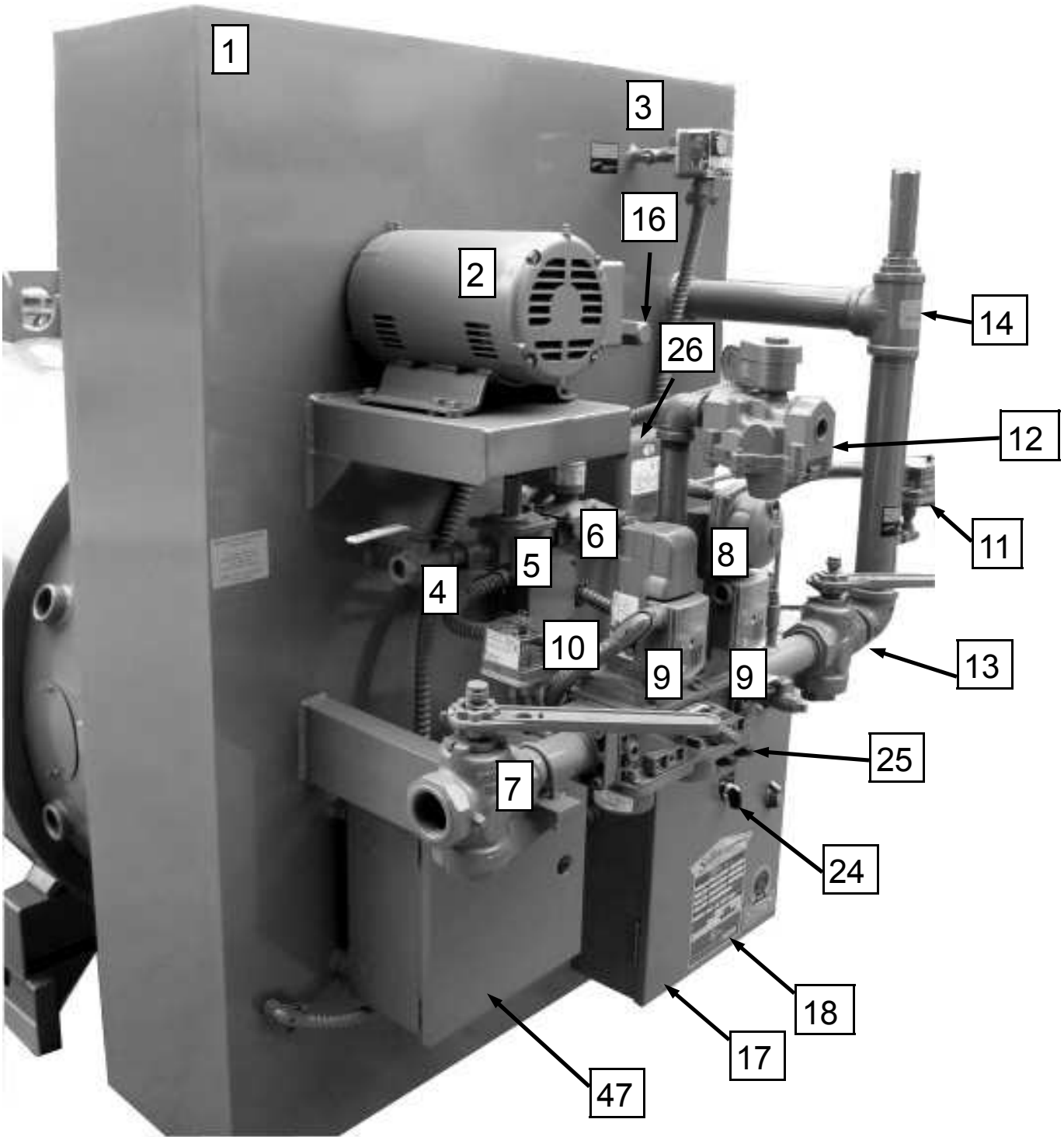
E. Rear Condensate Drain - Opening for draining initial condensation of water vapor from flue gases out of rear of boiler. (page 7)

F. Manhole Opening (if supplied) - Full size opening for access to water side of boiler for inspection and cleaning.

G. Handhole Opening(s) - Small opening for access to water side of boiler for inspection and cleaning. (page 7)

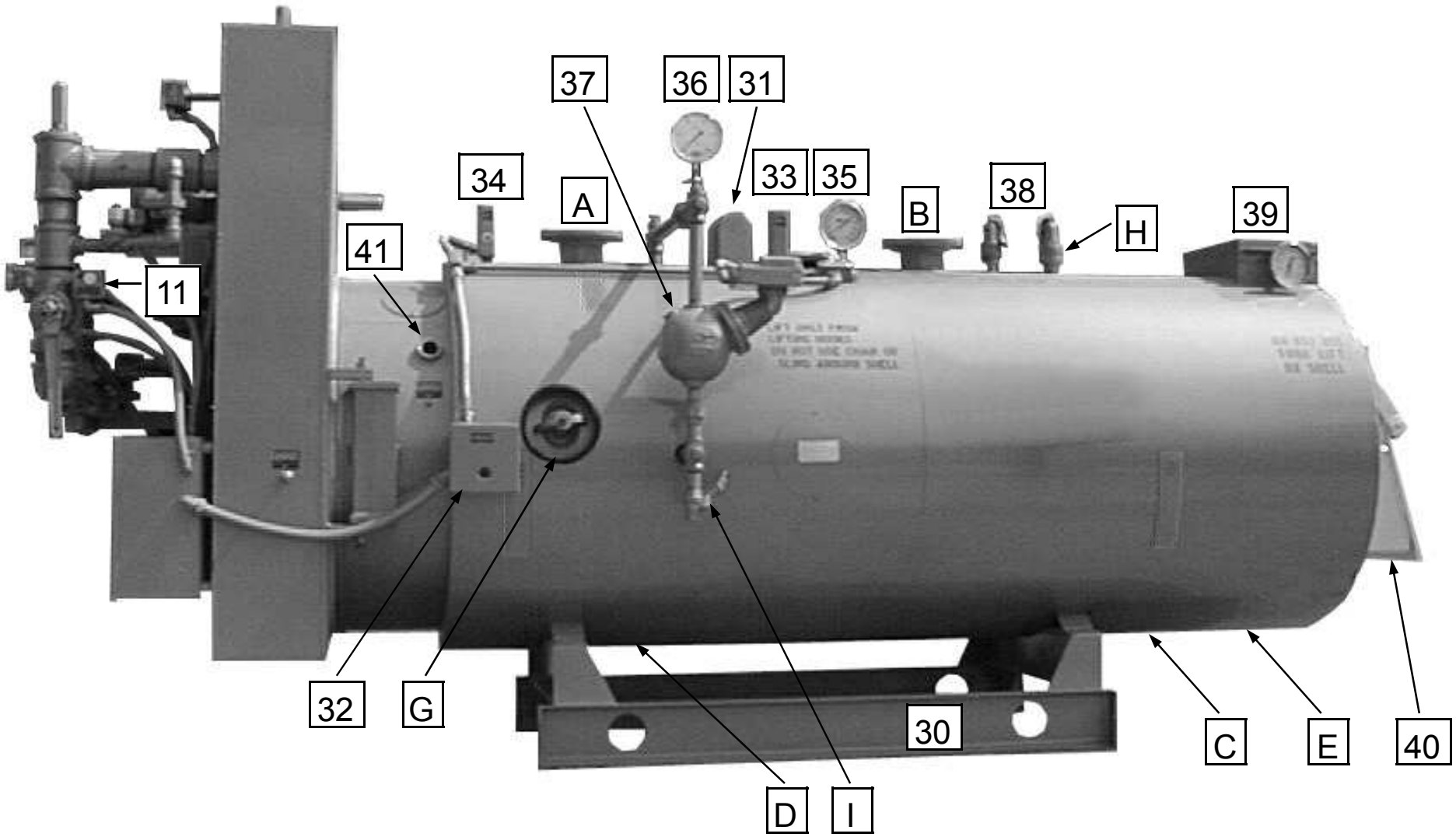
H. Relief Valve Openings – Opening for the discharge of the relief valve outlet to safe terminating point. (page 7)

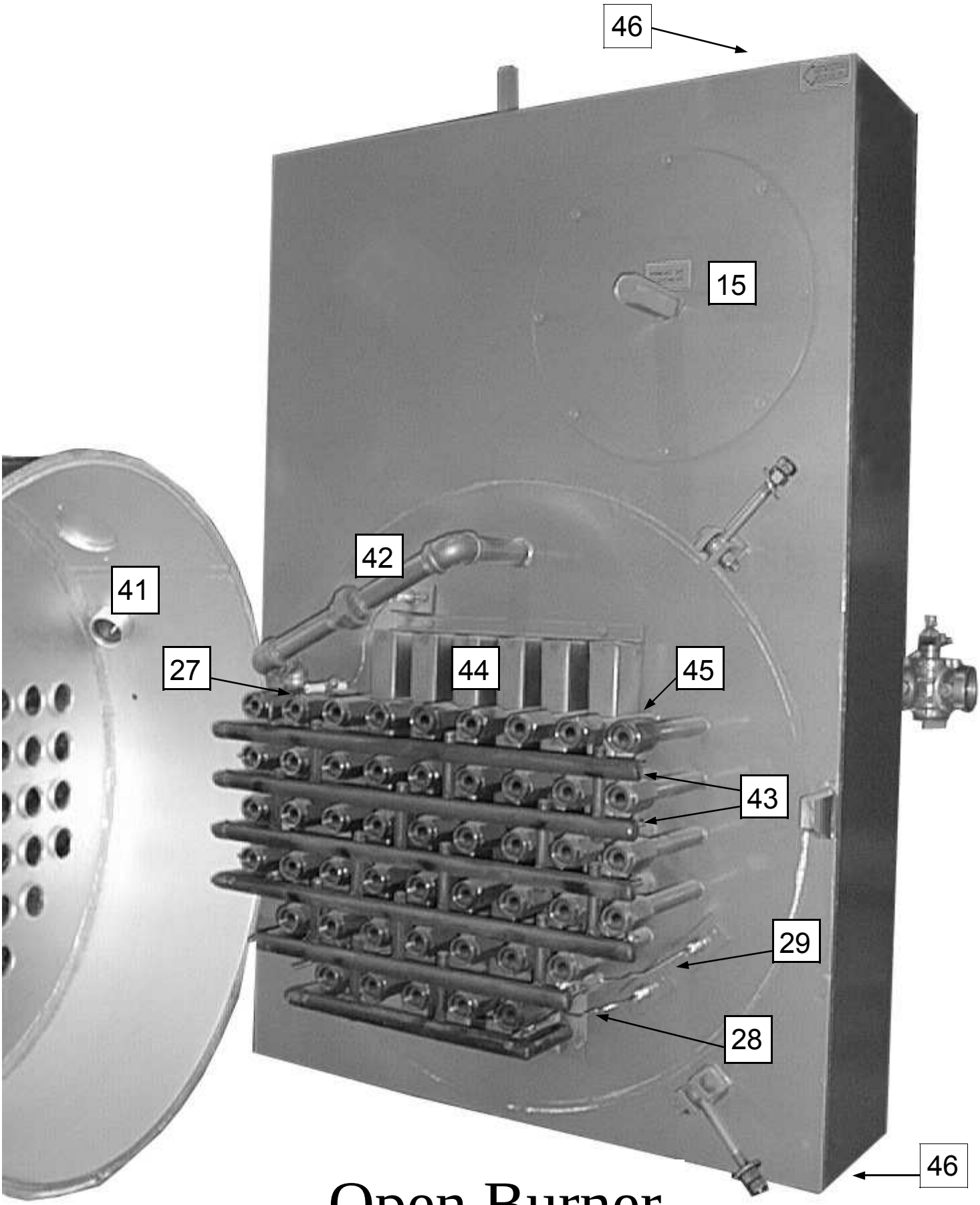
I. Float Type Low Water Cutoff Blowdown or Drain – Connection for the discharge of the low water cutoff drain to a safe terminating point. (page 7)



Front View

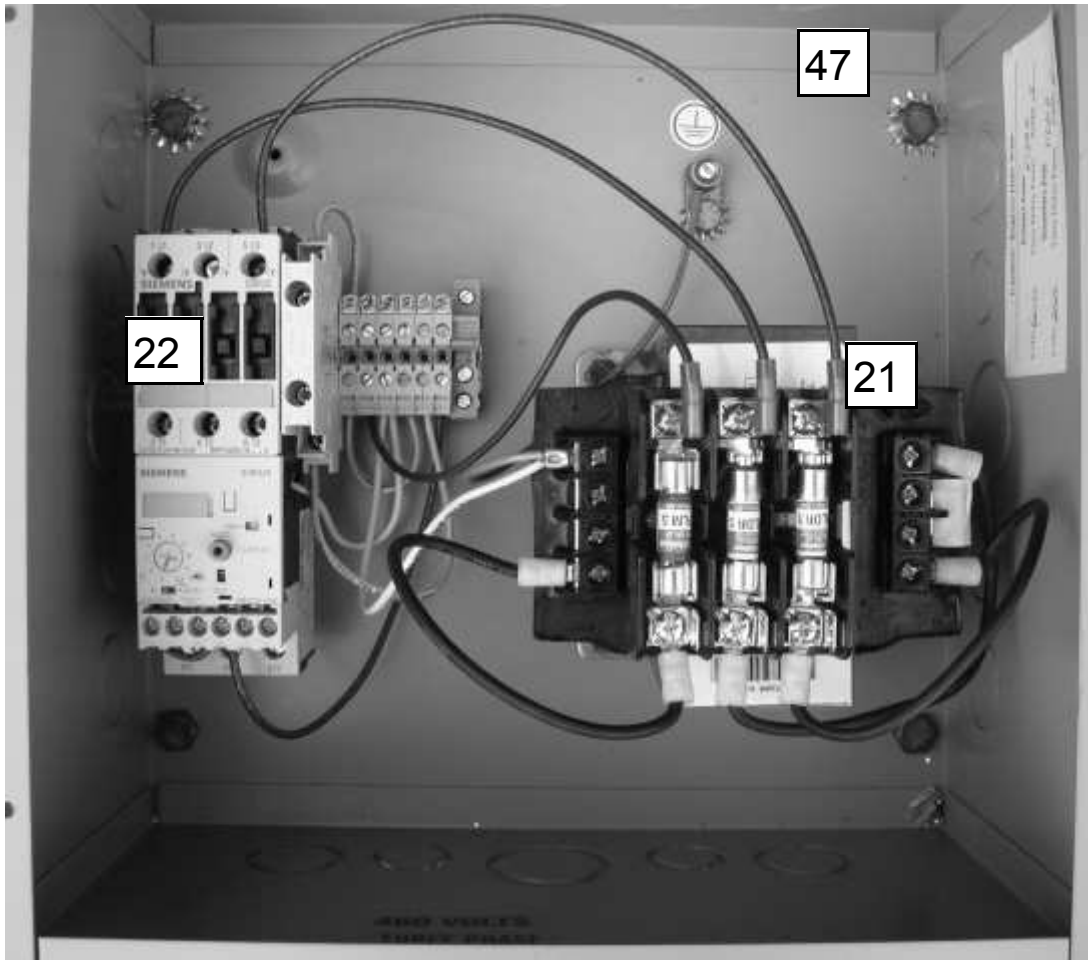
Hot Water Boiler Side



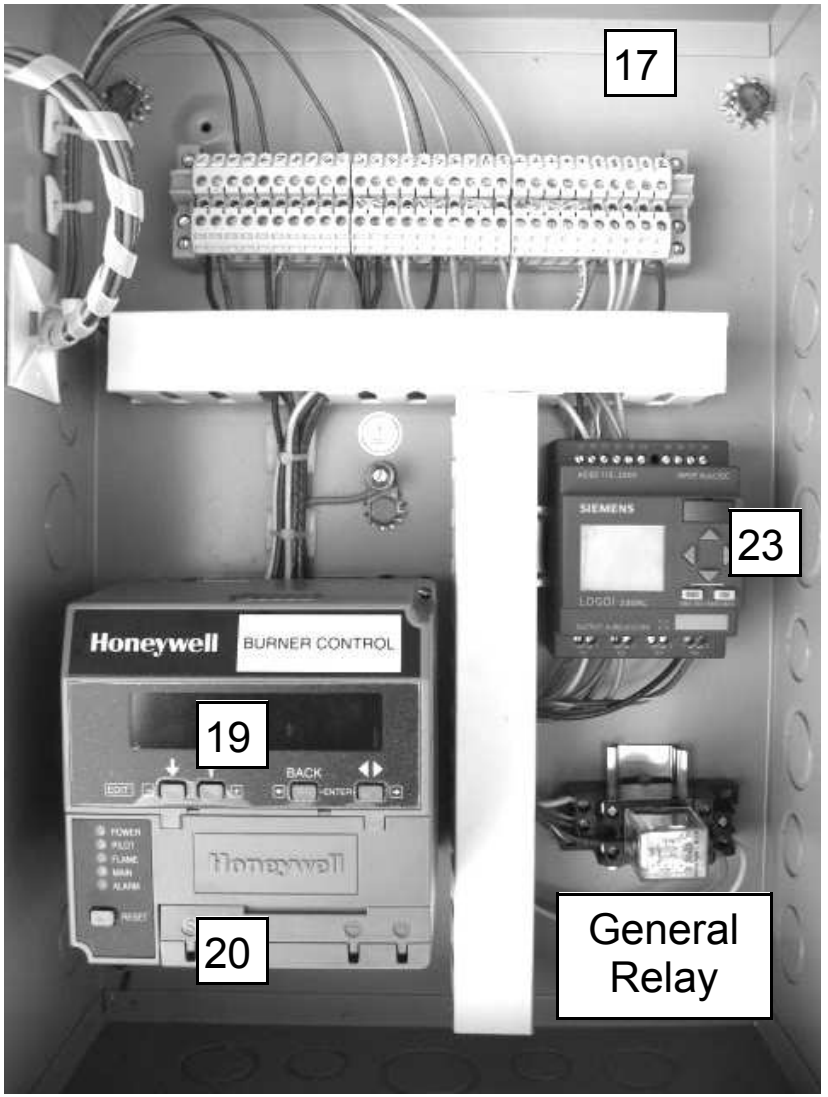


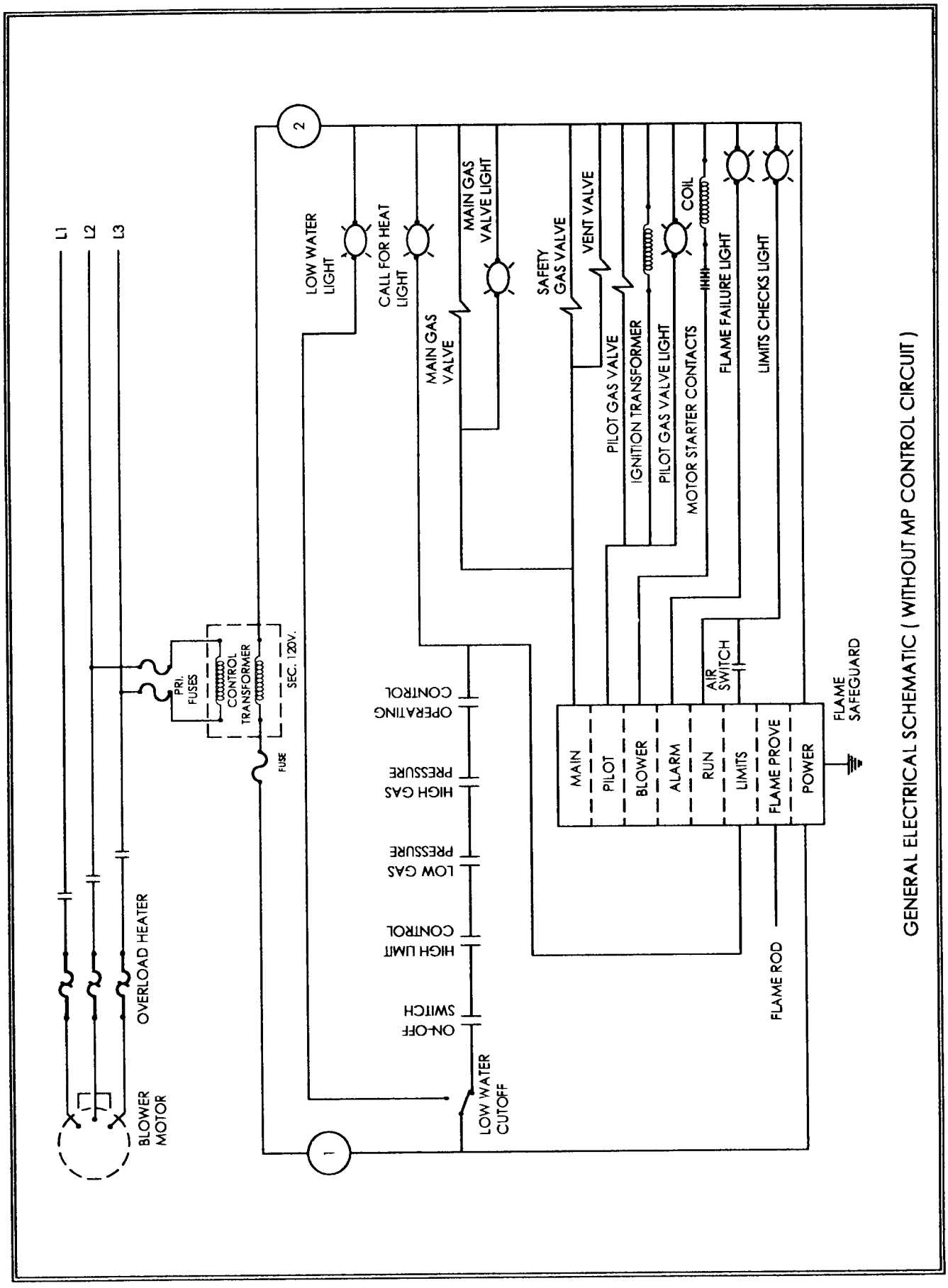
Open Burner

Motor Control Panel

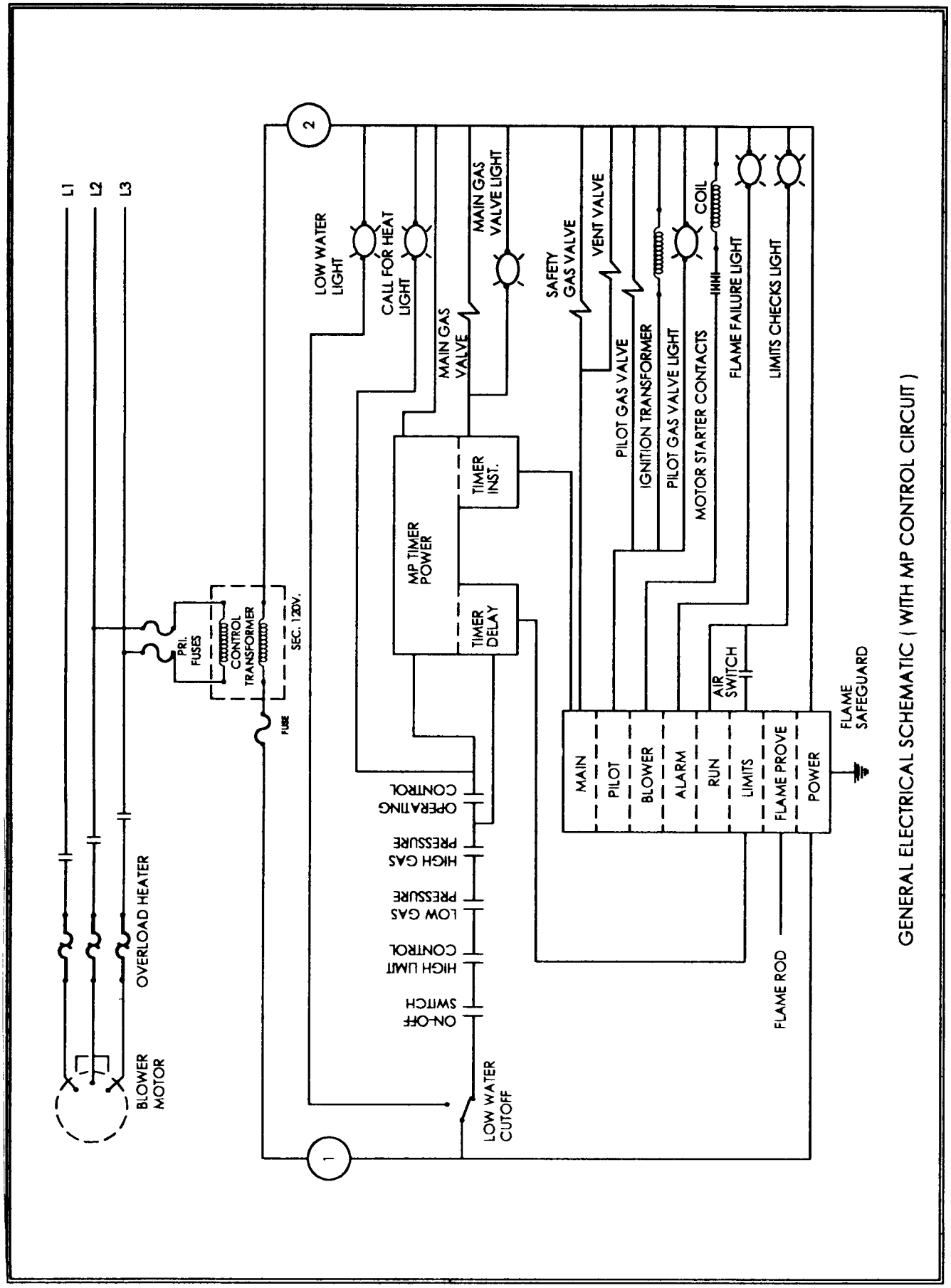


Control Panel





GENERAL ELECTRICAL SCHEMATIC (WITHOUT MP CONTROL CIRCUIT)



GENERAL ELECTRICAL SCHEMATIC (WITH MP CONTROL CIRCUIT)

INSTALLATION INSTRUCTIONS

LOCATION

Locate the boiler with due regard to local code regulations and insurance requirements. Local codes and specifications will apply to such conditions as foundation design and proximity to flammable materials. Adequate clearance must be provided for normal service operations.

Provide sufficient unobstructed space at the firing end and the exhaust end of the boiler to fully open the hinged main burner assembly and the back plate (if hinged). This will allow convenient access to all internal areas for normal inspection and service operations.

Provide room at either the firing end or the exhaust end of the boiler for possible future tube replacement. The minimum clearance necessary for easy removal and re-installation of firing tubes is listed in the boiler specification sheet.

The boiler room floor should be designed to support the full weight of the boiler and water. A raised concrete pad or piers should be provided for the boiler base. The base dimensions are also provided in the boiler specification sheet. Make certain the base assembly is level.

AIR SUPPLY

It is critically important to provide ample air for proper combustion and ventilation. The minimum air supply opening required for combustion air is approximately ½ square foot per 1,000,000 Btu of input. Additional air is required for ventilation to maintain safe and appropriate ambient air conditions under normal operation. The total minimum air supply opening required is approximately 250 square inches per 1,000,000 Btu of input. This minimum cross sectional area can increase with more complex duct systems or ventilation systems. Air can be provided through louvered panels in window or door openings or through specially prepared openings in the walls of the room. The effect of exhaust fans in the general area must be counteracted to prevent difficulty in the removal of the products of combustion from the building.

WATER CONNECTIONS

All water piping to the boiler must comply with all local code requirements. The boiler openings are labeled at the factory. The specification sheet also lists the openings on the boiler. Proper piping support must be used. Do not use the boiler to support the piping.

Complete the piping connections between the hot water outlet on the boiler and the heating water supply header or supply line. Install a valve rated for the appropriate temperature and pressure and suitable for shutoff service in this line.

Complete the piping connections between hot water return inlet on the boiler and the heating water return header. Install a valve rated for the appropriate temperature and pressure and suitable for shutoff service in this line.

Connect the cold water supply line to the manual feed water inlet on the boiler. Complete the piping between the expansion tank and the top of the boiler shell.

Provide a drain line from the blowdown/drain opening on the bottom of the boiler shell to any convenient sewer or drain opening. Install a valve rated for the appropriate temperature and pressure and suitable for shutoff service in this line.

A drain or blow-down line with a valve rated for the appropriate temperature and pressure should be provided for float type low water cutoff control. These blowdown connections should be fully piped to a drain so that they can be discharged without posing a safety risk.

The pressure relief valve outlet(s) should be piped to a drain or to a suitable safe discharge point outside the boiler room. The condensate outlet on the boiler should be piped to a drain. Do not install a valve in any of these lines.

GAS PIPING

All gas piping to the boiler must comply with all local code requirements. Connect the gas supply line from meter to main burner and pilot inlet connections. The size of the gas line is dependent upon the gas input, the gas pressure available, the length of the line and the number of bends required. Assistance in determining the proper size is available from your local gas company. There should be a suitable master gas shutoff cock installed in this line. This is not furnished with the boiler. There should be a cleanout leg on all gas lines at the point of connection to the boiler.

Make certain the main gas supply line from the meter, and both the main burner and the pilot burner gas supply lines are clean before connecting to the boiler. Loose materials in the gas lines such as scale, welding slag, or metal chips are almost certain to cause faulty operation of gas pressure regulators and control valves.

Both the main burner and the pilot burner gas supply lines should be located to allow full opening the main burner assembly for normal inspection and maintenance. Provide unions in both the main burner and pilot burner gas supply lines. Locate these unions so the gas lines can be readily disconnected when it is necessary to open the main burner assembly.

The master gas shutoff cock should be installed in the gas line for emergency shutoff. Provide a tee with a branch opening of suitable size for the pilot gas line downstream from the master shutoff cock. Provide a distance of at least 4 ft. between the pilot line branch connection and the main burner gas pressure regulator.

Connect the pilot gas supply line to the inlet of the pilot shutoff cock. Connect the main gas supply line to the inlet of the main gas shutoff cock. After completing the gas piping, make certain the main and pilot gas trains are still in a horizontal position and the lines are level.

NOTE: When pressure testing the gas lines, the gas trains on the boiler must be isolated. The gas cocks must be closed. If any question exists as to the rating of the gas cocks relative to the required test pressure, the lines should be disconnected and

blocked off to avoid damage to gas train components.

NOTE: Both the main burner gas pressure regulator and the pilot burner gas pressure regulator are supplied with the boiler. These regulators have been furnished to operate with specific gas type and inlet pressure. These regulators have been adjusted to provide the appropriate outlet pressure when the boiler is in normal operation. If gas supplied is of a different type or supply pressure, the regulators may not be suitable for service.

It is important that both main burner and pilot burner gas pressure regulators be vented to the outside of the building. There may also be a normally open vent valve and high and low gas pressure limit switches installed on the gas train of the boiler. All of these components must be vented to the outside of the building. Vent lines should be of adequate size. At least ¾" line size will be required for the regulators and gas pressure switches. These items may be vented in common. The normally open vent valve must be vented with full size piping and must be vented separate from any other control containing a diaphragm. Unions must be supplied in appropriate locations in the vent lines to allow disconnection for opening the burner door. Where local governing agencies or gas companies have established regulations with regard to the venting of gas pressure regulators, their requirements should be rigidly followed. The termination points of the vent(s) should be turned down to prevent water from entering and should be protected against the entry of insects.

Gas piping should be tested for leaks using soap bubbles. Shipping and handling can cause small leaks. These must be tightened prior to boiler operation.

ELECTRICAL CONNECTION

All electrical wiring to the boiler must comply with all local code requirements. Connect the electric power supply lines to the marked wires or terminals in the junction box that is rigidly mounted on the boiler shell at the hinge. A fused line switch (safety switch) should be provided in the power supply line. This switch is not furnished with the boiler. The wire size must be adequate for the full electrical load on the boiler and the boiler must be well grounded. Any connections made to the single phase boiler control circuit must also be made at the hinge location. Any rigid conduit connections made directly to the control panel on the front of the burner will prevent the opening of the door.

The control circuit on all Immersion Fired Boilers is arranged for operation with a 120 volts, 60 cycles, 1 phase power supply. The blower motor may be either 1 phase or 3 phase with voltage as specified by the customer. When the blower motor circuit is other than 120 volts, single phase or when it is a three phase circuit, a small control circuit transformer of suitable electrical characteristics to provide a 120 volt, 60 cycle, 1 phase power supply for the control circuit is furnished with the boiler.

FLUE CONNECTION

All flue piping to the boiler must comply with all local code requirements. Install the flue piping full size from the flue outlet on the boiler to the building stack or to a separate stack. Flue piping material should be at least 18 gauge galvanized sheet metal unless other material is specified. Horizontal runs of the flue piping should be avoided and when necessary should be as short and direct as possible and pitched upward

approximately 1 inch per foot. The connection to the boiler must allow smooth exit of the gases from the boiler. Connection of the boiler exit to horizontal breechings must be accomplished using smooth angled wye connections or elbows. Tee connections will cause venting problems and must not be used. Many different brands of pre-fabricated boiler stack are available on the market. These are often superior to the single wall, sheet metal stacks described above because of the ease of installation and double wall construction. If this material is used it should be properly sized and the manufacturers instructions should be followed. Flue piping is not furnished with the boiler.

Sellers Immersion Fired Boilers are not dependent on stack draft for any air delivery requirements. The blower assembly provides all required combustion air, both primary and secondary. The pressure maintained in the enclosed combustion chamber is sufficient to expel the flue gases from the boiler itself. The flue gases, however, must be removed from the building. This is the function of the connected stack. To ensure the removal of flue gases from the building, the chimney or stack must produce a definite up draft (negative pressure). A down draft (positive pressure) in the stack will prevent proper burner operation.

Stack up draft is a function of the stack height, flue gas temperature, and friction loss in the stack. The amount of draft required for proper operation cannot be rigidly specified due to the effect of the varying conditions encountered. Sellers Engineering recommends an up draft of -0.02” to -0.04” inches water column. This will provide the most satisfactory performance. In general, excessive up draft can be eliminated with the use of barometric draft dampers. These dampers allow room air to be pulled into the stack along with flue products. These dampers can be adjusted. Excessive down draft must be eliminated in the design of the stack. In cases involving excessive down draft, additional up draft must be created to provide proper stack operation. This can be accomplished in a number of ways. The most common of these would be the addition of stack height, or the use of induced draft fans.

Always follow local code requirements in designing stack systems. General recommendations would include that the stack be at least as large in cross sectional area as the flue outlet opening on the boiler and that the stack should extend at least 4 ft. above adjacent building walls or roof ridge line. Consult the Engineering Department of the stack manufacturer for assistance when questions arise.

ENERGY EXTRACTORS

Stainless Steel Energy Extractors are installed in each firing tube at the factory. Check to make certain they are flush with the rear or exhaust end of the firing tube. The heat extractors can move partially out of the firing tubes during shipment. To restore the heat extractors to proper position, push them forward into the firing tube until flush with the tube end. This will assure maximum efficiency during operation.

PREPARING FOR OPERATION

Hot Water Boiler

GENERAL INSPECTION

Fill the boiler and connected system completely with water taking due precaution to prevent the entrapment of air in the various parts of the system. If the system is new and contaminated with oil or grease, it should be cleaned using a suitable cleaning solution. The boiler and system should then be re-filled with clean water.

Check all boiler water connections and all hand hole and manhole openings for possible leaks. Correct any leaks.

Make certain electric power supply is properly connected and that proper voltage and current characteristics are being supplied. Place all electric switches in the OFF position. Close all manually operated gas valves.

Check all screw type electrical terminal connections in the boiler control cabinet for normal tightness. Such terminals can loosen during shipment and a careful check will help to avoid unnecessary trouble during initial start-up operations.

Check the position of the ignition electrode and the flame rod. Both of these electrodes are located inside the pressurized combustion chamber at the firing end of the boiler. They are normally protected and not easily disturbed from their proper position during normal shipping and installation operations. The location of each rod can be checked visually by looking through the removable inspection windows provided on the front of the boiler shell.

The end of the ignition electrode should be positioned directly over the runner pilot ports between two of the main burner nozzles. The gap between the end of the electrode and the pilot is called the spark gap. This spark gap should be 3/32" minimum to 1/8" maximum. Improper spark gap is the leading cause of nuisance flame failures.

The runner pilot assembly has a flame proving leg attached to the lower bottom pilot tube. This proving leg extends back in perpendicular fashion towards the burner manifold. The flame rod, or flame proving electrode should be positioned directly over the drilled flame ports of this runner pilot proving leg. The flame rod should be 3/8" minimum and 1/2" maximum above the pilot proving leg. Positioning the flame rod too close or too far from the pilot proving leg can cause nuisance flame failures. If these electrodes are not in proper position, they can usually be correctly repositioned by opening the inspection window access door and bending the rod slightly to the desired position.
The flame proving electrodes are powered when the boiler control circuit is powered. To avoid electrical shock, be certain that the power is OFF prior to adjusting the electrodes.

INITIAL START AND BURNER ADJUSTMENT

NOTE: The flue gas analysis referenced in this section is representative of readings

expected from a natural gas flame. If the fuel is other than natural gas, the CO2 values will vary. The oxygen values will not vary.

Before attempting to start the boiler, make certain the following switches and valves are in the position indicated. Refer to Equipment and Component Description and Cross Reference for the location of these devices.

1. The master gas shutoff cock should be in the CLOSED position.

2. The main and leakage burner gas shutoff cocks should be in the CLOSED position.

3. The pilot gas cock should be in the CLOSED position.

4. The fused line switch should be in the OFF position.

5. The manual on/off switch (see wiring diagram) should be in the OFF position. This switch is located on the side of the control cabinet.

NOTE: The primary air, secondary air, pilot gas pressure, main gas pressure, and main burner gas input have all been adjusted at the factory. These adjustments should be left undisturbed for initial start-up of the boiler. If the gas supply pressure matches the pressure specified for boiler fabrication, only minor adjustments should be needed. Be certain to have available a copy of the factory fire test report. The data listed on the factory fire test report was recorded with the boiler firing. The blower pressure, manifold pressure, and combustion chamber pressure will not match the factory readings unless the main burners are on and stable. Do not attempt to adjust the burner to these settings unless the main burners are on.

1. Turn the fused line disconnect on. Verify both the primary voltage available to the blower motor starter and the control circuit voltage.
2. Open the master gas shutoff cock. Open the main burner gas cock. Verify the static gas pressure available to the burner on the upstream side of the main gas pressure regulator.
3. Push the manual reset mechanisms on the low water cutoff(s) (if supplied with manual reset), the high gas pressure switch and the high limit temperature controller. If the burner is supplied with a low gas pressure switch, adjust the set point of this switch to a value slightly below the static pressure measured. Reset this switch by pressing the manual reset mechanism.
4. Check blower operation and direction of rotation of the blower wheel (impeller). To do this, turn the manual on/off switch in the on position. The control system should energize the call for heat indicator light and the blower motor starter and the motor should start. Immediately turn the manual on/off switch back to the off position. The motor starter will be de-energized. As the wheel slows down, check for proper rotation by looking in the rear of the motor. The rotation should match the directional arrow on the burner. If the motor is rotating in the wrong direction, turn off the main disconnect and verify that power is off to the motor starter. Switch any two of the three wire leads from the bottom of the starter to the motor. Turn the fused disconnect back on and verify proper blower rotation.
5. Turn the on/off switch on and immediately turn the run/test switch on the flame safeguard control to the test position. Using a manometer, check the pressure at the air flow proving switch. It should be slightly lower than the pressure shown on the

factory fire test. If the pressure is considerably lower than the pressure listed on the factory fire test report, a main air or blower pressure adjustment may be needed. To adjust the blower pressure, use one of the following methods. If the burner is supplied with a hex shaped cap opposite the blower motor, remove the cap on the main air adjustment on the opposite side of the manifold from the blower motor and loosen the lock nut. To raise the blower pressure, unscrew or turn the threaded rod counterclockwise. To lower the blower pressure, screw the threaded rod in or turn it clockwise. These adjustments should be made ½ turn at a time. If the burner is supplied with a crank style adjustment on the left side of the burner, remove the set screw holding the crank in place and turn the crank one turn at a time to adjust the blower pressure. To raise the blower pressure, turn the crank clockwise. To lower the blower pressure, turn the crank counterclockwise. Set the blower pressure about ½" wc below the pressure listed on the factory fire test report for plain tube boilers and about 1-1/2" below the pressure listed on the factory fire test report for boilers equipped with XID tubes. Adjust the air flow proving switch set point to a value slightly below the measured pressure. Turn the run/test switch on the flame safeguard control back to the run position. Let the burner continue to progress through the initial sequence. The limits checked indicator light will remain on and the blower will continue to run if the air flow switch is made.

6. After 30 seconds of pre-purge time, the flame safeguard control will energize the ignition transformer, the pilot solenoid valve(s), and the pilot indicator light. As soon as this happens, return the run/test switch on the flame safeguard control to the test position and observe the pilot ignition trial through the sight ports on the front combustion chamber. There should be a visible spark at the ignition electrode. The pilot gas should ignite and the pilot flames should flash from the top pilot down and across the burner toward the proving electrode at the bottom. The pilot must be established in ten seconds or less. Check the pilot gas pressure using a manometer. The pilot gas pressure should be very close to the pressure listed on the factory fire test report. Make adjustments to the pilot gas only if needed. If there is air in the gas piping, several attempts may be needed to establish a stable pilot. Once a pilot is established, turn the manual on/off switch to the off position, turn the run test switch on the flame safeguard control back to the run position and prepare to light the main burner.
7. Place the manometer on the main gas test connection between the last main gas valve and the gas volume adjusting tee. If the boiler was supplied with a high gas pressure switch, this will be the location of the test tapping. Open the leakage gas shutoff cock. Turn the on/off switch to the on position and observe the boiler through the normal lighting sequence. After the ten second pilot ignition trial, the main gas valves will be energized and full gas flow will be allowed to the mixer. Watch the pressure on the manometer and watch the main firing nozzles in the observation windows. If a high gas pressure switch was supplied, it will have been intentionally set at a low value. It should trip open and shut the main valves. Adjust the set point on the high gas pressure switch to a value slightly above the value shown on the factory fire test report. Reset the high gas pressure switch by pressing the reset mechanism. This will restart the boiler. When the main burner nozzles are ignited they should project a long narrow flame straight down the tubes in the boiler. The gas pressure should be very close to the pressure listed on the factory fire test report. If the flames are unstable or the boiler rumbles, tum the on/off switch off immediately. A main gas adjustment is needed. A rumble generally indicates too much gas while no flame, or jumpy, pale flames indicate too little gas. Remove the hex shaped cap from the main gas adjusting tee and loosen the locknut on the

threaded rod. To add gas, unscrew or turn the threaded rod counterclockwise. To remove gas, screw the threaded rod in or turn it clockwise. These adjustments should be made ½ turn at a time. Do not continue to make adjustments for more than a few seconds if the flames do not stabilize. Turn the boiler off and let the system purge.

8. After establishing stable main burner operation, let the boiler warm up for ten to fifteen minutes. Observe the appearance of the pilots and the main burners. The pilots should be sharp and should lean forward towards the front head of the boiler. If the pilots are lazy and appear to be floating upwards and starving for air, the combustion chamber pressure is too low. If the pilots are sharp but are leaning over flat and blowing toward the front head, the combustion chamber pressure is too high. In either event, an adjustment is needed. To adjust the combustion chamber pressure, remove the hex shaped cap(s) from the secondary air adjustments and loosen the lock nuts on the threaded rod(s). To increase the combustion chamber pressure, turn the threaded rod(s) counterclockwise. To decrease the combustion chamber pressure, turn the threaded rod(s) clockwise. When making adjustments to the combustion chamber pressure, turn the threaded rod(s) ¼ turn at a time. When there are two secondary air adjustments, turn both threaded rods when making changes.
9. After establishing the best possible pilot, the final step in starting the boiler is making the final main gas adjustment. This cannot be done without an accurate flue gas analysis. Take a sample of flue gas using a properly calibrated instrument. The ideal flue analysis will result in a stack gas oxygen reading of 4.0% or a stack gas CO2 reading of 9.5%. A reading of less than 4.0% O2 or greater than 9.5% CO2 indicates that the main burner is fuel rich. A reading of greater than 4.0% O2 or less than 9.5% CO2 indicates that the main burner is fuel lean. To adjust the fuel input to the proper level, remove the hex cap from the gas volume adjusting tee and loosen the locknut. To add gas, unscrew or turn the threaded rod counterclockwise. To remove gas, screw the threaded rod in or turn it clockwise. These adjustments should be made ½ turn at a time. After each adjustment, take a flue gas sample to verify the results of the change. Once the O2 is 4.0% or the CO2 is 9.5%, tighten the locknut and replace the hex cap on all adjustments. Record all pressures and flue gas readings on the startup record.

CONTROL AND SAFETY CHECK

To complete the startup, it is essential that all safety and operating controls be checked and properly set. Check and set the controls in the following manner.

Low Water Cutoff (float type) – The best way to check the operation of this control is to drop the water level in the boiler to a level below the low water cutoff point. The entire low water cutoff mechanism and the interconnecting piping are checked in this manner. This is not usually practical in hot water heating systems. The next best way to check this control is to blow down the float chamber forcing the burner to cut off. In a hot water system, because the entire boiler shell is flooded, this check may not work either. To check the float type low water cutoff if the other methods are unworkable, remove the cover from the float chamber and, using a screwdriver, rock the float carriage forward, simulating the float dropping in the chamber. Take extra care to avoid electrical shock by using only insulated tools and wearing proper protective gear. The burner should shut down and the low water alarm light should illuminate. If the low water cutoff is supplied with a manual reset mechanism, be certain that the burner will not recycle

automatically, then reset the control and verify proper operation. If the low water cutoff is operating properly, record this test on the startup report.

Low Water Cutoff (probe type) - The best way to check the operation of this control is to drop the water level in the boiler to a level the below the low water cutoff point. The entire low water cutoff mechanism, including the relay and the probe assembly are checked in this manner. This is not usually practical in hot water heating systems. The probe type low water cutoff assemblies are often supplied with a test pushbutton. Simply depress and hold the test push button and verify that the burner cut off and the low water cutoff light illuminated. If the low water cutoff is supplied with a manual reset mechanism, be certain that the burner will not recycle automatically, then reset the control. If the low water cutoff is operating properly, record this test on the startup report.

Air Flow Proving Switch – With the boiler in operation and a manometer in place at the switch, remove the adjustment cap or cover from the air flow proving switch. Increase the set point of the switch until it is above the operating air pressure at the switch. The burner should cut off. On most boilers, the alarm light will illuminate and the flame safeguard control will lock out the boiler so it cannot automatically restart. Adjust the set point of the air flow proving switch to the highest value that will allow operation of the burner. Push the reset button on the flame safeguard control to restart the boiler. This will provide the highest level of safety. If the air flow proving switch is operating properly, record this test on the startup report and record the final set point of the switch.

Low Gas Pressure Switch – With the boiler in operation and a manometer in place at the switch, remove the adjustment cap or cover from the low gas pressure switch. Increase the set point of the switch until it is above the operating gas pressure at the switch. The burner should cut off and the switch should lock out the boiler so it cannot automatically restart. Adjust the set point of the low gas pressure switch to the highest value that will allow operation of the burner and reset the control. This will provide the highest level of safety. If the low gas pressure switch must be set more than 25% below the operating gas pressure at the switch because of a drop in gas pressure when the main gas valves open, then the gas supply system is reacting to slowly. This is a design problem and should be corrected so that the maximum level of safety can be achieved. If the low gas pressure switch is operating properly, record this test on the startup report and record the final set point of the switch.

High Gas Pressure Switch – With the boiler in operation and a manometer in place at the switch, remove the adjustment cap or cover from the high gas pressure switch. Decrease the set point of the switch until it is below the operating gas pressure at the switch. The burner should cut off and the switch should lock out the boiler so it cannot automatically restart. Adjust the set point of the high gas pressure switch to the lowest value that will allow operation of the burner and reset the control. This will provide the highest level of safety. If the high gas pressure switch is operating properly, record this test on the startup report and record the final set point of the switch.

High Limit Temperature Control – After the boiler has warmed up to near its desired

operating temperature, decrease the set point on the high limit temperature control to a value below the operating temperature of the boiler. The burner should cut off and the high limit temperature control should lock out the boiler so it cannot automatically restart. Adjust the set point of the high limit temperature control to the desired temperature and reset the control. This will provide the highest level of safety. If the high limit temperature control is operating properly, record this test on the startup report and record the final set point of the control.

Operating Temperature Control – After the boiler has warmed up to near its desired operating temperature, decrease the set point on the operating temperature control to a value below the temperature in the boiler. The control circuit should cut off the burner in a normal fashion without locking out or if supplied with an MP control circuit, should de-energize the downstream main gas valve and initiate an MP timing cycle. Adjust the set point of the operating temperature control to the desired cutoff temperature. Adjust the value of the differential temperature on the control. The differential temperature is the amount the operating temperature will drop below the operating cutoff point before bringing the boiler back on.

Stack Draft – After the boiler is warmed up, check the draft with an accurate draft gauge. The draft should ideally be -.02" to -.04" wc. Large variations from this value could cause problems and should be corrected.

NORMAL OPERATION

Normal operation is a term describing the daily automatic operation of the boiler in the system. Prior to normal operation, the boiler must have been properly installed and started by a qualified contractor or combustion specialist. The owner and operating personnel should have received training in the operation and maintenance of the boiler.

PUTTING THE BOILER IN SERVICE

The boiler should be visually inspected for any abnormal conditions. Any problems found should be corrected prior to operation of the boiler.

1. Confirm that the boiler water level is correct.
2. Make sure the on/off switch is off and turn the main power on.
3. Open the master gas shutoff cock, the pilot gas cock, and both the main and leakage gas cocks.
4. Reset low gas pressure switch and any other control requiring a reset after power interruption.
5. Turn on the boiler by putting the on/off switch in the on position.
6. Observe the lighting sequence and turn the on/off switch off in the event of an abnormal occurrence of any kind.
7. Refer to the troubleshooting section of the manual to identify basic problems and call your Sellers Representative for qualified service.

BASIC COMBUSTION

Combustion is a term referring to the controlled burning of fuel in the boiler to produce heat. For combustion to take place, there are three essential elements, fuel, oxygen, and heat to start the process. The fuel in most cases is natural gas, however the Sellers

Immersion Fired Boiler can be set up to burn propane or other gaseous fuels. Oxygen for the combustion process is supplied in the form of air. The Sellers Immersion Fired Boiler starts the combustion reaction with the pilot ignition from the spark electrode. The source of heat to ignite the main burners is the runner pilot assembly.

The combustion process begins with fuel and air. The process produces heat for the boiler in proportion to the amount of fuel being burned. The final products of the combustion process are carbon dioxide, water vapor, and the balance of the air not consumed in the process. These are the elements making up the flue gas exiting the boiler.

It is critically important that all of the fuel introduced into the process be completely burned. Incomplete combustion is a source of carbon monoxide. This is an odorless, colorless, and poisonous gas that is the produced when the combustion process is interrupted before all of the carbon in the fuel is converted to carbon dioxide. It poses a significant health risk. Incomplete combustion is also inefficient. The partially burned fuel actually absorbs heat from the fully burned combustion products and carries it out of the boiler. The BTU content of any gas not completely burned is also carried up the stack. This unburned or partially burned fuel is also a source of soot. Soot interferes with the heat transfer process by contaminating the fireside of the boiler.

Stoichiometric air refers to the exact amount of air required to burn a given amount of fuel. Stoichiometric air contains the exact amount of oxygen to theoretically convert all of the fuel to carbon dioxide and water vapor with no oxygen remaining. This would be the most efficient way to operate a boiler. Unfortunately, stoichiometric combustion, while sometimes attainable in laboratory conditions, does not work well in actual practice. There are too many variables that cause incomplete combustion to take place in a typical system. Fuel chemistry changes slightly. Air density and oxygen content change with changes in temperature and humidity. Air systems get dirty and adjustments can slip or stick. For this reason, burners are tuned to operate with “excess air”.

Excess air combustion is a term referring to the practice of burning the fuel with more air than that required for stoichiometric combustion. This cushion of extra air allows the burner to completely burn the fuel even with the minor changes in fuel, air, or any other variable.

The proper level of excess air for the boiler is 20%. The burner will operate at levels well below or above this level, but the 20 % excess air level will provide the most reliable operation while maintaining high efficiency. This 20% excess air level is equivalent to the 4.0% oxygen or 9.5% carbon dioxide level recommended in the Initial Start and Burner Adjustment section of this manual.

SEQUENCE OF OPERATION

The sequence of operation of the boiler can be summarized in five steps. Understanding this sequence of operation is the most important aspect of understanding your boilers operation.

PRE-PURGE PERIOD (30 Seconds)

The following switches or controls are closed (contacts made):

Low water cutoff(s)
Manual on-off switch
Low gas pressure switch (if provided)
High gas pressure switch (if provided)
High limit temperature control
Operating temperature control

The call for heat light on the control panel is illuminated.

Main gas valve proof of closure switch (if provided) must be closed. (contacts made.)

The blower motor starter is energized from the flame safeguard control and the blower starts.

The air flow proving switch must close (contacts made) within 7.5 seconds.

Limits checked indicator light is illuminated.

Blower runs and purges burner and boiler with air for 30 seconds.

PILOT IGNITION TRIAL (10 Seconds)

Thirty second prepurge has ended. All above switches and controls are still closed (contacts made).

Pilot burner indicator light is illuminated.

The pilot gas valve(s) and the ignition transformer are energized from flame safeguard control.

The ignition transformer and electrode produce a spark at the top pilot tube. Pilot gas is partially mixed with air in the pilot assembly and this mixture is ignited starting at the ignition electrode. The flames spread and travel (flash) down and across pilot runners. The pilot flame engulfs the pilot flame proving electrode at the bottom of the pilot assembly on the perpendicular proving leg at the end of the bottom pilot tube.

The pilot flame proving electrode proves the presence of a proper pilot, in the proper location, to the flame safeguard control through the flame safeguard amplifier.

MAIN FLAME IGNITION TRIAL (10 to 20 Seconds)

The pilot has been ignited and proved.

Main burner indicator light is illuminated.

Main burner gas valve(s) and the normally open vent valve (if furnished) are energized from the flame safeguard control.

Gas flows to the proportioning mixer and mixes thoroughly with the combustion air. This mixture exits the main burner nozzles, crossing the pilot flames, and is ignited.

If the boiler is 50 horsepower or smaller, the main flame ignition trial is ended.

If the boiler is 60 horsepower or above, the flame rod switching relay will be energized after ten seconds. This will switch flame supervision from the pilot flame proving electrode to the main flame proving electrode. The main flame proving electrode proves the presence of the main burner flame to the flame safeguard control through the flame safeguard amplifier.

RUN PERIOD

Burner operates until load demand is satisfied or safety interlock(s) open.

If burner is supplied with MP control circuit, the run period is extended by an adjustable time interval in the following sequence:

1. Operating control opens signaling demand satisfied. Call for heat indicator light is de-energized.
2. The downstream main burner gas valve closes. Main burner indicator light is de-energized.
3. MP control timer begins timing cycle. Blower motor and pilots remain on.
4. If operating control closes (contacts made) during the timing cycle, the call for heat indicator light is re-energized, the downstream main burner gas valve re-opens allowing main burner to re-light, and the main burner indicator light is re-energized.
5. If timing cycle is completed before operating temperature control closes (contacts made), the run period ends. The upstream main burner gas valve, the normally open vent valve, the pilot valve, and the ignition transformer are de-energized. The pilot indicator light is de-energized and the boiler shuts down in a normal fashion.

POST PURGE PERIOD

The run period is over. The operating temperature control contacts are open and all gas valves and the ignition transformer are de-energized. All indicating lights are out.

The blower motor runs for 15 seconds then shuts off. The boiler is in standby waiting for the next call for heat.

Post purge also occurs after any safety control trip.

MAINTENANCE

GENERAL

The dependable and consistent operation of your Sellers boiler will be maintained as long as a careful maintenance schedule is followed. This section of the manual describes periodic inspection and maintenance requirements.

1. After the unit has been started and adjusted by your Sellers service representative, air settings, fuel pressures and temperatures should not be changed or tampered with by persons not thoroughly experienced with the burner and fuel system. Service calls required as a result of tampering or poor maintenance procedures are not covered by any service plan or warranty.
2. Keep the boiler, the burner, and the entire boiler room clean. Do not allow fuel or water to leak anywhere. A clean boiler room is essential to reliable boiler operation.
3. Keep the burner control cabinet door closed. The electrical contacts in the cabinet are very sensitive to dust and dirt.
4. Never close vents supplying air to the boiler room when firing the boiler. If cold air currents cause difficulty with other equipment, air ducts should be installed to direct the flow of fresh air.
5. Repair all leaks promptly. All piping connections to the boiler and all accessories should be maintained leak-free because even a minor leak, if neglected, may soon become serious. This applies especially to water level control piping and manhole and handhole gaskets. If serious leaks occur shut down the boiler immediately and reduce pressure. Close return and supply valves to isolate boiler if the system allows. Do not attempt to make repairs while boiler is under pressure or at a high temperature.

DAILY MAINTENANCE SCHEDULE

1. Make full inspection of the boiler room. Check piping and valves for leaks. Look for any abnormal condition in the operation of motors, pumps and controls.
2. When starting boiler in the morning, make sure ignition is established properly and burner goes through its starting cycle correctly. If boiler is in constant operation, recycle boiler at least once every twenty-four hours.
3. Check to be sure "cold" returns do not cause excessive condensation of flue gases. There should be no condensate drip from the rear boiler condensate drain except during start up of a cold boiler.
4. Check water level.
5. Check low water controls.
6. Check expansion tank to be sure it is not water logged.
7. Check boiler water temperature and pressure.
8. Check burner firing to be sure the flame and pattern are proper.
9. Check all gauges and instruments (if any) to ensure normal conditions.
10. Keep a record or **Boiler Log** of all activities and observations related to the boiler.

QUARTERY MAINTENANCE SCHEDULE

1. Dust electrical controls carefully and check starter contacts. Turn main disconnect switch off before attempting this work.
2. Check all electrical contacts. Dirty contacts can be cleaned using normal procedures and standard cleaning solutions. Badly burned or pitted contacts should be replaced.
3. Clean water strainers.
4. Lubricate motor bearings as per manufacturer's directions.
5. Check operation and alignment of circulation pump and motor. If the circulation pump is out of alignment, it will cause serious vibration and undue wear on pump and motor bearings.
6. Clean water traps and strainers in gas lines.
7. Clean and adjust ignition and flame proving electrodes. Make sure that position of electrodes is correct.
8. Check and clean air intake screens if necessary.
9. Test relief valve by lifting hand lever with the boiler at operating pressure. (Be sure hot water is safely discharged to the proper place so that neither personnel, electrical equipment, or other components are endangered.) This test helps keep the valve free of scale.

ANNUAL MAINTENANCE SCHEDULE

Complete quarterly maintenance schedule plus:

1. Remove safety relief valves for inspection and test. Repair or replace as required. (Only certified firms may repair safety valves.)
2. Inspect and clean all electrodes. Replace if necessary.
3. Check all electric motors and circuits.
4. Examine water pumps and lines.
5. Examine burner and controls. Check all safety controls such as the limit controls and low water cutoffs to be sure they work under operating conditions.
6. Check the boiler tubes. Remove heat extractors and clean the tubes with a flue brush, then vacuum.

NOTE: If there is soot build up in the boiler tubes, this is evidence of improper combustion.

7. Contact your Sellers Engineering Company representative and make arrangements for a combustion tune-up at least once a year. Fuel is expensive. A properly tuned boiler will deliver optimum efficiency.
8. Check and clean air intake screens if necessary.
9. Open the front door of the boiler and inspect the pilot assembly and the main burner nozzles for any evidence of dirt, debris or clogging. Thoroughly clean the burner by blowing out all of the nozzles with compressed air or brushing out the nozzles and nipples with a small diameter brush. This is important in preventing dust, dirt or debris from clogging the nipple inlets and causing unsafe conditions. Replace the front door tadpole gasket, rear door flat gasket, and adjustment opening gaskets if needed.
10. Inspect the front and rear tube sheets and tubes. If any evidence of leakage is

found, contact a qualified boiler repair company to repair the pressure vessel leaks. Clean and repaint the heads if any corrosion is evident.

Hot water boilers in a “tight” closed loop system with little makeup should not be opened except for required service or inspection. A “tight” closed loop boiler and system prohibit the introduction of fresh water containing oxygen and impurities which can cause rusting and scaling in the boiler. Local codes or insurance inspectors may require opening and draining for inspection. If this is required, the boiler should be opened and prepared for inspection in the following manner:

1. Allow the boiler to cool and drain completely of water. Remove all handhole and manhole plates and flush out the boiler thoroughly using a high pressure hose. Place the hose through the top and bottom openings to make sure all loose scale and sediment are washed out of the shell. Remove plug from cross connection below water column and clean out line into the boiler. Remove the float assembly and clean out bowl of float type low water cutoff assemblies.
2. After washing out the boiler, the heating surface should be thoroughly examined for signs of corrosion, pitting or scale. Signs of any of these three conditions indicate the need for improved boiler water treatment. See "Water Treatment/Water Quality" section in this manual.
3. New handhole, manhole, and low water cutoff float gaskets should be installed when closing up the boiler.
4. To put the boiler back in service, refill the boiler with water and treatment, if required. Raise water temperature slowly and tighten up on all manhole and handhole plates with a wrench while boiler is warming up.

WATER TREATMENT / WATER QUALITY

Proper water treatment is one of the most important aspects of good boiler operating practice. **Failure to properly treat the water in the boiler will result in shortened life, excessive down time, and expensive repairs.** Secure the services of an experienced and reliable water treatment specialist. Work with the water treatment specialist to develop a program for the boiler that meets the unique needs of the installation. Understand this program and its objectives thoroughly and keep detailed records.

Water contains contaminants that are harmful to boilers. This manual will identify the two most common problems encountered in boilers as a result of contaminants. This by no means indicates that there are not other potential problems to be addressed. This is the reason for securing the services of an experienced professional to identify water treatment needs.

Water contains scaling agents (calcium and magnesium salts). The amount of scaling agents contained in water is referred to as hardness. These salts will come out of solution as water comes in contact with heating surface and will coat that heating surface. This coating is referred to as **scale**. This **scale** is an excellent insulator. It will prevent the free transfer of heat from the fireside of the boiler to the water. This in turn will overheat the boiler metal and this overheated metal can and will crack. This

overheating will also cause the mechanically expanded and sealed tube joints to loosen, lose their mechanical bond, and leak. **Scale** buildup in boilers will also result in inefficient operation as a result of the insulating affect. The stack gas exit temperature will be elevated because the heat transfer is impeded. **Scale** buildup in boilers must be prevented.

Water contains dissolved gases. The most dangerous of these is dissolved oxygen. Dissolved oxygen in the boiler water is very corrosive. This dissolved oxygen causes **pitting** of the metal surfaces in the boiler. **Pitting** is the appearance of small craters that turn into holes. This is most common on the firetubes of the boiler. The **pitting** action is accelerated at higher temperatures. **Pitting** will result in downtime and expensive repairs. **Pitting** of boiler metal must be prevented.

A good water treatment program will address the following:

- Elimination of dissolved gases
- Corrosion protection
- Elimination and prevention of scale or other deposits
- Prevention of embrittlement

With a properly implemented water treatment program the number of nuisance problems encountered will be reduced, and the boiler will retain its peak efficiency.

TROUBLESHOOTING

Sellers' boilers are completely assembled and fire tested prior to shipment. The previous sections of this manual provide information regarding the proper installation, startup, operation and maintenance of the boiler as well as detailed descriptions of the parts included on the boiler. This section of the manual will provide information about typical problems encountered with boilers and control systems. **This information is intended for use by experienced burner and boiler service technicians. If you are experiencing difficulty with your boiler, it is important to secure the services of an experienced technician with the proper tools and instruments to troubleshoot the problem.**

All Sellers boilers are controlled automatically by the flame safeguard control system. The flame safeguard control systems are generally supplied by either Honeywell or Fireye. Each follows the same basic sequence of operation. This is described in the section of the manual titled "Sequence of Operation". Understanding the sequence of operation is critically important in troubleshooting. This section of the manual will be set up to reflect the sequence of operation.

Many modern flame safeguard controls are equipped with diagnostic features that will identify common problems and specifically identify many failures. Use these tools if available. This will save time and effort.

STARTING OR PRE-PURGE PROBLEMS

BOILER WILL NOT START (no call for heat)

- Check the electric supply to be certain that the voltage is proper. Correct if improper.
- Check for loose wires or blown fuses. Tighten or replace as needed.
- Check the water level in the boiler and the gas supply. Correct as needed.
- Check all manual reset controls to be certain they have not tripped and are locked out. Reset as needed. If lockout persists, identify and correct the cause of the lockout.
- Check the limits circuit of the boiler. The limits circuit contains contacts for the low water cutoff(s), the high temperature limit control, the low gas pressure switch, the high gas pressure switch and the operating temperature control. The voltage at each of these contacts, if properly made, should be 120V. If the proper voltage is not present, identify the switch that is open and check for the appropriate conditions. Correct the problem or replace the switch if faulty.
- Check voltage at the MP timer (if supplied). If a proper call for heat signal is being transmitted from the limits circuit, the MP timer terminal #1 should read 120V. The same voltage should be present at terminals #4 & #5. The call for heat signal is transmitted to the flame safeguard control from MP terminal #5. If the MP timer is not re-setting on a call for heat it may need to be replaced.
- Check the boiler wiring for any connections made but not shown on the wiring diagram. Often wiring is altered or added in the field. This may consist of remote switches or contacts tied into the limits circuit of the boiler. If such alterations are

found, contact the installer and identify the nature and purpose of the change before proceeding. Correct any problems in these circuits as needed.
- Check for the presence of a flame in the combustion chamber.

BOILER WILL NOT START (call for heat, but no action)

- Check the pre-ignition interlock circuit (gas valve proof of closure switch). The voltage through the proof of closure switch should be 120V. If the proof of closure switch is open, leak test the valve and repair or replace as needed.
- Check the flame safeguard control blower motor starter terminal and the motor starter coil terminal. They should read 120V. If there is no voltage the flame safeguard control may be damaged or defective. Replace as needed.
- Check the reset on the motor starter. Reset as needed.
- Check the boiler wiring for any connections made but not shown on the wiring diagram. Often wiring is altered or added in the field. This may consist of remote switches or contracts tied into the limits circuit of the boiler. If such alterations are found, contact the installer and identify the nature and purpose of the change before proceeding. Correct any problems in these circuits as needed.
- Check for the presence of a flame in the combustion chamber.

BOILER WILL NOT START (blower starts but shuts down in a few seconds or enters a purge hold)

- Check the Lockout interlock circuit. This circuit typically contains the air flow proving switch and the instantaneous contacts on the motor starter. This circuit must close within 7.5 seconds after the beginning of the pre-purge period. Check the air pressure. Check the blower rotation. Check the set point of the switch. Repair, replace, or reset as needed.
- Check the boiler wiring for any connections made but not shown on the wiring diagram. Often wiring is altered or added in the field. This may consist of remote switches or contracts tied into the lockout interlock circuit of the boiler. If such alterations are found, contact the installer and identify the nature and purpose of the change before proceeding. Correct any problems in these circuits as needed.

BOILER WILL NOT START (blower starts but shuts down after 7.5 seconds but before pilot ignition trial)

- Check the Lockout interlock circuit. This circuit typically contains the air flow proving switch and the instantaneous contacts on the motor starter. This circuit must close within 7.5 seconds after the beginning of the pre-purge period. Check the air pressure. Check the blower rotation. Check the set point of the switch. Repair, replace, or reset as needed.
- Check the boiler wiring for any connections made but not shown on the wiring diagram. Often wiring is altered or added in the field. This may consist of remote switches or contracts tied into the lockout interlock circuit of the boiler. If such alterations are found, contact the installer and identify the nature and purpose of the change before proceeding. Correct any problems in these circuits as needed.

PILOT IGNITION TRIAL PROBLEMS

BOILER WILL NOT START (pre-purge completed but no pilot during trial for ignition)

- Check the wiring and voltage on the ignition transformer and pilot valve terminals. Repair as needed.
- Check the position of the ignition electrode. The end of the ignition electrode should be positioned directly over the runner pilot ports between two of the main burner nozzles. The gap between the end of the electrode and the pilot is called the spark gap. This spark gap should be 3/32" minimum to 1/8" maximum. Reset, replace or clean as needed.
- Check the ignition electrode insulator for cracks or dirt. Replace or clean as needed.
- Check the ignition transformer. With the proper spark gap it should produce a stable spark with 120V on the primary side and 6000V on the secondary side. Replace as needed.
- Check the pilot gas pressure downstream of the solenoid valve(s). The pressure should match the pressure listed on the startup report. If the pressure is low, adjust the pilot regulator. If there is no pressure or no gas, replace the pilot solenoid valve(s).

BOILER WILL NOT START (spark and pilot flame present but, not proven or sluggish)

- Check the pilot gas pressure downstream of the solenoid valve(s). The pressure should match the pressure listed on the startup report. If the pressure is low, adjust the pilot regulator.
- Check timing of the pilot flashing. The pilot must travel (flash) across and down the pilot assembly in no more than ten seconds. If the pilot is reaching the flame proving electrode in less than ten seconds, but the pilot is not proved at the flame safeguard control, check the position of the flame proving electrode. The flame proving electrode should be positioned directly over the drilled flame ports of the runner pilot proving leg. The flame rod should be 3/8" minimum and 1/2" maximum above the pilot proving leg. Reposition, replace or clean as needed.
- If the pilot is reaching the flame proving electrode in less than ten seconds, but the pilot is not proved at the flame safeguard control, the insulator could be cracked or dirty. Replace or clean as needed.
- If the pilot is reaching the flame proving electrode in less than ten seconds, but the pilot is not proved at the flame safeguard control, the flame amplifier on the flame safeguard control could be faulty. Replace as needed.
- If the pilot is not reaching the flame proving electrode in less than ten seconds, the pilots could be dirty or the pilot gas pressure could be low. Inspect the pilot runners and vertical flashers for rust, dirt, or other contamination. If they need to be cleaned, remove the pilots and drill the holes with a #53 drill bit. If the gas pressure is low, adjust the pressure at the pilot gas pressure regulator.
- If the pilot is not reaching the flame proving electrode in less than ten seconds, the secondary air pressure may be out of adjustment. Remove the hexagonal cap(s) on the secondary air adjustments and loosen the lock nuts. Increase or decrease the

secondary air one quarter turn per adjustment (some boilers have two) and try to light the pilots again. Once a suitable setting is reached, tighten the lock nuts and replace the hexagonal cap(s).

MAIN FLAME IGITION TRIAL PROBLEMS

BOILER WILL NOT START (pilot is established, but main burner will not ignite)

- Check the wiring and voltage on the main safety gas valve terminals. Repair as needed.
- Check the main gas pressure downstream of the main safety gas valve(s). The pressure should match the pressure listed on the startup report. If the pressure is low, refer to main burner adjustment instructions in the “initial startup and adjustments” portion of the “preparing for operation” section of this manual. If there is no main gas flow when the valves open, identify the faulty valve and repair or replace as needed.

BOILER WILL NOT START (pilot is established, but main burner will not ignite smoothly or pulsates)

- Check the main gas pressure downstream of the main safety gas valve(s). The pressure should match the pressure listed on the startup report. If the pressure is low, refer to main burner adjustment instructions in the “Initial Startup and Adjustments” portion of the “Preparing for Operation” section of this manual.
- Check the stack configuration and draft. If the draft is improper, correct the stack design or installation. If multiple boilers are connected to a single common breeching, it is absolutely essential that the turns are smooth, that sizing is generous, and that the connections to the boiler do not set up pulsation or resonance.
- Check the main burner nozzles for clogging of the retention rings or slots. Clean or replace as needed. Also check the burner nipples by shining a small light back into nipple toward the mixed manifold. **Do not operate boilers with clogged or dirty nozzles.**

OPERATING PROBLEMS

BOILER STARTS BUT OPERATION IS INTERRUPTED

- Check all safety controls. If any controls have tripped and require manual reset, determine cause of the trip. Do not simply change the setpoint of the control to a less safe operating value.
- Check the boiler wiring for any connections made but not shown on the wiring diagram. Often wiring is altered or added in the field. This may consist of remote switches or contracts tied into various places in the boiler control circuit. If such alterations are found, contact the installer and identify the nature and purpose of the change before proceeding. Correct any problems in these circuits as needed.

SELLERS

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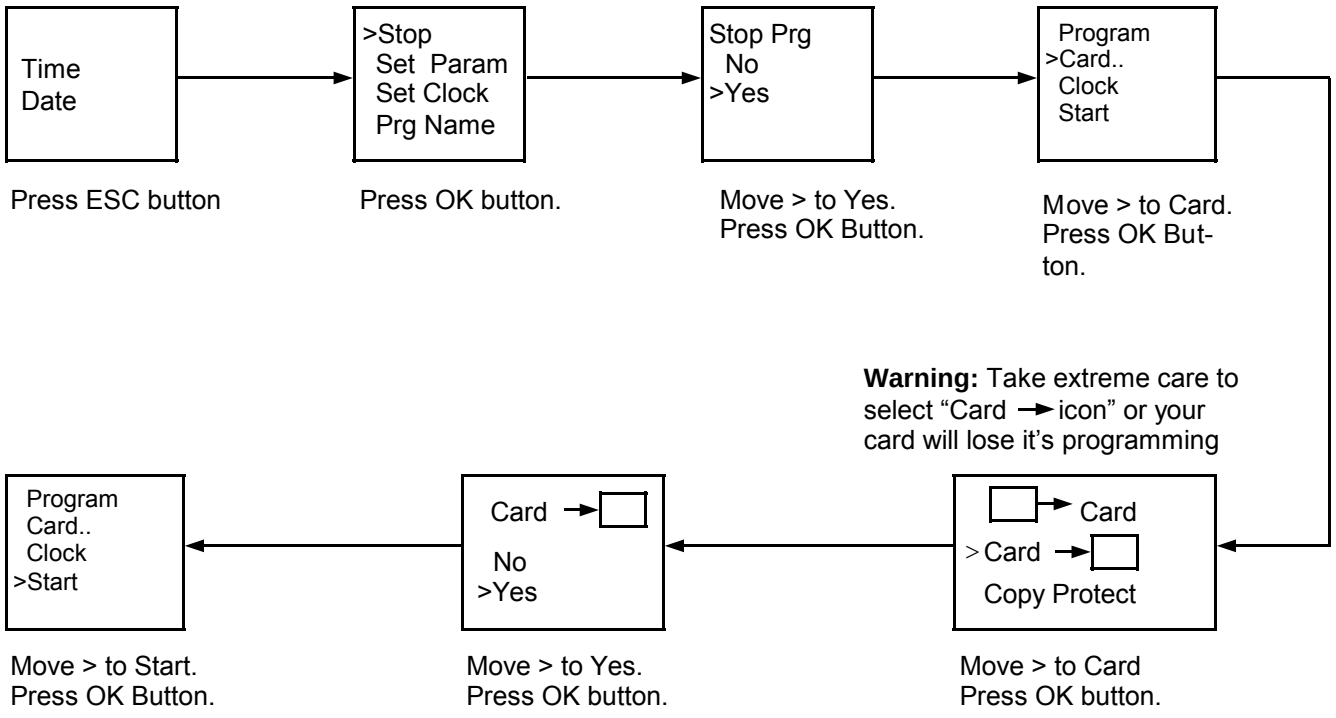
JANUARY 1, 2008

PLSC CONTROL CIRCUIT FOR IMMERSION FIRED PRODUCTS

PROGRAMMING THE SIEMENS PLSC TIMER USING THE MEMORY CARD

The PLSC Timer for the Immersion fired products, if provided, will ship pre-programmed with PLSC timing sequence set at one minute. If the timer must be re-programmed for any reason then a memory card will be required. This can be provided by the factory. Using a small flat head screwdriver, remove the dust cover from the top right hand corner of the timer. Insert the memory card . Use the following instructions to re-program the timer:



If you experience any difficulties, please consult the factory.

Sellers ENGINEERING COMPANY
P.O. Box 48 · Danville, Kentucky 40423-0048
Phone: 859/236-3181
Web-site: sellersengineering.com

SELLERS

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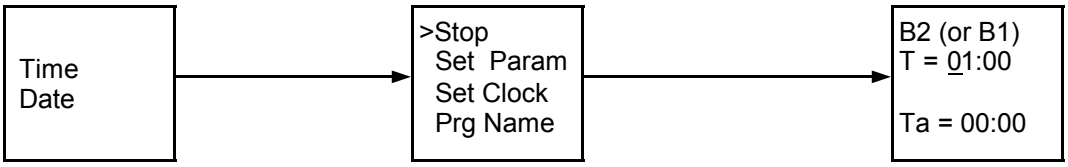
PLSC CONTROL CIRCUIT FOR IMMERSION FIRED PRODUCTS

ADJUSTING THE TIMER SET-POINT FOR SIEMENS PLSC TIMER

The PSLC Timer for the Immersion fired products, if provided, will ship with the PLSC timing sequence set at one minute. This is an adjustable time period and can be changed at any time. The following instructions describe how to change this set-point.



Press ESC button

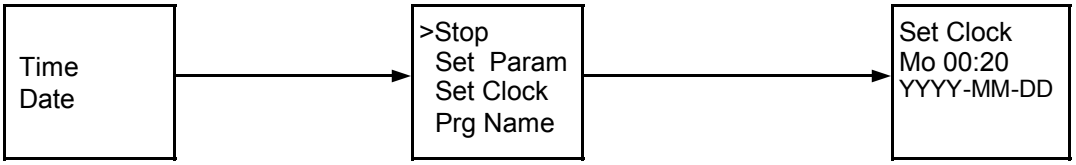
Press Down arrow to move > to Set Param. Press OK button.

Press OK button. Use Arrows to Change Time. Press OK Button. Press ESC Button Twice.

CAUTION: DO NOT ALTER THE VALUES FOR B3 OR B4.

SETTING THE CLOCK FOR SIEMENS PLSC TIMER

(This is not required for proper operation of Timer)



Press ESC button

Press Down arrow to move > to Set Clock. Press OK button.

Use Arrows to Change Time. Press OK Button. Press ESC Button.

Please consult the factory if you experience problems with the timer. If the programming accidentally get changed it can be reset with the use of a memory chip that can be supplied by the factory to restore the unit to factory settings.

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