



PRECISION BOILERS

Installation and Operating Instruction

FIRED STEAM BOILER

Model FPS

With

Power Burners

FOR YOUR SAFETY

This product must be installed and serviced by a professional service technician or gas/oil supplier, qualified in steam boiler installation. Improper installation and/or operation could cause serious injury or death. Improper installation and/or operation will void the warranty. Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

WARNING

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Read the manual thoroughly. For assistance or additional information consult a qualified installer, service agency or the gas/oil supplier.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

IMPORTANT

These instructions Are Intended as a Guide for the Installing Contractor and as a Reference for the Operator, Owner and Serviceman

RETAIN THESE INSTRUCTIONS NEAR THE EQUIPMENT FOR READY REFERENCE

The instructions contained in this manual are intended as a guide only and do not supplant any National, State or Local Codes.

This unit must be installed in accordance with those installation regulations in force in the local area where the installation is to be made. Local regulations shall be carefully followed in all cases. Authorities having jurisdiction shall be consulted before installation is made.

PRECISION has a commitment to product improvement and provides a continuing quest for the highest standards of product performance. In pursuing this policy of continuous development of products, the Manufacturer reserves the right to vary any details in this manual without notice.

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I. GENERAL INFORMATION

IMPORTANT WARNING

The Model FPS Boiler shall be installed according to the procedures detailed in this manual, or the PRECISION warranty may be voided. The installation must conform to the requirements of the local jurisdiction having authority, and to the latest edition of the National Fuel Gas Code, ANSI Z223.1. Any modifications to the Boiler or its gas/oil controls may void the warranty. If field conditions require modifications, consult the Factory.

A. INTRODUCTION

This manual supplies information on the application, installation and operation of Model FPS – (Firetube) Steam Boiler. Review all application and installation procedures completely before proceeding with the installation. Consult the PRECISION Factory, or local Factory Representative, with any problems or questions regarding this equipment. Experience has shown that improper installation causes most operating problems. The FPS models are offered in the basic configuration shown in Figure 1 and Table 1.

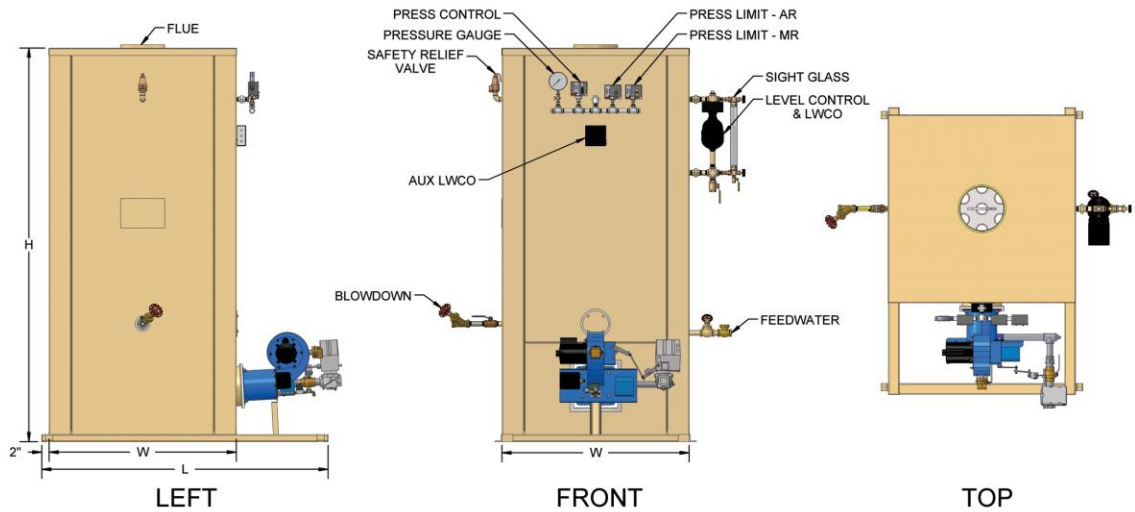
B. WARRANTY

PRECISION Fired Steam Boilers are covered by a limited warranty. A copy of the warranty is included in the back of this manual. Make all warranty claims to an authorized PRECISION Representative or directly to the Factory. Claims must include the unit serial number, model number (per the name plate) and installation date. Shipping and labor costs are not included in the warranty coverage.

Some accessory items may be shipped in separate packages. Verify receipt of all packages listed on the packing slip. Inspect everything for damage immediately upon delivery, and advise the carrier of any shortages or damage. File any such claims with the carrier. The carrier, not the shipper, is responsible for shortages and damage to the shipment, whether visible or concealed.

C. ENGINEERING ASSISTANCE

Consult the Representative or Factory regarding any questions or problems which may come up involving the specification, installation or operation of PRECISION equipment. An experienced engineering staff is ready to assist in assuring their proper application and performance.



NOTE: MINIMUM OF 18" CLEARANCE AROUND BOILER.

MODEL NUMBER	NOM BOILER HP	RATED INPUT MBTU	NOM OUTPUT PPH*	VESSEL DIMS (IN.)		WATER VOL** (GAL)	OVERALL DIMENSIONS (IN.)			CONNECTIONS (NPT)				FLUE SIZE	BURNER BLOWER HP (GAS)		
				DIA	HEIGHT		W	L**	H	FEED		BLOWDOWN				STEAM OUTLET	
										WATER	15PSI	150PSI	15PSI			150PSI	15PSI
FPS-24-06	6	250	210	24	45	52	28	50	80	3/4"	1"	1"	1-1/2"	1"	6"	1/4	
FPS-24-09	9.5	400	330	24	54	64	28	50	91	3/4"	1"	1"	1-1/2"	1"	6"	1/4	
FPS-24-10	10	420	340	24	57	69	28	50	94	3/4"	1"	1"	1-1/2"	1"	6"	1/4	
FPS-31-15	15	630	520	31	48	88	35	57	85	3/4"	1"	1"	2"	1"	8"	1/4	
FPS-31-20	20	840	690	31	60	117	35	57	97	3/4"	1"	1"	2"	1"	8"	1/3	
FPS-39-20	20	840	690	39	45	128	43	65	80	3/4"	1"	1"	2-1/2"	1-1/4"	8"	1/3	
FPS-39-25	25	1,050	880	39	52	156	43	65	89	3/4"	1"	1"	2-1/2"	1-1/4"	10"	1/3	
FPS-39-30	30	1,260	1,030	39	60	188	43	65	97	3/4"	1"	1"	3"	1-1/2"	10"	1/3	
FPS-46-35	35	1,470	1,210	46	48	196	50	76	83	3/4"	1-1/4"	1"	3"	1-1/2"	12"	1/3	
FPS-46-40	40	1,674	1,370	46	52	218	50	76	89	3/4"	1-1/4"	1"	3"	1-1/2"	12"	1/3	
FPS-58-50	50	2,110	1,730	58	52	275	62	88	87	1"	1-1/4"	1"	4" FF##	2"	14"	1/3	
FPS-58-60	60	2,500	2,050	58	60	332	62	96	95	1"	1-1/4"	1"	4" F	2"	14"	1	
FPS-58-72	72	3,000	2,460	58	64	336	62	96	101	1"	1-1/4"	1"	4" F	2"	14"	1	
FPS-62-72	72	3,000	2,460	62	56	319	66	106	91	1"	1-1/4"	1"	4" F	2"	14"	1	
FPS-62-84	84	3,500	2,870	62	64	378	66	106	101	1"	1-1/2"	1"	4" F	2-1/2"	16"	1-1/2#	
FPS-62-100	100	4,200	3,440	62	64	325	66	106	105	1"	1-1/2"	1"	6" F	3" F	16"	1-1/2#	

*From and At 212°F.

**Actual Operating; multiply by 1.3 to obtain approximate flooded volume

***Dependent on burner stick-out; Dimension given is for Power Flame burners

Indicates 3-phase blower (includes stepdown transformer for burner controls)

Indicates Flanged Connection (150#RF)

II. INSTALLATION

A. UNCRATING

1. Care must be given not to damage controls or to deform the unit's casing during remove of the crate.
2. When using pry bars or fork lifts, be certain to support the unit on the shipping skids or the channel base.
3. Storage – Electrical equipment can be damaged if exposed to adverse weather. The unit should be stored inside. The electrical panel and controls must be covered with plastic throughout all construction to avoid accumulation of dust and moisture on the controls and other components.

B. PLACEMENT

1. Provide a firm, level foundation for the unit. Standard fired units are not suitable for placement on combustible flooring.
2. Leave a permanent space of 18 inches on the sides and rear, and 24 inches on the front for burner maintenance.
3. Be sure to keep the burner and controls covered at all times while work is in progress.

CAUTION: DO NOT USE THE UNIT'S HOUSING TOP FOR SCAFFOLDING!!

C. PIPING CONNECTIONS

NOTE: Refer to applicable dimensionable drawing (DD) appended to this manual.

1. Boiler piping connections and valves **MUST** comply with state and local codes, in addition to compliance with ASME piping requirements.
2. Install the safety valve(s) on the connection(s) provided. Plumb the safety valve outlet full size to the floor drain for low pressure boilers, or to a safe point of discharge for high pressure boilers. When two or more valves are used, discharge lines may be manifolded provided unions are included for disassembly and the common discharge pipe size must be greater or equal in area to the total area of all safety valve outlets combined. Check local codes for proper safety valve discharge piping.
3. Connect the feedwater supply to the feedwater valve train as shown on the DD.
CAUTION: Do not oversize feedwater piping and valves on Steam Boilers, as this may result in severe pressure fluctuations during feedwater cycles if the fill rate is too rapid.

4. Pipe both the bottom blowdown, and surface blowoff (if provided) to a nearby drain (low pressure Boilers) or to a blowdown receiver (Boilers greater than 15 psi). Check compliance with local codes. Be sure to provide a low point drain to enable complete draining of the Boiler.

D. ELECTRICAL CONNECTIONS

CAUTION: The Boiler must be electronically grounded in accordance with the most recent edition of the National Electrical Code, ANSI/NFPA 70. Do not rely on the gas or water piping to ground the metal parts of the Boiler. The use of plastic pipe or dielectric unions may isolate the Boiler electrically. Service and maintenance personnel may be standing on wet floors and could be severely shocked by an ungrounded Boiler.

1. Check the Boiler wiring diagram (WD) for correct voltage, frequency, phase and amperage of the required branch circuit. The branch circuit must be protected by a properly sized circuit breaker or fused safety switch.
2. Electrically ground the unit per NEC and local code requirements using AWG #10 Cu wire minimum.
3. All field installed electrical safety devices and controls (draft switches, relays, timers, pressure reset devices, etc.) can be connected as shown in the wiring diagram designated "Field Interlock Provision".

E. FUEL CONNECTIONS

NOTE: Also refer to the burner literature supplied as an appendix to this manual relative to the actual burner supplied with your unit.

-GAS

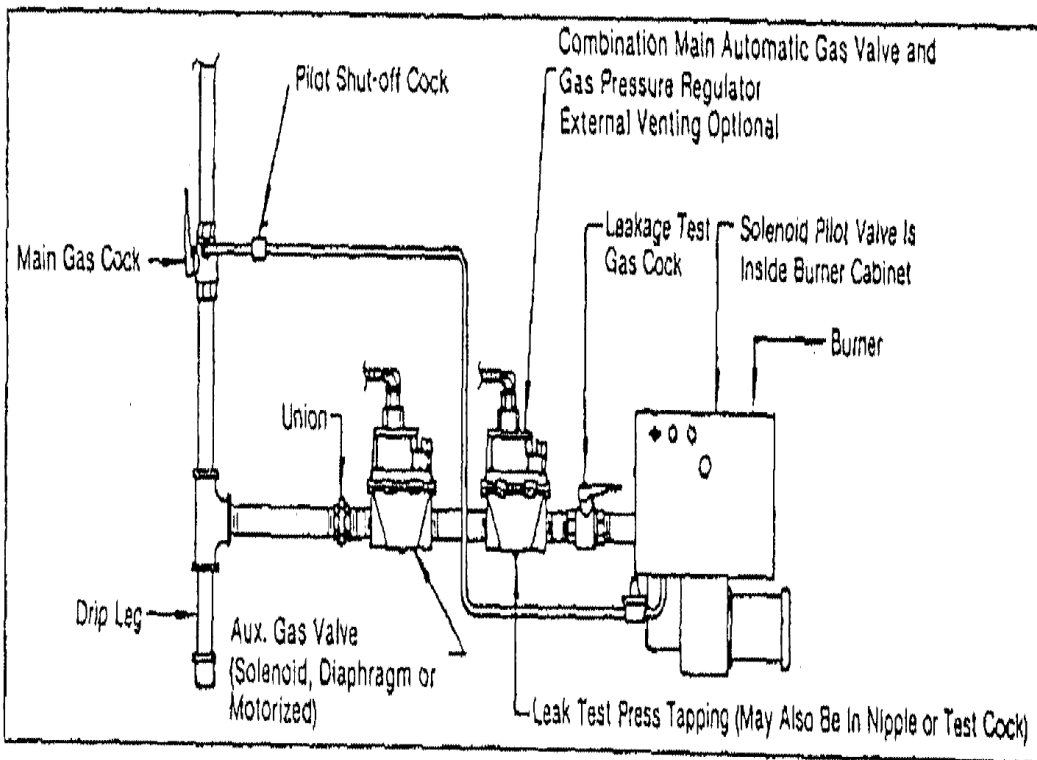
NOTE: Contact your local gas service company to assure that adequate gas service is available and to review applicable installation codes for your area. The gas line pressure should be in the range of 5-14 ins WC.

1. Size the main gas line in accordance with Table 2. The figures shown are for straight lengths of pipe at 0.2 ins. WC pressure drop, which is considered normal for low pressure systems. Note that fittings such as elbows and tees will add to the pipe pressure drop.
2. Refer to Figure 2 for details of gas piping. Mount any items of the gas train shipped loose as shown. Install the main gas cock with drop leg upstream of the regulator and automatic valves. The pilot line should be piped into the upstream tapping on the main gas train shut-off cock.

Gas Piping Pressure Drop Data

EQUIVALENT LENGTH OF STRAIGHT PIPE IN FEET									
	20	30	40	50	60	80	100	150	200
Pipe Size in Inches	CFH GAS WITH .2" PRESSURE DROP								
1"	300	250	210	190	180	150	135	110	75
1 ¼"	520	425	360	325	300	260	230	190	165
1 ½"	800	690	580	500	480	410	370	300	260
2"	1700	1400	1200	1100	1000	850	750	600	540
2 ½"	3000	2500	2100	1900	1800	1550	1375	1100	950
EQUIVALENT LENGTHS OF STANDARD PIPE IN FEET FOR LISTED FITTINGS									
Fitting Type	1	1 ¼	1 ½	2	2 ½	Nominal Pipe Size in Inches			
Std. Tee	5.5	7.5	9.0	12.0	13.5				
Std. Elbow	2.7	3.7	4.5	5.5	6.1				

FIGURE 2



NOTE: For ease of servicing we recommend the use of a union immediately upstream of the main gas pressure regulator or combination gas valve/pressure regulator.

3. Install vent lines from main gas regulator (if used) and (if applicable) diaphragm gas valve. Vent line should be run to the outside of the building, terminating clear of windows or fresh air intakes. Outside termination of vent should have a screen to prevent insects from building nests in vent pipe. The vent should terminate in a manner which will preclude the possibility of water, dirt or other matter from entering the line.
4. Test gas lines for leaks using soap solution. Your local gas service company may wish to carry out or witness this test.

CAUTION: Gas pressure above 14 ins. WC may damage the standard diaphragm gas shut-off valve. Do not exceed this value when pressure testing lines unless you cap off the line upstream of the main gas cock and pilot take-off.

-OIL

CAUTION: Most oil burners supplied on Model FPS and TPS units are designed for use with light grade fuel oils – commercial standard grades #1 or #2.

1. Prior to installation, it is recommended that all national, local and other applicable codes be reviewed to ensure total compliance.

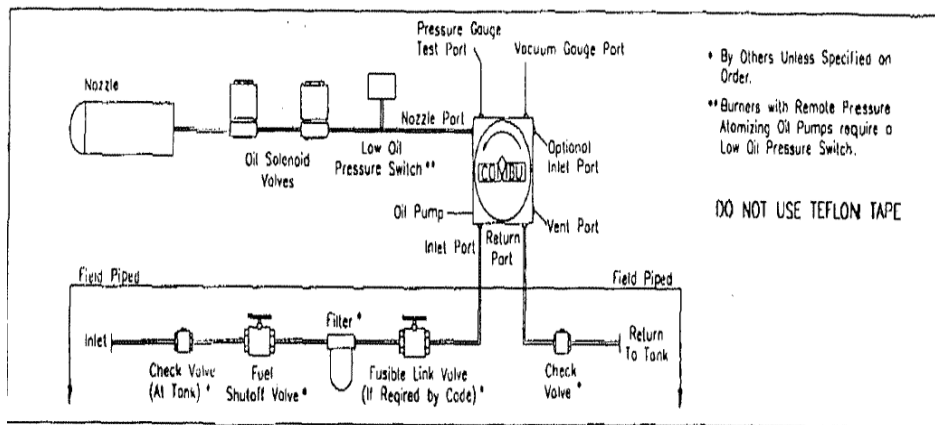
NOTE: A two pipe (separate suction and return line) system must always be used. The fuel pump is pre-set at the Factory for use only with a two pipe system. The pump warranty will be voided if a one pipe system is used with this burner. Rigid pipe connected directly to the pump may cause excessive vibration. It is recommended that the connection to the pump be of copper tubing, complete with vibration dampening loop, on both suction and return lines. **Do not use Teflon tape.** The pump warranty will be voided if Teflon tape is used.

2. Size the oil supply and return lines in accordance with the guidelines provided in the fuel pump instructions appended to this manual. It is very important to properly size the oil suction line and oil filter to provide fuel flow to the burner without exceeding 10" suction pressure (vacuum) at the oil pump suction port. Use copper tubing with flare fitting or iron pipe on all installations. Use ½" OD oil lines whenever possible. All units must utilize the proper size and type of suction line oil filters.

3. Refer to Figure 3 for details of oil piping. All field piped components must be mounted in the proper order as shown with the proper direction of oil flow.

FIGURE 3

Typical 2-Line Oil Supply Piping



CAUTION: Oil supply pressure to the burner oil pump must not exceed 3 psi per NFPA Codes.

NOTE: Do not install manual valves in the return line between the pump and the tank unless required by a specific code. If a manual valve is required, an automatic relief valve must be installed across the manual valve to ensure that oil will bypass directly back to the tank in the event the manual valve is inadvertently left in the closed position.

4. Before starting up the system, all appropriate air and oil leak tests should be performed. Make certain that the tank atmospheric vent line is unobstructed.

F. FLUE

CAUTION: Jurisdictional authority relating to venting/flue requirements vary widely. In order to make certain of compliance, the controlling authorities should be consulted.

1. Use positive pressure breeching material. Breeching should be short, straight and full size. Horizontal runs over 10' or over (2) elbows should be avoided. Runs should pitch upward at least 1" per foot.
2. A full size barometric damper should be installed in the breeching to regulate the drafts. After startup, check the damper and breeching by holding a match near the edge of the damper. A correct installation will pull the flame with the burner running.

G. COMBUSTION AIR

1. Provide fresh air to support combustion and to supply adequate location ventilation.

NOTE: All fuels require approximately 10 cubic feet of standard air (sea level at 60 degrees) per 1000 BTU's firing rate, for theoretical perfect combustion. In actual practice, a certain amount of excess air is required to ensure complete combustion, but this can vary substantially with specific job conditions. Additional air is lost from the boiler room through barometric dampers, draft diverters and similar venting devices. It is generally accepted that ½ square inch of free air opening (for each gas or oil burner in the room) per 1000 BTU/hr firing rate will be adequate.

2. After startup, test to assure a positive boiler room pressure with the Boiler operating at 100% input.

CAUTION: Under no circumstances should a boiler room be under negative pressure. If combustion air is ducted to the burner, make sure the duct size is adequate to assure proper burner operation.

III. START-UP

A. PRE-STARTUP CHECKS

1. Piping Connections

Are they complete and correct?

2. Pumps

Are the feed pumps functional?

Is the motor rotation correct?

3. Electrical

Is the branch circuit power supply as required per the burner name plate?
Is the unit properly grounded?

4. Combustion Air

Is adequate fresh combustion available?
Is the breeching/stack open and unobstructed?

5. Gas

Is the gas supply available?

6. Oil

Is there adequate amount of oil in the tank?
Is the oil the proper grade?

B. FILLING THE SYSTEM

1. The system and the Boiler should be thoroughly flushed before start up.
2. Operate water column and level control drain/blowdown valves to assure that these are thoroughly flushed and operate properly.
3. Before firing the unit, be sure the unit is filled to the proper water level.

C. CONTROL SETTINGS

1. Controller

This is the pressure sensing device which controls the operation of the burner. Set the controller for the desired steam pressure.

2. High Limits

Set the high limit auto reset control approximately 10% above the setting of the controller. Manual reset limits should be set approximately 5% above the auto reset limit, but should not be set higher than 95% of the safety valve set pressure.

3. Low Water Cut-Off

This limit is always Factory-set. If additional units are field installed, manual reset LWCO's should be positioned below the automatic reset limit.

D. BURNER

IMPORTANT: Read the burner O&M manual (Appendixed to this manual) thoroughly before attempting to start the burner.

CAUTION: Failure to properly follow the detailed start up instructions given in the burner O&M manual may result in an explosion which could cause property damage, injury, or loss of life.

1. Preparation for Start Up – All Fuels
 - a. Run an inspection of the tightness of all electrical connections and retighten as necessary. This tightness inspection is vital because vibration during shipment can often loosen electrical connections.
 - b. Set the burner control panel switch to the “OFF” position.
 - c. Turn the operating control down to its lowest setting.
 - d. Check fuses and replace as necessary.
 - e. Depress the flame safeguard programming control reset button.

2. Start Up
 - **GAS BURNER**
 - a. Manually open and close the main gas shut off cock, leak test cock and pilot cock to determine that they operate freely. Open all three cocks. (Reset low gas pressure switch if supplied).
 - b. Set the main power switch and burner panel control switch to the “ON” position. Wait 30 seconds and turn up the operating control to the desired setting.
 - c. The burner blower motor will start and after a suitable prepurge period (this will vary with the type of flame safeguard control supplied- but will usually be a minimum of 30 seconds to a maximum of 90 seconds) the burner pilot will light, after which the main flame will be established.
 - d. When burning gas on a Combination Gas/Oil unit that has a blower motor driven oil pump, open all oil line valves. Oil must circulate through the oil pump, even when burning gas.

 - **OIL BURNER**
 - a. Open all valves in oil lines
 - b. If pilot gas ignition system is supplied – open and close the pilot gas cock to determine that it is operating freely. Open the pilot gas cock.
 - c. Set the main power switch and burner panel control switch to the “ON” position. Wait 30 seconds and turn up the operating control to the desired setting.
 - d. The burner blower motor will start. Depending upon the type of flame safeguard system supplied, the fuel ignition system may energize within 1 or 2 seconds after the blower motor starts or could be as long as 90 seconds.

NOTE: For more detailed burner start-up information, refer to the burner literature supplied as an appendix to this manual relative to the actual burner supplied with your unit.

IV. OPERATION AND MAINTENANCE

A. OPERATION

1. When the operating controller calls for pressure, the burner blower motor will start and after a suitable prepurge period (30-90 seconds approximately) the burner pilot will light. (The unit performs its own safety check and opens the main valve only after the pilot is proven to be lit). The main flame is then established.
2. The operating controller will control to the desired steam pressure. The differential adjustment should be set at the highest value which will still provide acceptable steam pressure variation. Two pressure controllers are supplied on hi-lo fired units, and a proportional controller is supplied on modulating burners.
3. An automatic reset pressure limit is supplied as standard on all modulating units.
4. A manual reset high limit is provided as standard equipment on all units. The burner will automatically shut down whenever an over pressure condition occurs.
5. A manual reset low water cutoff is also provided as standard equipment on all units. The low water cutoff automatically shuts off the burner whenever the water level drops below the Factory set level in the upper part of the tank.

NOTE: Warranty does not cover any damage caused by lack of required maintenance or improper operating practices.

B. MAINTENANCE

1. At startup and at least every six months thereafter, the pilot and main burner flame should be observed for proper performance. (Refer to burner literature supplied with this manual for detailed information).
2. Inspect the venting system for obstruction, leakage, and corrosion at least once per year.
3. Keep Boiler area clean and free from combustible material, gasoline and other flammable vapors and liquids.
4. Be certain all combustion air and ventilation openings are unobstructed.
5. The gas and electric controls installed on these Boilers are engineered for both dependable operation and long life, but the safety of this equipment completely depends on their proper functioning. It is strongly recommended that the basic

items be checked yearly by a competent service person and replaced as necessary.

The basic controls are:

- a. Operating Control
 - b. Pilot Safety System
 - c. Automatic Electric Gas/Oil Valve(s)
 - d. Limit Controls
6. Low water cutoffs should be inspected every six months, including cleaning probes and flushing floats.
 7. Firebox inspections can be made by removing the burner. If repairs are required, the entire firebox can be withdrawn from beneath the pressure vessel by use of the (3) jacking eyes attached to the vessel's lower flange.