



# Installation Operation And Maintenance Manual

Rev 07/07

# Fulton PulseHW Gas Pulse Combustion Hydronic Heating Boilers



# Fulton Pulse Combustion Hydronic Boilers. . . The Modern Approach to Commercial Heating



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 into the heating boiler industry.

Fulton has brought Pulse combustion applications out of the residential and light commercial markets into larger industrial/commercial heating uses.

## **Benefits of Gas Pulse Combustion:**

### **Reliability**

Flame sensing by pressure switches and 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**

Pulse combustion 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 98% depending on return water temperature and firing rate.

### **Simple Reliable Ignition**

No pilot or complex start sequence. Only a small assist fan is required. Following ignition this assist fan is shut off, so there is no continuous blower motor electrical usage.

### **Low NOx Emissions**

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

NOx (Nitrogen Oxide) commonly referred to as "smog" is a prime contributor to acid rain. Environmental control agencies are beginning to deal with this pollution problem.

Fulton Pulse combustion hydronic heating boilers already meet or exceed most new emission standards.

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**Section**

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# Safety Warnings and Precautions

## For Your Safety

The following **WARNINGS**, **CAUTIONS**, and **NOTES** appear in various sections 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 Fulton Pulse combustion hydronic heating boiler is not designed for use in systems where water is replenished. Mineral buildup can occur on the heat transfer surfaces and result in over heating and possible failure of the heat exchanger.

### CAUTION

Do not install the boiler in an uncontrolled environment where the condensate will be subject to freezing temperatures.

### 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 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. Flex connectors must be installed on the gas supply water inlet and water outlet lines. Spring loaded pipe hangers may be used on the air inlet, water inlet and outlet, and the flue gas vent. Contact your Fulton Representative for vibration isolation packages designed specifically for your application.

### CAUTION

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

### NOTE

The boiler, when used in conjunction with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler. If the boilers are connected to heating coils, located in air handling units where they may be exposed to refrigerated air circulation, such boiler piping systems shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

### NOTE

See the above chart for required gas line size, based on overall length of pipe from meter plus equivalent length of all fittings. Approximate sizing may be based on 1,000 BTU for 1 cubic foot of natural gas.

### 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.

### 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

### NOTE

High/Low Gas Pressure Switch: Low pressure switch should not be set less than 50% of manifold pressure. High pressure switch should not be set any more than 150% of the manifold pressure.

### 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.

# Safety Warnings and Precautions

## NOTE

Intake PVC piping must be assembled using cement. This will ensure that the intake is air tight and will not allow contaminants from the boiler room into the boiler. The cement shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall not show gelation, stratification, or separation that cannot be removed by stirring.

## WARNING

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 cement vapors. Avoid contact of cement with skin and eyes.

## NOTE

Time is critical at this stage. Do not allow primer to dry before applying cement.

## NOTE

Assembly should be completed within 20 seconds after last application of cement. Do not use hammer to insert pipe.

## NOTE

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

## WARNING

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

## NOTE

The following purge procedure is applicable to the piping configuration as shown in Figure 15 on the following page.

## WARNING

Never leave an opened manual air vent unattended. In the event an opened vent is left unattended, water damage can occur.

## WARNING

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

## 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.

## NOTE

Prior to starting, make sure the procedure for purging the heating system has been accomplished as detailed in Section 2.

## CAUTION

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

## NOTE

Do not change the Flame Pressure Switch settings.

## NOTE

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

## NOTE

It is important to know that if the following parameters are altered, the entire set of factory values will be altered: (In) or (UNIT) located in the Input/Output Menu; (AL1) in the Functional Parameters Menu; (A1) in the Operating Parameters Menu.

## NOTE

If the rh (Range High) value has been changed in the Input/Output Menu, the Setpoint Temperature will read zero (0) after return from the menus. Simply press the Up Arrow key until the desired setpoint value is shown. Hit SET/ENT once to store and begin operation.

## NOTE

At high fire, the gas butterfly valve will be full open in the horizontal position. Exhaust butterfly valve will be full open in the vertical position.

## NOTE

The unit will still shut off at setpoint plus 5°F (standard settings). Also, being in manual mode, the temperature control ignores any PID or auto tune settings.

## NOTE

Your Fulton Pulse Combustion Hydronic 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.

## WARNING

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

## NOTE

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

## NOTE

Should you suspect that the boilers flue passage ways have become blocked, contact your recognized Fulton representative.

## NOTE

On models PHW300 through PHW1400 the spark plug is located in the top of the boiler. In PHW2000 the spark plug is located in the gas injector behind the air flapper, and requires a spark plug removal tool.

# Safety Warnings and Precautions

This manual is provided as a guide to the correct operation and maintenance of your Fulton PulseHW Boiler, and should be permanently available to the staff responsible for the operation of the boiler.

These instructions must not be considered as a complete code of practice, nor should they replace existing codes or standards which may be applicable.

The requirements and instructions contained in this section generally relate to the standard Fulton PulseHW Boiler. When installing a packaged unit, this entire section should be read to ensure that the installation work is carried out correctly.

Prior to shipment the following tests are made to assure the customer the highest standards of manufacturing:

- a) Material inspections.
- b) Manufacturing process inspections.
- c) ASME welding inspections.
- d) ASME hydrostatic test inspection.
- e) Electrical components inspection.
- f) Operating test.
- g) Final Engineering Inspection
- h) Crating inspection.

All units are crated for fork lift transport. Once uncrated, all units can be transported with a forklift. Under no circumstances should weight be allowed to bear on the jacket, control panel, or fan housing of any Fulton Boiler.

Rigging your boiler into position should be handled by a competent rigger experienced in handling heavy equipment.

The customer should examine the boiler for any damage. **It is the responsibility of the installer to ensure all parts supplied with the boiler are fitted in a correct and safe manner.**

The installation of the Fulton PulseHW Boiler should be carried out by competent personnel in accordance with all applicable local codes. All state and jurisdictional codes beyond the scope of the applicable ASME Boiler and Pressure Vessel Codes, for its corresponding classification, should be followed in all cases. Jurisdictional authorities must be consulted prior to installation.

## WARNING

**Operating the boiler beyond its design limits can damage the boiler, it can also be dangerous. Do not operate the boiler outside its limits. Do not try to upgrade the boiler performance by unapproved modifications. Unapproved modifications can cause injury and damage. Contact your Fulton dealer before modifying the boiler.**

## WARNING

**A defective boiler can injure you or others. Do not operate a boiler which is defective or has missing parts. Make sure that all maintenance procedures are completed before using the boiler. Do not attempt repairs or any other maintenance work you do not understand. Obtain a Service Manual from Fulton or call a Fulton Service Engineer.**

**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.

# Safety Warnings and Precautions

The following are copies of safety labels and warnings which are affixed to the Fulton Pulse Combustion Hydronic 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.

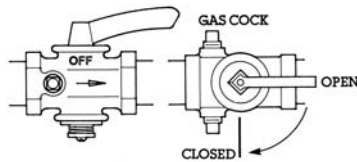
- A. This boiler does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
- B. BEFORE OPERATING smell all around the boiler area for gas. Be sure to smell next to the floor because some gas is heavier than air and will 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 Z23.1. 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.
Minimum 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... 3/4 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** **1** **Installation**

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# Installation

## General specifications and information about Fulton Pulse Combustion Commercial/Industrial Hydronic Boilers

Models	PHW750	PHW950	PHW1000	PHW1400	PHW2000
BTU/HR. Input	750,000	950,000	1,000,000	1,400,000	2,000,000 NG 1,800,000 LPG
BTU/HR Output*	637,500	800,000	840,000	1,204,000	1,700,000 NG 1,530,000 LPG
Fuel	NG/LPG	NG/LPG	NG/LPG	NG Only	NG/LPG
Approx. Dry Weight	2,275 lbs.	2,275 lbs.	2,275 lbs.	2,970 lbs.	3,785 lbs.
Approx. Operating Weight	2,625 lbs.	2,625 lbs.	2,625 lbs.	3,635 lbs.	4,385 lbs.
Floor Loading	270 lbs/ft <sup>2</sup>	270 lbs/ft <sup>2</sup>	270 lbs/ft <sup>2</sup>	240 lbs/ft <sup>2</sup>	250 lbs/ft <sup>2</sup>
Power Required	120/60/1	120/60/1	120/60/1	120/60/1	120/60/1
Min. Required	7" W.C.NG	7" W.C.NG	7" W.C. NG	7" W.C.NG	7" W.C.NG
Gas Pressure	11" W.C. LPG	11" W.C. LPG	11" W.C. LPG		11" W.C. LPG
Max. Amp Draw (F.L.A.)	4.0	4.0	4.0	4.0	10.0
MAWP	60/160 PSI	60/160 PSI	60/160 PSI	60/160 PSI	60/160 PSI
Boiler Width	27.5 IN	27.5 IN	33.6 IN	33.6 IN	33.6 IN
Boiler Height	76 IN	76 IN	76 IN	81 IN	81 IN
Boiler Depth	50.8 IN	50.8 IN	50.8 IN	65 IN	75.8 IN
Unit Size (Output) HP	19	24	26	36	49
KW	190	237	25.8	357	492

Note: \*Based on 120°F in -140°F out.

## Introduction

The Fulton Pulse combustion hydronic boiler is an automatic gas fired, direct vent boiler. This boiler utilizes 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 or can be vented conventionally. 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.

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.

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.

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

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.

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.

## The following items are standard trim for Fulton pulse combustion hydronic boilers:

- Fully Insulated
- Microprocessor Based Control - 120 volt
- Low Water Cutoff (Probe Type)
- Control Panel Completely Wired with Diagram
- Operating Temperature Control
- Hi-Limit Temperature Control w/ Manual Reset
- Air Pressure Switches
- Spark Ignition
- Main Motorized Gas Valve
- Main Gas Pressure Regulator
- Manual Lubricated Gas Cock
- Second Gas Valve (Solenoid)
- Flame Rod

## Included with and packaged separately with each boiler are the following components:

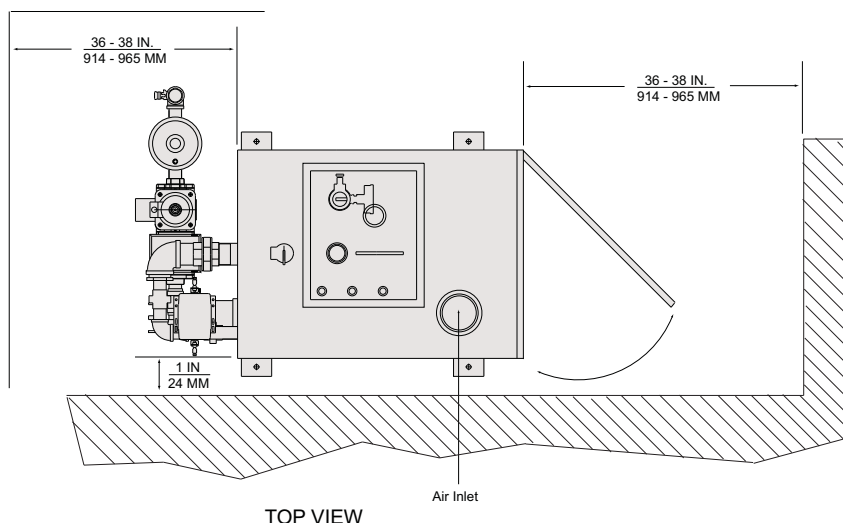
- ASME Pressure Relief Valve
- Pressure-Temperature Gauge
- Air Intake and Exhaust Pipe Adaptors
- Installation, Operation, and Maintenance Manual
- Elastomer Coated Fiberglass Cubes
- Gas and Water Flex Connectors (for Models PHW750, 950, 1000, 1400 & 2000)
- Intake and Exhaust Mufflers (for Models PHW750, 950, 1000, 1400 & 2000)

## Optional Accessories

- Condensate Drain
- Flex Connectors
- Spring Mounts
- Mufflers



**Figure 1**



\*Clearance from top of boiler to combustibles must be no less than 12".

## AIR INTAKE PIPING

Number of

Model No.	Type	Base Diameter/In.	Length/Ft.	90 Degree Elbows
PHW300	PVC	3	10 Minimum	0
		3	35 Maximum	4
PHW500	PVC	3	10 Minimum	0
		3	35 Maximum	4
PHW750	PVC	4	10 Minimum	0
		4	35 Maximum	4
PHW950	PVC	4	10 Minimum	0
		4	35 Maximum	4
PHW1000	PVC	4	10 Minimum	0
		4	35 Maximum	4
PHW1400	PVC	4	10 Minimum	0
		6	35 Maximum	4
PHW2000	PVC	6	10 Minimum	0
		6	35 Maximum	4

## EXHAUST VENT PIPING

Model No.	Type	Base Diameter/In.	Length/Ft.	Number of 90 Degree Elbows
PHW300	Stainless Steel	4	10 Minimum	0
		4	35 Maximum	4
PHW500	Stainless Steel	4	10 Minimum	0
		4	35 Maximum	4
PHW750	Stainless Steel	4	10 Minimum	0
		4	35 Maximum	4
PHW950	Stainless Steel	4	10 Minimum	0
		4	35 Maximum	4
PHW1000	Stainless Steel	4	10 Minimum	0
		4	35 Maximum	4
PHW1400	Stainless Steel	4	10 Minimum	0
		6	35 Maximum	4
PHW2000	Stainless Steel	6	10 Minimum	0
		6	35 Maximum	4

# Installation

## Locating The Boiler

The boiler should 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. (Page 9) See Figure 1 for minimum clearances between the boiler and any combustible surfaces.

### NOTE

**The Fulton Pulse combustion hydronic heating boiler is not designed for use in systems where water is replenished. Mineral buildup can occur on the heat transfer surfaces and result in over heating and possible failure of the heat exchanger.**

### CAUTION

**Do not install the boiler in an uncontrolled environment where the condensate will be subject to freezing temperatures.**

### 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.**

## Installing Elastomer Cube Isolation Mounts

(Figure 2a)

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 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 gas supply, water inlet and water outlet lines. Spring loaded pipe hangers should be used on the air inlet and the flue gas vent. Contact your Fulton Representative for vibration isolation packages designed specifically for your application.

### NOTE

**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. .**

## Installing Spring Isolation Mounts

(Figure 2b)

1. 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.
2. Coordinate the location of each isolator.
3. 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.
4. Insert the small cap screw through the bracket and thread into the top of the leveling bolt and tighten finger tight.
5. Lower the boiler (evenly) onto the spring isolators. Do not overload any one isolator and take care not to push the boiler sideways.
6. Do not attempt to place all the weight on one spring, but distribute the load proportionately by adjusting each isolator in sequence.
7. Continue to adjust each leveling bolt (in sequence) until the boiler is at it's proper height. When the boiler is filled with water, the springs will compress approximately 1-2".
8. Tighten the small cap screw, thus securing the spring isolator to the supported equipment and locking the leveling bolt against turning.
9. 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

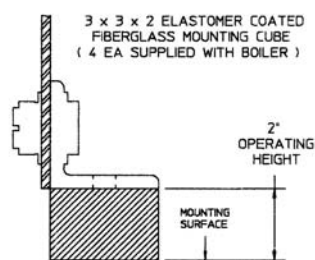
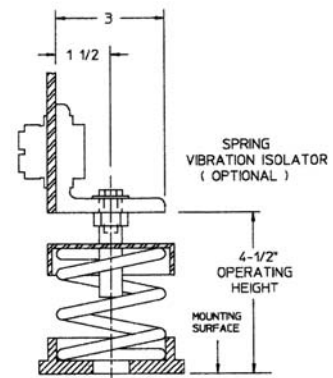


Figure 2b

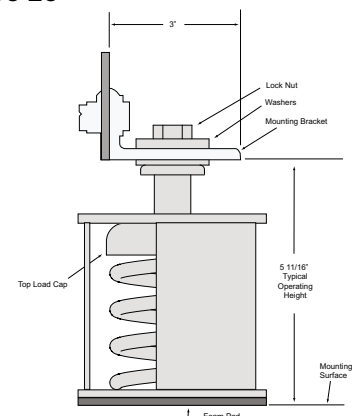


## Installing Seismic Spring Isolation Mounts

(Figure 2c)

1. Thread the leveling bolt 1/2" into the top of the load cap.
2. 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.
3. Coordinate the location of each isolator.
4. 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.
5. 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.
6. Lower the boiler onto the spring isolators taking care not to overload any one isolator and taking care not to push the boiler sideways.
7. Install second washer and lock nut one inch down from top of leveling bolt.

Figure 2c



8. 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.
9. Tighten the lock nuts on the leveling bolts, thus bolting the spring to the boiler and locking the leveling bolt against turning.
10. 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.

a 6" nipple (8" for PHW2000) 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.

### CAUTION

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

2. 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 pressure temperature gauge is installed.

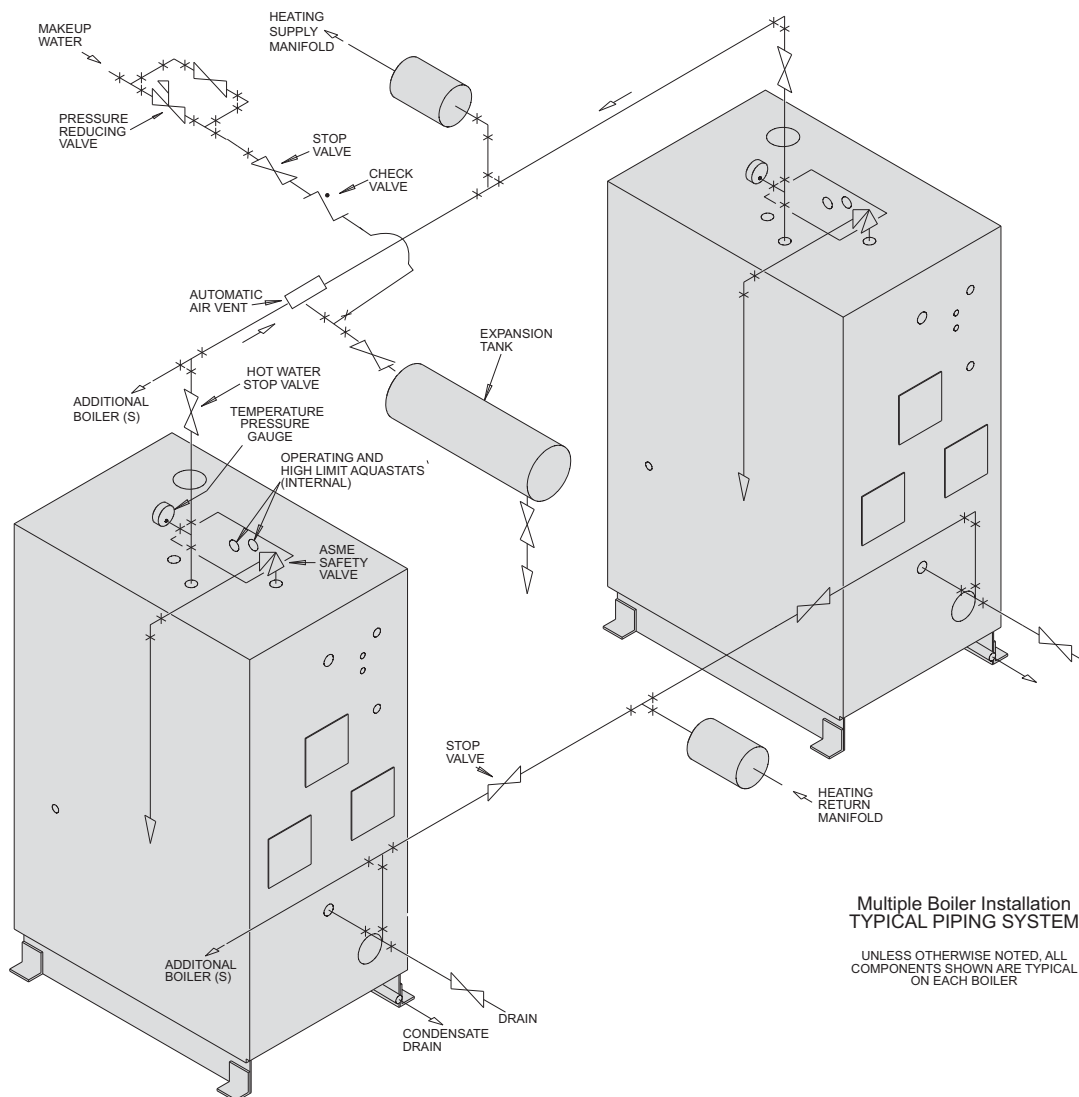
## Installing Water Piping

1. The bottom connection to the boiler is the INLET and must be connected as the return from the system.
2. The top connection on the boiler is the OUTLET and must be connected as the supply to the system.
3. Connect hot water supply to heating system feed line.
4. Connect expansion tank.
5. Connect return water to boiler return water connection.

## Installing Boiler Trim

1. 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 (Figure 3a). The safety relief valve must be installed with

FIGURE 3a



# Installation

6. Install an air separator and air eliminator (air vent) which is necessary as there is no built in boiler air eliminating feature.
  - a. If a sealed diaphragm-type expansion tank is used, install air eliminator in hot water piping at air separator.
  - b. If an air cushion type expansion tank is used, pipe tank directly into boiler supply.
  - c. On multi zoned systems (or a system with both space and domestic water heating), air elimination must be provided either in the common piping or every loop.
  - d. When the boiler is installed at a higher level than baseboard radiation, air elimination must be provided directly above the unit.
7. Install hot water circulator, remote mounted from boiler. Do not attach directly to the boiler. Flexible connectors must be placed between the circulator and the boiler.
8. Install manual purging valves in all loops and zones. Install pressure reducing (automatic fill) valve in the cold water fill line to the boiler system.
9. Check that the proposed operation of zone valves, zone circulator(s) and diverting valves will not isolate air separator(s) and/ or expansion tank(s) from the boiler.

10. Clearance from hot water pipes to combustibles must be at least 6".

## NOTE

**The boiler, when used in conjunction with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler. If the boilers are connected to heating coils, located in air handling units where they may be exposed to refrigerated air circulation, such boiler piping systems shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.**

11. The boiler is furnished with a probe type low water cutoff. No field piping is required. If the probe does not sense water, the boiler will shut down and a red indicator will be illuminated on the control panel.
12. The boiler is not provided with external drain connections. A drain valve must be installed near the inlet connection to the boiler and piped to a suitable floor drain.
13. Before filling the boiler clean and flush the system to remove any debris. Clean and flush old piping thoroughly before installing the boiler. Consider installing a strainer ahead of the boiler.

## Condensate Drain Kit

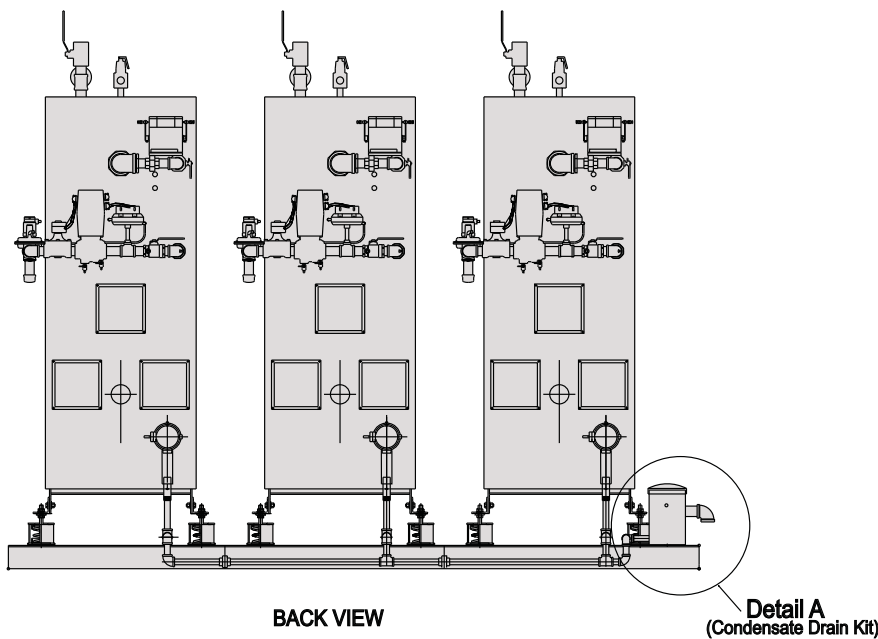
The condensate drain kit is intended to be utilized with any size pulse unit supplied by Fulton. The 3/4" condensate drain on the pulse unit will be connected to the 1" inlet on the drain kit. One or more drain lines may be connected to this inlet (maximum of 8 total per drain kit) through a common header.

An uninterrupted water supply is required and shall be connected to the 1/4" compression fitting on the drain float. The water supply maintains a water level in the drain kit to prevent the flue gas from entering the boiler room through the condensate connection. The 1 1/2" connection shall be piped to an appropriate drain for disposal. If the water supply must be temporarily disconnected, the boiler(s) must be turned off to prevent accidental flue gas emission into the boiler room.

The cover should be kept on at all times, except during maintenance of the drain. This drain should be monitored and checked regularly in your pulse maintenance schedule.

Model Part Number	4-57-000440
Recommended Operating Temp.	175°F max.
Capacity	4 QT
Inlet Size:	1"
Outlet Size	1 1/2"
Water Supply (100 psi max.)	1/4" COMP.
Max. units to attach to drain	8

Figure 3b



For multiple boiler installation, maintain a minimum pipe size of 1" for the header piping.  
(8 boilers maximum per drain kit)

## Pipe Capacity For Natural Gas

Nominal Iron Pipe Size Inches	Internal Diameter Inches	Equivalent Pipe Length 90° Elbow Feet	Tee Feet	Maximum Capacity in Cubic Feet of Natural Gas Per Hour Pressure Drop of 0.5" W.C. Equivalent Length of Pipe in Feet						
				20	40	60	80	100	150	200
1.25	1.38	3.50	6.90	950	—	—	—	—	—	—
1.50	1.61	4.00	8.00	1460	990	810	—	—	—	—
2.00	2.07	5.20	10.30	2750	1900	1520	1300	1150	950	800
2.50	2.47	6.20	12.30	4350	3000	2400	2050	1850	1500	1280
3.00	3.07	7.70	15.30	7700	5300	4300	3700	3250	2650	2020
4.00	4.03	10.10	20.20	15800	10900	8800	7500	6700	5500	4600

### Installing Condensate Drain Piping (Figure 3b)

A condensate collecting tank and condensate pump will be required if a floor drain is not available to collect condensate (Collecting tank and pump are not supplied with the boiler). Complete condensate drain kits are available from Fulton.

1. All piping must be galvanized or stainless steel and should be free of leaks.
2. Make sure either elastomer coated fiberglass cubes or spring mounts have been installed under each leg of the boiler.
3. Install the condensate piping to the condensate drain in the lower right hand side of the boiler.
4. Connect 3/4" condensate drain(s) to the 1" header connected in a manifold as shown in Figure 3b. The header must be 5 1/2" below the condensate outlet and must remain flooded.
5. Connect 1 1/2" drain outlet to an appropriate waste line following applicable codes. The 1 1/2" drain connection on the condensate drain must be the highest point prior to going to the drain. Failure to keep drain piping lower than this point will result in overflow of the condensate drain. Slope the drain pipe away at a minimum pitch of 1" for every 12 feet.

6. Attach a 1/4" water supply to the compression fitting on the float. The water line must be connected to an uninterruptible supply. Fulton recommends connecting it before the "Fast-Fill" valve to the boiler supply but after the back flow preventer to avoid contamination of a potable water supply. Maximum allowable water pressure to the compression fitting is 100 PSI.

2. The pipe and the fittings used should be new and free of dirt or other deposits. Piping must be of the proper size to insure adequate gas supply.
3. Gas pressure to inlet of gas train should be 7" WC for natural gas and 11" WC for propane. Connect gas supply line to the open end of the tee on which the drip leg is installed.

### Installing Gas Piping (Figure 4)

#### NOTE

See the above chart for required gas line size, based on overall length of pipe from meter plus equivalent length of all fittings. Approximate sizing may be based on 1,000 BTU for 1 cubic foot of natural gas.

1. 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.

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

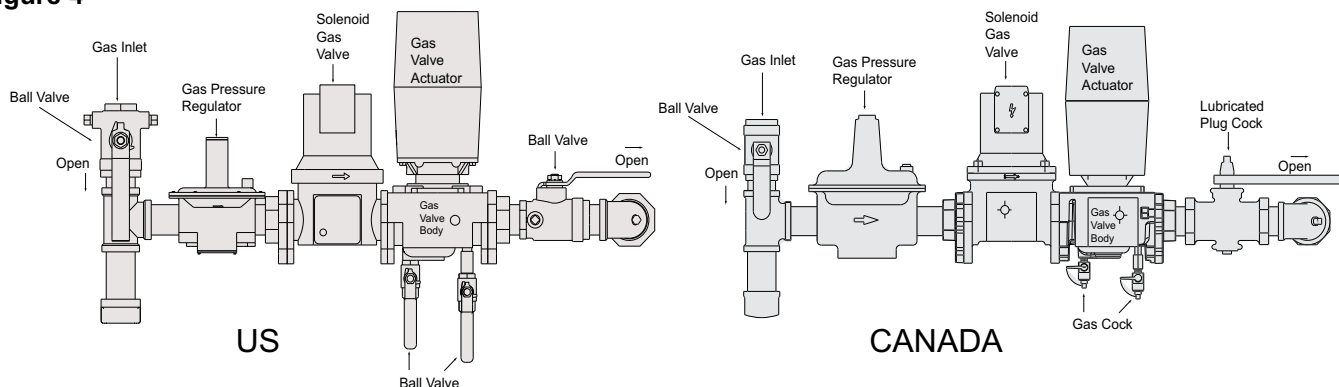
4. When making gas piping joints, use a sealing compound resistant to the action of liquefied petroleum gases. Do not use teflon tape on gas line threads.
5. After gas piping is completed and before wiring installation is started, carefully check all piping connections, (factory and field), for gas leaks. 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.

6. 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).

Figure 4



# Installation

7. 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).
8. 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

## NOTE

High/Low Gas Pressure Switch: Low pressure switch should not be set less than 50% of manifold pressure. High pressure switch should not be set any more than 150% of the manifold pressure.

## Installing Field Wiring (Figure 5)

It is recommended that an independent power supply line be provided for the boiler. Connect one 120 volt (60Hz) fused powerline to terminal block to hot. Connect applicable wires to neutral and ground. Connect a ground wire to green colored ground lug in electrical control box.

## 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.

## Sequence of Operation

1. Turn on main breaker.
2. Low water safety relay (LWSR) is energized when the main breaker is turned on. Red light on the boiler panel is lit and if the optional alarm is provided, alarm will go off. Current is not allowed to pass to the high limit temperature control until both the probe in the boiler shell senses the water and the manual reset switch is reset. If conditions are both satisfied, the red light is turned off.
3. Burner switch is then closed to energize the operating temperature control. (Green light on the panel is lit).
4. The Temperature Control allows current to pass to the High Temperature Control Circuit if the temperature control senses a "Call for Heat".
5. High limit temperature control allows current to pass to the next control if the temperature in the boiler water is not causing the control to open the circuit.
6. The Condensate Sensing Relay allows current to pass to the Blocked Exhaust Switch, Low Gas Pressure and High Gas Pressure Switch.
7. If all of the safeties/limits are made, the Flame Programmer starts the Purge Fan.
8. Purge fan switch is made, signaling the control to proceed. Purge Fan runs for 35 seconds.
9. Spark plug is energized.
10. Gas valve is energized.
11. Flame sensing is proven allowing sequence to continue. Purge Fan shuts off.
12. Pulse combustion process will continue until temperature control is satisfied.

FIGURE 5a

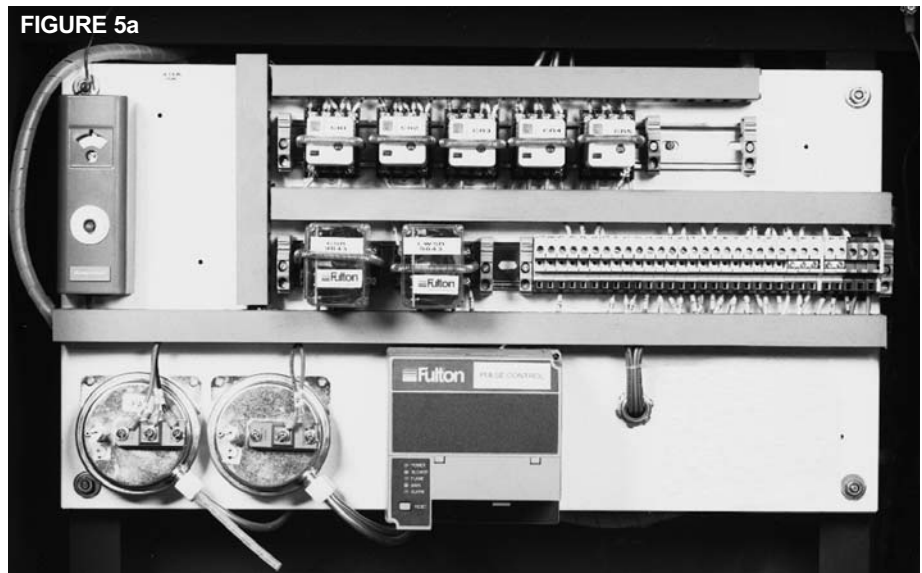
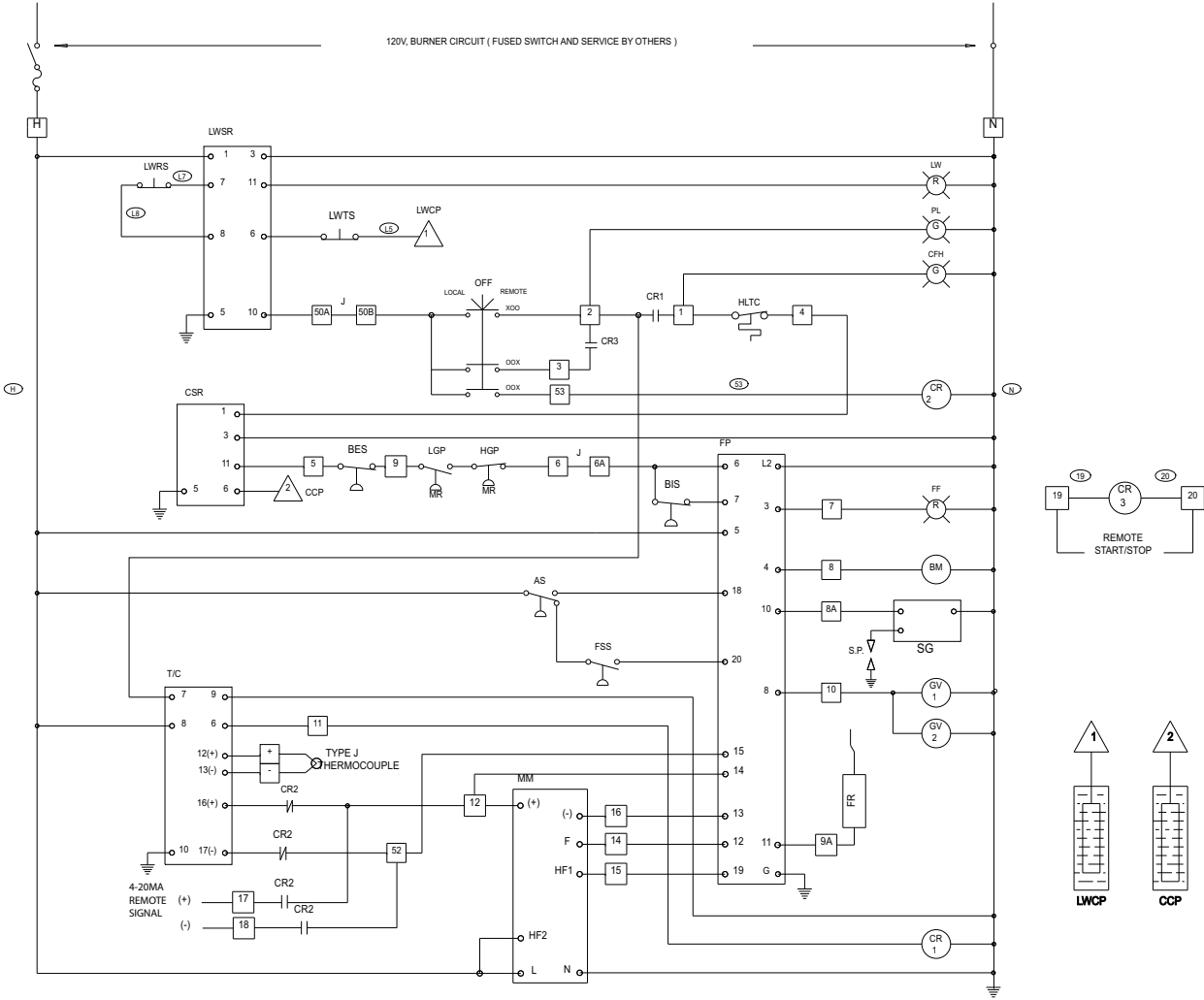


Figure 5a



53	52	51	50B	50A	20	19	18	17	16	15A	15	14	13	12	11	10	9A	9	8A	8	7	6A	6	5	4	3	2	1	N	N	N	N	H	H	H
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**Glossary**

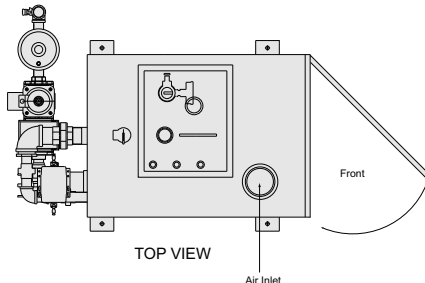
- BM - Purge Fan Motor
- CR - Control Relay
- HLTC - Hi Limit Temp. Contro
- LW - Panel Light (Low Water Indicator)
- LWCP - Low Water Cutoff Probe
- LWRS - Low Water Reset Switch
- LWSR - Low Water Safety Relay
- LWTS - Low Water Test Switch
- GV1,2 - Main Gas Valve
- PL - Panel Light (Power on Green)
- SG - Spark Generator
- S.P. - Spark Plug
- CFH - Panel Light (Call for Heat)
- FF - Panel Light (Flame Failure)
- FP - Flame Programmer
- CSR - Condensate Sensing Relay
- AS - Air Switch
- FSS - Flame Sensing Switch
- LGP - Low Gas Pressure Switch
- HGP - High Gas Pressure Switch
- T/C - Operating/Firing Rate Control
- MM - Modulation Motor
- BIS - Blocked Intake Switch
- BES - Blocked Exhaust Switch
- FR - Flame Rod

# Installation

## Air Intake Supply Piping Installation Preparation

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

Figure 6

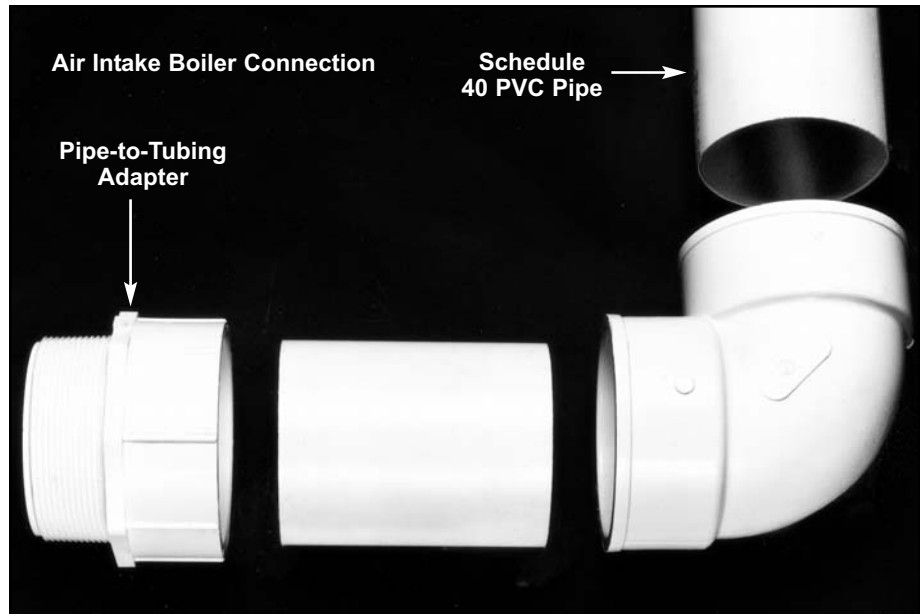


Air supply is on the top. See Figure 6. For Models PHW300 and PHW500 these connections are 3" NPT threaded female fittings and for Models PHW750, PHW950, PHW1000, and PHW1400 they are 4" NPT thread female fittings. These fittings will accept 3" and 4" male/female pipe to tubing adaptors respectively. Model PHW2000 has 6" NPT threaded female fitting.

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 Schedule 40 PVC pipe, fittings, primer and 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. The cement shall be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement shall not show gelation, stratification, or separation that cannot be removed by stirring.**



### WARNING

**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 cement vapors. Avoid contact of cement with skin and eyes.**

The following procedure for cementing joints (per ASTM D2855) should be adhered to:

1. Measure and cut PVC pipe to desired length.
2. Chamfer end of pipe, removing any ridges or rough edges. If end is not chamfered, the edge of the pipe may remove cement from the fitting socket and result in a leaking joint.
3. Clean and dry surfaces to be joined.
4. Test fit joint and mark depth of fitting on the pipe.
5. Uniformly apply liberal coat of primer to inside socket surface of fitting and male end of pipe to depth of fitting socket.
6. Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly—but uniformly—to inside of socket. Take care to keep excess cement out of socket. Apply second coat to pipe end.

### NOTE

**Time is critical at this stage. Do not allow primer to dry before applying cement.**

7. Immediately after applying last coat of cement to pipe, while inside socket surface and end of pipe are wet with cement, insert end of pipe into socket, turn pipe 1/4 turn to distribute cement evenly, continue to insert pipe until it bottoms out.

### NOTE

**Assembly should be completed within 20 seconds after last application of cement. Do not use hammer to insert pipe.**

8. After assembly, wipe excess cement from pipe at end of fitting socket. A properly made joint will show a bead around its entire perimeter. Any gaps may indicate a defective assembly due to insufficient cement.

9. Handle joints carefully until completely set.

## Intake Muffler Installation

Follow steps 1-9 above for cementing joints. **For best noise attenuation, the muffler should be installed as close to the boiler as possible.**

## Exhaust Vent Piping Installation Preparation

### NOTE

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

The boiler is equipped with an exhaust vent connection located at the rear of the boiler. For models PHW300 and PHW500 the connections are 4" NPT threaded female fittings. For Models PHW750, PHW950, PHW1000, and PHW1400 they are 4" NPT threaded female fittings. Model PHW2000 has 6" NPT threaded female fitting.

The exhaust line must be sloped down toward the unit with a pitch of at least 1/4" 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. **In supporting piping, or routing it through a rafter or wall, always use vibration eliminating hangers around the piping to prevent vibration transmission.**

Always avoid rigid connections between piping and structural members of the building.

Flue vent pipes and fittings for all models shall be 316L stainless steel. The stainless steel shall be UL temperature rated at minimum air clearance to combustibles. At 480°F temperature rating, a 5" minimum air space clearance to combustibles is required. 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. The gas vent installer should be familiar with these federal Codes as well as local codes and regulations.

**The procedure for adhesive joining stainless steel pipe and fittings follows:**

1. Do not mix stainless steel pipe with galvanized or other alternatives for the entire length of the system.
2. All joints between sections of the vent connector and the vertical conduit must be sealed with a high temperature sealant or gasket to prevent any possible leakage of flue gas.
3. Apply a bead of sealant, about 1/2" in diameter, completely around the male (without tabs) end of each conduit section or elbow, between 1/4" and 3/8" from the end of the section. Also run a similar sized bead down the seam weld of each section, from the edge of the pipe to the top of the bulge.
4. Fully insert the male end of the section into the female fitting of the section below. Spread any sealant that squeezes out around the circumference of the joint. Attach the sections together with the locking ring and tabs. Again spread any extruded sealant around the joint. Inspect the joint to ensure that flue gases will not escape. If necessary, apply additional sealant to any voids. Allow the sealant 24 hours to cure before operating the boiler.

## Exhaust Muffler Installation

Follow steps 1-5 above to join the fittings. For muffler drain installation:

1. For mufflers installed in the vertical configuration the drain can be plugged.
2. For mufflers installed in the horizontal configuration, the drain opening should be at the downslope "6 o'clock" position and should be piped to the drain line between the boiler and the condensate drain. **For best noise attenuation, the muffler should be installed as close to the boiler as possible.**

# Installation

## Air Intake Supply and Exhaust Vent Installation

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

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 8. 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.

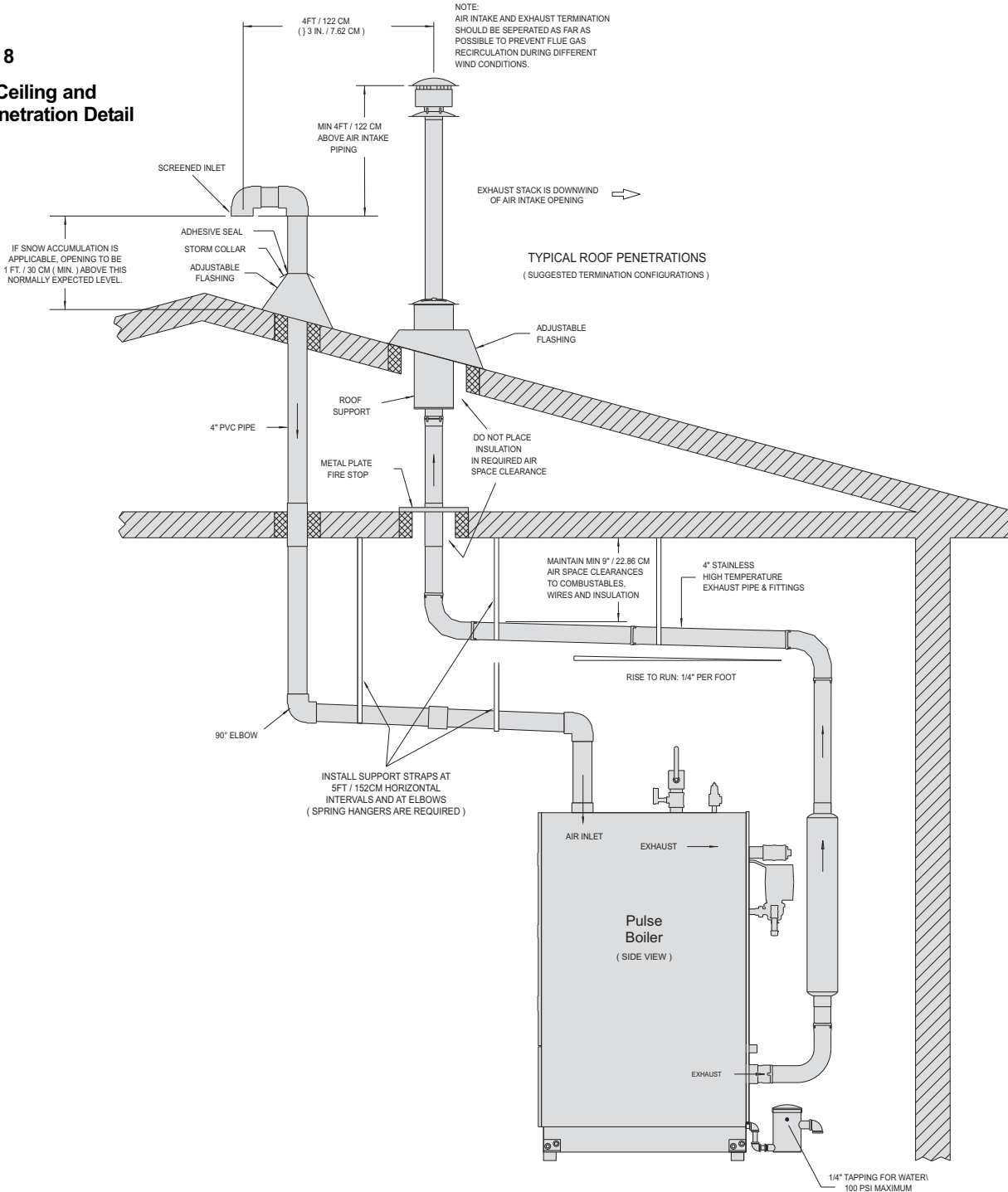
The required minimum air space clearances also apply to electrical wires and any kind of building insulation away from gas vent and out of the required air space clearance.

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. (Figure 9). When passing through a floor or ceiling frame, provide an opening 5" to 9" air space clearance to vent pipe as applicable. The fire stop fits to the bottom of a framed opening 13 1/4" 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" square with the dished position down. Nail the flange to the top of the framing.

Pass the vent pipe through the opening in the fire stop. If used as a support, install the

**FIGURE 8**  
**Typical Ceiling and Roof Penetration Detail**



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 of vent pipes and are recommended at all floor and ceiling penetrations. Figure 10. Air intake supply and exhaust vent pipes and fittings must be securely supported. For pitched roofs refer to figure 12.

Horizontal sections require supports every 5 feet and at elbows. From the boiler, all horizontal sections must rise at least 1/4" per foot, 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.

For vertical through the roof installations all gas vents extending above the roof by more than 2 1/2 feet 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.

## Vertical Vent Flashing and Installation

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. Figure 11.

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

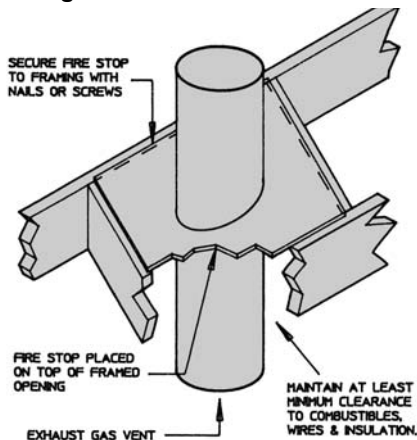
## Vertical Vent Termination

The vent pipe must extend through the flashing to a height above the roof as required in Figure 12. A storm collar is installed on the vent pipe over the opening between pipe and flashing.

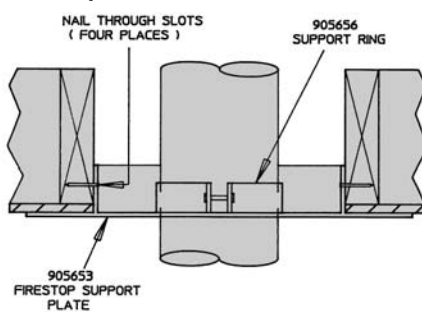
Adhesive material is used over the joint between the vent pipe and the storm collar. Figure 12. The vent termination is joined to the end of the vent pipe.

Termination height for the vent pipe must be such that no discharge opening is less than 2 feet horizontally from the roof surface, and the lowest discharge opening shall be no lower than the minimum height specified in Fig. 12. These minimum heights may be used provided the vent is not less than 8 feet from any vertical wall.

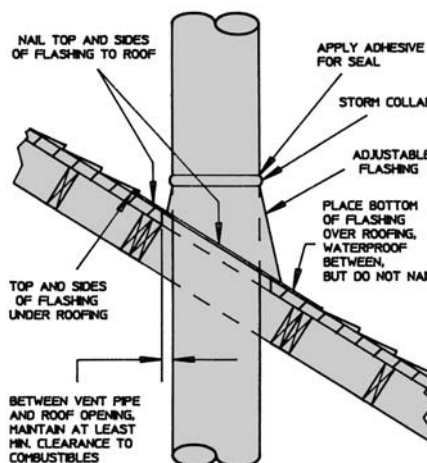
**FIGURE 9**  
Fire Stopping Required For All Ceiling/Floor Penetrations



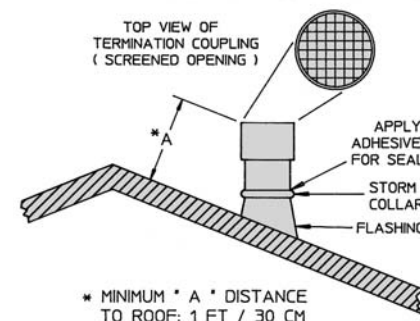
**FIGURE 10**  
Fire Stop



**FIGURE 11**  
Elements For Correct Roof Flashing Installation



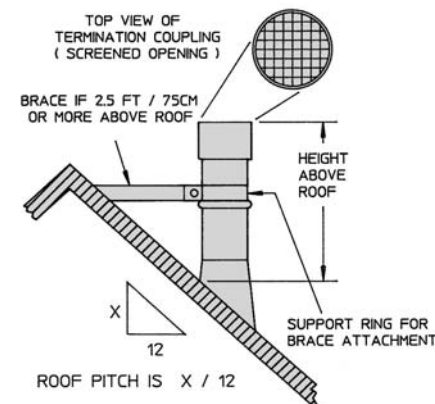
**FIGURE 12**  
For Roof Pitch of Flat to 7/12



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**



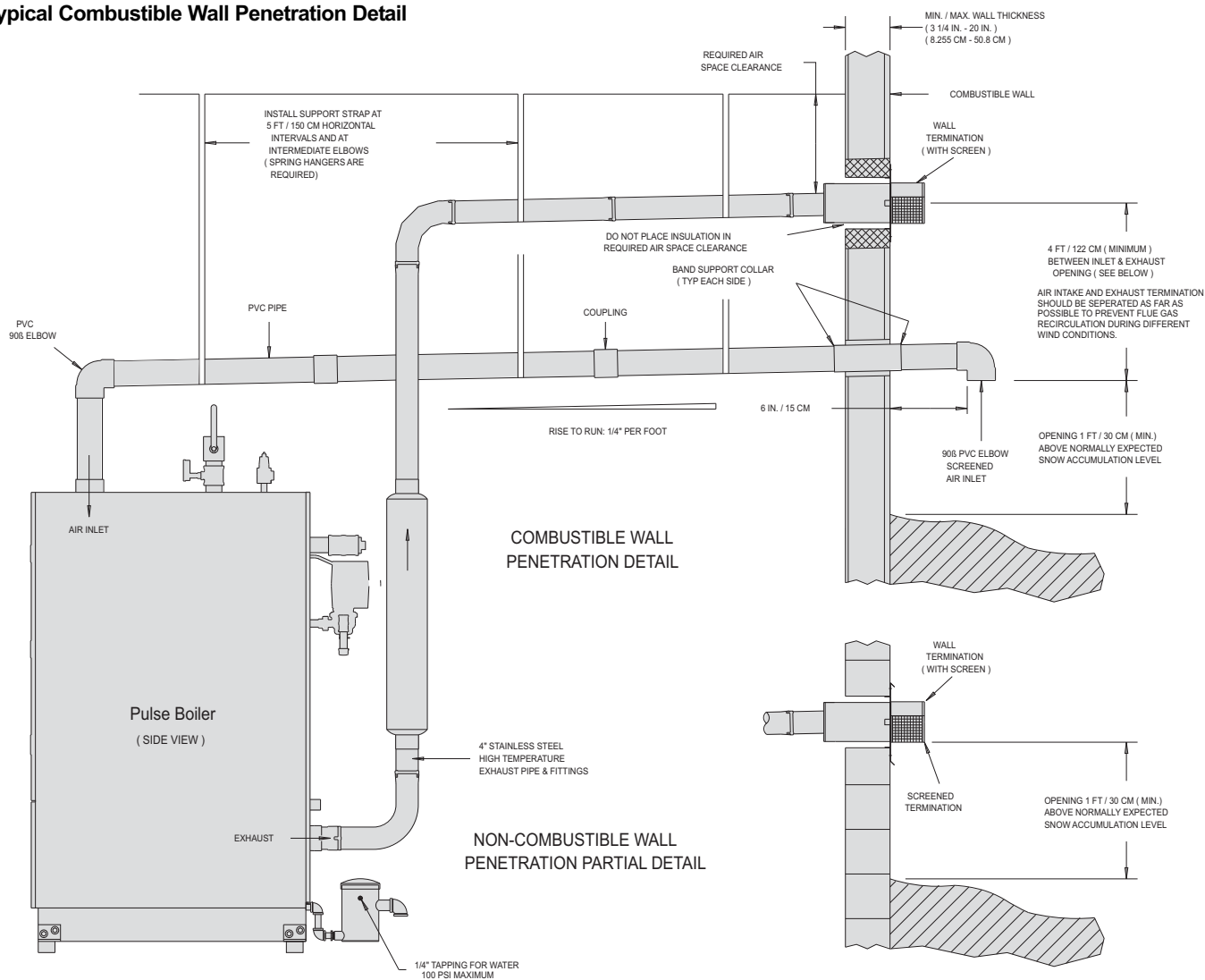
ROOF PITCH ( RISE OVER RUN )	HEIGHT ABOVE ROOF	
	FT	CM
OVER 12/12 TO 14/12	5.0	150
OVER 14/12 TO 16/12	6.0	180
OVER 16/12 TO 18/12	7.0 [2]	210 [2]
OVER 18/12 TO 20/12	7.5	225
OVER 20/12 TO 21/12	8.0	240

[2] BRACE TO ROOF AT TOP AND MID POINT

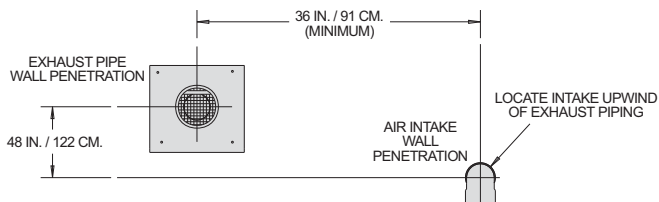
# Installation

FIGURE 13

Typical Combustible Wall Penetration Detail



AIR INTAKE & EXHAUST PIPES WALL PENETRATION CLEARANCES



AIR INTAKE AND EXHAUST TERMINATION SHOULD BE SEPARATED AS FAR AS POSSIBLE TO PREVENT FLUE GAS RECIRCULATION DURING DIFFERENT WIND CONDITIONS

## Horizontal Installation Wall Penetrations (Figure 13)

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

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. When penetrating a combustible wall, a wall thimble must be used. See next page

Figure 14 for installation instructions. Minimum wall thickness through which vent system may be installed is 3 1/4". Maximum wall thickness through which vent system may be installed is 20 inches.

## Wall Thimble Installation

A 9" 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. Figure 14. 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, then tighten securely. They will prevent the intake and vent pipes from being pushed or pulled.

Insure wall thimble for exhaust vent contains internal insulation prior to installation.

## Horizontal Vent Termination

The vent termination is joined to the vent pipe outside the wall. Use the same joining procedures for vent pipe and fittings. The termination of the vent system must be at least 12" above the finished grade, or at least 12" above normal snow accumulation level (for applicable geographical areas). Refer back to previous page Figure 13. The termination of the vent system shall not be located in traffic areas such as walkways, adjacent buildings, openable windows and building openings unless the venting system is at least 7 feet above finished grade, (National Fuel Gas Code, ANSI Z223.1). 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.

The air supply inlet and exhaust outlet must be separated from 3ft. minimum to 10ft. maximum on the same wall. The exhaust outlet must be installed 4ft. minimum 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.

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

## After Installation/Prior to Start-Up

### WARNING

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

Completely fill and purge the heating system using the following sample procedure.

### NOTE

**The following purge procedure is applicable to the piping configuration as shown in Figure 15 on the following page.**

1. Close combination shutoff/purge valve in supply, all drain cocks, the shutoff valve for the pressure reducing (fill) valve, and all manual air vents.
2. Open all other system shutoff valves one of the zone valves, the vent on the combination shutoff / purge valve, and the shutoff valve to the pressure reducing (fill) valve.
3. Water will now begin to fill the system. Air will escape through the vent on the combination shutoff/ purge valve. Continue filling until a constant stream of water (no bubbling) is discharged from the vent.
4. Close the zone valve on the purged loop, and open the zone valve on the next loop to be purged. When all air has escaped and only water is discharged, close the zone valve. When all zones

have been purged. (one at a time), close the vent on the combination shutoff/ purge valve.

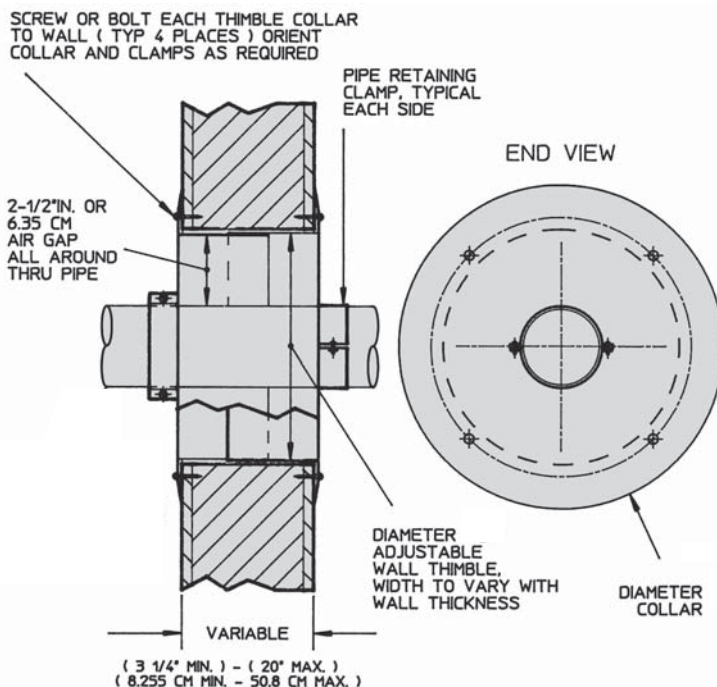
5. At this point, the system has been initially filled. However, air pockets may still remain at high points in the system and in heating loops above the level of the combination shut/off purge valve. It is quite possible, depending on the particular system that all piping above the combination shutoff/purge valve still contains air. If manual vents are installed on the system high points, these should be opened to vent these locations. When only water is discharged from all vents, the initial purging is complete.
6. Open the combination shutoff/ purge valve (keep the vent closed). With the gas shutoff valve closed, turn on power to the boiler and operate the circulator. Circulate the system water for approximately 30 minutes to move all air to the automatic air separation point.
7. Again, open manual air vents at high points of heating loop until a constant stream of water is discharged from the vent. Close the vent and make sure it's watertight. Repeat procedure for all high points and for every zone.

### WARNING

**Never leave an opened manual air vent unattended. In the event an opened vent is left unattended, water damage can occur.**

8. Check temperature/pressure indicator reading, which should equal the pressure reducing (fill) valve set pressure. No more water should be entering the system. Close the shutoff valve on the cold water fill line.
9. Visually inspect all pipe joints and equipment connections for leaks. If necessary, drain system, repair leaks and refill/purge the system. If no pressure drop is detected for a period of two hours under pressure, the system may be considered water tight.

FIGURE 14



### Nominal Pipe & Thimble Diameters

Pipe Size (in)	A Ø	B Ø	C Ø
3"	6 7/8"	5 7/16"	3 5/16"
4"	9 3/8"	8 1/2"	4 3/16"
6"	8 1/8"	Fixed	6 1/8"

Pipe Size (cm)	A Ø	B Ø	C Ø
7.62	17.46	13.81	8.41
10.16	23.81	21.59	10.63
15.24	20.64	Fixed	15.56

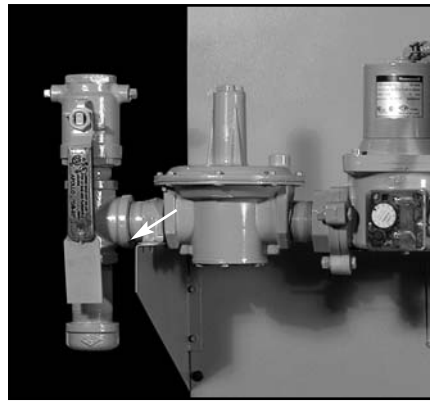
# Installation

10. When purging is completed, make sure the following are open—combination shut-off/purge valve, shutoff valve to pressure reducing (fill valve), shutoff valve in cold water fill line, and shutoff valve in return line.

11. Make sure the following are closed—all drain cocks, the vent on the combination shutoff-purge valve, and all manual vents. Reset zone valves to normal mode of operation and turn off power to boiler.

Open gas shutoff valve, allowing gas to flow to boiler.

4. Open the manual shut off gas valve.



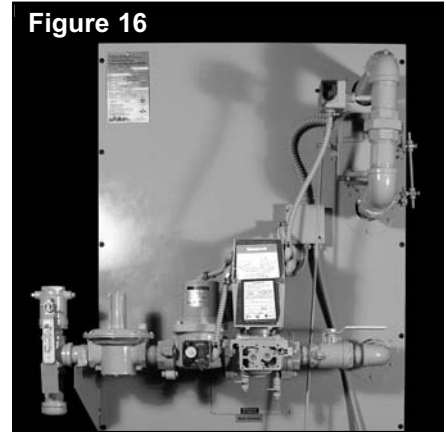
5. Close the circuit breaker or the fuse disconnect.

6. Turn the on-off switch to “ON”

## Measure Gas Flow Rate

Turn off the boiler and close the manual gas shutoff valve. Remove manifold (downstream) pressure test plug from the 90 degree elbow.

Replace the plug with a 1/4 N.P.T. to 1/4" compression (or flare) adaptor and a short piece of tubing. Connect a piece of rubber hose from the tubing to a manometer. Open the gas shutoff valve (gas cock) and turn on boiler.



## Installation Checkpoints

1. Before Starting The Boiler: Do not turn on the boiler unless it is filled with water as shown by indicating light on panel box.

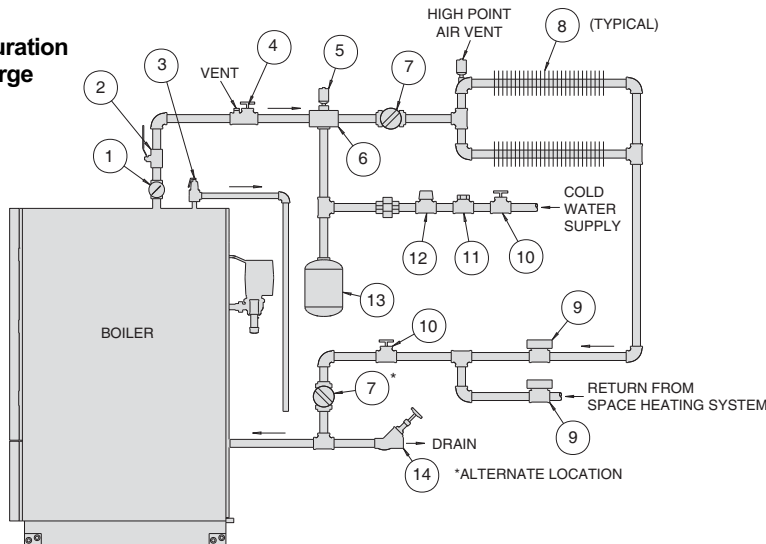
2. Check that the front door of the air decoupler box is closed. Door must be closed before starting the boiler. **Do not open during operation.**

3. Set the temperature control to the desired setting.



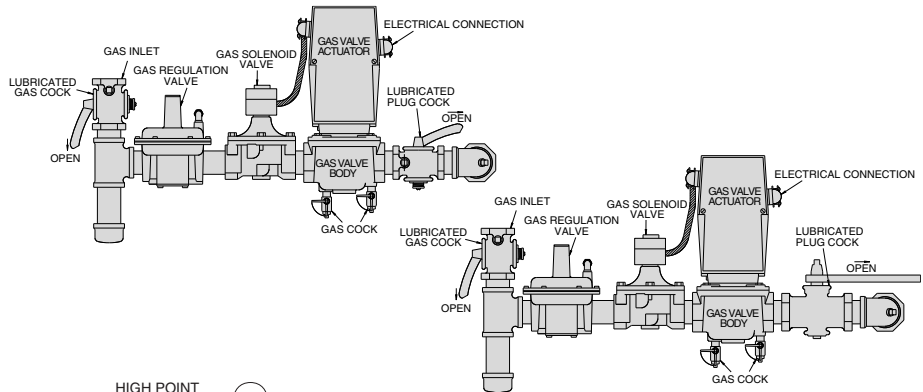
FIGURE 15

**Piping Configuration for System Purge**  
(represents any heating load)



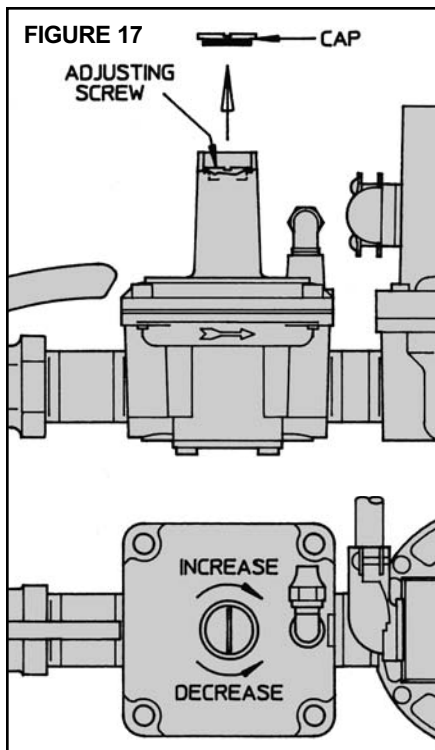
## Testing Ignition Safety Shut Off

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.



## Glossary

1. Temperature/Pressure Indicator
2. Hot Water Outlet Stop Valve
3. Safety Valve
4. Combination Shutoff-Purge Valve
5. Automatic Air Vent
6. Air Scoop
7. Circulator
8. Heat User
9. Zone Valve
10. Stop Valve
11. Check Valve
12. Pressure Reducing Valve
13. Diaphragm Expansion Tank
14. Drain Valve



## To Check for High Gas Pressure

1. 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).
2. Turn off boiler and turn off gas supply to manual gas shutoff valve. Remove the 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 a manometer.
3. Open gas supply to manual gas shutoff valve and turn on boiler. After combustion starts, manometer should read 7" WC (178mm) minimum for natural gas and 11" WC (25mm) minimum for propane.
4. If reading exceeds 14" WC. (178mm) install regulator upstream of gas valve to reduce pressure.

## For High Gas Pressure Installations

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

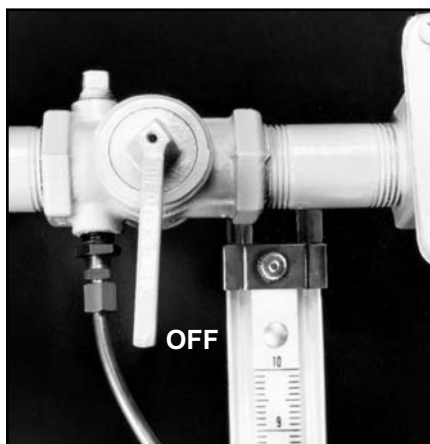
1. Locate the stepdown regulator as far away from the Pulse boiler as possible.
2. When stepping down from more than 2 psig to 14" WC, the stepdown should be done in two steps:
  - a. Reduce the pressure to 2 psig.
  - b. Reduce the pressure from 2 psig to 14" WC
3. The preferred regulator for this application is the Fisher S202 with a stabilizing booster cartridge (SBC).
4. Consult your Authorized Fulton Representative for selection.

This recommendation is made to avoid regulator chatter. It is also recommended to avoid high lockup pressures which can cause light off reliability problems. Regulators, other than specified, may be acceptable, but it has been our experience that the above listed regulators operate the most satisfactorily.

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.

**Pressure for Natural Gas** should measure 1 to 3" WC at the last elbow on the gas train at high fire, or full rate on on/off units. For more specific information, consult the test fire report which is included with the User Manual. There should be 7" WC at the inlet of the train.

**Pressure for Propane** should be 11" WC at inlet to the gas train.



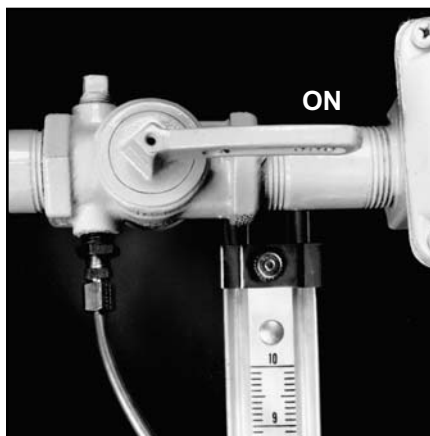
## Before Leaving The Installation

Check all controls to insure they are operating properly. Cycle boiler several times by raising and lowering operating temperature on the temperature controller.

Make sure installation complies with all applicable codes.

## To Correct Input—Adjust Gas Pressure Regulator

Turn boiler off and remove cap from regulator. (Figure 17) Turn adjusting screw clockwise to increase gas flow. Turn adjusting screw counter-clockwise to decrease gas flow. Always replace cap before turning on boiler. Vent must terminate outdoors. A flow restricting bleed valve shall not be used.



## Rating The Boiler

After the boiler has been operating for about 15 minutes check gas input rate to be sure boiler is operating at design capacity.



1  
2  
3  
4  
5

**Section**

**Operation**

# Operation

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.

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

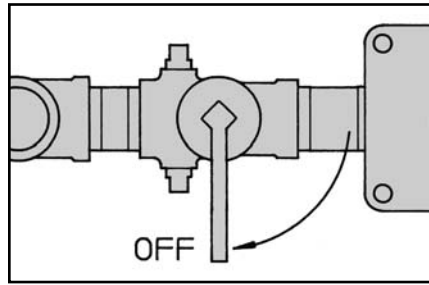
**DO NOT** use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and/or gas control(s) which has been under water.

## Before operating your Fulton Pulse Boiler

**STOP!** Make sure you have read and followed all previous safety information.



1. Turn off all electric power to the boiler.
2. Turn gas cock knob clockwise to "OFF". Figure 18. (This gas cock knob is also the emergency shut-off device.)

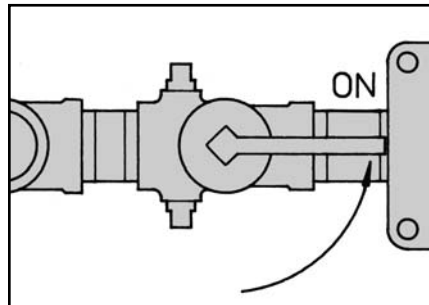


## Starting the Fulton Pulse Combustion Hydronic Heating Boiler

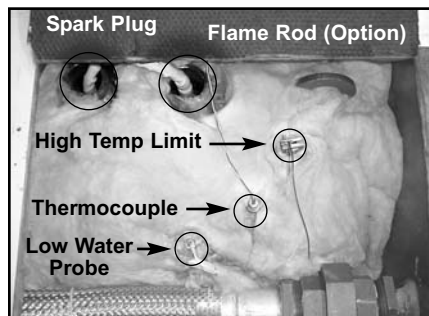
### NOTE

**Prior to starting, make sure the procedure for purging the heating system has been accomplished as detailed on page 23.**

1. Open the main gas cock knob counter clockwise 1/4 turn to "ON" position.



2. Turn on all electric power to the boiler.
3. Set temperature control to desired setpoint.
4. Turn operating switch on boiler to "ON" position. The boiler is energized and 35 second prepurge begins. After 35 seconds the spark ignitor 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.



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



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 Never Seize on threads of plug.

When the unit fires and pressure is sensed in air valve housing, 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 pressure is sensed in the air valve housing (proof of flame), the assist fan and spark will turn off.

## Do Not Change Flame Pressure Switch Settings.



## CAUTION

**Should overheating occur or the gas supply fail to shut off, shut off the gas supply at a location external to the boiler.**

## If The Boiler Doesn't Start

### ADJUST BLOCKED AIR INTAKE SWITCH (BIS)

1. Screw the switch fully in. Do not over tighten the screw.
2. With the boiler running in manual and 100% high fire, back the switch out until the boiler switches off.
3. Turn the BIS in one full turn.
4. Re-start the boiler.

#### NOTE

**Do not change the Flame Pressure Switch settings.**

Check that the temperature control is set higher than water temperature in the boiler. Check for tripped circuit breaker or blown fuse.

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).

**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. Turn off all electric power to the boiler if service is required.
2. Turn gas cock knob clockwise to "OFF".

## Sequence of Operation

### 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.

Causes for hold conditions in the INITIATE sequence are:

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

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

### 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.

### 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.

### IGNITION TRIALS

**(Without Flame Rod Option)**

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 (CPSP). 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 only if the selected number of retry attempts is not exceeded. After the eight seconds, the RM7865 will enter the RUN period.

### IGNITION TRIALS (RM7865B)

**(With Flame Rod Option - Natural Gas Only)**

1. Main Flame Establishing period (MFEP)
  - a. The ignition transformer, terminal 10, is energized for two seconds prior to opening of the main fuel valve.
  - b. The Main Fuel valve, terminal B, is energized for four seconds. Flame signal must be proven and the Purge Fan switch must be proven Off (open) by the end of the six seconds of MFEP to allow the sequence to continue to the main Flame Stabilization Period. If the flame signal is not proven or the Purge Fan switch is on, the RM7865 will recycle to PREPURGE, if the selected number of retry attempts is not exceeded. If the retry attempts exceed the limit, lockout occurs.
2. Main Flame Stabilization Period (MFSP), The RM7865 enters an eight second Main Flame Stabilization Period. If the Flame signal is lost or the Purge Fan switch closes during this time, the RM7865 will recycle to PREPURGE, if the selected number of entry attempts is not exceeded. If the retry attempts exceed the limit, lockout occurs,

### RUN

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 (RM7865A) or the flame signal is lost (RM7865B), the RM7865 will enter the POSTPURGE period. The fan motor is de-energized during RUN.

# Operation

## POSTPURGE

The RM7865 provides a 35 second 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.

1. The main fuel valve and ignition, terminals 8 and 10, are de-energized. The purge fan switch is energized and the POSTPURGE period begins.
2. After the 35 second POSTPURGE period is completed, the RM7865 returns to STANDBY.

## Sequence of Operation for Modulated Pulse Hot Water Boilers

1. When the boiler receives a call for heat, the prepurge cycle is initiated.
2. The mod motor is driven to high fire.
3. After the high fire switch in the mod motor is closed, the prepurge count begins.
4. Following prepurge, the spark generator energizes and the gas valves open.
5. Upon proof of flame, the fan and spark are turned off.
6. At this point, the modulation temperature controller controls the mod motor and firing rate of the boiler.
7. When the boiler outlet temperature reaches set point, the boiler is turned off and prepurge begins.
8. The boiler control then monitors the outlet temperature 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.

## Programming Instructions for Yokogawa UT320 Standard Program

1. Hold SET/ENT key until control is in Operator mode. PV display will show **oppa**.
2. Press Down Arrow key until control is in Set Up mode. PV display will show **stup**.
3. Press SET/ENT key twice until control is in Function mode. PV display will show **func**.
4. Press Down Arrow key until control is in Input/Output mode. PV display will show **I/O**.
5. Press SET/ENT key to bring you to the first parameter in the Input/Output mode.

Parameter Setting Procedure: The values for each parameter that are shown in the PV display should match the values entered at the factory. If they differ, press the Up Arrow key or Down Arrow key until the factory value is displayed. Some values, such as High Temperature Range (**rh**), can be adjusted according to system design.

Once the desired value is displayed, press the SET/ENT key to maintain it in the control's memory.

Only those values that are Shaded with Bold & Italic values in the menu pertain to the program constructed for Fulton pulse boilers.

### NOTE

**It is important to know that if the following parameters are altered, the entire set of factory values will be altered: (In) or (UNIT) located in the Input/Output Menu; (AL1) in the Functional Parameters Menu; (A1) in the Operating Parameters Menu.**

6. After the Input/Output values have been confirmed or entered, return to Function mode by holding the SET/ENT key until the PV display shows **func**.

Repeat Parameter Setting Procedure.

The **HY1** parameter or Hysteresis may be adjusted to overshoot the setpoint temperature by half the value of **A1** entered. The unit will also start again only after the supply temperature decreases half the value entered below setpoint.

7. After the Function values have been confirmed or entered, hold the SET/ENT key until the Setpoint Temperature appears in the PV Display.
8. Repeat the last step until the control is in Operator mode. The PV Display will show **oppa**. Repeat Parameter Setting Procedure.
9. When the **PID** parameter appears in the PV Display, press one of the Arrow keys until **(1)** appears in the SP Display, press SET/ENT--this will take you to a subset of parameters. Repeat Parameter Setting Procedure.
10. After confirming or entering the **PID** value (**1.MR**), the control automatically returns to the remaining Operating parameters. Repeat Parameter Setting Procedure.
11. When finished, hold SET/ENT key to return to Setpoint Temperature. Boiler is ready for operation.

### NOTE

**If the rh (Range High) value has been changed in the Input/Output Menu, the Setpoint Temperature will read zero (0) after return from the menus. Simply press the Up Arrow key until the desired setpoint value is shown. Hit SET/ENT once to store and begin operation.**

## Worksheets

Use the worksheets to record the values set at site under **Customer Value**. If the unit is not operating correctly, call your Fulton representative. Have your customer values handy for trouble shooting.

## Worksheets for Yokogawa UT320/UT350 Temperature Control Program for Pulse Modulating Boilers

### Input/Output Menu

SYMBOL	DESCRIPTION	DEFAULT VALUE	FULTON VALUE	CUSTOMER VALUE
IN	Input Type	1	4	
UNIT	Input Unit Selection	C	F	
RH	Range High	variable	210	
RL	Range Low	variable	0	
SDP	Scale Decimal Point	1	1	
SH	Scale High	100	0	
SL	Scale Low	0	0	
RJC	On/Off	on	on	
BSL	Burnout Selection	1	1	
OT	Output type	0	2	
RET	Retransmission	1	1	
RTH	Retransmission High	variable	210	
RTL	Retransmission Low	variable	0	
DIS	Digital Input	off	off	
C.S1	Custom Select	off	off	
C.S2	Custom Select	off	off	
C.S3	Custom Select	off	off	
C.S4	Custom Select	off	off	
LOCK	Key Lock	off	off	
PWD	Password	0	0	

NOTE: Parameters with bold values only will be used.

### Functional Parameters

SYMBOL	DESCRIPTION	DEFAULT VALUE	FULTON VALUE	CUSTOMER VALUE
AL1	Alarm 1 Type	1	4	
AL2	Alarm 2 Type	2	off	
AL3	Alarm 3 Type	3	off	
HY1	Alarm 1 Hysteresis	0.5	10	
HY2	Alarm 2 Hysteresis	0.5	off	
HY3	Alarm 3 Hysteresis	0.5	off	
CT	Control Output Type	30	1	
CTc	Control Output Type	30	same	
PO	Preset Output	0	0	
Poc	Preset Output Cooling	0	0	
C.MD	PID Control	0	0	
ZON	Zone PID Control	off	off	
AR	Anti-Reset Windup	auto	auto	
TMU	Time Unit for Ramp	0	1	
P.SL	Protocol Selection	0	0	
BPS	Communication Speed	4	4	
PRI	Parity	1	1	
STP	Stop Bit	1	1	
DLN	Data Length	8	8	
ADR	Address	1	1	
RP.T	Minimum Response Time	0	0	
TEST	Test Control	0	0	

NOTE: Parameters with bold values only will be used.

# Operation

## Operating Parameters

SYMBOL	DESCRIPTION	DEFAULT VALUE	FULTON VALUE	CUSTOMER VALUE
AL1	Alarm 1 Setting	<b>100</b>	<b>5</b>	
AL2	Alarm 2 Setting	0	0	
AL3	Alarm 3 Setting	100	0	
AT	Auto-Tune	<b>off</b>	<b>off</b>	
SC	Super Function On/Off	<b>off</b>	<b>off</b>	
SP.no	Target Setpoint	<b>1</b>	<b>1</b>	
Pld	PID Parameter	<b>0</b>	<b>Enter 1 for PID Menu then 0</b>	
FL	PV Input Filter	<b>off</b>	<b>0</b>	
BS	PV Input Bias	<b>eus (0.0%)</b>	<b>0</b>	
UPR	Rising Value Setting	<b>off</b>	<b>off</b>	
DNR	Descending Gradient	<b>off</b>	<b>off</b>	
OH	Output High Limit	<b>100</b>	<b>100</b>	
OL	Output Low Limit	<b>0</b>	<b>0</b>	
H	Hysteresis On/Off	0.10%	0.10%	
DR	Direct/Reverse Action	<b>0</b>	<b>0</b>	
HB1	Heater Disconnect	off	off	
HB2	Heater Disconnect	off	off	
HC1	Heater Disconnect	off	off	
HC2	Heater Disconnect	off	off	
ORB	On/Off Rate Detection	<b>eus (1.0%)</b>	<b>0</b>	
ORH	On/Off Rate Upper Limit	<b>100</b>	<b>100</b>	
ORL	On/Off Rate Lower Limit	<b>0</b>	<b>0</b>	
OR	On/Off Rate	<b>0</b>	<b>0</b>	
1.SP	Target Setpoint 1	<b>0</b>	<b>0</b>	
2.SP	Target Setpoint 2	<b>0</b>	<b>0</b>	
3.SP	Target Setpoint 2	<b>0</b>	<b>0</b>	
4.SP	Target Setpoint 4	<b>0</b>	<b>0</b>	

NOTE: Parameters with bold values only will be used.

## PID Functions

SYMBOL	DESCRIPTION	DEFAULT VALUE	FULTON VALUE	CUSTOMER VALUE
1.P	Proportional Band	<b>5</b>	<b>10</b>	
1.I	Integral	<b>240</b>	<b>off</b>	
1.d	Derivative	<b>off</b>	<b>off</b>	
1.MR	Manual Reset	<b>60</b>	<b>0</b>	
1.Pc	Proportional Band	5	5	
1.Ic	Integral Time	240	240	
1.Dc	Derivative Time	60	60	
1.DB	Dead Band	3	3	
1.RP	Reference Point 1	100	100	
2.RP	Reference Point 2	100	100	
RDV	Reference Deviation	0.5	0.5	

NOTE: Parameters with bold values only will be used.

## Advanced Programming Features

The Yokogawa UT320 is a sophisticated temperature control with “smart” features that internally calculates how close the appliance is to setpoint and adjusts it proportionally to arrive without overshooting. The smart logic must be initiated in the Operating parameters by setting the following values:

1. Under the Functional Parameters menu, scroll to **HY1** and set the value to 20.
2. When the process temperature is within 10°F of the setpoint temperature, scroll to **AT** in the Operating Parameters menu and set the value to 1.
3. **AT** or Auto-Tune will increase the modulation (mod) motor output to 100% until the process temperature is 2% of input span above setpoint. The output will go to 0% until the process temperature decreases to 2% of input span below setpoint.
4. The control will increase the mod motor again to 100% until the process temperature is 2% of input span above setpoint. During this time the manual mode light on the temperature control will be flashing until completed.
5. If the three samples are not the same, an error message will be displayed and the temperature will drop out of Auto Tune mode. Reset the zero and span adjustments on the mod motor and/or adjust modulation linkage accordingly.
6. PID values will be set when this procedure is successfully completed.
7. Repeat Step 1 and change the **HY1** value back to 10 (standard).
8. Scroll under Operating Parameters to **SC** (Super Function) and adjust the value to “on”. This parameter works with Auto-Tune in calculating the target setpoint.
9. Return to Auto mode.

## Siemens RWF40 Control

Fulton can provide a RWF40 Outdoor Reset Temperature Control as an option. A copy of the Standard program for this control is provided in this manual. Please reference the RWF40 manual provided with the boiler for programming instructions.

### Worksheets for Siemens RWF40 Temperature Controller Standard Program

Display	Parameter	Vendor Setting	Fulton Setting	Customer Setting
<b>Configuration Level</b>				
C111	Analog input 1; analog input 2; analog input 3; setpoint changeover/shift	9030	<b>D030</b> - Outdoor sensor <b>D331<sup>a</sup></b> - 4-20mA external setpoint with outside sensor <b>D431<sup>a</sup></b> - 0-10 VDC external setpoint with outside sensor	
C112	Limit comparator <sup>b</sup> ; controller type; setpoint 1; locking	0010	<b>0210</b> - standard program <b>C210b</b> - "C" enables K6 relay used for warm weather shutdown	
C113	Instrument address; decimal place/unit, signal for out-of-range	0110	<b>0121</b>	
SCL	Range start analog input 1 <sup>c</sup>	0	<b>0</b>	
SCH	Range end analog input 1 <sup>c</sup>	100	<b>210</b> stainless steel <b>250</b> carbon steel	
SCL2	Range start analog input 2 <sup>c</sup>	0	<b>0</b>	
SCH2	Range end analog input 2 <sup>c</sup>	100	<b>210</b> stainless steel <b>250</b> carbon steel	
SPL	Lower setpoint limit <sup>c</sup>	0	<b>0</b>	
SPH	Upper setpoint limit <sup>c</sup>	100	<b>210</b> stainless steel <b>250</b> carbon steel	
OFF1	Process value correction analog input 1 <sup>c</sup>	0	<b>0</b>	
OFF2	Process value correction analog input 2 <sup>c</sup>	0	<b>0</b>	
OFF3	Process value correction analog input 3 <sup>c</sup>	0	<b>0</b>	
DF1	Filter time constant for digital filter, analog input 1	1	<b>0</b>	
DF3	Filter time constant for digital filter, analog input 3	1	<b>0</b>	
oLLo	Lower working range limit	-1999	<b>0</b>	
OLHi	Upper working range limit	9999	<b>210</b> stainless steel <b>250</b> carbon steel	
dt	Bus Watch Dog Timer	30	<b>0</b>	

## Worksheets for Siemens RWF40 Temperature Controller Standard Program

Display	Parameter	Vendor Setting	Fulton Setting	Customer Setting
<b>Parameter Level</b>				
AL	Limit value of limit comparator <sup>b,c</sup>	0	<b>70 (Variable)</b>	
HYS1	Switching differential for limit comparator <sup>b,c</sup>	1	<b>4 (Variable)</b>	
Pb.1	Proportional band <sup>c</sup>	10	<b>10</b>	
dt	Derivative band <sup>c</sup>	80	<b>10</b>	
rt	Reset time	350	<b>40</b>	
db	Contact spacing <sup>c</sup>	1	<b>0</b>	
tt	Actuator operating time	15 s	<b>0</b>	
HYS1	Switch-on level burner / stage II <sup>c</sup>	-5	<b>0</b>	
HYS2	Switch-off level stage II <sup>c</sup>	3	<b>0</b>	
HYS3	Upper switch-off level <sup>c</sup>	5	<b>10</b>	
q	Response threshold	0	<b>0.0</b>	
H	Heating curve slope	1.0	<b>1.8 (Variable)</b>	
P	Parallel shift <sup>c</sup>	0	<b>20 (Variable)</b>	
<b>Process Data</b>				
SP1	Setpoint 1 <sup>a</sup>	0	-	
SP2	Setpoint 2 (option) <sup>a)</sup>	0	-	
dsp	Digital Setpoint Shift	0	-	
TA	Outside Temperature	-	Actual outdoor temperature	
SP.E	Pre-definition of external setpoint	-	-	

## Linkage Adjustment for Pulse Modulated Boilers

This instruction covers the adjustment of the linkage arms and rods between the modulation (mod) motor and gas butterfly valve and also between the mod motor and exhaust butterfly valve.

### Prior to Start-Up

With the boiler off, both the gas and exhaust butterfly valves will be in the closed position.

### Setting High Fire

When the boiler is energized the mod motor will be driven to High Fire driving the gas and exhaust butterfly valves to the open position.

At High Fire the slot in the shaft of the mod motor should be horizontal in orientation.

At this point it is important to note that the mod motor and gas butterfly valve linkage arms are as close to parallel as possible. Also note that the mod motor and exhaust butterfly valve linkage arms should be parallel.

Location of the lock nuts on the linkage rods is not important.

### Linkage Relationships

The location of the linkage rods and the speed at which the butterfly gas valve and butterfly exhaust valve opens or closes will determine whether the unit operates smoothly or not.

### Gas Butterfly Valve Side

The longer the radius on the mod motor pivot arm, the quicker the gas butterfly valve shuts off. Conversely, the shorter the radius the slower the gas butterfly valve shuts off. The longer the radius on the gas valve pivot arm, the slower the gas butterfly valve shuts off. Conversely, the shorter the radius the quicker the gas butterfly valve shuts off.

### Exhaust Butterfly Valve Side

The longer the radius on the mod motor pivot arm, the quicker the exhaust butterfly valve shuts off. Conversely, the shorter the radius the slower the exhaust butterfly valve shuts off.

The longer the radius on the exhaust valve pivot arm, the slower the exhaust butterfly valve shuts off. Conversely, the shorter the radius the quicker the exhaust butterfly valve shuts off.

At High Fire the linkage arms should NOT begin or finish travel in the vertical position. If this occurs there is a possibility that the gears will bind and cause damage to the mod motor.

The gas pressure regulator is the only means for adjusting High Fire input to the factory test fire values. After the boiler is operated at High Fire to the desired settings, proceed to operate at Low Fire.

#### NOTE

**At high fire, the gas butterfly valve will be full open in the horizontal position. Exhaust butterfly valve will be full open in the vertical position.**

### Low Fire Settings

Manually adjust the temperature controller on the front of the boiler to read 50% input. At 50% check to see if the unit is within test fire values. Proceed to step the boiler down to 40%, 30%, 20% 10% and 0% each time checking to see if the unit is within test fire values. 0% represents low fire and 100% represents high fire.

If you are unable to reach 0%, you will need to make adjustments on the gas valve to either increase or decrease fuel input. The exhaust butterfly valve may also need adjustment. Start by adjusting one valve at a time.

The gas butterfly valve should be used to adjust Low Fire input. The exhaust butterfly valve should be adjusted to set proper combustion. Closing the exhaust butterfly valve will also decrease input slightly.

At Low Fire the linkage arms should NOT begin or finish travel in the vertical position. If this occurs there is a possibility that the gears will bind and cause damage to the mod motor.

## Procedure to Zero and Span the Modulation Motor

The following procedure is done on each modulation (mod) motor at the factory. It may be necessary to do in the field in the event the mod motor requires replacement or the mod motor linkage is moving up or down the range when there is no change in the operating or setpoint temperature difference.

1. Turn boiler OFF.
2. Put the temperature control in manual mode (press the A/M key once – the SP display will show a value between 0 and 100).
3. Follow the electrical drawing and remove the connection between (F) and (-) on the mod motor. Disconnect relay CR3 for safety.
4. Contact point 16(+) on the temperature control is wired through CR1 normally closed to contact point (+) on the mod motor. Contact point 17(-) on the temperature control must be disconnected. Install a jumper from 17(-)

to contact point (-) on the mod motor. This will provide a direct connection between (+) and (-) on the temperature control to (+) and (-) on the mod motor.

5. Refer to the zero and span adjustment information for the mod motor (Pages 5 and 10). Follow steps 1 through 8 on page 10 of the mod motor brochure included in the Pulse Operation and Maintenance manual.
6. Be sure the linkage does not bend or catch in any position during travel.
7. When zero and span are complete, scroll the input rate to 100% - this will drive the burner to high fire and purge any left over combustibles- and adjust the blue cam, if necessary, until the high edge of the cam pushes against the end switch.
8. Remove the jumper and install the wire on contact point 17(+) of the temperature control. Connect relay CR3.
9. Test the mod motor signal by manually setting the output signal from zero (low fire – 4 mA) to 100 (high fire – 20 mA). At high fire, the slot in the shaft of the mod motor should be horizontal in orientation.

#### NOTE

**The unit will still shut off at setpoint plus 5°F (standard settings). Also, being in manual mode, the temperature control ignores any PID or auto tune settings.**

10. Set the temperature back to the Auto setting by pressing the A/M key – the operating and setpoint temperatures will be displayed in the PV and SP displays, respectively.

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**Section**

**Maintenance**

# Maintenance

## NOTE

Your Fulton Pulse Combustion Hydronic 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.

## Before Each Heating Season

1. Check air intake and exhaust vent outlet for any blockage or restrictions.
2. Check for any leaks in exhaust piping.
3. Check for any leaks in the heating system or boiler piping.
4. Check the air intake and exhaust vent piping for sagging.
5. Follow purge procedure outlined in Section 2 of this manual.
6. Follow start up procedure outlined in Section 3 of this manual.
7. With the boiler running, check for visible cracks at fittings and joints.

## WARNING

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

## Recommended Monthly Maintenance

1. Inspect the air intake and exhaust vent pipes for broken seals at the joints.
2. Inspect the screens on the air intake and exhaust vent terminal and make sure they are free of dirt or any foreign matter which may block the terminals.
3. Check air intake and exhaust vent outlet for any blockage or restrictions.
4. Check for any leaks in exhaust piping.

## Recommended Annual Maintenance

1. Change the spark plug.
2. Clean/replace flapper valve gaskets.
3. Verify proper combustion and adjust as necessary.
4. Lubricate the modulation motor arms, gas and exhaust butterfly valves. Ensure the motion of the valves is smooth.
5. Remove the low water cut off probe and clean. Replace the probe in the boiler.
6. On units utilizing a flame rod, the flame rod should be changed. The flame rod is located in the top of the boiler.

## NOTE

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

## NOTE

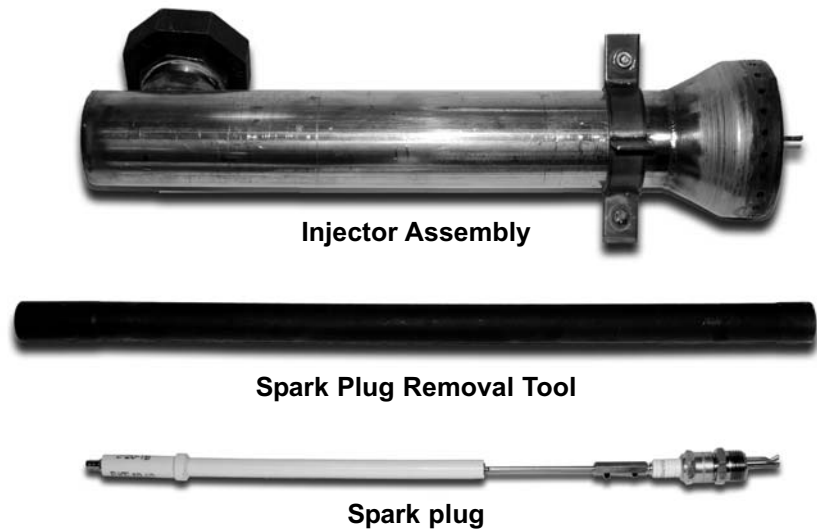
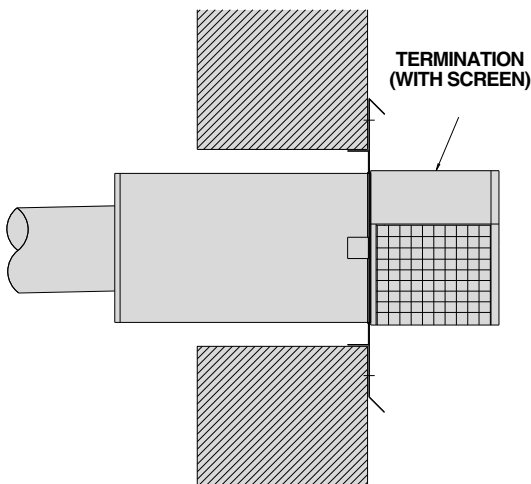
Should you suspect that the boilers flue passage ways have become blocked, contact your recognized Fulton representative.

## NOTE

On models PHW300 through PHW1400 the spark plug is located in the top of the boiler. In PHW2000 the spark plug is located in the gas injector behind the air flapper, and requires a spark plug removal tool.

## NOTE

Pulse hydronic loops should be configured so that each boiler does not cycle more than 12,000 times per year. Warranty may be void if excessive cycling is apparent.



(Typical for PHW2000 only)

## Troubleshooting

This 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.

<b>Problem</b>	<b>Cause</b>	<b>Check</b>
<b>Starting or Purge Failure</b>	Power Supply	Check fuse or circuit breaker. Reset or replace, as necessary.
	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 build up, moisture, cracks in porcelain. Check for proper gap (.050" to .060" for Champion sparkplug). Clean or replace as necessary.
	Loose Wire Connection	Check connections to all components.
	Temperature Control	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.	
<b>Flame Failure</b>	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.
<b>In All Cases:</b>		<b>Reset main control in panel box on flame failure.</b>
<b>Poor Combustion</b>	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 of air inlet line and remove.

# Maintenance

## Troubleshooting - Fault Code Diagnosis

Fault Code	System Failure	Recommended Troubleshooting
Fault 02 *AC Frequen/Noise*	Excess noise or device running on slow AC.	<ol style="list-style-type: none"> <li>1. Check the relay module and display module connections.</li> <li>2. Reset and sequence the 7800.</li> <li>3. Check the 7800 power supply to assure that both frequency and voltage meet specifications.</li> <li>4. Check the backup power supply as appropriate.</li> </ol>
Fault 03 *AC *Line Dropout*	AC Line dropout detected.	<ol style="list-style-type: none"> <li>1. Check the relay module and display module connections.</li> <li>2. Reset and sequence the 7800.</li> <li>3. Check the 7800 power supply to assure that both frequency and voltage meet specifications.</li> <li>4. Check the backup power supply as appropriate.</li> </ol>
Fault 04 *AC Frequency*	Device running on fast AC.	<ol style="list-style-type: none"> <li>1. Check the relay module and display module connections.</li> <li>2. Reset and sequence the 7800.</li> <li>3. Check the 7800 power supply to assure that both frequency and voltage meet specifications.</li> <li>4. Check the backup power supply as appropriate.</li> </ol>
Fault 05 *Low Line Voltage*	Low AC line detected.	<ol style="list-style-type: none"> <li>1. Check the relay module and display module connections.</li> <li>2. Reset and sequence the 7800.</li> <li>3. Check the 7800 power supply to assure that both frequency and voltage meet specifications.</li> <li>4. Check the backup power supply as appropriate.</li> </ol>
Fault 15	Flame Detected.	<ol style="list-style-type: none"> <li>1. Verify correct jumper is clipped.</li> <li>2. Reset control.</li> <li>3. If fault persists replace 7865 flame programmer.</li> </ol>
Fault 19	Main Flame Ignition Failure	<ol style="list-style-type: none"> <li>1. Check flame rod connections.</li> <li>2. Check amplifier.</li> <li>3. Reset control.</li> <li>4. If fault persists replace 7865 flame programmer.</li> </ol>
Fault 32 *Airflow Switch*	Combustion airflow interlock fault.	<ol style="list-style-type: none"> <li>1. Check wiring--correct any errors.</li> <li>2. Inspect the fan, assure that there is no blockage of the air intake and that it is supplying air.</li> <li>3. Assure that the Airflow Interlock switches are functioning properly and that their contacts are free from contaminants.</li> <li>4. Reset and sequence the 7800 to Prepurge. Measure the voltage between terminal 7 and G (ground). 120 Vac should be present.</li> </ol>
Fault 47 *Jumpers Changed*	The configuration jumpers differ from the sample taken at startup.	<ol style="list-style-type: none"> <li>1. Inspect the jumper connections. Assure that clipped jumpers have been completely removed.</li> <li>2. Reset and sequence the 7800.</li> <li>3. If fault persists, replace the relay module.</li> </ol>
Fault 54 *Comb. Pressure*	Combustion pressure switch fault	<ol style="list-style-type: none"> <li>1. Check wiring; correct any errors.</li> <li>2. Inspect the Combustion Pressure Switch to assure that it is functioning properly.</li> <li>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.</li> <li>4. If fault persists, replace the relay module.</li> </ol>
Fault 55 *Purge Fan Sw. On*	Purge fan switch is on when it should be off.	<ol style="list-style-type: none"> <li>1. Check wiring; correct any errors.</li> <li>2. Inspect the Purge Fan Switch terminal 18 and connections. Assure that the switch is functioning correctly and is not jumpered or welded.</li> <li>3. Reset and sequence the 7865.</li> <li>4. If the fault persists, replace the relay module.</li> </ol>
Fault 56	Blocked intake fault	<ol style="list-style-type: none"> <li>1. Check wiring; correct any errors.</li> <li>2. Inspect the Block Intake Switch and make sure it is working properly.</li> <li>3. Reset and swquence the relay module.</li> <li>4. During PREPURGE, measure the voltage bewteen terminal 7 and G (ground). 120 Vac should be present. If not, the Block Intake Switch is defective and should be replaced.</li> <li>5. If fault persists, replace the relay module.</li> </ol>

Fault 57 *Purge Fan Sw. Off*	Purge fan switch is off when it should be on.	<ol style="list-style-type: none"> <li>1. Inspect the Purge Fan Switch terminal 18 and connections. Assure that the switch is functioning correctly.</li> <li>2. Reset and sequence the 7865.</li> <li>3. If the fault persists, replace the relay module.</li> </ol>
Fault 58	Combustion pressure switch failure and flame rod failure.	<ol style="list-style-type: none"> <li>1. Check for proper incoming gas pressure.</li> <li>2. Check flame rod and pressure switch condition and connections.</li> <li>3. Check incoming power to 7865 subbase at terminal 20.</li> <li>4. Check for voltage on the flame rod amplifier.</li> <li>5. Reset control.</li> <li>6. If fault persists replace 7865 flame programmer.</li> </ol>
Fault 105-127	Call Service.	<ol style="list-style-type: none"> <li>1. Replace 7865 controller.</li> </ol>

## Troubleshooting--RM7865C without display

When the control has faulted out, you can identify the fault by counting the number of blinks the "LED" displays.

6 Blinks - Unit has exceeded 15 cycles per hour.

5 Blinks - High fire switch fault.

4 Blinks - Purge fan switch fault.

3 Blinks - Blocked intake switch fault.

2 Blinks - Flame combustion switch fault.

1 Blink - Other fault

## Honeywell RM7865C

### Jumpers

### Result of Clipping Jumper

JR1	JR2	JR3	
ON	ON	ON	For On/Off Application, RM7865A Retrofit (4 Attempts)
ON	OFF	ON	For On/Off Application, Flame Rod, RM 7865B Retrofit (4 Attempts)
OFF	ON	ON	Modulated, No Flame Rod (4 Attempts)
OFF	OFF	ON	Modulated, Flame Rod RM7865C Standard (4 Attempts)
OFF	OFF	OFF	Modulated, Flame Rod (1 Attempt)



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**Section**

**5**

**Parts and  
Warranty**

# Parts and Warranty

Part Number	Description	Models PHW				
		750	950	1000	1400	2000
<b>Gas Train</b>						
2-30-000516	Gas pressure regulator-1-1/2"RV81				X	X
2-30-000105	Gas pressure regulator-1-1/4"RV61		X	X		
2-30-000750	Gas pressure regulator-1"RV61	X				
2-30-001141	Gas solenoid valve-1-1/2" V4297A					X
2-30-000304	Gas solenoid valve-1-1/2"				X	
2-30-000307	Gas solenoid valve- 1-1/4"		X	X		
2-30-000306	Gas solenoid valve-1"	X				
2-30-001145	Gas valve-motorized-1-1/2" V5097C			X	X	X
2-30-001143	Gas valve-motorized-1-1/2" V5097A				X	X
2-30-000311	Gas valve-motorized-1-1/4"		X	X		
2-30-000310	Gas valve-motorized-1"	X				
2-40-000214	Gas valve actuator	X	X	X	X	X
2-40-000220	Gas valve actuator w/P.O.C.	X	X	X	X	X
2-30-003020	Gas butterfly valve-2"-Eclipse					X
2-30-003003	Gas butterfly valve-1-1/4"-Eclipse		X	X	X	
2-30-003002	Gas butterfly valve-1"-Eclipse	X				
2-30-001139	HGP Switch-C6097B1028					
2-30-001140	LGP Switch-C6097A					X
2-12-000552	Gas flapper gaskets	X	X	X	X	X
7-37-000201	Gas flapper valve - in union	X	X	X	X	X
7-52-002000	Gas injector assy					X
7-57-000125	Gas decoupler	X	X	X	X	
7-57-000128	Gas decoupler					X
<b>Air Flapper / Air Decoupler</b>						
7-37-000124	Air flapper valve assy	X				
7-37-000150	Air flapper valve assy		X			
7-37-000123	Air flapper valve assy			X		
7-37-000125	Air flapper valve assy				X	
7-37-000008	Air flapper valve assy					X
2-22-000181	Air flapper spacer-.030	X	X			
2-22-000182	Air flapper spacer-.050			X		
2-22-000186	Air flapper spacer-.060				X	
2-22-000187	Air flapper spacer					X
2-12-000551	Air flapper gaskets	X	X	X		
2-12-000553	Air flapper gaskets				X	
2-12-000554	Air flapper gaskets					X
2-11-000089	Air flapper housing-only					
2-11-000090	Air flapper housing-only-alum.	X	X	X	X	
5-11-000095	Air flapper housing -only					X
2-22-000038	Air flapper Lock Washer	X	X	X	X	X
2-22-000125	Air flapper Screw 8-32x1 1/2	X	X	X	X	X
8-00-000049	Air flapper housing tool	X	X	X	X	
2-12-001010	Air Decoupler Door Gasket	X	X	X		
2-12-001006	Air Decoupler Door Gasket				X	
2-12-001014	Air Decoupler Door Gasket					X
2-12-001051	Air Decoupler Insulation Set				X	
2-12-001053	Air Decoupler Insulation Set					X

Part Number	Description	Models PHW				
		750	950	1000	1400	2000
<b>Electrical / Safety Switches</b>						
2-20-000090	Spark plug	X	X	X	X	X
2-45-000017	Spark plug wire per foot	X	X	X	X	X
2-45-000026	Spark plug connector	X	X	X	X	X
2-45-000149	Wire heat cover per foot	X	X	X	X	X
2-20-002000	Porcelain ext. rod for spark plug assy					X
2-40-001011	Flame Rod	X	X	X	X	X
2-20-000023	Low water probe 3"	X	X	X	X	X
2-20-000108	Water probe-ex-decoupler-13"	X	X	X		
2-20-000109	Water probe-ex-decoupler-15"				X	X
2-30-000232	Air switch -purge fan & blocked intake switch	X	X	X	X	X
2-30-001334	Air switch -proof of flame-mod.	X	X	X	X	X
2-30-000445	Purge blower motor/fan	X	X	X	X	
2-40-000200	Motor starter relay	X	X	X	X	X
2-30-001337	Purge fan-G185					X
2-40-002000	Purge fan motor-1/2hp RB					X
2-40-000082	Ignition transformer	X	X	X	X	X
2-40-000131	Ice cube relay 120V	X	X	X	X	X
2-40-000096	Base for ice cube relay	X	X	X	X	X
2-40-000121	Time delay relay, .2-10 sec. 120V	X	X	X	X	X
2-40-000421	Fulton burner LWCO Relay-120V	X	X	X	X	
2-40-000423	Base for LWCO relay	X	X	X	X	X
2-45-000092	Low Water Test Switch	X	X	X	X	X
2-40-000562	Ice cube relay 24V	X	X	X	X	X
2-45-000468	Time delay relay 5 min. 120V	X	X	X	X	X
2-45-000469	Time delay relay base	X	X	X	X	X
2-40-000274	Aquastat-hi limit-L4008E1305-100-240F	X	X	X	X	X
2-40-000294	Aquastat-hi limit L4008E1313-100-200F	X	X	X	X	X
2-40-000268	R7847A1041 AMP	X	X	X	X	X
2-40-000270	Base for RM7865	X	X	X	X	X
2-40-000272	Display module for 7865	X	X	X	X	X
2-40-000302	Display case-S7800 #206311	X	X	X	X	X
2-40-000321	RM7865C Programmer	X	X	X	X	X
2-40-000863	Mod. temp control-UT320	X	X	X	X	X
2-40-000384	Siemens temp. control-RVWF40	X	X	X	X	X
2-40-000386	Siemens outdoor sensor-QAC22	X	X	X	X	X
2-40-000425	Mod. Temp control-T771J1050 outsideRS	X	X	X	X	
2-40-000722	Mod.motor-M7284Q1009	X	X	X	X	X
2-40-000801	Type "J" Thermocouple	X	X	X	X	X
2-40-000830	Type "J" Thermocouple wire	X	X	X	X	X
2-40-000940	Header sensor w/well for MSC	X	X	X	X	X
2-40-000941	Outdoor sensor-MCS 1000OHM 91/OAS	X	X	X	X	X
2-45-000101	Terminal block	X	X	X	X	X
2-45-000212	H-O-A Switch	X	X	X	X	X
2-45-000269	N/C contacts	X	X	X	X	X
2-45-000300	N/O contacts	X	X	X	X	X
2-45-000305	Low water reset switch w/ light	X	X	X	X	X
2-45-000306	Flame failure light	X	X	X	X	X
2-45-000307	On/off switch light green	X	X	X	X	X
2-45-000314	4 Pos. switch	X	X	X	X	X
2-45-000339	On/off switch light 3 position	X	X	X	X	X
2-45-000411	Flame failure light-red	X	X	X	X	X
2-45-000412	Call for heat light-green	X	X	X	X	X
2-45-000020	Din rail - per foot	X	X	X	X	X

# Parts and Warranty

Part Number	Description	Models PHW				
		750	950	1000	1400	2000
<b>Safety Valves</b>						
2-30-000020	Safety Valve 3/4" 125#-10-614-25	x	x	x		
2-30-000120	Safety Valve 3/4" 30#-10-614-05	x	x	x		
2-30-000121	Safety Valve 3/4" 60#-10-614-12	x	x	x	x	
2-30-000145	Safety Valve 3/4" 100#-10-614-20	x	x	x	x	
2-30-000166	Safety Valve 3/4" 160#-10-614-36	x	x	x	x	
2-30-000851	Safety Valve 1" 30#-10-615-05					x
2-30-000951	Safety Valve 1" 60#-10-615-12					x
2-30-000221	Safety Valve 1-1/4" 30#-10-616-05					x
2-30-000266	Safety Valve 1-1/4" 60#-10-616-12					x
2-30-000269	Safety Valve -1 1/4" 160#-10-616-36					x
<b>Trim / Accessories</b>						
2-23-000172	Paint-Tech Tan spray-6 oz.	x	x	x	x	x
4-23-000016	Paint-Tech Tan -quart	x	x	x	x	x
2-30-000174	Gas pressure gauge- 0-15 W.C.	x	x	x		
2-30-000201	Press/temp gauge 0-100psi-70-320F	x	x	x	x	
2-30-000203	Press/temp gauge 0-200psi-70-320F	x	x	x	x	
2-35-000801	1-1/2" gas flex cont.				x	x
2-35-000532	1-1/4" gas flex cont.		x	x		
2-35-000531	1" gas flex cont.	x				
2-30-000550	4" x 16" flex cont. water-flanged					x
2-35-000862	2-1/2" x 16" flex cont. - water				x	
2-35-000861	2" x 14" flex cont.-water	x	x	x		
2-35-000835	Isolation cube	x	x	x	x	x
2-35-000611	Seismic iso spring FHS-1-800	x	x	x		
2-30-000653	Seismic iso spring FHS-1-1000				x	
	Seismic iso spring					x
4-57-000160	3" PVC term. w/screen-45 deg. elbow					
4-57-000162	3" PVC term. w/screen-coupling					
4-57-000164	4" PVC term. w/screen 45 deg. elbow	x	x	x	x	
4-57-000166	3" PVC term. w/screen 90 deg. elbow					
4-57-000168	4" PVC term. w/screen-coupling	x	x	x	x	
4-57-000170	4" PVC term. w/screen-90 deg. elbow	x	x	x	x	
2-35-000819	6" PVC adaptor					x
2-35-000799	PVC Air-intake adaptor - 4"	x	x	x	x	
2-35-000798	PVC Air-intake adaptor - 3"					
2-35-000855	4-3" PVC reducer	x	x	x	x	x
4-57-000440	Condensate drain kit	x	x	x	x	x
5-20-000614	Condensate drain TEE assembly - mod	x	x	x	x	x
2-10-000168	Condensate drain float assembly	x	x	x	x	x
	Instruction Manual	x	x	x	x	
8-00-000048	Multi-port orifice removal tool					
8-00-000049	Air flapper housing tool	x	x	x	x	
8-00-002000	Spark plug wrench					x
8-00-002001	Flame rod tool					x
2-60-000114	Hi temp. sealant - 10oz	x	x	x	x	x

Part Number	Description	Models PHW				
		750	950	1000	1400	2000
<b>Vent Material</b>						
Misc.	Acousti-k27 Vent 4" 90° Elbow	x	x	x		
Misc.	Acousti-k27 Vent 6" 90° Elbow				x	x
Misc.	Acousti-k27 Vent 4" 45° Elbow	x	x	x		
Misc.	Acousti-k27 Vent 6" 45° Elbow				x	x
Misc.	Acousti-k27 Vent 4" Straight	x	x	x		
Misc.	Acousti-k27 Vent 6" Straight				x	x
Misc.	Fernco Flexible Coupling 4 x 6	x	x	x	x	
Misc.	Fernco Flexible Coupling 10 x 6					x
<b>Vent Material - Single Wall Stainless Steel</b>						
2-35-000987	Roof Sup/Jack Assembly 5480C1					
2-35-000812	Vent Termination - 5490C1					
2-35-000571	4" Pulse Adapter - 7401FUL					
2-35-000810	3" x 4" Increaser - 7374GC					
2-35-000583	4" x 3" Decreaser - 7473					
2-35-000983	Rain Cap - 7400GC					
2-35-000980	4" x 6" Vent - 7401GC					
2-35-000981	4" x 12" Vent - 7402GC					
2-35-000582	4" x 18" Vent - 7404GC					
2-35-000573	4" x 24" Vent - 7405GC					
2-35-000982	4" x 36" Vent - 7407GC					
2-35-000574	4" x 48" Vent - 7408GC					
2-35-000575	4" 45° Elbow - 7411GC					
2-35-000576	4" 90° Elbow - 7414GC					
2-35-000577	4" Vent Tee - 7416GC					
2-35-000962	4" Boot Tee - 7416GCB					
2-35-000960	4" Drain Cover - 7417GCD					
2-35-000985	4" Support Clamp - 7423GC					
2-35-000572	4" x 18" Adjustable - 7424GC					
2-35-000984	4" Strm/spt Collar - 7426GC					
2-35-000961	4" Boot Tee w/3" Take-off - 7443GCB					
2-35-000813	4" Horizontal Termination - 7490GC					
2-35-000986	16" x 16" Cover Plate - 7473GC					
2-35-000971	3" Rain Cap - 7300GC					
2-35-000811	3" Pulse Adapter - 7301FUL					
2-35-000972	3" x 6" Vent - 7301GC					
2-35-000973	3" x 12" Vent - 7302GC					
2-35-000974	3" x 18" Vent - 7304GC					
2-35-000975	3" x 24" Vent - 7305GC					
2-35-000976	3" x 36" Vent - 7307GC					
2-35-000977	3" x 48" Vent - 7308GC					
2-35-000991	3" 45° Elbow - 7311GC					
2-35-000992	3" 90° Elbow - 7314GC					
2-35-000993	3" Vent Tee - 7316GC					
2-35-000994	3" Vent Boot Tee - 7316GCB					
2-35-000995	3" Vent Tee Cover w/Drain - 7317GCD					
2-35-000997	3" x 18" Adjustable - 7324GC					
2-35-000998	3" Horizontal Termination - 7390GC					
2-35-000996	3" Horizontal Support - 7323GC					
2-60-000114	Hi Temp Sealant - 10 oz.					
Misc.	7000RTV Sealant - 5 oz.					
Misc.	7000RTVL Sealant - 10 oz.					



# Warranty for PulseHW Hydronic Boilers With Carbon Steel Exhaust Pipes

## 10 Year (120 Month) Thermal Shock Warranty

Fulton Heating Solutions, Inc. guarantees the Pulse hot water boiler pressure vessel, combustor, and Fulton's exclusive Thermaflex exhaust pipes against thermal shock for ten (10) years when the boiler is installed as a closed loop hot water boiler. This guarantee will cover damage due to thermal shock, such as leaks to the pressure vessel, combustor, and exhaust pipes. This guarantee does not cover damage due to corrosion, scaling, sooting or to improper installation or operation. The inlet and outlet water temperature differential across the boiler cannot exceed 170°F.

The pressure vessel shell is also covered for a period of ten years against failure due to materials or workmanship, providing the boiler is installed in a closed loop system.

The guarantee is limited solely to the repair or replacement of the components listed above. An inspection must be performed by Fulton or their Representative to determine the cause of the damage. The warranty does not cover labor or freight.

## 10 Year (120 Month) Warranty Against Corrosion and Material & Workmanship

The pressure vessel, combustor and exhaust pipes are covered against corrosion from flue gas condensation and material & workmanship defects for a period of ten (10) years (according to the schedule below) from the date of shipment from the factory. Fulton will repair or replace F.O.B. factory any part of this equipment as defined above, provided this equipment is operated and maintained by the buyer in accordance with approved practices, and on the provision that the buyer gives proper notification in writing as soon as the defect becomes apparent, and that he has properly filled out and returned his warranty card. This warranty covers any failure caused by flue gas corrosion; however, water side corrosion or scaling is not covered. Therefore, it is imperative that the boiler is installed as a closed loop hot water boiler as outlined in the "Installation, Operation and Maintenance Manual".

<u>Year</u>	<u>Prorated schedule:</u>
0-7	100%
8	50%
9	30%
10	20%

**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 loss of business, even if Fulton has been advised of the possibility of such damages.**

Controls, motors, auxiliaries, accessories, and all parts not specified in the above are warranted for a period of 12 months from the date of shipment from factory.

**PLEASE NOTE:** Excessive cycling will reduce the life of ANY boiler. Verify that your system is properly designed and check cycling rate according to maintenance procedures listed in manual.

**This warranty is contingent upon proper sizing, installation, operation and maintenance of the boiler. Warranty valid only if installed, operated and maintained as outlined in this manual.**



Fulton Heating Solutions, Inc.  
972 Centerville Road, Pulaski, NY 13142



# Warranty for PulseHW Hydronic Boilers With Stainless Steel Exhaust Pipes

## 10 Year (120 Month) Thermal Shock Warranty

Fulton Heating Solutions, Inc. guarantees the Pulse hot water boiler pressure vessel, combustor, and Fulton's exclusive Thermaflex exhaust pipes against thermal shock for ten (10) years when the boiler is installed as a closed loop hot water boiler. This guarantee will cover damage due to thermal shock, such as leaks to the pressure vessel, combustor, and exhaust pipes. This guarantee does not cover damage due to corrosion, scaling, sooting or to improper installation or operation. The inlet and outlet water temperature differential across the boiler cannot exceed 170°F.

The pressure vessel shell is also covered for a period of ten years against failure due to materials or workmanship, providing the boiler is installed in a closed loop system.

The guarantee is limited solely to the repair or replacement of the components listed above. An inspection must be performed by Fulton or their Representative to determine the cause of the damage. The warranty does not cover labor or freight.

## 5 Year (60 Month) Warranty Against Corrosion and Material & Workmanship Warranty

The pressure vessel, combustor and exhaust pipes, are covered against corrosion from flue gas condensation and material & workmanship defects for a period of five (5) years from the date of shipment from the factory. Fulton will repair or replace F.O.B. factory any part of this equipment as defined above, provided this equipment is operated and maintained by the buyer in accordance with approved practices, and on the provision that the buyer gives proper notification in writing as soon as the defect becomes apparent, and that he has properly filled out and returned his warranty card. This warranty covers any failure caused by flue gas corrosion; however, water side corrosion or scaling is not covered. Therefore, it is imperative that the boiler is installed as a closed loop hot water boiler as outlined in the "Installation, Operation and Maintenance Manual".

**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 loss of business, even if Fulton has been advised of the possibility of such damages.**

Controls, motors, auxiliaries, accessories, and all parts not specified in the above are warranted for a period of 12 months from the date of shipment from factory.

**PLEASE NOTE:** Excessive cycling will reduce the life of ANY boiler. Verify that your system is properly designed and check cycling rate according to maintenance procedures listed in manual.

**This warranty is contingent upon proper sizing, installation, operation and maintenance of the boiler. Warranty valid only if installed, operated and maintained as outlined in this manual.**



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