Fulton Pulse PHP/PLP Horizontal Steam Boilers

Installation, Operation and Maintenance Manual

Serial # _____

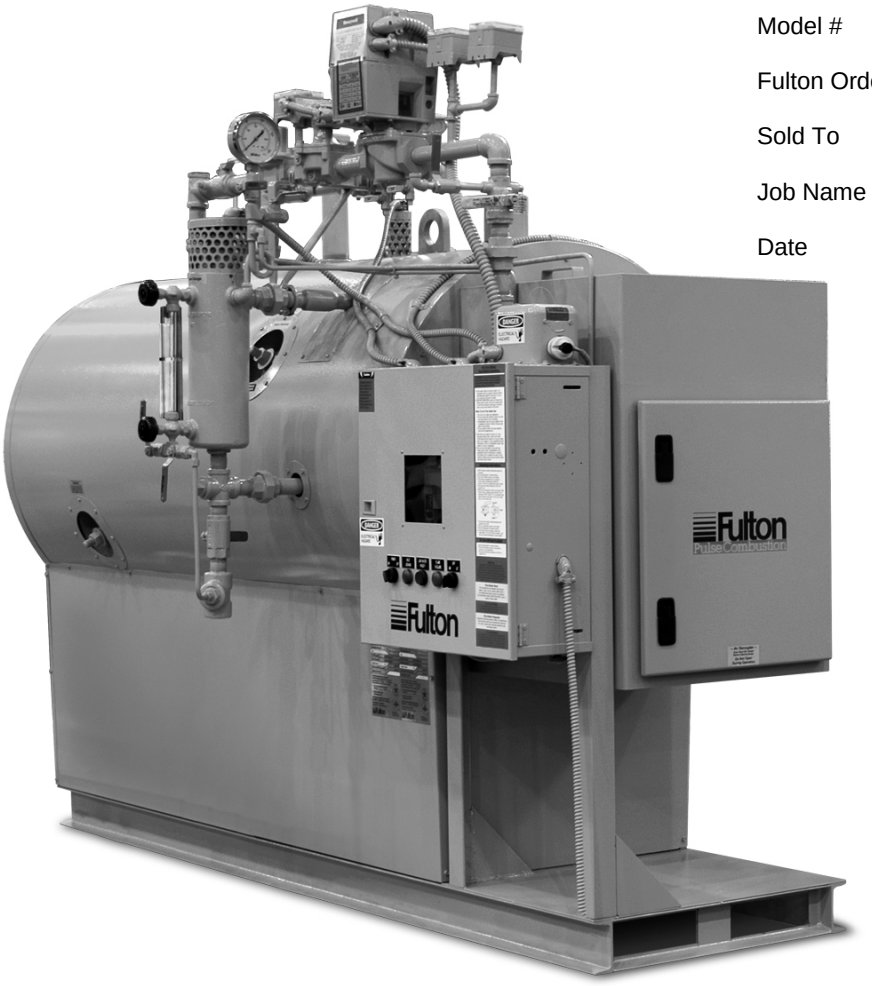
Model # _____

Fulton Order # _____

Sold To _____

Job Name _____

Date _____



PHP Series
500,000/650,000/700,000
BTU/hr

PLP Series
500,000/650,000/750,000
BTU/hr

Fulton Heating Solutions, Inc.
972 Centerville Road
Pulaski, NY 13142
Telephone: (315) 298-5121
Facsimile: (315) 298-6390
www.fulton.com

Fulton Pulse
Horizontal Steam Boilers

Built & Stamped to ASME Code

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliances.

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.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

The application of the pulse combustion principle illustrates how fresh perceptions and changing needs can breathe new life into an old idea. The oldest patents related to this method of burning fuel in a resonating system were issued before the end of the 19th century.

Today...advanced pulse technology has finally found and proven its way to the heating boiler industry.

Fulton has brought pulse combustion applications out of the residential and light commercial application to larger commercial/industrial heating uses.

Benefits of Gas Pulse Combustion:

Reliability
Flame sensing by flame rod, no constant blower required.

Durability
These new boilers are constructed to ASME Code. The design compensates for expansion and contraction, which cause other boilers to eventually leak or fail.

No Expensive Chimney Needed
The pulse combustion burner is self-venting through an AL29-4C stainless steel vent. Sidewall venting does not require a draft inducing fan.

Highest Efficiency Possible
Boiler efficiency is up to 86% with modulation.

Simple Reliable Spark Plug Ignition
No pilot or complex start sequence. Only a small assist starting fan is required. Following ignition this is shut off so there is no continuous electrical usage.

Gas and Pulse Combustion
Our country's most abundant natural resource...gas... combined with modern-day pulse combustion is the cleanest most efficient combination for commercial/industrial applications today.

Table of Contents

Section 1

Section 1 – Safety Warnings & Precautions

For Your Safety

The following **WARNINGS**, **CAUTIONS** and **NOTES** appear in various chapters of this manual. They are repeated on these safety summary pages as an example and for emphasis.

- **WARNINGS** must be observed to prevent serious injury or death to personnel.
- **CAUTIONS** must be observed to prevent damage or destruction of equipment or loss of operating effectiveness.
- **NOTES** must be observed for essential and effective operating procedures, conditions, and as a statement to be highlighted.

It is the responsibility and duty of all personnel involved in the operating and maintenance of this equipment to fully understand the **WARNINGS, CAUTIONS** and **NOTES** by which hazards are to be eliminated or reduced. Personnel must become familiar with all aspects of safety and equipment prior to operation or maintenance of the equipment.

Note

The boiler must not be installed on carpeting. Section 2.

Warning

The boiler shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service. Section 2.

Note

All pulse combustion boilers must be installed with vibration isolators. No pulse combustion boiler shall be lagged directly to the concrete floor due to the transfer of vibration. In the box of trim shipped with each pulse boiler, Fulton supplies 4 elastomer coated fiberglass cubes used for vibration isolation. For all non-critical installations these 3" x 3" x 2" cubes must be under each foot of the boiler. Flex connectors must be installed on the water inlet and outlet lines. For installations near "sensitive" areas such as offices, classrooms, or hospital rooms, spring mounts-which fit under the corner of each boiler-must be used instead of the cubes, and flex connectors must be installed on the water inlet and steam outlet lines. Flex connectors may be installed on the gas inlet if necessary. Spring loaded pipe hangers may be used on the air inlet, water inlet and outlet, and the flue gas outlet pipes, Contact your Fulton Representative for vibration isolation packages designed specifically for your application. Section 2.

Warning

The discharge from safety relief valve shall be so arranged that there will be no danger of scalding of personnel. Section 2.

Note

No shutoff of any kind shall be placed between the safety relief valve and the boiler or on the discharge pipe between such valve and the atmosphere. Doing so can cause an accidental explosion from over-pressure. Section 2.

Note

Intake PVC piping must be assembled using cement. This will ensure that the intake is air tight and will not allow contaminates from the boiler room into the boiler. Section 2.

Note

See table on Page 15 for required pipe size, based on overall length of pipe from meter plus equivalent length of all fittings. Approximate sizing may be based on 1 cubic foot of natural gas per 1,000 BTU/Hr. input. Section 2.

Note

Piping schematic consistent with the ANSI/ASME Boiler & Pressure Vessel Code Section IV. Section 2.

Caution

Some soaps used for leak testing are corrosive to certain types of metals. Rinse all piping thoroughly with clean water after leak check has been completed. Section 2.

Note

Do not use matches, candles, flame or other sources of ignition to check for gas leaks. Section 2.

Note

The vent line connection on the gas pressure regulator and the low and high gas pressure switches must be piped to outdoor air by installer in accordance with the National Fuel Gas Code. Section 2.

Warning

Do not attempt to start boiler to test wiring before filling and purging the boiler. A dry-fire will seriously damage the boiler and may result in property damage or personnel injury and is not covered by warranty. Section 2.

Warning

Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Proper ventilation should be maintained to reduce the hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes. Section 2.

Note

It is recommended that an authorized Fulton Pulse start up agent or your gas utility make any required gas input adjustments. Section 2.

Warning

If you do not follow these instructions exactly a fire or explosion may result causing property damage, personnel injury, or loss of life. Section 3.

Note

Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and/or gas control(s), which have been under water. Section 3.

Caution

Should overheating occur or the gas supply fails to shut off, shut off the gas supply at a location external to the boiler. Section 3.

Caution

The flame safety pressure switch in this unit has been pre-set at the factory. Do not attempt to change any settings. Section 3.

Caution

If the boiler is being operated automatically on a time clock, the blow down operation may be done at the end of the day. Section 4.

Note

If for any reason, the air intake or exhaust vent piping is disassembled, re-assemble the piping in accordance with the installation procedure outlined in the installation section of this manual. Section 4.

Note

Your Fulton Pulse Combustion Boiler has been designed for years of trouble-free performance. To ensure the continued safety and efficiency of the boiler, the schedule of maintenance outlined in this section should be adhered to. The boiler should be inspected annually. All service should be performed by a certified contractor. Section 4.

Warning

Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Section 4.

The following are copies of safety labels and warnings, which are affixed to the Fulton Pulse Combustion Boilers. They are reproduced here as a further safety precaution and as a reminder to quickly identify them on the boiler.

For Your Safety Read Before Operating

WARNING: If you not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

A. This boiler does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

What To Do If You Smell Gas

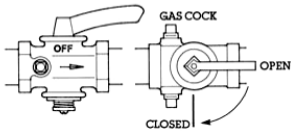
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control which has been under water.

Operating Instructions:

1. STOP: Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to boiler.
4. This boiler is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
5. Turn gas cock knob clockwise to OFF one quarter turn.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.



7. Turn gas cock knob counterclockwise one quarter turn to ON.
8. Turn on all electric power to the boiler.
9. Set the thermostat to the desired setting.
10. If the boiler will not operate, follow the instructions "To Turn Off Gas To Boiler" and call your service technician or gas supplier.

To Turn Off Gas To Boiler

1. Set the thermostat to the lowest setting.
2. Turn off all electric power to the boiler if service is to be performed.
3. Turn gas cock knob clockwise to OFF one quarter turn.

Warning

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. Refer to the user's information manual provided with this boiler. For assistance or additional information consult a qualified installer, service agency or the gas supplier.

This Boiler Must

Be installed in accordance with local codes, if any. If not, follow ANSI 223.1. In Canada this boiler must be installed in accordance with CAN/CGA B149.1 and .2 and/or local codes.

For Your Safety

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this boiler or any other appliance.

This Boiler Requires

A special venting system. Refer to installation instructions section in Installation Manual for roof or side wall venting methods and necessary parts.

This Unit Must

Be installed at a minimum clearance of 1 inch or more (on either side) to any combustible wall(s) and/or ceiling. This unit shall be installed in a space larger in comparison than the size of the boiler.

This Boiler is a Direct Vent Boiler for Installations on Non-Combustible Floors Only

Fulton Gas Fired Pulse Combustion Boiler

Type of Gas: ☐ Natural ☐ Propane

Boiler Model No.		
Boiler National Board No.		
Year		
Min. BTU Input/Hr.	Min. BTU Output/Hr.	
Max. BTU Input/Hr.	Max. BTU Output/Hr.	
Design Pressure	PSI	Pounds/Hr.
Mimimum Relief Valve Capacity:		Inches W.C.
Manifold Gas Pressure:		

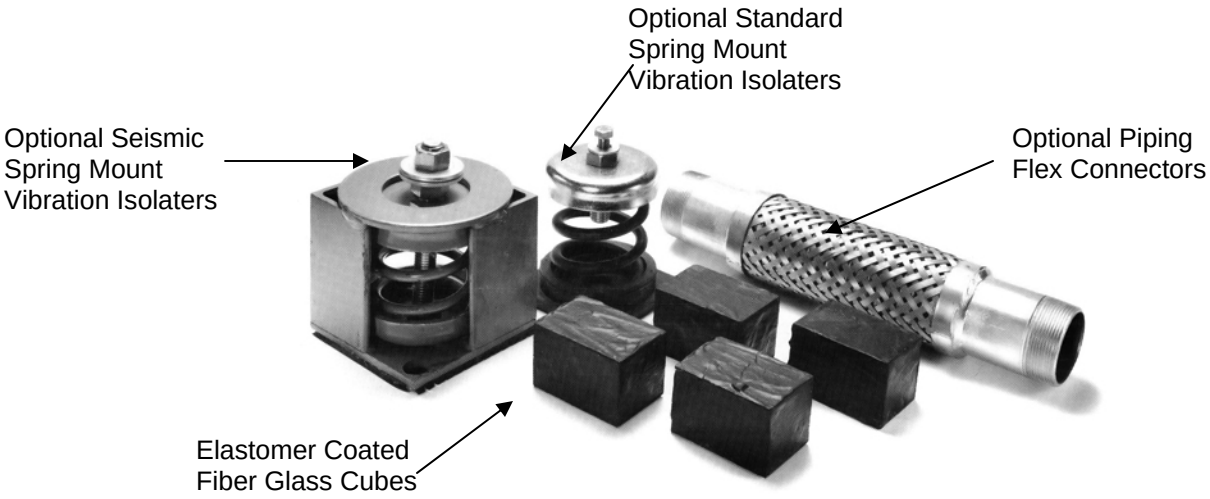
Maximum Gas Supply Pressure: 14 Inches W.C.
Minimum Permissible Gas Supply Pressure for Purpose of Input Adjustment: ☐ 7 Inches W.C. ☐ 11 Inches W.C.
Electrical Ratings: 120 Volts — 60 Hz Less than 12 Amps
ANS Z21.13b-1994 Low-Press. Boiler
CAN1.3.1-1977 Industrial & Commercial Gas-Fired Packaged Boilers
Minimum Wall Thickness Through Which Vent System May Be Installed. . . 3 1/4 Inches
Maximum Wall Thickness Through Which Vent System May be Installed. . . 20 Inches
Min. Clearance to Combustibles. . 1 Inch (Sides) . . 24 Inches (Front & Rear)

Fulton®

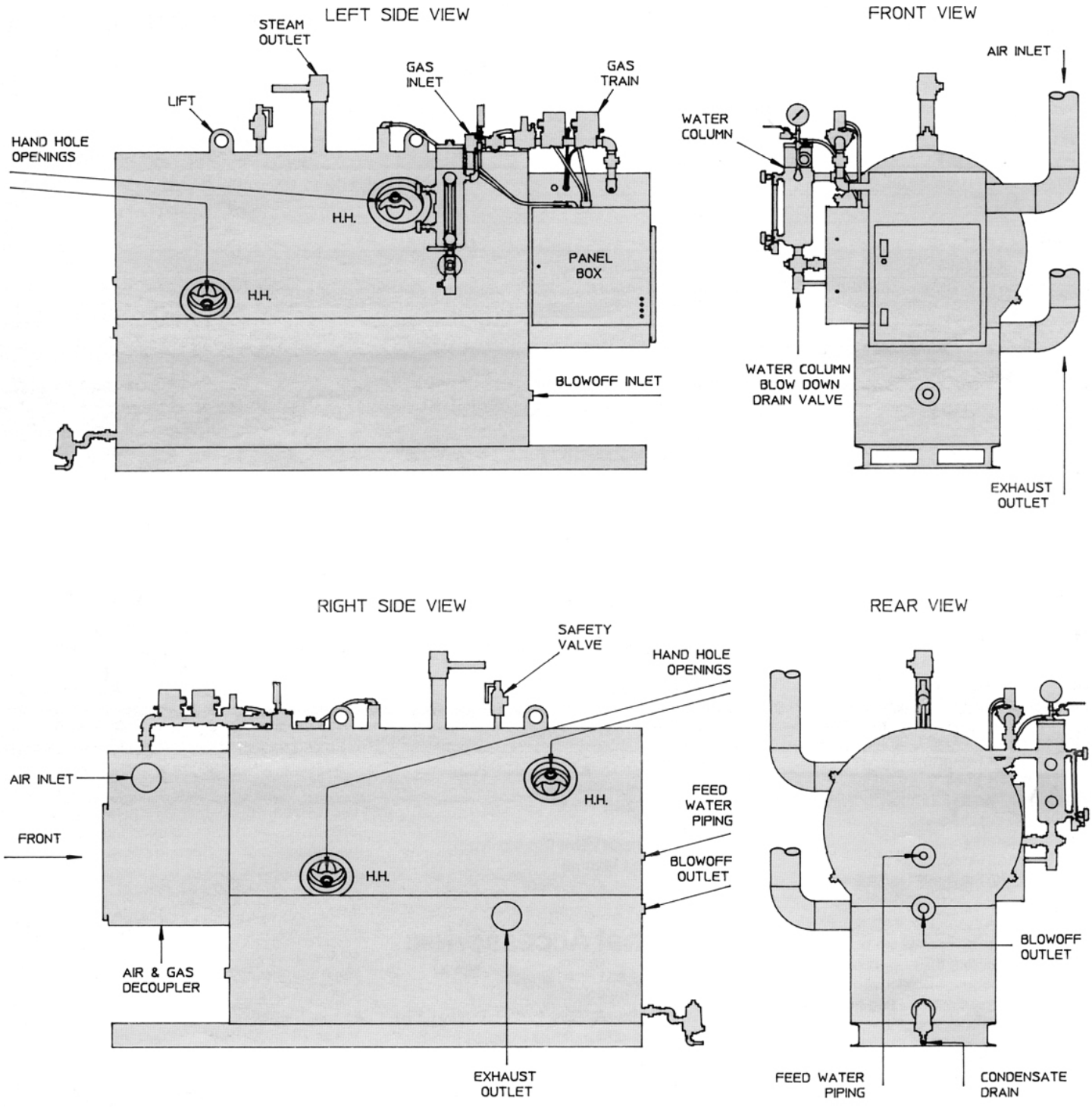
Manufactured by
The Fulton Companies
Pulaski, New York 13142

Section 2

Section 2 – Installation



Models	**PHP500 and FBP-012**	**PHP700 and FBP-017**	**PHP650 and FBP-016**	**PLP500**	**PLP750**	**PLP650**
BTU/HR. Input	500,000	700,000	650,000	500,000	750,000	650,000
Horsepower Output	12	17	16	13	19	16
Type of Gas	Natural gas	Natural gas	Propane	Natural gas	Natural gas	Propane
Approx. Dry Weight	2,370 lbs	2,370 lbs	2,370 lbs	2,370 lbs	2,370 lbs	2,370 lbs
Approx. Operating Weight	3,184 lbs	3,184 lbs	3,184 lbs	3,184 lbs	3,184 lbs	3,184 lbs
Floor Loading	206 lb/ft^2	206 lb/ft^2	206 lb/ft^2	206 lb/ft^2	206 lb/ft^2	206 lb/ft^2
Power Required	120/60/1	120/60/1	120/60/1	120/60/1	120/60/1	120/60/1
Max. Required Gas Pressure	7” W.C.	7” W.C.	7” W.C.	7” W.C.	7” W.C.	11” W.C.
Max. Amp Draw (FLA)	4.0	4.0	4.0	4.0	4.0	4.0
MAWP	150 PSI	150 PSI	150 PSI	15 PSI	15 PSI	15 PSI
Max. Width w/o Water Bottle	34 inches	34 inches	34 inches	34 inches	34 inches	34 inches
Max. Height	71 inches	71 inches	71 inches	68 inches	68 inches	68 inches
Length	91 ½ inches	91 ½ inches	91 ½ inches	91 ½ inches	91 ½ inches	91 ½ inches
Electric Boiler Equivalency	119 KW	164 KW	156 KW	119 KW	164 KW	156 KW


LEFT SIDE VIEW
STEAM OUTLET
LIFT
GAS INLET
GAS TRAIN
HAND HOLE OPENINGS
H.H.
H.H.
PANEL BOX
BLOWOFF INLET
FRONT VIEW
AIR INLET
WATER COLUMN
WATER COLUMN BLOW DOWN DRAIN VALVE
EXHAUST OUTLET
RIGHT SIDE VIEW
SAFETY VALVE
HAND HOLE OPENINGS
AIR INLET
FRONT
H.H.
H.H.
FEED WATER PIPING
BLOWOFF OUTLET
AIR & GAS DECOUPLER
EXHAUST OUTLET
REAR VIEW
BLOWOFF OUTLET
FEED WATER PIPING
CONDENSATE DRAIN

2. Introduction

a) The Fulton pulse combustion steam boiler is an automatic gas fired, direct vent boiler. This boiler utilizes the pulse combustion principle. It requires no conventional burner controls, no pilot and no chimney. The combustion components are of integral design with the heat exchanger. For combustion, the boiler uses 100% outside air supplied through schedule 40 PVC pipe. The products of combustion are vented outdoors through non-corrosive venting materials, which will withstand 480°F (249°C) temperatures. These pipes can be routed either through a roof or through the side wall of a building.

b) This Fulton Steam Boiler is designed for use in a closed loop (>75% condensate return) steam application.

c) Each boiler is built to ASME and CSD-1 Codes, hydrostatically tested, test fired, and shipped as a complete packaged unit. Gas, water, and electrical connections are similar to conventional boilers.

d) All installations must be in accordance with the American National Standard “National Fuel Gas Code,” latest edition, and with the requirements of local utilities or other authorities having jurisdiction. Such applicable requirements take precedence over the general instructions herein.

e) Since an external electrical source is utilized, the boiler, when installed, must be electrically grounded in accordance with the National Electrical Code, ANSI/NFPA 70- latest edition

f) In some cases the approval authority may insist that the installation conform to the American Society of Mechanical Engineers ASME safety standard for controls and safety devices for automatically fired boilers, or CSD-1.

g) In Canada, gas installations must be in accordance with the current CAN/CGA B149.1 and .2 and/or local codes. Electrical installations must be installed in accordance with the current CSA C22.1 Canadian Electrical Code and/or local codes.

3. The following items are standard trim for Fulton Pulse Combustion Steam Boilers:

a) Fully Insulated

b) Microprocessor Based Control - 120 volt

c) Water Level Probes/Float Level Control

d) Control Panel Completely Wired with Diagram

e) Operating Pressure Control

f) Hi-Limit Pressure Control w/ Manual Reset

g) Air Pressure Switch

h) Spark Ignition

i) Main Motorized Gas Valve

j) Main Gas Pressure Regulator

k) Manual Lubricated Gas Cock

l) Second Gas Valve (Solenoid)

m) Pump Water Level Relay

1. (Probe Type) with Starter Relay
2. (Single Phase)

4. Recommended Water Conditions

a) Following are recommendations for feed water and boiler water. Contact your local water treatment professional for testing and treatment recommendations. It is very important that a strict water treatment program be followed.

b) It is critical that the boiler pH follow the attached schedule whenever water is in the boiler. Solids that enter in with the feed water will concentrate in the boiler. A regular schedule of boiler blowdown must be maintained to prevent high solid concentrations from corroding the vessel or forming deposits.

	Carbon Steel	
Parameter	**Feedwater**	**Horizontal Boiler/SteamPac Water**
pH	7.5-9.5	8.5-10.5
Feedwater Temperature	140F*	---
Hardness as CaCO3	< 2ppm	< 15 ppm
Chlorides	---	---
Total Alkalinity	---	< 500 ppm
Total Dissolved Solids	---	< 3000 ppm
Suspended Solids	No visual turbidity**	No visual turbidity**
Total Organic Carbon	No sheen No foam +	No sheen No foam +
Iron	Colorless liquid++	Colorless liquid++
Dissolved Oxygen	<1 ppm*	ND
Visual Oil	ND	ND
Conductivity (µS/cm)	---	< 4477

NOTES:

*Feedwater temperatures below 200^{o}F will require an oxygen scavenger

** Suspended solids: Take a water sample. After the sample sits for 10 minutes, no solids should be visible.

+ Total Organic Carbon: Take a water sample. Shake vigorously for 30 seconds. No sheen or foam should be visible.

++ Iron: Take a water sample. Hold the sample against a white background. The water should have no visible yellow, red or orange tinge.

ND: None Detected.

5. Water Supply

a) The quality of the water used in the boiler will affect the life of the elements and pressure vessel and it is strongly recommended that a competent water treatment company be consulted prior to the installation of the boiler. Elements/PV damaged due to adverse water conditions will not be replaced under warranty.

b) Natural feedwater supplies contain solids and dissolved gases. These may promote scale, foaming, corrosion, and/or poor steam quality. To prevent this, feedwater must be studied individually and treated accordingly. The treatment should provide quality feedwater to the boiler such that corrosion and deposition in the boiler will be minimized. Thermal cycling, dissolved oxygen, high or low pH can all be major causes of corrosion. Untreated hardness is the major cause of scale deposits. Poor quality feedwater requires increased blowdown and increased chemical treatment costs to prevent boiler corrosion and scaling.

c) One way to lower the amount of dissolved gases in the boiler feed water is to preheat the feedwater. This option injects live steam into the feedwater to increase the water temperature to 180 degrees F or higher which removes oxygen and carbon dioxide from the water.

d) RO/DIWater: Reverse Osmosis / Deionized water is water that all dissolved solids have been removed. Osmosis is a process that uses a semi-permeable membrane, under pressure, to reject dissolved salts and allow water to pass through. When a solution of salt and water is separated by a membrane, the osmotic pressure forces the water through the membrane, diluting the salt solution. When pressure greater than osmotic pressure is applied to the salt solution, the membrane allows the water from the salt solution to pass into the water solution and rejects the dissolved salts. The osmotic process is reversed, hence, reverse osmosis. RO/DI water has no buffering capacity and a pH of <6.5. It is corrosive to carbon steel, however, not to stainless steel. Very high purity steam quality can be obtained with RO/DI water.

e) Electric boiler and unfired steam generators' pressure vessels made from carbon steel that use RO/DI water for the supply water will require pH neutralization for vessel longevity. Electric boilers and unfired steam generators with stainless steel pressure vessels do not require pH neutralization. ASME Code allows electric boilers to be manufactured with stainless steel pressure vessels provided RO/DI water is used as the water supply.

f) The Fulton Warranty does not cover damage or failure that can be attributed to corrosion, scale or fouling.

6. Glossary of Water Supply Terms

a) **Dissolved Oxygen**: Oxygen that is dissolved in the feedwater will cause the steel in the boiler and the feedwater system to be attacked by the water in a manner described as

"pitting". The pits that are produced can vary from tiny depressions to holes large enough to penetrate the boiler metal and are usually covered with tubercles of iron oxide. Once pitting starts, it may be extremely hard to arrest. Pitting can proceed at a surprisingly rapid rate and can occur not only in the boiler proper, but also in pre-boiler equipment such as ecomomizers, feedwater tanks, and feedwater lines.

b) **Sodium Sulfite**: Its purpose is to chemically remove the dissolved oxygen left in the feedwater after the feedwater has been mechanically deareated. Sodium Sulfite reacts chemically with dissolved oxygen, producing sodium sulfate. Since it is desirable to remove dissolved oxygen from the feedwater before it reaches a boiler. Sodium sulfite is best introduced continuously at some suitable point in the feedwater system (the storage section of the feedwater heater or deareator, six inches below the water line). Chemical residual control is based on the maintenance of a specific excess of sodium sulfite in the boiler water. The essential requirement being to maintain in the feedwater at all times slightly more than enough sodium sulfite to consume all of the dissolved oxygen that slips through the deareating equipment. Sulfite as a treatment represents the second line of defense against oxygen corrosion. Primary protection against this type of attack requires adequate facilities for mechanical deareation of the feed-water plus a vigorous maintenance program to safe guard against oxygen leakage into the pre-boiler system.

c) **Suspended Solids**: Suspended solids are the undissolved matter in water, inc-luding dirt, silt, vegetation, iron oxides, and any other insoluble matter. Normally suspended solids are expressed in terms of turbidity. Suspended solids may also deposit in low velocity areas and create fouling. In line filters, or various types of pretreatment can be used to lower the suspended solids level. Various polymers assist in holding solids in suspension. Periodic blowdowns will eliminate suspended solids.

d) **Alkalinity**: Alkalinity is the capacity of a water to neutralize acids. Common water alkalinities consist of bicarbonate, carbonates, hydroxide, phosphate, and silicate. These alkalinities, especially bicarbonates and carbonates, break down to form carbon dioxide in steam, which is a major factor in the corrosion on condensate lines. High alkalinity also causes foaming and carry over in boilers. Both foaming and carry over cause erratic boiler operation. When foaming occurs an antifoam should be added or increased. The reason for the high alkalinity should be determined. It may result from lack of sufficient blow off. Quite often the source of alkalinity is an overdose of alkaline internal water treatment chemical.

e) **pH**: pH is a measure of the degree of acid or base of solution. pH ranges of 8.0-10.5 will have little influence on the corrosion rate of carbon steel. A low pH can result in corrosion of metals, while a high pH can result in scale formation or caustic embrittlement. In order to control boilers and equipment used for the external treatment of make up water, it is essential that reliable pH measurements be made. RO/DI water will have a pH of 6.0 - 6.5 and will require neutralization if used in a carbon steel vessel.

f) **Chlorides**: If chloride levels are high enough to cause severe corrosion, they can be controlled by limiting the cycles of concentration and increasing boiler blowdowns. Corrosion from chlorides can also be controlled by increasing the amount of corrosion inhibitor or changing to a more effective inhibitor. Reverse osmosis is another method of pretreatment to reduce chlorides. Chlorides are a major concern in a stainless steel vessel.

g) **Oil**: Oil is not a natural constituent of boiler water; still it can frequently enter a system through leaks in a condenser or other heat exchanger. Oil can also enter a system through the lubrication of steam driven reciprocating equipment. Whatever the source, the presence of oil in boiler water is undesirable. Oil can act as a binder to form scale. In high heat-transfer areas oil can carbonize and further contribute to the formation of scale and low pH. Foaming is one indication of oil in boiler water. Its presence can also be confirmed by first shaking a bottle containing boiler water. If oil is present foam will result. Often oil in boiler water will originate in the condensate. This contaminated condensate should be directed to the sewer until the source of the oil is determined and corrective steps taken.

h) **Iron (oxides):** Iron in any of its oxide or complex forms is undesirable in boiler water. Iron in its various forms can originate in the raw water makeup, condensate return water, or form directly in the boiler as a result of corrosion. It can concentrate in the boiler and it tends to collect in stagnant areas. If a boiler is using raw water makeup, iron is almost certain to be a major component of developing scale or create fouling.

i) **Water Hardness**: Water hardness is the measure of calcium and magnesium content as calcium carbonate equivalents. Water hardness is a primary source of scale in boiler equipment. Hardness is removed by softening.

j) **Feedwater**: Feedwater is the combination of fresh makeup and returning condensate that is pumped to the boiler.

k) **Condensate:** Condensate is condensed steam that is normally low in dissolved solids. Hence, it does not contribute to the dissolved solid content of the feedwater. In addition, condensate is very expensive to waste. It's been chemically treated, heated, pumped, converted to steam, and condensed. This costs money and when condensate is returned to the boiler, money is saved.

7. Locating the Boiler

a) The boiler shall be located so that the air supply and exhaust piping between the boiler and outside wall/roof are within the minimum and maximum lengths for horizontal or vertical venting. See Figure 1 for minimum clearances between the boiler and any combustible surfaces.

Note

The boiler must not be installed on carpeting.

Note

The boiler shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service.

Note

All pulse combustion boilers must be installed with vibration isolators. No pulse combustion boiler shall be lagged directly to the concrete floor. In the box of trim shipped with each pulse boiler, Fulton supplies four elastomer coated fiberglass cubes used for isolation. (Figure 2a) For all non-critical installations these 3" x 3" x 2" cubes must be under each foot of the boiler. White lines on blocks should be in "up" position. Flex connectors must be installed on the water inlet and steam outlet lines. Flex connectors must be installed on the gas inlet. Spring loaded pipe hangers should be used on the air inlet, water inlet and steam outlet, and the flue gas outlet pipes. Contact your Fulton Representative for vibration isolation packages designed specifically for your application.

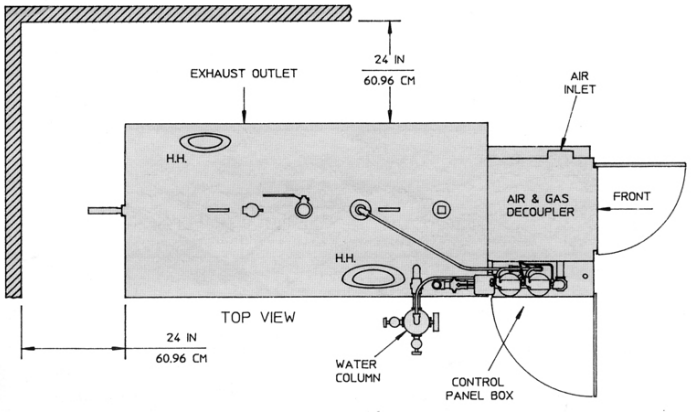


Figure 1

8. Installing Spring Isolation Mounts (Figure 2a)

a) Thread the leveling bolt into the top load plate of the spring until the head of the bolt is within 1/8" of the top load plate of the spring.

b) Coordinate the location of each isolator.

c) Remove the small cap screw and washer. Raise the boiler with jacks or similar tools (Do not attempt to raise the boiler via one (1) lifting point, but lift evenly around the perimeter

of the boiler). Slide the spring isolator under the boiler or mounting bracket with the bolt head on the underside of the bracket.

d) Insert the small cap screw through the bracket and thread into the top of the leveling bolt and tighten finger tight.

e) Lower the boiler (evenly) onto the spring isolators. Do not overload any one isolator and take care not to push the boiler sideways.

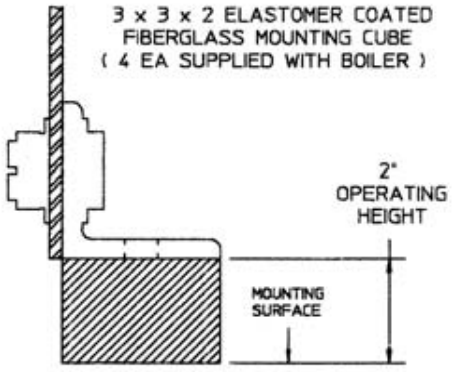
f) Do not attempt to place all the weight on one spring, but distribute the load proportionately by adjusting each isolator in sequence.

g) Continue to adjust each leveling bolt (in sequence) until the boiler is at its height. When the boiler is filled with water, the springs will compress approximately 1-2".

h) Tighten the small cap screw, thus securing the spring isolator to the supported equipment and locking the leveling bolt against turning.

i) Do not attempt to move the boiler laterally while it is supported on the isolators. If it is necessary to move the boiler remove the weight from the isolators by raising the boiler before moving. Failure to follow this procedure could result in bent or broken leveling bolts or springs, or damage to the neoprene bottom spring cap.

Figure 2a



9. Installing Seismic Spring Isolation Mounts (Figure 2b)

a) Thread the leveling bolt 1/2" (12 mm) into the top of the load cap.

b) Remove the lock nut and one washer from the top of the leveling bolt. Locate leveling nut as far down on leveling bolt as it will travel.

c) Coordinate the location of each isolator.

d) Place a one inch shim next to each bracket between the boiler and the housekeeping pad or structural floor. If an operating clearance of other than one inch is desired, use an appropriate size shim.

e) Raise the boiler and slide the spring isolator under the equipment mounting bracket. With the leveling nut and one washer on the under side of the bracket.

f) Lower the boiler onto the spring isolators taking care not to overload any one isolator and taking care not to push the boiler sideways.

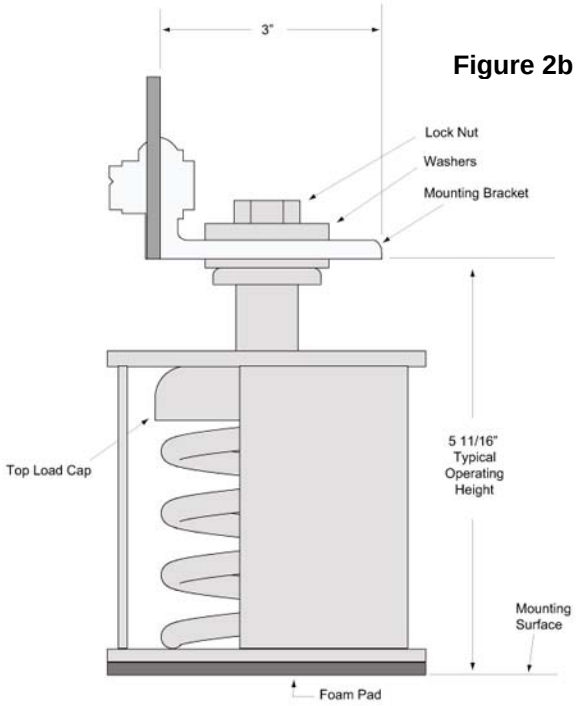
g) Install second washer and lock nut one inch down from top of leveling bolt.

h) Grasp top of leveling bolt with vice grip and turn leveling nut in a counter clockwise rotation until the boiler just touches the shim. The shim may now be removed. Proceed with adjustment of the other three isolators.

i) Tighten the lock nuts on the leveling bolts, thus bolting the spring to the boiler and locking the leveling bolt against turning.

j) Do not attempt to move the isolators laterally with the weight of the boiler on them. If it is necessary to move the boiler, remove the weight from the isolators by raising the equipment before moving.

Figure 2b



10. Installing Boiler Trim (Figure 3a)

a) Each boiler is supplied with a safety relief valve sized in accordance with ASME requirements. The safety relief valve shall be connected to the coupling located in the top of the boiler. The safety relief valve must be installed with a 6" (152 mm) nipple between the boiler and the safety valve. The safety relief valve must always be installed in the vertical position. The discharge pipe shall be not less than the full area of the valve outlet. The discharge pipe shall be as short and straight as possible and so arranged as to avoid

undue stress on the valve.

Warning

The discharge from safety relief valve shall be so arranged that there will be no danger of scalding of personnel.

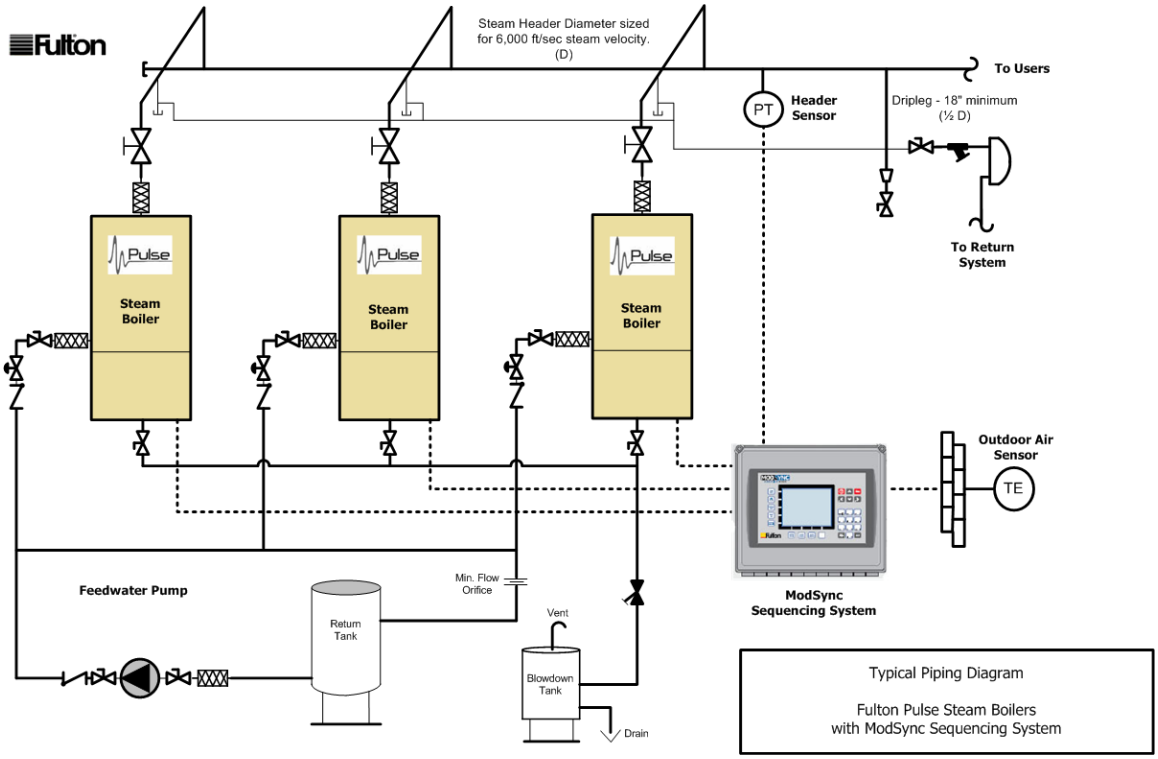
When the safety relief valve discharge is piped away from the boiler to the point of discharge, there shall be provisions made for properly draining the piping.

Warning

No shutoff of any kind shall be placed between the safety relief valve and the boiler or on the discharge pipe between such valve and the atmosphere. Doing so can cause an accidental explosion from over-pressure.

b) Each boiler is supplied with a pressure-temperature gauge. A nipple is installed in the boiler water outlet. A tee is installed on the nipple. In the side port of the tee the temperature gauge is installed.

Figure 3a



11. Installing Feed Water Piping

a) Connect the factory supplied feedwater stop valve to the feed water inlet connection at the boiler as shown on the rear of boiler and then connect the factory supplied check valve (upstream) to the stop valve. A second check valve is recommended (supplied by others).

b) Installing steam piping, pipe the steam supply away from the steam outlet connection. There should be a 2” (51 mm) clearance around all steam piping. Steam pipes should be insulated to minimize system losses.

12. Installing Condensate Drain Piping **(Figure 3b)**

a) The header is to be level or slightly pitched toward the drain.

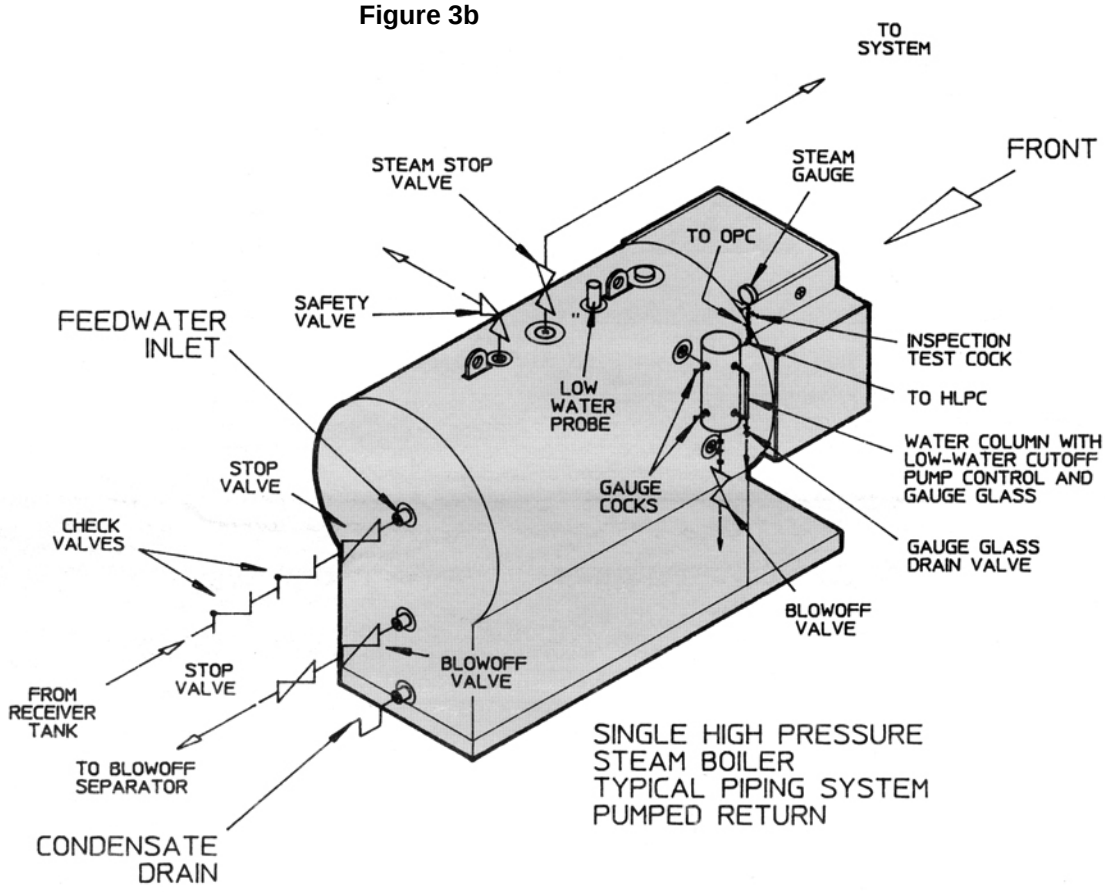
b) Header material is to be galvanized or 316L stainless steel.

c) The header should be taken to the lowest point possible, and at least 5 1/2” drop from 1 1/2” condensate drain kit/trap outlet.

d) The 1 1/2” condensate drain kit/trap outlet must never be above the 1” boiler condensate outlet(s).

e) Exhaust mufflers in the vertical position have their drains plugged. If the mufflers are to be mounted in the horizontal position they are required to be drained back to the condensate drain trap header.

Figure 3b



Pipe Capacity for Natural Gas

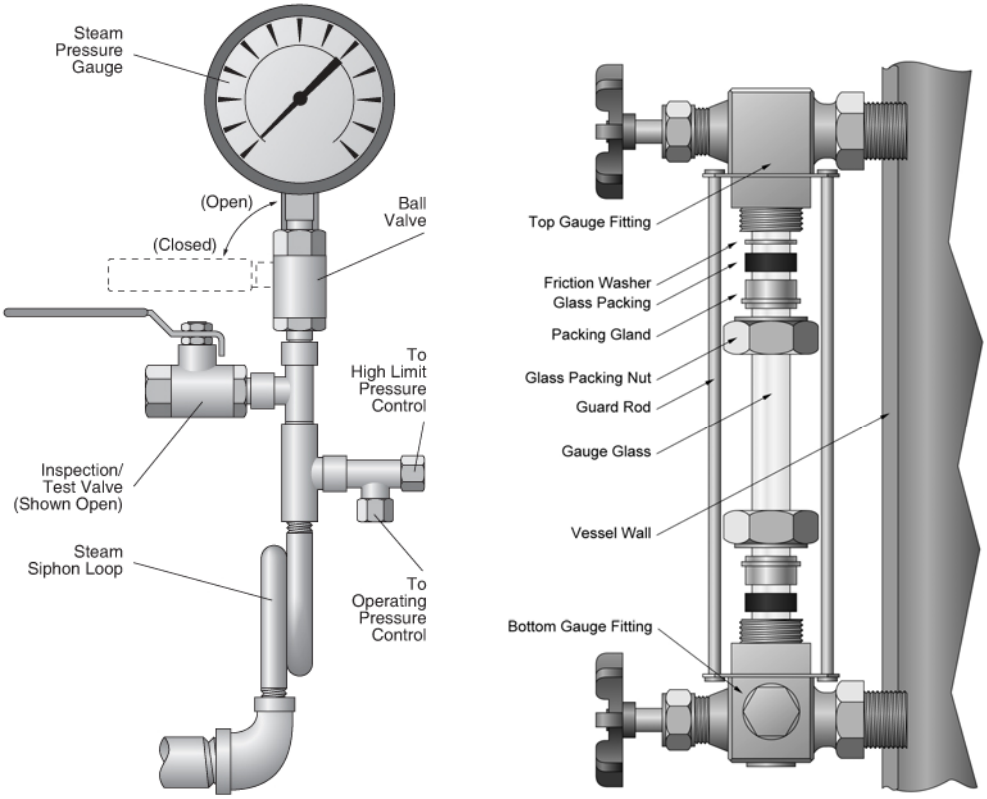
Nominal Iron Pipe Size		Internal Diameter		Equivalent Pipe Length 90° Elbow		Tee		Maximum Capacity in Cubic Feet of Natural Gas Per Hour Pressure Drop of .05 W.C. Equivalent Length of Pipe in Feet							Maximum Capacity in Cubic Meters of Natural Gas Per Hour Pressure Drop of .125kPa Equivalent Length of Pipe in Meters					
Inches	MM	Inches	MM	Feet	Meters	Feet	Meters	20	40	60	80	100	150	200	6	12	18	24	46	61
1.25	31.8	1.38	35.1	3.5	1.1	6.9	2.1	950							27					
1.50	38.1	1.61	40.9	4.0	1.2	8.0	2.4	1460	990	810					41	28	23			
2.00	50.8	2.07	52.6	5.2	1.6	10.3	3.1	2750	1900	1520	1300	1150	950	800	78	54	43	37	27	23
2.50	63.5	2.47	62.7	6.2	1.9	12.3	3.7	4350	3000	2400	2050	1850	1500	1280	123	85	68	58	42	36
3.00	76.2	3.07	78.0	7.7	2.3	15.3	4.7	7700	5300	4300	3700	3250	2650	2280	218	150	122	105	75	65
4.00	101.6	4.03	102.4	10.1	3.1	20.2	6.2	15800	10900	8800	7500	6700	5500	4600	447	309	249	212	156	130

13. Installing Steam Pressure Gauge Assembly (Figure 4)

a) Install the steam gauge and the siphon into the opening on the top of the boiler.

b) Connect the copper tubings from the steam pressure controls to the tees on the steam siphon.

Figure 4



14. Installing Water Level Control Assembly

a) Install water gauge valves and sight glass. Install blow-off piping from water level control shut off valve to a safe blow-off point or a blow down separator. Install blow-off piping from the bottom of the sight glass to a tee on the blow-off piping.

15. Installing Gas Piping (Figure 5)

a) Gas Piping should be installed in accordance with National Fuel Gas Code, ANSI Z223 1 1991 or latest addenda and any other local codes which may apply.

b) In Canada gas installations must be in accordance with the current CAN/CGA B149.1 and .2 and/or local codes.

c) The pipe and the fittings used should be new and free of dirt or other deposits. Piping must be of the proper size to ensure adequate gas supply.

d) Gas pressure to inlet of gas train should be 7"-11" WC. (1.75-2.75 kPa) for natural gas. Connect gas supply line to the open end of the tee on which the drip leg is installed.

e) When making gas piping joints, use a sealing compound resistant to the action of liquefied petroleum gases. Do not use Teflon tape on gas line threads.

f) After gas piping is completed and before wiring installation is started, carefully check all piping connections, (factory and field), for gas leaks. Use a soap and water solution.

Caution

Some soaps used for leak testing are corrosive to certain types of metals. Rinse all piping thoroughly with clean water after leak check has been completed.

g) The boiler must be disconnected at the boiler shut off valve from the gas supply piping system during any pressure testing of the system at pressure in excess of 1/2 psig (14" WC) (3.5 kPa).

h) The boiler must be isolated from the gas supply piping system by closing its individual manual shut off valve during any pressure testing of the gas supply system at test pressures equal or less than 1/2psi (3.5kPa).

i) Gas vents to outdoor air must be provided for the pressure regulator and gas pressure switches. Restricting orifices or bleed orifices should not be used at anytime.

Warning

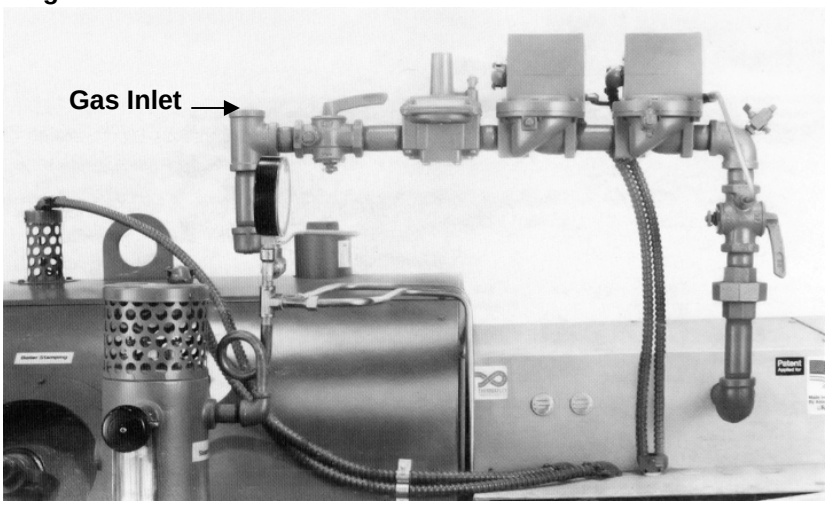
Do not use matches, candles, flame or other sources of ignition to check for gas leaks.

Note

The vent line connection on the gas pressure regulator and the low and high gas pressure switches must be piped to outdoor air by installer in accordance with the National Fuel Gas Code, ANSI Z223 1 1991 or latest addenda.

In Canada gas installations must be in accordance with the current CAN/CGA B149.1 and .2 and/or local codes.

Figure 5



16. Installing Field Wiring (Figure 6)

a) It is recommended that an independent power supply line be provided for the boiler. Connect one 120 volt (60Hz) fused power line to terminal block as shown in Figure 6. Connect applicable wires to neutral and ground. Connect a ground wire to green colored ground lug in electrical control box. See Figure 8 & 9 for a detailed electrical drawing. A detailed electrical drawing should be inside the panel of the boiler.

Warning

Do not attempt to start boiler to test wiring before filling and purging the boiler. A dry fire will seriously damage the boiler and may result in property damage or personnel injury and is not covered by warranty.

Caution

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

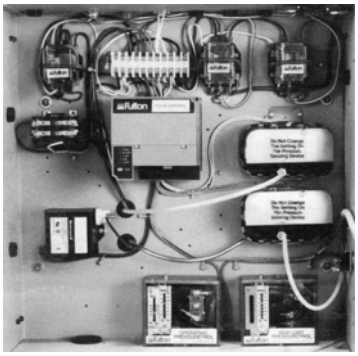


Figure 6

17. Air Intake Supply Piping Installation Preparation (Figure 7)

a) The boiler is equipped with air intake supply and exhaust vent connections located at the top and rear of the boiler.

b) Air supply is on the top (See Figure 8). For models PVLP750 and PVLP1150 the connections are 4" (102 mm) NPT threaded female fittings. This line must be sloped away from the unit with a pitch of at least 1/4" (6mm) per foot. Failure to do so can result in a condensate pocket, which can result in an inoperative boiler. A high spot is acceptable, provided the pitch from the high spot is maintained away from the boiler and to the outside point of air intake.

c) The air intake must be piped out of the building. Air Intake pipes and fittings for all models shall be Schedule 40 PVC pipe. All PVC pipe, fittings, primer and solvent cement must conform with American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM standards.)

Note

Intake PVC piping must be assembled using cement. This will ensure that the intake is air tight and will not allow contaminates from the boiler room into the boiler.

Warning

Solvent cements for plastic pipe are flammable liquids and should be kept away from all sources of ignition. Proper ventilation should be maintained to reduce the hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes.

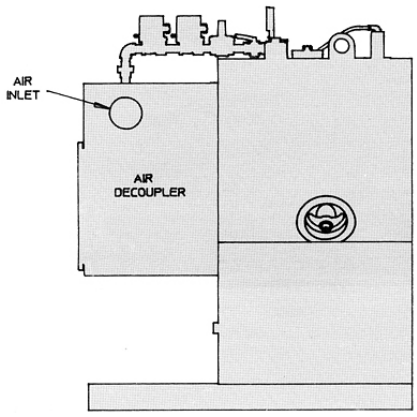
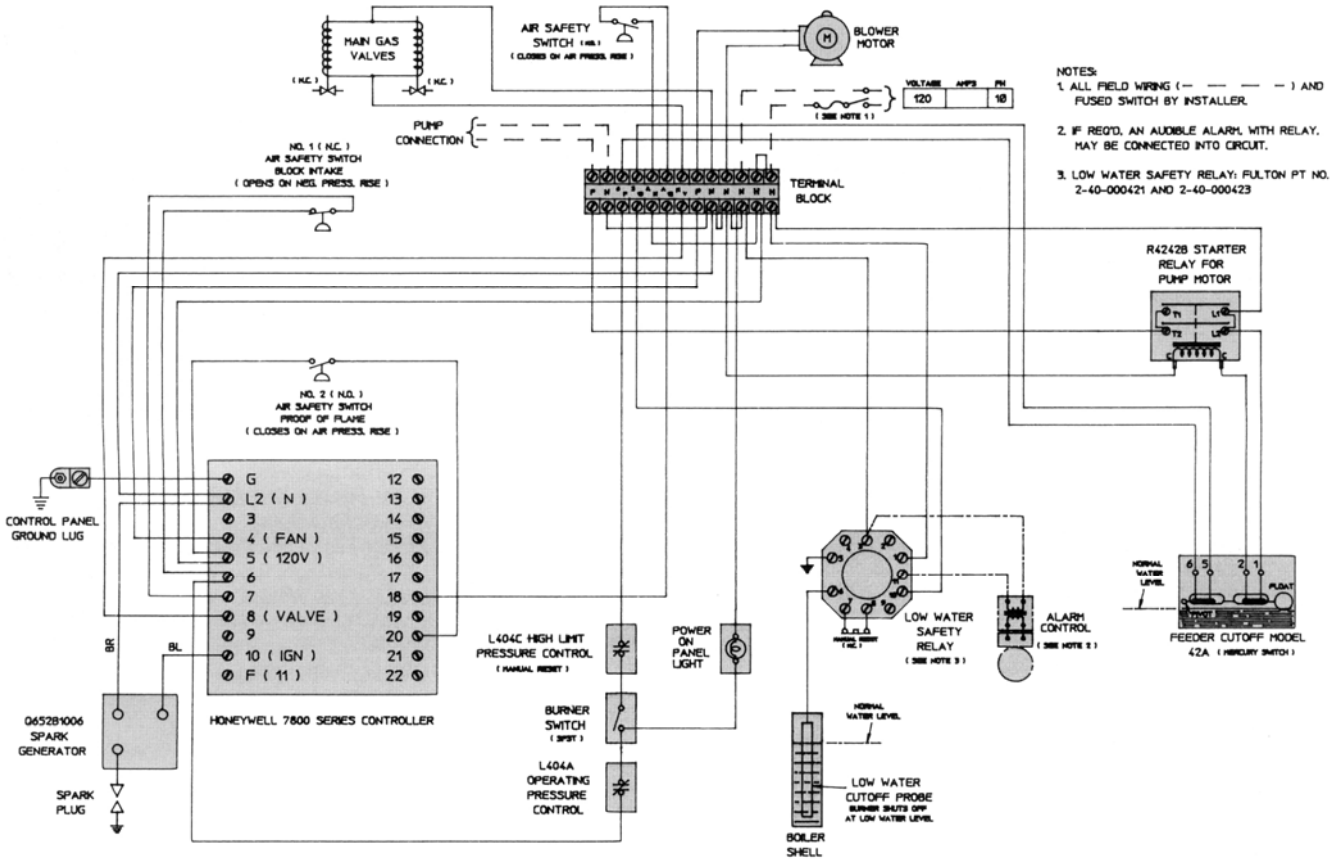
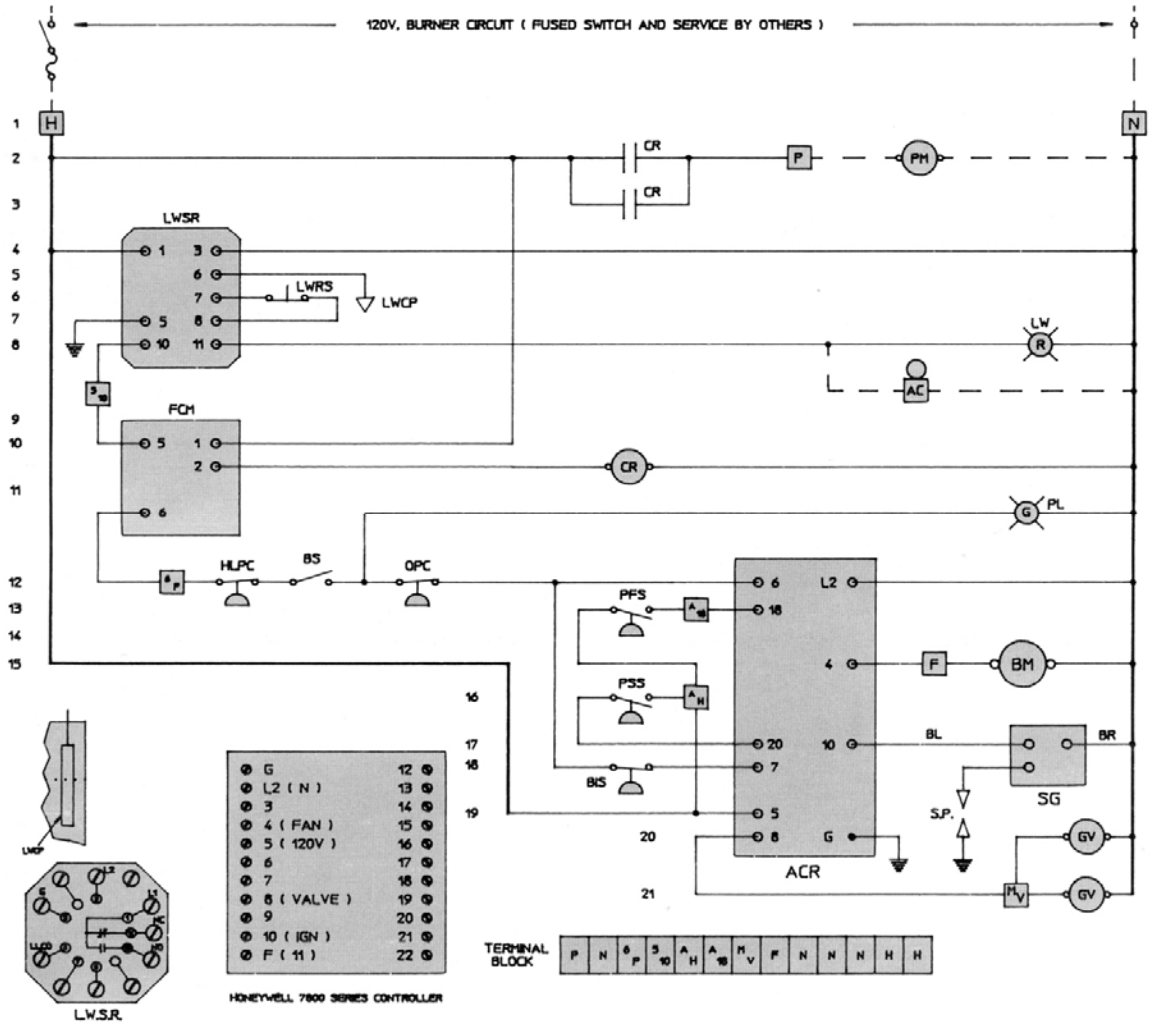


Figure 7

Typical Boiler Electrical Logic-Figure 8



Electrical Schematic (Ladder Diagram)-Figure 9



Sequence of Operation

1. Turn on main breaker.
2. Water level relay senses no water through probe and mercury switch and pump motor relay is energized.
3. Pump motor starter coil is energized allowing current to energize feedwater pump filling boiler with water.
4. Low water safety relay (LWSR) and the feeder cutoff are energized when the main breaker is turned on, but current is not allowed to pass to the high limit pressuretrol unit: a) the mercury switch senses the water, satisfying feeder cutoff and b) the probe in the boiler shell senses the water, satisfying LWSR and c) the manual reset switch is reset.
5. High limit pressure control allows current to pass to the next control if the pressure in the boiler is not causing the control to pen the circuit.
6. Burner switch is then closed to energize the operating pressuretrol.
7. Operating pressure control allows current to pass to the automatic control relay if the pressure in the boiler is not causing the control to open the circuit.
8. 120V power is input to the automatic control relay (RM7865A).
9. Purge blower is energized for 35 seconds.
10. Purge fan switch is made, signaling the control to proceed.
11. Spark plug is energized and gas valve is energized.
12. Pressure sensing switch is made (proof of flame) allowing sequence to continue.
13. Block intake switch is normally closed. If there is no restriction to air flow, pulse combustion will continue until one or more of the following things happen:
    a. Operating pressuretrol is satisfied.
    b. High limit pressuretrol is satisfied.
    c. Low water safety relay loses water on probes.
    d. Feeder cutoff loses water.
    e. Burner switch is turned off.
    f. Main breaker is turned off.

Glossary

AC-Audible Alarm Control (Optional)
ACR-Automatic Control Relay (7800 series)
BIS-Block Intake Switch No. 1
BM-Blower Motor
BS-Burner Switch
FCM-Feeder Cutoff Model
CR-Control Relay
HLPC-High Limit Pressure Control
LW-Panel Light (Low Water Indicator)
LWCP-Low Water Cutoff Probe (Boiler)
LWRS-Low Water Reset Switch
LWSR-11 Pin Low Water Safety Relay
GV-Main Gas Valve (2 each)
OPC-Operating Pressure Control
PFS-Purge Fan Switch
PL-Panel Light (Power on-Green)
PM-Pump Motor & Field Wiring (By Others)
PSS-Pressure Sensor Switch No. 2
SG-Spark Generator
S.P.-Spark Plug
TB-H-Terminal Block (Hot)
TB-N-Terminal Block (Neutral)

18. Intake Muffler Installation

a) For best noise attenuation, the muffler should be installed as close to the boiler as possible.

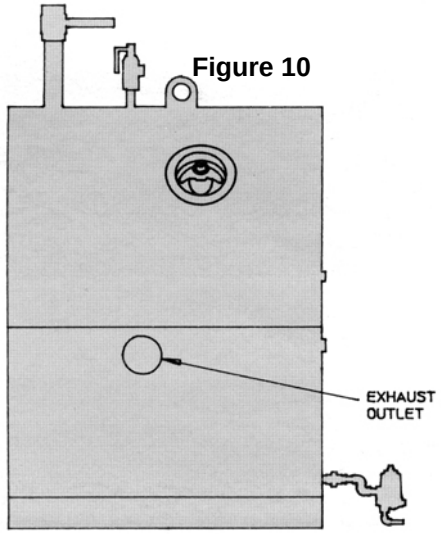
19. Exhaust Vent Piping Installation Preparation (Figure 10)

Note

A Fulton Pulse boiler should not be connected to a common venting system with other types of gas appliances.

a) The boiler is equipped with an exhaust vent connection located at the side of the boiler.

Figure 10



b) The exhaust line must be sloped down toward the unit with a pitch of at least 1/4" (6mm) per foot. Failure to do so can result in a condensate pocket, which can result in an inoperative boiler. There must be no low spots in the exhaust pipe, as this can also result in a condensate pocket. A high spot is acceptable, provided the pitch from the high spot is maintained back to the boiler to the outside point of the exhaust.

c) In supporting piping, or routing it through a rafter or wall, always use vibration eliminating hangers around the piping to prevent transmission of pulsations. Always avoid rigid connections between piping and structural members of the building. Flue exhaust pipes and fittings for all models shall be stainless steel. The stainless steel shall be UL temperature rated at minimum air clearance to combustibles. At 480°F (249°C) temperature rating, a 5" (127mm) minimum air space clearance to combustibles is required. Fulton pulse combustion boilers require a special venting system. Applicable

Federal Codes are NFPA 54/ANSI Z223.1 National Fuel Gas Code and NFPA/ANSI 211 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances. In Canada refer to the venting section of CAN/CGA B149.1 and .2. These codes contain information on special gas vents. The gas vent installer should be familiar with these Federal Codes as well as local codes and regulations.

20. Exhaust Muffler Installation

a) For mufflers installed in the vertical configuration the drain can be plugged.

b) For mufflers installed in the horizontal configuration, the drain should be piped to the drain line between the boiler and the liquid drainer. For best noise attenuation, the muffler should be installed as close to the boiler as possible.

21. Air Intake Supply & Exhaust Vent Installation **(Figure 11)**

a) Air intake supply and exhaust vent pipes and fittings are suitable for vertical, through-the-roof or horizontal through-the-wall installation. The vent system must be installed in accordance with the manufacturer's instructions.

b) All vent pipes and fittings must be installed with appropriate air space clearances to combustibles. These air space clearances apply to indoor or outdoor vents—whether they are open, enclosed, horizontal or vertical or pass through floors, walls, roofs, or framed spaces. See Figure 16. The air space clearances should be observed to joists, studs, subfloors, plywood, drywall or plaster enclosures, insulating sheathing, rafters, roofing, and any other material classed as combustible.

c) The required minimum air space clearances also apply to electrical wires and any kind of building insulation away from gas vent and out of the required air space clearance.

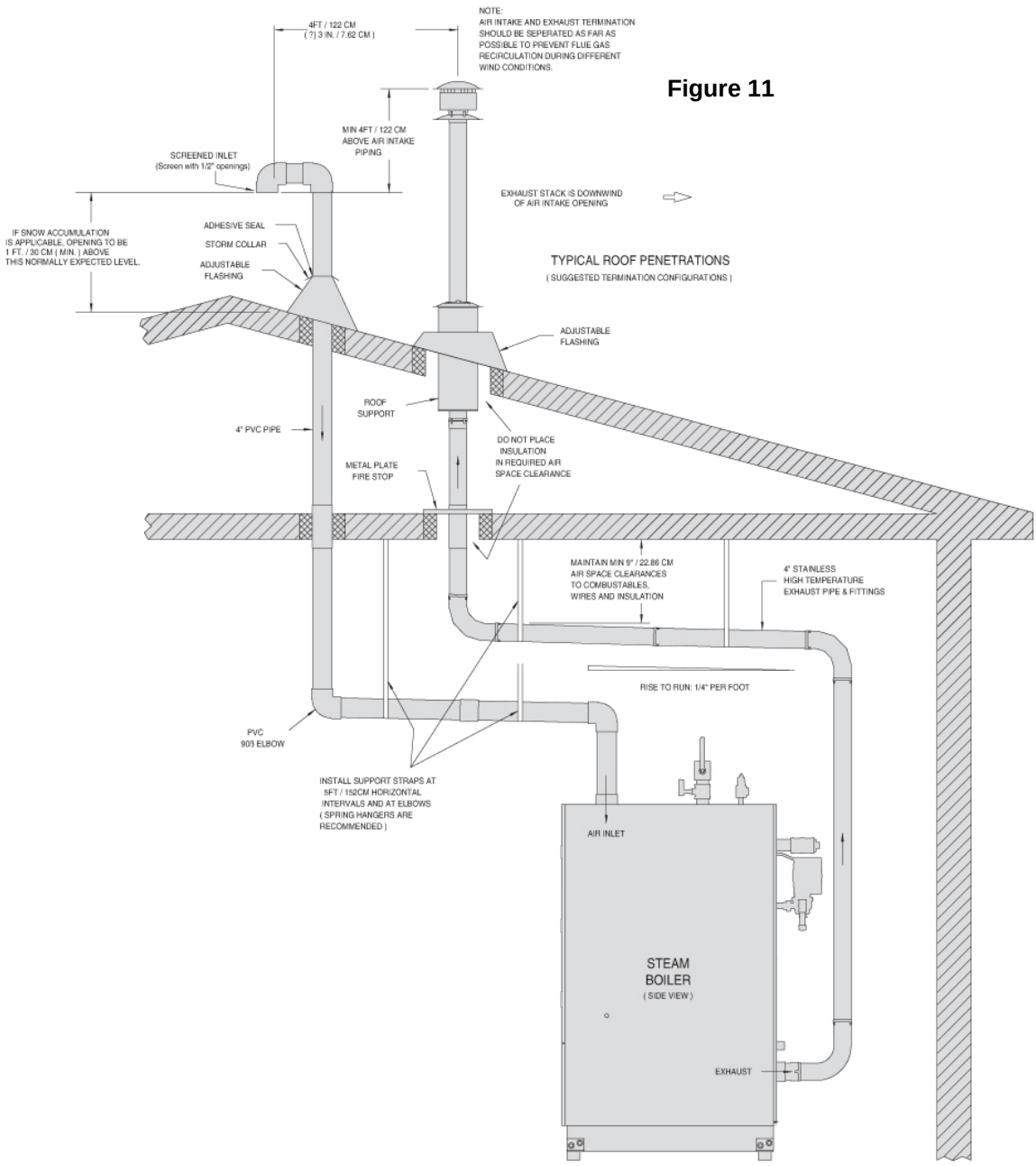


Figure 11

d) Vertical runs or vent pipes and fittings passing through floors, ceilings, or in framed walls must be fire stopped at floors and ceilings. The fire stop must close in the area between the outside of the vent and the opening in the structure.

e) Figure 12: When passing through a floor or ceiling, frame in an opening providing 5" (127 mm) or 9" (229 mm) air space clearance to vent pipe as applicable. The fire stop fits to the bottom of a framed opening 13 1/4 " (337 mm) square. Nail into the inside of the framed opening through the four holes in the ring. The fire stop is placed on top of a framed opening 14 1/4 " (362 mm) square with the dished position down. Nail the flange to the top of the framing. For pitched roofs refer to Figure 15.

f) Pass the vent pipe through the opening in the fire stop. If used as a support, install the support ring around the vent pipe above the fire stop. Slide the support ring down to the top of the fire stop and tighten it securely to the vent pipe. Firestop supports can support up to 10 feet (3 meters) of vent pipes and are recommended at all floor and ceiling penetrations.

Figure 13: Air intake supply and exhaust vent pipes and fittings must be securely supported. For pitched roofs refer to Figure 15.

g) Horizontal sections require supports every 5 feet (15 meters) and at elbows. From the boiler, all horizontal sections must rise at least 1/4 " per foot (2 cm per meter), and there must be no sags or dips where condensate could collect. The upward pitch is required so condensate will run back to the boiler for collection and disposal.

h) For vertical through the roof installations all gas vents extending above the roof by more than 2 1/2 feet (0.76 m) must be securely guyed or braced—inside and outside wall—2 clamps. Use a support ring to attach guys or braces to the vent pipe.

Figure 12

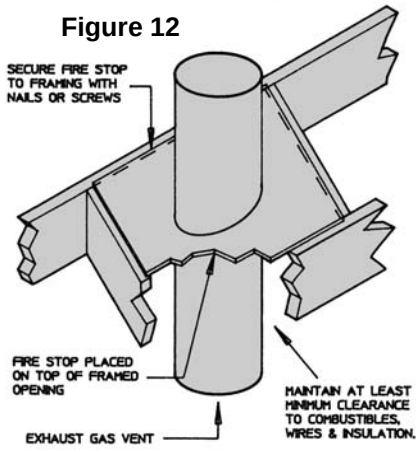
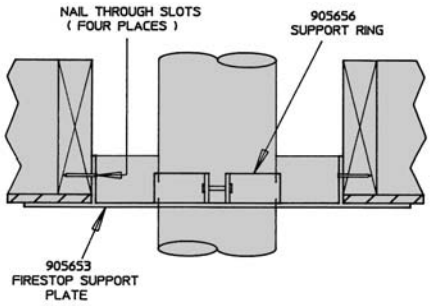


Figure 13



22. Vertical Vent Flashing & Installation (Figure 14)

a) The roof opening should be located and sized such that the vent is vertical and has the required air space clearance. The roof flashing is positioned with the lower portion of the base flange over roofing material.

b) Nail through the upper portion and sides of the base flange. Use nails with neoprene washers or cover the nail heads with a neoprene plastic. Finish roofing around that flashing, covering the sides and upper flange with roofing material.

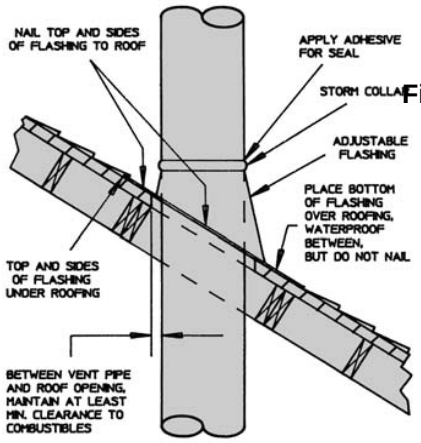


Figure 14

23. Vertical Vent Termination

a) The vent pipe must extend through the flashing to a height above the roof as required in Figure 15.

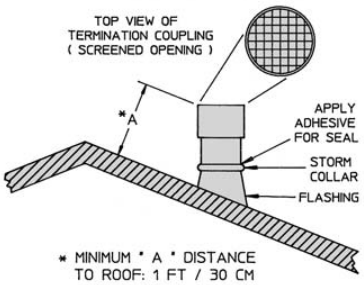
b) A storm collar is installed on the vent pipe over the opening between pipe and flashing. Adhesive material is used over the joint between the vent pipe and the storm collar.

c) **Figure 15:** The vent termination is joined to the end of the vent pipe.

d) Termination height for the vent pipe must be such that no discharge opening is less than 2 feet horizontally from the roof surface, and no discharge opening shall be lower than the minimum height specified in Figure 15. These minimum heights may be used provided the vent is not less than 8 feet (2-44m) from any vertical wall.

Figure 15

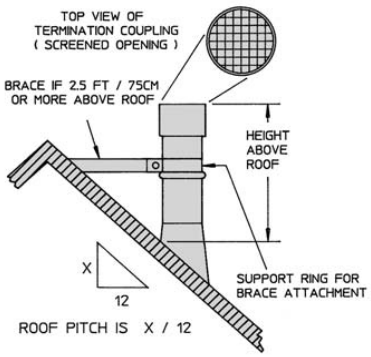
FOR ROOF PITCH OF FLAT TO 7/12



ROOF PITCH (RISE OVER RUN)	HEIGHT ABOVE ROOF	
	FT	CM
FLAT TO 7/12	1.0	30
OVER 7/12 TO 8/12	1.5	45
OVER 8/12 TO 9/12	2.0	60
OVER 9/12 TO 10/12	2.5	75
OVER 10/12 TO 11/12	3.25 [1]	100 [1]
OVER 11/12 TO 12/12	4.0	120

[1] BRACE TO ROOF AT TOP

FOR ROOF PITCH OF 7/12 OR MORE



ROOF PITCH (RISE OVER RUN)	HEIGHT ABOVE ROOF	
	FT	CM
OVER 12/12 TO 14/12	5.0	150
OVER 14/12 TO 16/12	6.0	180
OVER 16/12 TO 18/12	7.0 [2]	210 [2]
OVER 18/12 TO 20/12	7.5	225
OVER 20/12 TO 21/12	8.0	240

[2] BRACE TO ROOF AT TOP AND MID POINT

24. Horizontal Installation Wall Penetrations (Figure 16)

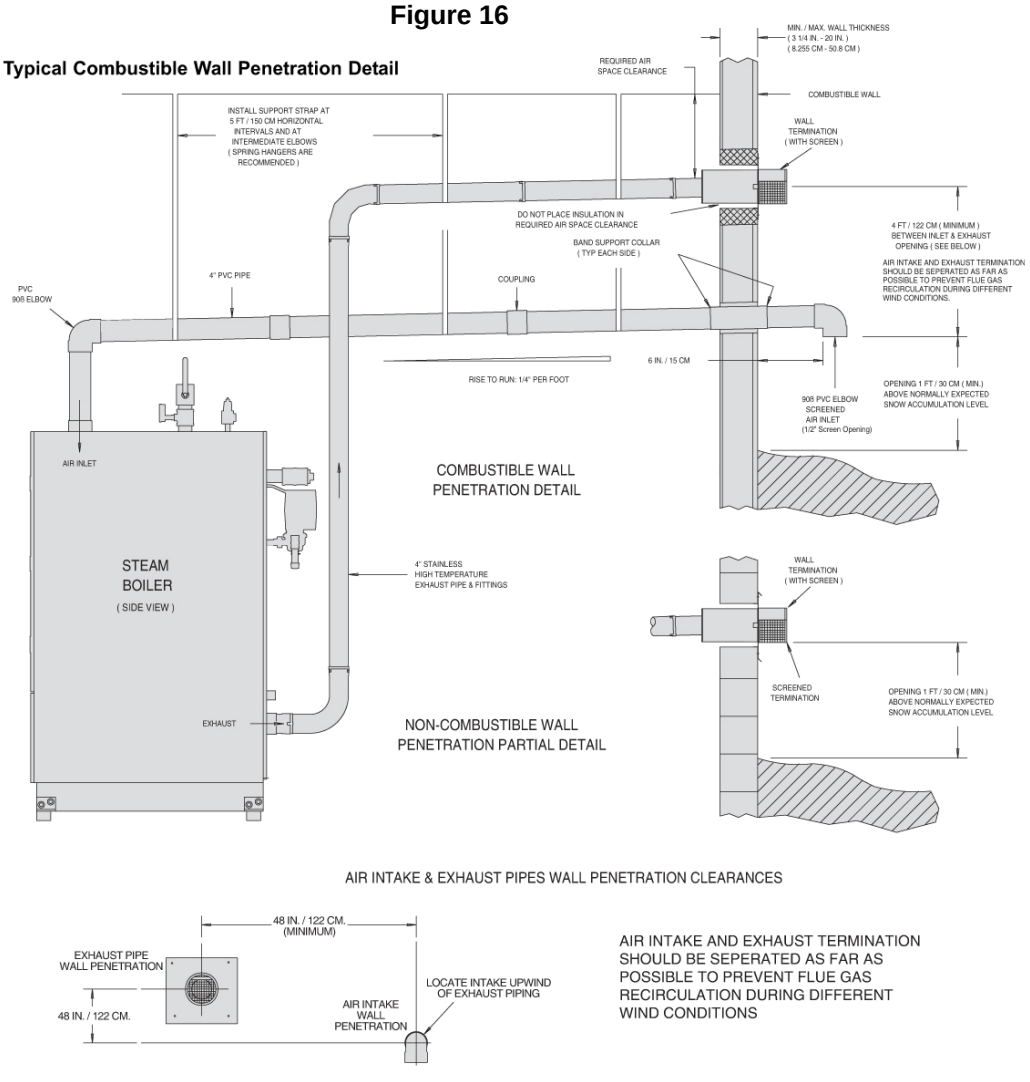
a) Select the point of penetration where a minimum of 1/4" per foot (2 cm per meter) upward pitch can be maintained.

b) When penetrating a non-combustible wall, the hole through the wall must be large enough to maintain the pitch of the vent and provide sealing. Use adhesive material to seal around the vent on both sides of the wall.

c) When penetrating a combustible wall, a wall thimble must be used. See next page Figure 16 for installation instructions.

d) Minimum wall thickness through which vent system may be installed is 31/4" (83 mm). Maximum wall thickness through which vent system may be installed is 20 inches (508 mm).

Figure 16

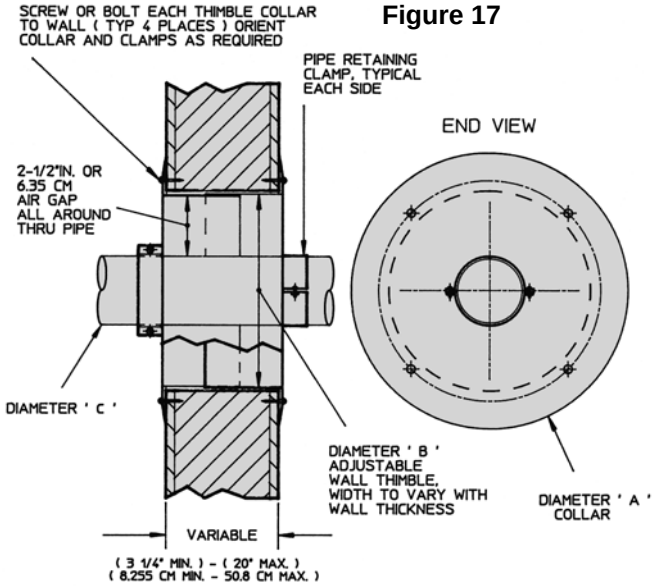


25. Wall Thimble Installation

b) A 9” (229 mm) diameter thimble is inserted through the wall from the outside. Secure the outside flange to the wall with nails or screws, and seal with adhesive material. Install the inside flange to the inside wall, secure with nails or screws and seal with adhesive material. Pass the vent pipe through the thimble from the outside and join to the rest of the vent system. Seal the pipe to the thimble flange with adhesive material.

c) **Figure 17:** Install two pipe retaining clamps around the intake as well as vent pipes on both ends of the wall thimble (on the inside and outside of the wall) through which intake and vent pipes are passed when tightened securely. They will prevent the intake and vent pipes from being pushed or pulled.

Figure 17



Nominal Pipe & Thimble Diameters			
Pipe Size (in)	**A**	**B**	**C**
4”	9 3/8”	8 ½”	4 3/16”
Pipe Size (cm)	**A**	**B**	**C**
10.16	23.81	21.59	10.63

26. Horizontal Vent Termination

a) The vent termination is joined to the vent pipe outside the wall. Use the same joining procedures for vent pipe and fittings.

b) The termination of the vent system must be at least 12” (305mm) above the finished grade, or at least 12” (305mm) above normal snow accumulation level (for applicable geographical regions).

c) Refer back to previous page-Figure 16: The termination of the vent system shall not be located in traffic areas such as walk-ways, adjacent buildings, openable windows and building openings unless the venting system is at least 7 feet (2.1m) above finished grade (National Fuel Gas Code, ANSI Z223.1)

d) The vent termination must be at least 4 feet (1.22m) horizontally from, and in no case above or below--unless a 4 foot (1.22m) horizontal distance is maintained from-- electric meters, gas meters, regulators, and relief equipment.

e) The air supply inlet and exhaust outlet must be separated by a distance ranging from 3ft. (0.91m) (minimum) to 10ft. (3.05m) (maximum) on the same wall. The exhaust outlet must be installed a minimum of 2ft. (610mm) above and downwind from air supply inlet to prevent exhaust recirculation. Under certain wind conditions some building materials may be affected by flue products expelled in close proximity to unprotected surfaces. Sealing or shielding of the exposed surfaces with a corrosion resistant material (such as aluminum sheet) may be required to prevent staining or deterioration.

f) Do not locate the vent termination too close to shrubbery as flue products may stunt or kill them.

27. Installation Checkpoints

a) Before Starting The Boiler: Do not turn on the boiler unless it is filled with water to the correct level (may be seen through gauge glass).

b) Check that the front door of the air decoupler is closed.

c) Check pressure setting.

d) Open the manual shutoff gas valve.

e) Close the circuit breaker or the fuse disconnect.

f) Turn the on-off switch to “ON”.

28. Testing Ignition Safety Shut Off

a) Open gas shut off valve, allowing gas to flow to boiler. Close gas shut off valve. Reset low gas pressure switch. Turn on the boiler. The boiler will run through its purge and trial for ignition cycle. After 6 seconds of ignition trial, the boiler will recycle. Switch the boiler off. Open the gas shut off valve. Restart the boiler.

29. Measure Gas Flow Rate

a) Turn off the boiler and the manual gas shutoff valve. Remove manifold (down-stream) pressure test plug from the 90 degree elbow. Figure 18: Replace the plug with a 1/4 N.P.T. to 1/4" (6mm) compression (or flare) adaptor and a short piece of tubing. Connect one piece of rubber hose from tubing to a manometer. Open the gas shutoff valve (gas

cock) and turn on boiler. Read the gas pressure on the manometer (make sure to add both water columns together to get reading on manometer).

b) The following pressures are for reference only. Depending on the calorific value of the gas, and length of intake and vent piping, the actual pressure can be significantly higher or lower.

c) Refer to factory supplied test fire sheet to set the boiler at the correct last elbow and head of the gas train pressures.

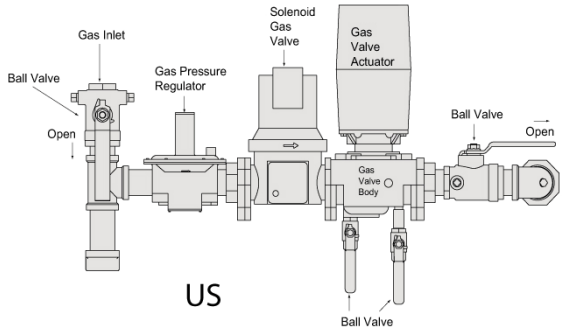
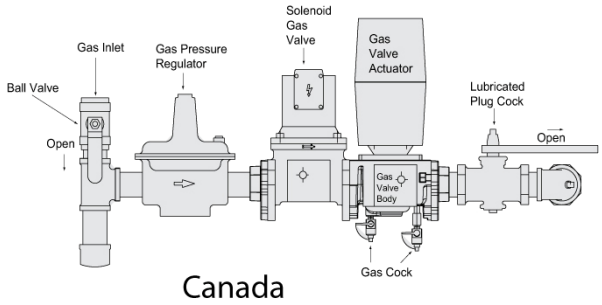


Figure 18



30. To Correct Input-Adjust Gas Pressure Regulator

a) Turn boiler off and remove cap from regulator. Figure 19: Turn adjusting screw clockwise to increase gas flow Turn adjusting screw counter clockwise to decrease gas flow. Always replace cap before turning on boiler.

31. To Check for High Gas Pressure

a) The boiler and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.5 kPa). The boiler must be isolated from the gas supply piping system by closing the individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 kPa).

b) Turn off boiler and turn off gas supply to manual gas shutoff valve. Remove line pressure test plug on manual shutoff gas valve. Replace with a 1/4" NPT to 1/4" compression (or

flange) adaptor and a short piece of tubing. Connect a piece of rubber hose from tubing to one side of manometer.

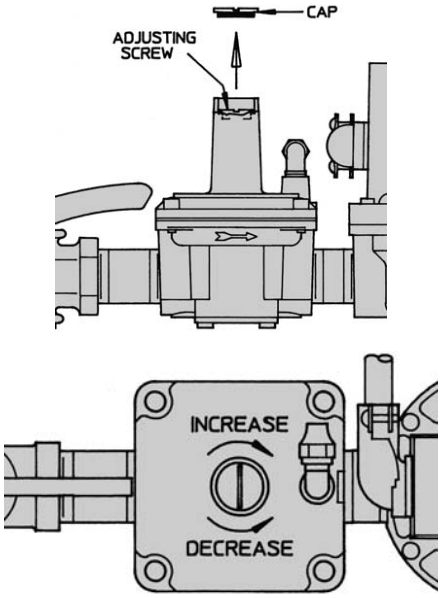
Note

It is recommended that an authorized Fulton Pulse Start-up Agent or your gas utility make any required gas input adjustments.

c) Open gas supply to manual gas shutoff valve and turn on boiler. After combustion starts, manometer should read 7" WC (178mm).

d) If reading exceeds 7.0" WC. (178mm) install regulator upstream of gas valve to reduce pressure. If pressure is less than 6"W.C. (152mm), consult your gas company for adjustment to the supply pressure.

Figure 19



32. For High Gas Pressure Installations

a) In high gas pressure areas, it is good practice to step the pressure down as described below.

1. Locate the stepdown regulator as far away from the pulse boiler as possible.
2. When stepping down from more than 2 psig to 7" WC (14 kPa to 1.75 kPa), the stepdown should be done in two steps:
    a. Reduce the pressure to 2 psig (14 kPa).

b. Reduce the pressure from 2 psig to 7" WC (14 kPa to 1.75 kPa).

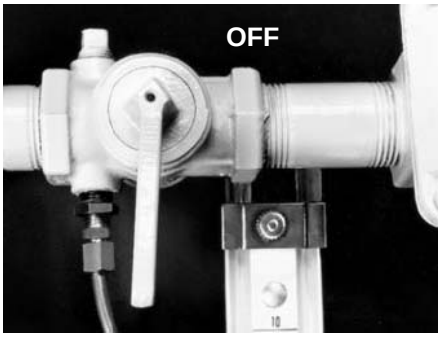
3. The preferred regulator for this application is the Fisher S Series with lock up capability with booster cartridge.
4. Consult your Authorized Fulton Representative for selection.

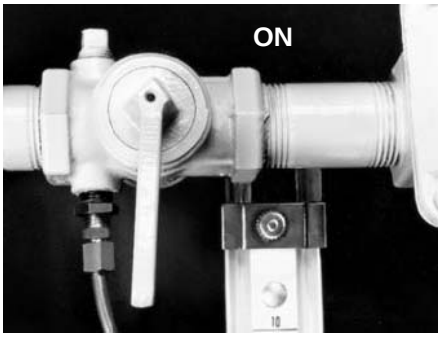
b) This recommendation is made to avoid the regulators chattering. It is also recommended to avoid high lockup pressures, which can cause light off reliability problems.

c) Regulators, other than specified, may be acceptable, but it has been our experience that the above listed regulators operate the best.

Note

After installation is complete and prior to operation, the pressure vessel should be cleaned.





33. Cleaning the Pressure Vessel

a) After the boiler has been installed and before it is placed in service, it is advisable to purge the pressure vessel of any oil film, dirt, or other impurities. Clean the pressure vessel as follows:

1. Isolate the boiler from the system by shutting off the main steam valve.
2. Remove the steam safety valve.
3. Mix Oxiclean with water in a one-gallon container and pour it into the boiler through the steam safety valve opening.
4. The mixture of Oxiclean to water is as follows:

Boiler Size	Oxiclean
15-20	2 lb (908 g)

5. Replace the steam safety valve.

6. Fill the boiler with water. Water level is about center in the water gauge glass.
7. Generate 5 PSI (0.352 kg/cm2) of steam and shut off the boiler. Allow this hot solution to remain in the boiler for 10 minutes.
8. Drain and flush the boiler twice with fresh water.
9. To remove all the oil and dirt from the main steam and the condensate return lines, allow the returns to go into a floor drain or a safe discharge point for the first week of operation.

34. Before Leaving the Installation

a) Check all controls to insure they are operating properly. Cycle boiler several times by raising and lowering operating pressure.

b) Make sure installation complies with all applicable codes.

Section 3

Section 3 – Operation

1. Instructions

a) Post these instructions in an appropriate place near the boiler and maintain in good legible condition.

Warning

If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or loss of life.

b) Fulton pulse combustion boilers do not have a pilot. They are equipped with an ignition device, which automatically lights the boiler. **Do not** try to light the boiler by hand. **BEFORE OPERATING** smell all around the boiler area for gas. Be sure to smell next to the floor as some gas is heavier than air and will settle. **IF YOU SMELL GAS**: Do not light any appliance. Do not touch any electric switch. Do not use any phone in your building. Immediately call your gas supplier from a neighbor's phone, and then follow your gas supplier's instructions. If you cannot reach your gas supplier, call the fire department. Use only your hand to turn the gas cock knob. Never use tools. If the knob will not turn by hand, don't try to repair it. Call a qualified service technician. **FORCE OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.**

Note

DO NOT use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and/or gas control(s), which has been under water.

c) Shut off the main manual supply valve when the equipment is closed down for an extended period of time.

d) Before operating your Fulton Pulse Combustion Boiler: STOP! Make sure you have read and followed all previous safety information.

1. Set the pressure control to lowest setting.
2. Turn off all electric power to the boiler.
3. Turn gas cock knob clockwise to "OFF".

Figure 20. (This gas cock knob is also the emergency shut-off device.)

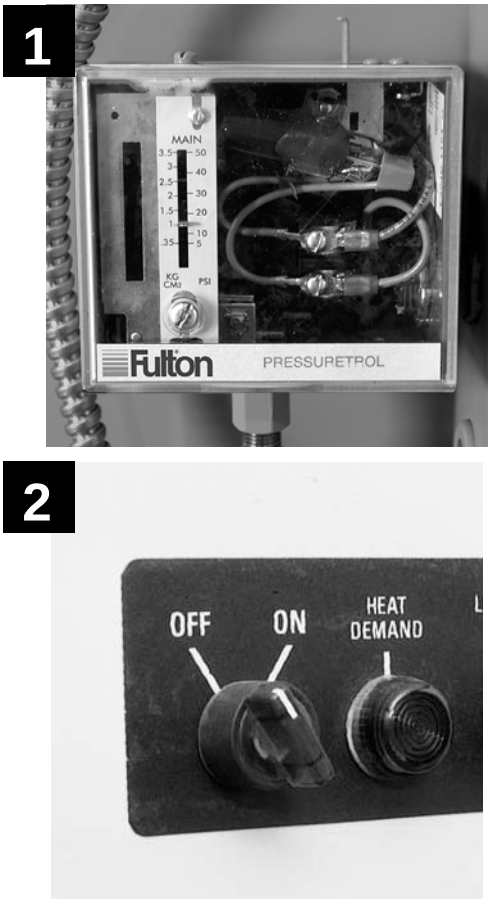


Figure 20

This boiler is equipped with an ignition device, which automatically lights the burner. Do not try to light the burner by hand.

Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow safety information. If you do not smell gas, go to next step.

2. Start-Up Preparation

a) Check with local authorities where approval for start-up is required. In some localities, final inspection of services may be required.

b) Refer to the following instructions on the initial start-up of the pulse boiler and on every subsequent occasion when restarting boiler after shut down:

1. Open the steam stop valve at the top of the boiler.
2. Open all valves in the water feed line.
3. Open the water column isolation valves.
4. Open the water gauge valves.
5. Close the blow down valves on the boiler and on the water column.
6. Switch on the feedwater pump motor.

Note

The pump will continue to operate until the water reaches the correct level in the boiler. This level is approximately the center of the water gauge.

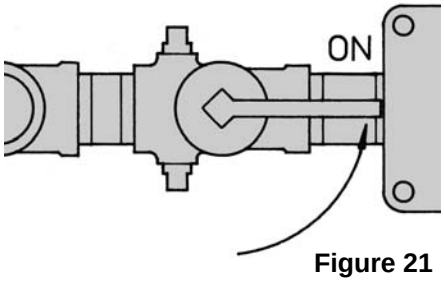


Figure 21

3. Starting the Fulton Pulse Combustion Boiler

a) Open the main gas cock knob counter-clockwise 1/4 turn to “ON” (Figure 21). Turn on all electric power to the boiler. Set thermostat to desired position. Turn operating switch on boiler to “ON” position. The boiler is energized and 35 second prepurge begins.

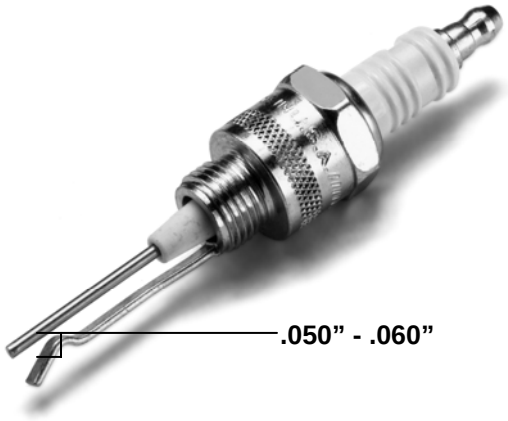
b) After 35 seconds the spark igniter and gas valve (2 seconds later) are energized. If combustion is not sensed within 4 seconds, gas and spark are de-energized. The control will recycle to prepurge, only if the selected number of retry attempts is not exceeded.

c) If after 37 seconds the gas valve opens but the boiler does not start, check the spark plug to be sure it is working properly.

d) The plug may be bad or the plug wire may be loose. Check gap of plug It should be .050" to .060". When replacing plug be sure to use anti-seize compound on threads of plug. When the unit fires and flame is sensed in the combustion chamber, the unit will continue to operate until main power is shut off to the controller either through the temperature switch or main power switch. Once the flame is sensed the blower and spark will turn off.

Caution

Should overheating occur or the gas supply fail to shut off, do not turn off or disconnect the electrical supply to the pump. Instead, shut off the gas supply at a location external to the boiler.



4. If The Boiler Does Not Start

a) Check that the pressure control is set higher than steam pressure in the boiler. Check for tripped circuit breaker or blown fuse.

b) Check for possible restrictions (foreign objects, snow, rags, leaves, etc.) in either the air supply inlet or the exhaust outlet on the outside of the building. For all models, check reset switch. Check for proper water level in the boiler (low water cutoff).

c) **If the boiler still does not operate, follow these instructions to shut off the gas and call your service technician and/or gas supplier:**

1. Set the thermostat to the lowest setting. Turn off all electric power to the boiler if service is required. Turn gas cock knob clockwise to “OFF” a quarter of a turn.
   Figure 20.

d) Emergency Shut Down

1. Shut off electric power to the boiler.
2. Shut off the main gas valve.

5. Sequence of Operation

a) **INITIATE:** The RM7865 enters the five second INITIATE sequence when the Relay Module is powered. The RM7865 can also enter the INITIATE sequence if the Relay Module verifies voltage fluctuations of +/- 10-15% or frequency fluctuations of +/- 10% during any part of the operating sequence. The INITIATE sequence lasts for five seconds unless the voltage or frequency tolerances are not met. When the tolerances are not met, a hold condition will be initiated and will be displayed on the optional display module for at least five seconds. When the tolerances are met, the INITIATE sequence will restart. If the condition is not corrected and the hold condition exists for four minutes, the RM7865 will lockout.

b) Causes for hold conditions in the INITIATE sequence are:

1. AC line dropout is detected.
2. AC line frequency error caused by using a 60 Hz device on a 50 Hz line or vice-versa.
3. AC line noise that can prevent a sufficient reading of the line voltage inputs.
4. Brownouts caused by a low line voltage.

c) The INITIATE sequence will be initiated if the operating control input is de-energized during PREPURGE.

d) **STANDBY:** The RM7865 is ready to start an operating sequence when the operating control input determines a call for heat. The burner switch, limits, operating control, inter-locks, critical loads and all microcomputer monitored circuits must be in the correct state for the RM7865 to continue into the PREPURGE sequence.

e) **NORMAL START-UP PREPURGE:** The RM7865 provides a PREPURGE timing of 35 seconds with power applied and the RM7865 operating control indicating a call for heat.

1. Combustion pressure switch, purge fan switch ILK, burner switch, limits, operating control and all microcomputer
   monitored circuits must be in the correct operating state.

2. The fan motor output, terminal 5, is powered to start the PREPURGE sequence.
3. The purge fan switch ILK input must close within three seconds to start the 35 second PRE-PURGE; otherwise, lockout occurs.

f) IGNITION TRIALS:

1. Combustion Pressure Establishing Period (CPEP):
    a. The ignition transformer, terminal 10, is energized two seconds prior to opening of the main fuel valve.
    b. The Main fuel valve, terminal 8 is energized for four seconds. Combustion pressure must be proven by the end of the six seconds of CPEP to allow the sequence to continue to the combustion pressure Stabilization Period. If combustion pressure is not proven by the end of CPEP, the RM7865 will recycle to PREPURGE.
2. Combustion Pressure Stabilization Period (CPSP):
    a. If the Combustion Pressure Switch is energized at the end of CPEP, the RM7865 enters an eight second Combustion Pressure Stabilization Period. If the Combustion Pressure Switch ILK opens, the RM7865 will recycle to PREPURGE if the selected number of retry attempts is not exceeded. After the eight seconds, the RM7865 will enter the RUN period.

g) RUN

1. After the CPSP/MFSP, the RM7865 will enter into the RUN sequence. The RM7865 will remain in RUN until the controller input, terminal 6, opens indicating that the demand is satisfied or that the limit has opened. If the Combustion Pressure Switch Interlock opens or the flame signal is lost (RM7865B), the RM7865 will enter the POSTPURGE period. The fan motor is de-energized during RUN.

h) POSTPURGE

1. The RM7865 provides a 35 seconds POSTPURGE following the completion of the RUN period; and the fan motor output is powered to drive all products of combustion and any unburned fuel from the combustion chamber. The RM7865 will also enter POSTPURGE if the operating control input is de-energized during CPEP, CPSP or RUN.
    a. The main fuel valve and ignition, terminals 8 and 10, are de-energized. The purge fan switch is energized and the POSTPURGE period begins.

b. After the 35 second POSTPURGE period is completed, the RM7865 returns to STANDBY.

6. Sequence of Operation for Pulse Steam Boilers

a) When the boiler receives a call for heat, the prepurge cycle is initiated.
b) Following prepurge, the spark generator energizes and the gas valves open.
c) Upon proof of flame, the fan and spark are turned off.
d) When the boiler outlet pressure reaches set point, the boiler is turned off and prepurge begins.
e) The boiler control then monitors the boiler pressure and waits for the next call for heat.

Note

A series of relays are used in the above sequence of operation. Please refer to the wiring diagram for details.

Section 4

Section 4 – Maintenance

Note

Your Fulton Pulse Combustion Boiler has been designed for years of trouble-free performance. To ensure the continued safety and efficiency of the boiler, the schedule of maintenance outlined in this section should be adhered to. The boiler should be inspected annually. All service should be performed by a certified contractor.

1. Before Each Heating Season

a) Check air intake and exhaust vent outlet for any blockage or restrictions.
b) Check the air intake and exhaust vent piping for sagging.
c) Check the water level in the sight glass (water level should be about halfway in the sight glass) to prevent dry fire condition.

Warning

Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids.

For Typical heating applications (closed loop system) feedwater treatment may not be necessary.

2. Recommended Weekly Maintenance

a) Make inspection of boiler and system for leaks or any unusual condition in the operation of the controls and feed pump.
b) To assure safe operation, the boiler power should be left on during daily blow down so that correct operation of the low water relay may be checked. While blowing down boiler, the pressure will drop significantly. While blowing down with power on, it is normal to hear boiler feed pump come on.
c) Combustion should not occur. If combustion does occur, turn boiler off and contact your local service representative or our factory immediately.
d) Blow down weekly by starting the boiler and generating not more than 3 PSI (.25KG/CM2) of steam. Then shut off the boiler. Turn on tap water to blow-off separator. Open the boiler blow off valve for approximately 10 seconds. Close the valve. Shut off tap water to blow-off separator. Blow down water level control each morning by opening the

control and water gauge blow-off valves for approximately 10 seconds. Close valves. Observe how long it takes for return water to fill the glass.

e) If the boiler is being operated automatically on a time clock, the blow down operation may be done at the end of the day.

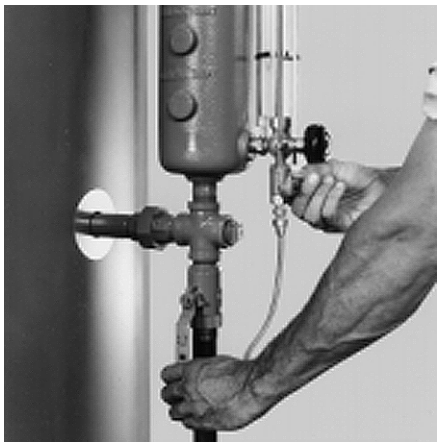
f) If the feedwater is being treated by compounds, make sure this treatment is continually carried out according to the specific manufacturer's instructions.

1. Check water level in sight glass and operation of tri cocks.
2. Check to be sure feedwater pump is working.

Note

To ensure the continued safety and efficiency of the boiler, the schedule of maintenance outlined in this section should be adhered to.

Blow down the boiler weekly. Shown here is blow down "Y" value.

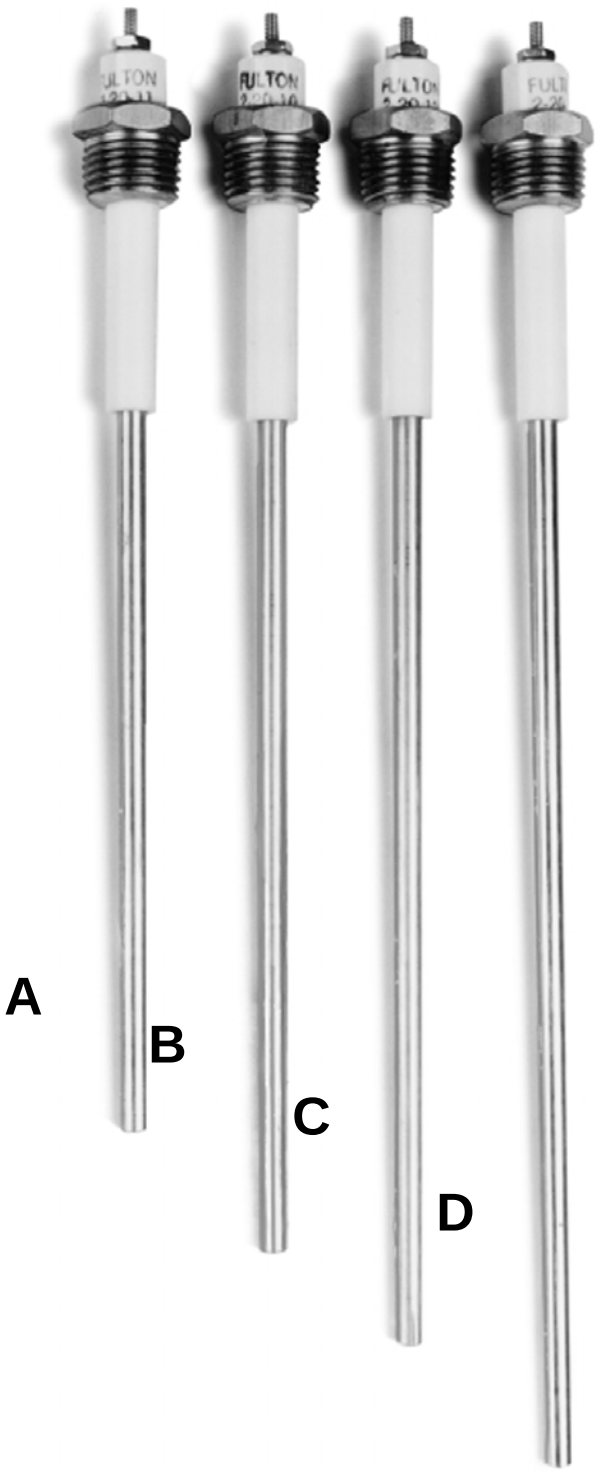


Blow down the water level control each morning by opening the control and water gauge blow-off valve.

3. Procedure for Cleaning Water Probes

a) Clean probes on top of boilers shell and probes in water column. Make sure there is no pressure on the boiler during the removal of the probes. Remove one probe (using a 7/8" (22-2mm) socket), clean with a very fine emory cloth and replace it before removing another to assure no probe mix-ups that would change the control functions.

b) For replacement purposes, installed probe lengths are indicated in the chart below. For a universally adaptable plug and probe, which can be cut to length in the field to fit all boilers, order Part No. 2-20-017.



A=7” – 178mm
B=8” – 203 mm
C=9” – 229 mm
D=19 ½” – 495mm

4. Recommended Annual Maintenance

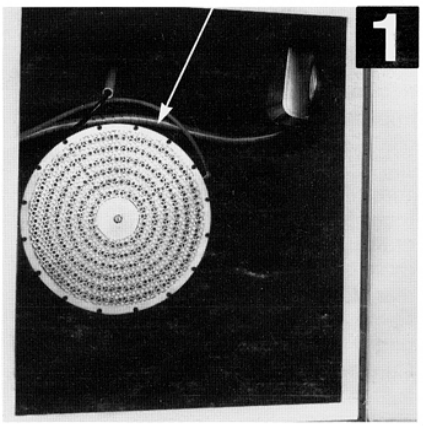
a) Cleaning of flue gas passageways (exhaust) and condensate drain is required at least once a year, using the following procedure.

b) Turn the power to the boiler off; turn the gas supply off; and disconnect gas supply pipe from gas train.

1. Disconnect plastic tubing from air valve housing.
2. Take the ENTIRE AIR VALVE HOUSING OUT by turning it counterclockwise.
3. Connect a 3” coupling to the 3” pipe on which the air valve housing was connected.
4. Connect a 24” long, 3” nipple to the 3” coupling.
    a. Connect a 3” cap on the open end of the 24” long nipple.
    b. Remove the spark plug and adaptor.
    c. Plug the spark plug opening with a ½” –14 NPT solid plug.
5. Disconnect the bleed lines from the gas decoupler.
    a. Separate the gas train from the gas decoupler by disconnecting the union (make sure to support the gas train)
    b. Disconnect the gas flapper valve from the gas decoupler.
    c. Remove the 2 ½” coupling (with the gas flapper valve attached to it) from the gas pipe going into the boiler.
    d. Connect a 2 ½” cap to the gas pipe.
6. Remove the 2 ½” cap located on top of the boiler (orifice access cap)
    a. Remove the plug from the 2 ½” orifice access pipe.
    b. Carefully remove the orifice.
    c. Insert a long reach funnel into orifice access pipe.
    d. Mix 3 lbs of detergent or sodium hydroxide (NaOH) with 30 gallons of warm water.
    e. Slowly pour the solution into the combustion chamber through the funnel.
    f. Place a container big enough to collect 10 gallons of cleaning solution under the 3” pipe coming out of the air decoupler. During the following rinse cycle calling for 20 gallons, the additional 10 gallons will flow out the boiler drain.

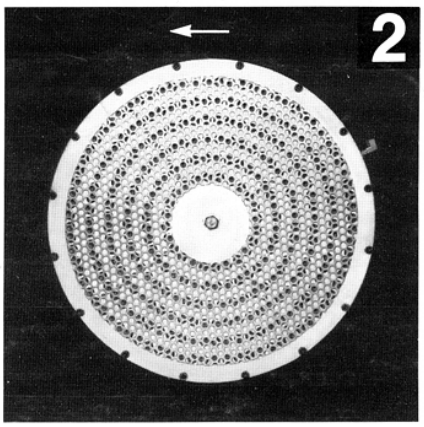
g. Disconnect the 3” cap and let the cleaning solution drain completely out of the combustion chamber.
    1. Replace the 3” cap.
    2. Rinse the flue gas passageway with 20 gallons of water.
    3. Remove the 3” cap and drain.
    4. Replace the cap and rinse again with 20 gallons of water.
    5. Remove the 3” cap and drain.
h. Remove the 2 ½” cap from 2 ½” gas pipe in the gas decoupler compartment.
i. Remove the plug from spark plug opening.
j. Allow half an hour for the moisture inside the heat exchanger to dry.

Air Valve Housing



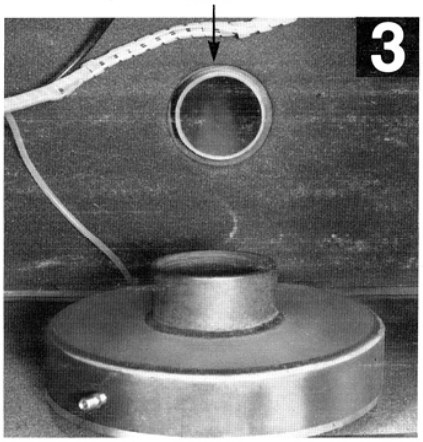
Disconnect Plastic Tubing From Air Valve

Remove By Turning Counter Clockwise



Take Entire Air Valve Housing Out

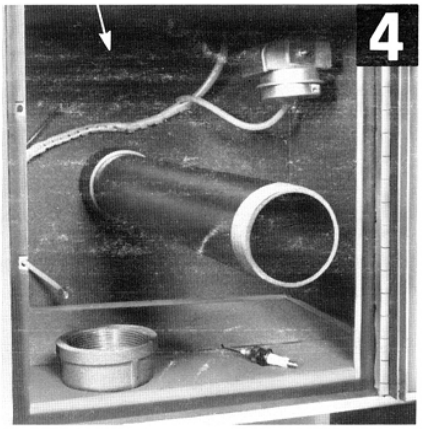
Connect 3″ Coupling Here



Connect 3″ Coupling to 3″ Pipe Where Air Valve Housing Was

Remove Spark Plug and Adaptor

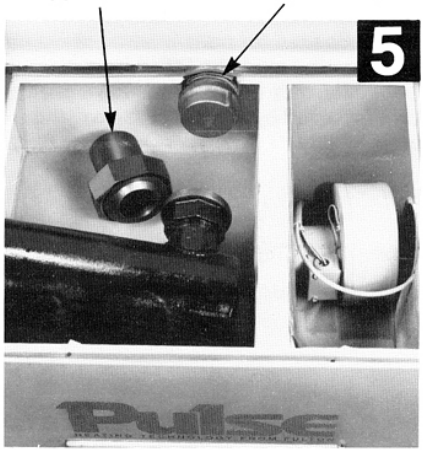
Plug Spark Plug Housing With A ½″ 14 NPT Solid Plug



Connect A 24″ Long 3″ Nipple To 3″ Coupling

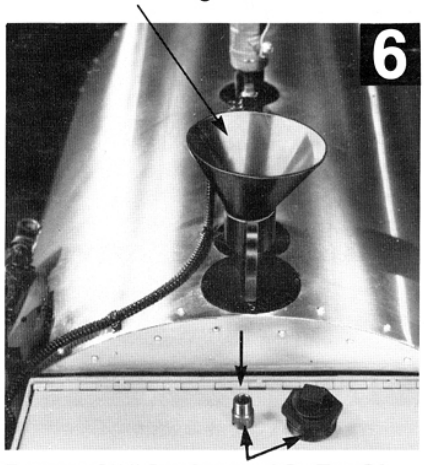
Disconnect Gas Flapper Valve

Connect 2½″ Cap To The Gas Pipe



Disconnect Bleed Lines, Separate Gas Train From Gas Decoupler

Insert Long Reach Funnel For Cleaning



Remove 2½″ Cap Located On Top Of Boiler. Remove Orifice.

5. Troubleshooting

The following troubleshooting guide will assist in the diagnosis and correction of minor field problems. It should be used in conjunction with the unit wiring diagram. In any case requiring additional assistance, the Fulton Service Department should be contacted.

Fault Code Diagnosis		
Fault Code	**System Failure**	**Recommended Troubleshooting**
Fault 02 *AC Frequen/Noise*	Excess noise or device running on slow AC	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3. Check the 7800 power supply to assure that both frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 03 AC Line Dropout	AC line dropout detected	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3.Check the 7800 power supply to assure that both Frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 04 AC Frequency	Device running on fast AC	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3.Check the 7800 power supply to assure that both Frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 05 Low Line Voltage	Low AC line detected	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3.Check the 7800 power supply to assure that both Frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.

Fault 32 Airflow Switch	Combustion airflow interlock fault	1.Check wiring—correct any errors 2.inspect the fan, assure that there is no blockage of the air intake and that it is supplying air. 3.Assure that the airflow interlock switches are functioning properly and that their contacts are free from contaminants. 4.Reset and sequence the 7800 to prepurge. Measure the voltage between terminal 7 and G (ground). 120Vac should be present.
Fault 47 Jumpers Changed	The configuration jumpers differ from the sample taken at startup.	1.Inspect the jumper connections. Assure that clipped jumpers have been completely removed. 2.Reset and sequence the 7800. 3.If fault persists, replace the relay module.
Fault 54 Comb. Pressure	Combustion pressure switch fault	1.Check wiring; correct any errors. 2.Inspect the combustion pressure switch to assure that it is functioning properly. 3.Reset and sequence the 7865. During standby or prepurge, measure the voltage between terminal 20 and G (ground). 120 Vac should be present. If not, the combustion pressure switch may be defective and need replacement. 4.If fault persists, replace the relay module.
Fault 55 Purge Fan Sw. On	Purge fan switch is on when it should be off	1.Check wiring; correct any errors. 2.Inspect the purge fan switch terminal 18 and connections. Assure that the switch is functioning correctly and is not jumpered or welded. 3.Reset and sequence the 7865. 4.If fault persists, replace the relay module.
Fault 57 Purge Fan Sw. Off	Purge fan switch is off when it should be on	1.Inspect the purge fan switch terminal 18 and connections. Assure that the switch is functioning correctly. 2.Reset and sequence the 7865. 3.If the fault persists, replace the relay module.
Faults 105-127	Call Service	1.Replace 7865 controller.

Problem	Cause	Check
Starting or Purge Failure	Power Supply	Check fuse or circuit breaker. Reset or replace as necessary
	Pressuretrol	Disconnect all power to the controller. Disconnect the wires from the controller. Connect an ohm meter between the switch terminals. Lower the set point of the controller. Switch should either make or break. Raise the set point and re-check ohm meter. Switch should either make or break. If the controller operates improperly, replace it.
	Pressuretrol Setting	Check that the operating pressure control is set higher than pressure in the boiler.
	Reset switch	For all models check reset switch. (turn on-off toggle switch to off and wait five seconds.)
	Loose Tubing	Check to see if the tubing on the air valve housing is securely connected
	On/Off switch	For all models check to see if on/off switch is illuminated.
	Bad air switch	Try adjusting sensitivity of switch or replace
	Bad Fan	Check fan for operation, replace if necessary
	Flame Rod (option)	Check for carbon buildup, cracks in porcelain
	Main Control	Check for bad ground, or bad control. Replace control
	Plugged air inlet	Check for blockage of air inlet line and remove
	Spark plug	Check for carbon buildup, moisture, cracks in porcelain. Check for proper gap (.05 to .06" for Champion spark plug) Clean or replace as necessary.

	Loose wire connection	Check that the operating temperature control is set higher than temperature of the boiler water.
	Loose Tubing	Check to see if the copper tubing on the air valve housing is securely connected.
Boiler Will Not Maintain Pressure	Gas Supply	Check gas pressure coming into gas train. If low, contact gas company. Should be 7"WC. Check coil in gas valve with amp meter. Replace if bad. Check gas regulator setting and readjust as necessary
	Pressuretrol	Disconnect all power to the controller. Disconnect the wires from the controller. Put an ohm meter between the switch terminals. Lower the set point of the controller. Switch should either make or break. Raise the set point and recheck ohm meter. Switch should either make or break. If the controller operated improperly replace it
	Scale Built up in Boiler	Call your authorized Fulton LoNox Pulse Combustion boiler Distributor
	Steam Traps Blowing Through	Check traps, clean or replace as necessary
Flame Failure	Power Supply	Check fuse or circuit breaker. Reset or replace as necessary
	Main Control	Check for bad ground or bad control, replace if necessary.
	Proof of Flame Switch	Check adjustment of pressure switch no. 2. It should be set at 1.5" W.C. replace if necessary
	Flame Rod (Option)	Check for carbon buildup, cracks in porcelain
	Loose Wire Connection	Check connections to all components

	Air Flappers	Check to see if the flappers on the air valve plate are placed correctly (covering the holes)
	Gas Flappers	Check to see if the flappers on the gas valve plate are placed correctly (covering the holes)
	Plugged Exhaust Line	Check for a blockage of the exhaust piping and remove
Poor Combustion	**In All Cases:**	**Reset main control in panel box on flame failure.**
	Air Flappers	Check to see if the flappers on the air valve plate are placed correctly (covering the holes)
	Gas Flappers	Check to see if the flappers on the gas valve plate are placed correctly (covering the holes)
	Plugged Air Inlet	Check for blockage or air inlet line and remove.
Boiler is Surging	Steam traps blowing through	Check traps. Clean or replace as necessary.
	Perc (Cleaning Solvent in Boiler)	Clean boiler with washing soda per instruction manual. Inspect steam system for other contaminates.
	Scale build up or lime deposits	Call your authorized Fulton LoNox Pulse Combustion Boiler Distributor.
	Too much compound in system (water treatment)	Dump return tank, flush system or stop treatment for a week.
	Pump is vapor locking	Allow system to cool down. Check steam traps and check to be sure return lines are not insulated. Check return tank temp. If it is above 180 deg F vapor locking of pump will occur.
	Too much water softener (high PH)	Alternate the use of raw water with softener.
	Too much of a load	Check total equipment horsepower required against horsepower of boiler being used. Decrease amount of equipment being used at one time.

	Hole in baffle behind top pipe of water column plugged with scale	Drill ¼" hole in baffle through top pipe connection.
	Boiler new (not cleaned)	Clean per instructions in instruction manual.
Boiler Pushing Water with the Steam	Steam Traps	Check traps. Clean or replace as necessary.
	Too much boiler compound	Dump return tank, flush system or stop treatment for a week.
Pump will not Cutoff	Dirty Probes	Clean or replace as necessary.
	Relay sticking burned	Replace relay.
	Ground connection	Check for tightness & clean
	Water Column pipe clogged	Clean column piping.
Pump runs but does not put Water into Boiler.	Vapor lock of pump	Check for bad steam traps, insulated return lines and return tank for temp over 180F. Reduce temp of return tank.
	Impeller Adjustment	Check for impeller ware and adjust per component information in instruction manual.
	Back pressure on pump	Need to install repair kit on pump.
	Plugged feedwater nipple	Check & clean if necessary.
Water Pump will not Come on at Times	Scale on Probes	Check & clean if necessary.
	Bad Contactor	Check to see if contactor is being powered. Check to see if contactor coil is pulling in. Replace if necessary.
	Bad Pump	Check the incoming power to the pump to be sure it is receiving power. If power is present but motor does not run, replace it.
Low Fuel Pressure	Gas pressure regulator wrong size or defective	Check and replace.

Section 5

Section 5 – Parts & Warranty

Replacement Parts (available from authorized Fulton Representative)

Model Number:	PHP500 and FPB-012		PHP650 and FBP-016		PHP700 and FBP-017	
Description	**No. Req.**	**Part No.**	**No. Req.**	**Part No.**	**No. Req.**	**Part No.**
Gas Valve	2	2-30-000301	2	2-30-000301	2	2-30-000301
Gas Pressure Regulator	1	2-30-000104	1	2-30-000104	1	2-30-000104
Gas Cock	1	2-30-000113	1	2-30-000113	1	2-30-000113
Gas Decoupler	1	7-57-000100	1	7-57-000100	1	7-57-000100
Gas Flapper Valve Assembly	1	7-37-000200	1	7-37-000200	1	7-37-000200
Spark Plug	1	2-20-000090	1	2-20-000090	1	2-20-000090
Air Flapper Valve Assembly	1	7-37-000100	1	7-37-000100	1	7-37-000100
Air Flapper Valve Housing	1	5-57-000080	1	5-57-000080	1	5-57-000080
Purge Blower	1	2-30-000445	1	2-30-000445	1	2-30-000445
Air Safety Switch	1	2-30-000118	1	2-30-000118	1	2-30-000118
Terminal Block	1	2-45-000101	1	2-45-000101	1	2-45-000101
Combustion Controller with	1	2-40-000970	1	2-40-000970	1	2-40-000970
Pump Motor Starter Relay	1	2-40-000200	1	2-40-000200	1	2-40-000200
Low Water Safety Relay	1	2-40-000403	1	2-40-000403	1	2-40-000403
Water Level Relay	1	2-40-000403	1	2-40-000403	1	2-40-000403
Operating Pressure Control	1	2-40-000229	1	2-40-000229	1	2-40-000229
High Limit Pressure Control	1	2-40-000233	1	2-40-000233	1	2-40-000233
Burner Switch	1	2-45-000091	1	2-45-000091	1	2-45-000091
Power On Panel Light	1	2-45-000107	1	2-45-000107	1	2-45-000107
Proof of Flame Safety Switch	1	2-40-000240	1	2-40-000240	1	2-40-000240
Block Intake Safety Switch	1	2-40-000240	1	2-40-000240	1	2-40-000240
Water Bottle 15” Long	1	2-11-000206	1	2-11-000206	1	2-11-000206
Sight Glass	1	2-12-000185	1	2-12-000185	1	2-12-000185
Sight Glass Valve Set	1	2-30-000255	1	2-30-000255	1	2-30-000255
Sight Glass Protector 2” OD x 9.5” long	1	2-12-000811	1	2-12-000811	1	2-12-000811
Universal Plug & Probe	4	4-11-000013	4	4-11-000013	4	4-11-000013
Probe Cover-Water Bottle	1	2-21-000013	1	2-21-000013	1	2-21-000013
Steam Gauge Assembly-Gauge, Siphon	1	5-30-000100	1	5-30-000100	1	5-30-000100
Safety Valve	1	2-30-000070	1	2-30-000070	1	2-30-000070
Hand Hole Cover Assembly-Yoke	4	4-11-000014	4	4-11-000014	4	4-11-000014

Model Number:	PLP500		PLP750		PLP650	
Description	**No. Req.**	**Part No.**	**No. Req.**	**Part No.**	**No. Req.**	**Part No.**
Gas Valve	2	2-30-000301	2	2-30-000301	2	2-30-000301
Gas Pressure Regulator	1	2-30-000104	1	2-30-000104	1	2-30-000104
Gas Cock	1	2-30-000113	1	2-30-000113	1	2-30-000113
Gas Decoupler	1	7-57-000100	1	7-57-000100	1	7-57-000100
Gas Flapper Valve Assembly	1	7-37-000200	1	7-37-000200	1	7-37-000200
Spark Plug	1	2-20-000090	1	2-20-000090	1	2-20-000090
Air Flapper Valve Assembly	1	7-37-000100	1	7-37-000100	1	7-37-000100
Air Flapper Valve Housing	1	5-57-000080	1	5-57-000080	1	5-57-000080
Purge Blower	1	2-30-000445	1	2-30-000445	1	2-30-000445
Air Safety Switch	1	2-30-000118	1	2-30-000118	1	2-30-000118
Terminal Block	1	2-45-000101	1	2-45-000101	1	2-45-000101
Combustion Controller with	1	2-40-000970	1	2-40-000970	1	2-40-000970
Wiring Harness	1	2-40-000975	1	2-40-000975	1	2-40-000975
Pump Motor Starter Relay	1	2-40-000200	1	2-40-000200	1	2-40-000200
Low Water Safety Relay	1	2-40-000403	1	2-40-000403	1	2-40-000403
Water Level Relay	1	2-40-000403	1	2-40-000403	1	2-40-000403
Operating Pressure Control	1	2-40-000229	1	2-40-000229	1	2-40-000229
High Limit Pressure Control	1	2-40-000233	1	2-40-000233	1	2-40-000233
Burner Switch	1	2-45-000091	1	2-45-000091	1	2-45-000091
Power On Panel Light	1	2-45-000107	1	2-45-000107	1	2-45-000107
Proof of Flame Safety Switch	1	2-40-000240	1	2-40-000240	1	2-40-000240
Block Intake Safety Switch	1	2-40-000240	1	2-40-000240	1	2-40-000240
Water Bottle 15” Long	1	2-11-000206	1	2-11-000206	1	2-11-000206
Sight Glass	1	2-12-000185	1	2-12-000185	1	2-12-000185
Sight Glass Valve Set	2	2-30-000255	2	2-30-000255	2	2-30-000255
Sight Glass Protector 2” OD x 9.5” Long	1	2-12-000911	1	2-12-000911	1	2-12-000911
Low Water Cutoff Probe-Shell	1	2-11-000052	1	2-11-000052	1	2-11-000052
Steam Gauge Assembly-Gauge, Siphon	1	5-30-000100	1	5-30-000100	1	5-30-000100
Safety Valve	1	2-30-000070	1	2-30-000070	1	2-30-000070
Hand Hole Cover Assembly-Yoke	4	4-11-000014	4	4-11-000014	4	4-11-000014
4” to 3” Bushing	2	2-35-000386	-	2-35-000386	-	2-35-000386
3” Pipe to Tube Adapter	2	2-35-000800	-	2-35-000800	-	2-35-000800
3” 90 Degree Elbow	6	2-35-000820	-	2-35-000820	-	2-35-000820
3” 90 Degree Termination	1	2-35-000845	-	2-35-000845	-	2-35-000845
3” Plastic Pipe (5’ long)	8	2-35-000840	-	2-35-000840	-	2-35-000840

4” Pipe to Tube Adapter	-	2-35-000802	2	2-35-000802	2	2-35-000802
4” 90 Degree Elbow	-	2-35-000822	6	2-35-000822	6	2-35-000822
4” 90 Degree Termination	-	2-35-000846	1	2-35-000846	1	2-35-000846
4” Plastic Pipe (5’ long)	-	2-35-000842	8	2-35-000842	8	2-35-000842
High Temperature Silicone	-	2-60-000114	-	2-60-000114	-	2-60-000114
Graphite Gauge Glass Gasket		2-12-000256		2-12-000256		2-12-000256
Brass Gauge Glass Nut		2-22-000263		2-22-000263		2-22-000263
Brass Gauge Glass Washer		2-22-000264		2-22-000264		2-22-000264
Brass Gauge Glass Packing Gland		2-20-000002		2-20-000002		2-20-000002

Standard Warranty for Fulton Pulse Steam Boilers

Warranty Valid for Models PVLP, PHP and PLP

One (1) Year (12 Month) Material and Workmanship Warranty
The pressure vessel is covered against defective material or workmanship for a period of one (1) year from the date of shipment from the factory. Fulton will repair or replace F.O.B. factory any part of the equipment, as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by Fulton. The commissioning agency must also successfully complete and return the equipment Installation and Operation Checklists to Fulton's Quality Assurance department. This warranty covers any failure caused defective material or workmanship; however, waterside corrosion or scaling is not covered. Therefore, it is imperative that the boiler water management and chemistry be maintained as outlined in the Installation and Operation Manual.

Parts Warranty
Fulton will repair or replace F.O.B. factory any part of the equipment of our manufacture that is found to be defective in workmanship or material within one (1) year of shipment from the factory provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by both Fulton and the component manufacturers and the commissioning agency has successfully completed and returned the equipment Installation and Operation Checklists to Fulton's Quality Assurance department.

General
Fulton shall be notified in writing as soon as any defect becomes apparent. This warranty does not include freight, handling or labor charges of any kind.

These warranties are contingent upon the proper sizing, installation, operation and maintenance of the boiler and peripheral components and equipment. Warranties valid only if installed, operated, and maintained as outlined in the Fulton manual.

No Sales Manager or other representative of Fulton other than the Quality Manager or an officer of the company has warranty authority. Fulton will not pay any charges unless they were pre-approved, in writing, by the Fulton Quality Manager.

This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Fulton shall in no event be liable for any consequential or incidental damages arising in any way, including but not limited to any loss of profits or business, even if the Fulton Companies has been advised of the possibility of such damages. Fulton's liability shall never exceed the amount paid for the original equipment found to be defective.

To activate the warranty for this product, the appropriate commissioning sheets must be completed and returned to the Fulton Quality Assurance department for review and approval.

Fulton

9/9/09

Fulton Boiler Works, Inc., Fulton Heating Solutions, Inc. & Fulton Thermal Corporation are part of the Fulton Group of Companies, a global manufacturer of steam, hot water and thermal fluid heat transfer systems.