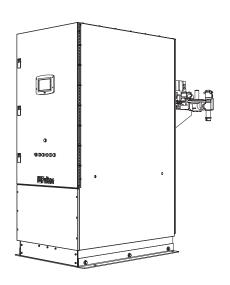


INSTALLATION AND OPERATION MANUAL

Gas Pulse Combustion Hydronic Heating Boiler (PHW)



Serial/National Board #	
Model	
Fulton Order	
Sold To	
Job Name	
Date	

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Standard Warranty for Fulton Pulse Boilers

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Overview

Prior to shipment, the following inspections and tests are made to ensure the highest standards of manufacturing for our customers:

- Material inspections
- Manufacturing process inspections
- American Society of Mechanical Engineers (ASME) welding inspection
- ASME hydrostatic test inspection
- Electrical components inspection
- Operating test
- Final engineering inspection
- Crating inspection

This manual is provided as a guide to the correct operation and maintenance of your Fulton equipment, and should be read in its entirety and be made permanently available to the staff responsible for the operation of the boiler. It should not, however, be considered as a complete code of practice, nor should it replace existing codes or standards which may be applicable. Fulton reserves the right to change any part of this installation, operation and maintenance manual.

Installation, start-up, and maintenance of this equipment can be hazardous and requires trained, qualified installers and service personnel. Trained personnel are responsible for the installation, operation, and maintenance of this product, and for the safety assurance of installation, operation, and maintenance processes. Do not install, operate, service or repair any component of this equipment unless you are qualified and fully understand all requirements and procedures. Trained personnel refers to those who have completed Fulton Service School training specific to this product.

When working on this equipment, observe all warnings, cautions, and notes in literature, on stickers and labels, and any additional safety precautions that apply. Follow all safety codes and wear appropriate safety protection. Follow all jurisdictional codes and consult any jurisdictional authorities prior to installation.

Warnings & Cautions

WARNINGS and CAUTIONS appear in various chapters of this manual. It is critical that all personnel read and adhere to all information contained in WARNINGS and CAUTIONS.

- 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.

All Warnings and Cautions are for reference and guidance purposes, and do not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes or regulations.

Disclaimers and Local Codes

Installation of the equipment shall conform to all the requirements or all national, state and local codes established by the authorities having jurisdiction or, in the absence of such requirements, in the US to the National Fuel Gas Code ANSI Z2231/NFPA 54 latest edition, and the specific instructions in this manual. Authorities having jurisdiction should be consulted prior to installation.

When required by local codes, the installation must conform to the American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers (ASME CSD-1).

The boiler heat exchanger is manufactured and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section IV for a maximum allowable working pressure of 160 psig. Maximum allowable working temperature varies by design (210 F for duplex; 240 F for carbon).

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WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.



CAUTION

This boiler is certified for indoor installation only.

This boiler is not designed for use in systems where water is continuously replenished. Mineral build-up may occur on the heat transfer surfaces and result in overheating and possible heat exchange failure. The warranty is valid for closed loop systems only.

Fulton cannot be held responsible for the selection, engineering, installation, or sizing of any additional equipment or components of the hydronic heating system.

This boiler, when installed in conjunction with a refrigeration system, must be installed so that 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 must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

Product Overview

Prior to the performance of installation, operation, or maintenance procedures, personnel should become familiar with the equipment (Table 1, Figures 1 and 2) and its components.

The Fulton Pulse combustion hydronic boiler is an automatic gas fired, direct

vent boiler. This boiler utilizes pulse combustion principle. It does not have conventional burner controls or chimney. The combustion components are of integral design with the heat exchanger. Each boiler is built to ASME and CSD-1 Codes, hydrostatically tested, test fired, and shipped as a complete packaged unit.

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.

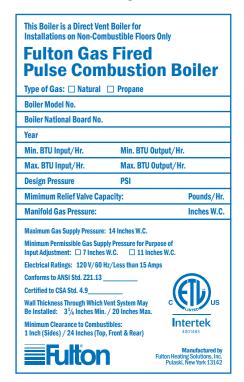


FIGURE 1 - PULSE BOILER PLATE

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.

Review Shipment Contents

Your Fulton Pulse Boiler shipment should be fully reviewed upon receipt. The following are standard and accessory items that may be included with your shipment.

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

INSTALLATION

▶ STANDARD TRIM

The following items are standard trim for Fulton Pulse Combustion Hydronic Boilers:

- Microprocessor Based Control 120 volt with built-in operating and high limit controls, and separately wired dual element sensor
- Low Water Cutoff (Probe Type)
- Control Panel Completely Wired with Diagram
- Gas Pressure Switches
- Spark Ignition
- Factory-Assembled and Mounted Fuel Train
- Flame Rod

PACKAGED SEPARATELY

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

- ASME Pressure Relief Valve
- Pressure-Temperature Gauge
- Air Intake Pipe Adaptor
- Installation, Operation, and Maintenance Manual
- Elastomer Coated Fiberglass Cubes or Springs For Mounting
- Gas and Water Flex Connectors
- Intake and Exhaust Mufflers
- 1 Can Touch-up Paint

▶ OTHER ACCESSORIES

Other items that may be included are:

- Condensate Drain one condensate drain kit can accommodate the condensate from up to 12 MM BTUs.
- PH Neutralization Kit

Placement & Rigging

Proper placement of your Fulton product is essential. Correct placement is the first step to trouble-free installation, operation, and maintenance.

Adhere to the following for placement and rigging:

- 1. Check building specifications for permissible floor loading. Use Table 1 for unit reference.
- Conform to all the requirements of all national, state and local codes
 established by the authorities having jurisdiction and/or the U.S. to the
 National Fuel Gas Code, latest edition. Authorities having jurisdiction
 should be consulted before installations are made. Where required by local
 codes, the installation must conform to American Society of Mechanical
 Engineers Safety Code for Controls and Safety Devices for Automatically
 Fired Boilers (ASME CSD-1).
- 3. Since an external electrical source is utilized, the boiler, when installed, must be electrically ground in accordance with the National Electric Code,

NAI

WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.

Competent personnel in accordance with all applicable local codes should carry out the installation of the Fulton equipment. 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.

A competent rigger experienced in handling heavy equipment should handle rigging your equipment into position.

The equipment must be installed on a non-combustible surface.

Failure to provide required and safe access to the equipment could impede commissioning and maintenance.
Service technicians are instructed not to commence commissioning if hazardous conditions exist.

Failure to provide proper minimum clearances between equipment and combustible materials may result in fire.

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CAUTION

Do not allow weight to bear on equipment components to prevent damage.

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Model	PHW	300	500	750	1000	1400	2000
Specifications	•				•		
Input	BTU/Hr	300,000	500,000	750,000	1,000,000	1,400,000	2,000,000
Nat. Gas consumption @ rated capacity	FT3/Hr	300	500	750	1000	1400	2000
Propane Consumption @rated capacity	FT3/Hr	120	200	300	400	560	720
Electrical Requirements	120V/60/1	4.2/0.6	4.2/0.6	4.2/0.6	4.2/0.6	4.2/0.6	10/.75
(Amps: Max/Run)	240V/60/1	2.1/0.3	2.1/0.3	2.1/0.3	2.1/0.3	2.1/0.3	5/0.4
MAWP	PSI	160	160	160	160	160	160
	BAR	4.1/11.0	4.1/11.0	4.1/11.0	4.1/11.0	4.1/11.0	4.1/11.0
Water Content	Gal	34	34	42	42	80	75
Dry Weight	LB	1395	1395	1800	1800	2230	2900
Operating Weight	LB	1680	1680	2150	2150	3195	3500
Dimensions				·			,
A. Boiler Width	IN	27.5	27.5	27.5	27.5	33.6	33.6
B. Overall Boiler Height	IN	71.25	71.25	83.2	83.2	88.1	89
C. Overall Boiler Depth	IN	53.25	53.25	51.3	51.3	62.6	70.1
D. Exhaust Outlet Diameter	IN	4	4	4	4	4	6
E. Air Inlet Diameter	IN	3	3	4	4	4	6
F. Water Inlet/ Outlet Diameter	IN	2	2	2	2	2.5	4 Flanged
G. Min. Clearance to Ceiling	IN	24	24	24	24	24	24
H. Min. Clearance to Either Side Wall	IN	1	1	1	1	1	1
I. Min. Clearance in Front of Boiler	IN	36	36	36	36	36	36
J. Min. Clearance Behind Boiler	IN	24	24	24	24	24	24

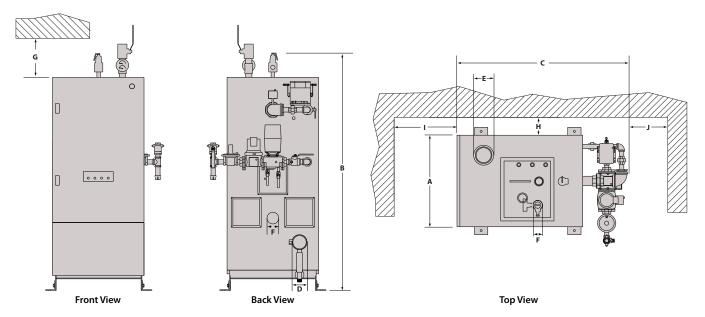


FIGURE 2 -PULSE COMBUSTION HYDRONIC BOILER

American National Standards Institute (ANSI) National Fire Protection Association (NFPA) 70, latest edition.

- 4. Install so that all system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service.
- 5. Install on a level, non-combustible surface in the vertical position. Concrete is strongly recommended.
- 6. Provide combustion and ventilation air in accordance with applicable provisions of local building codes or: USA NFPA 54/ANSI Z223.1, Section 5.3, Air for Combustion and Ventilation.
- 7. Locate the boiler so that the air supply and exhaust piping between the boiler and outside wall/roof are within length or pressure drop requirements. See **Clearances and Serviceability** section of this manual.

Clearances and Serviceability

Adhere to the following for clearances and serviceability:

- All local and national codes (NFPA, ANSI, UL, ETL, ASME, CSA) must be followed for proper clearances and serviceability for your boiler or heater. Authorities having jurisdiction should be consulted before installations are made.
- 2. Appropriate front, back, side and top clearances must be maintained (Figure 2, Table 1). This will allow access around the equipment to facilitate maintenance and a safe work environment. An 1 inch (25.4 mm) side clearance is acceptable between boilers. Custom configurations may not allow 1 inch (25.4 mm) side clearance.
- 3. Ensure all labels on the boiler will be fully visible for maintenance and inspection.

Install Isolation Mounts

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. 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.

How to Install Elastomer Cube Isolation Mounts

Adhere to the following for elastomer cube isolation mounts (see Figure 3):

- 1. Locate in the box of trim shipped with each Pulse boiler the 4 elastomer cubes (3" x 3" x 2") used for vibration isolation.
- 2. Insert these cubes under each foot of the boiler.

♠ WARNING

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

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CAUTION

Do not install this boiler on carpeting.

Install boiler such that gas ignition system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service.

WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.

\triangle CAUTION

Do not attempt to move the boiler laterally while it is supported on isolators. Bent or broken leveling bolts or springs, or damage to the neoprene bottom spring cap could result

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

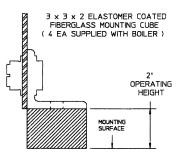


FIGURE 3 - INSTALLING ELASTOMER CUBE ISOLATION MOUNTS

- NOTE: 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.
- NOTE: Contact your Fulton Representative for vibration isolation packages designed specifically for your application.

How to Install Spring Isolation Mounts

Adhere to the following for Spring Isolation Mounts (see Figure 4):

- 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.
- Remove the small cap screw and washer. Raise the boiler with jacks or similar tools. Do not attempt to raise the boiler via one 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 its 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.

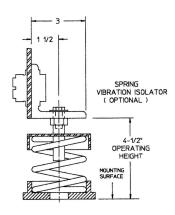


FIGURE 4 - INSTALLING SPRING ISOLATION MOUNTS

■ NOTE: 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.

■ How to Install Seismic Spring Isolation Mounts

Adhere to the following for installation of Seismic Spring Isolation Mounts (see Figure 5):

- 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.
- 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.
- 8. Turn the 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.

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WARNING

The discharge from the safety relief valve must be arranged to ensure no danger of scalding personnel, or equipment damage.

Provisions must be made to properly pipe the safety relief discharge away from the boiler to the point of discharge.

The hydronic system should never be flushed while the boiler is attached to the system since the debris could accumulate in the boiler and block water from passing through the heat exchanger.

Ensure all labels on the boiler are legible. All connections and safety devices, both mechanical and electrical, must be kept clean, with ease of access for inspection, use and maintenance.

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

WARNING

Discharge from the safety relief valve must be arranged so that there is no danger of scalding. When the safety relief valve is piped away from the boiler to the point of discharge, there must be provisions to properly drain the piping.

No shutoff of any kind may be placed between the safety relief valve and the boiler, or on the discharge pipe between the safety relief valve and the atmosphere. Doing so may cause an accidental explosion from overpressure.



Care needs to be taken to eliminate oxygen from the water system, as excess oxygen in the system will reduce the life of any boiler. The boiler warranty does not cover heat exchanger replacement due to oxygen contamination of boiler water.

Heat exchanger failure due to inappropriate water quality, foreign matter or debris damage is not covered under the warranty.

If the piping system attached to this unit will be chemically cleaned, the boiler must be disconnected from the system and a bypass installed so that the chemical cleaning solution does not circulate through the boiler.

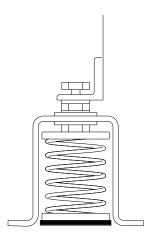


FIGURE 5 - INSTALLING SEISMIC SPRING ISOLATION MOUNTS

■ NOTE: 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.

Install Boiler Trim

Each boiler is supplied with a safety relief valve sized in accordance with ASME requirements.

Adhere to the following for installation:

- 1. Connect the safety relief valve to the coupling located in the top of the boiler. The safety relief valve must be installed with 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.
- 2. Install pressure-temperature gauge in the side port of a tee installed in the boiler water outlet. A tee is installed on the nipple.

Water Chemistry Requirements

All water supplies contain some amount of solids, dissolved gases and dissolved minerals. These materials may promote corrosion, deposition and/or fouling of equipment. To prevent these contaminants from impacting on boiler performance, valve operation and general pipe longevity, each location must be analyzed and treated accordingly. The following are installation recommendations for "closed-loop" recirculating hot water heating systems.

- 1. Automatic pressure activated water make up valve with backflow preventer providing water to the system, not fed directly to the boiler, set to maintain:
- Required NPSH for recirculating pump(s).

- A positive system pressure at the highest point of 5 to 10 psi.
- Make up water valve should be designed to add water to the system at the outlet of the boiler and should not be fed directly into the boiler.
- 2. Air removal equipment, including air separator and automatic air breather valves.
- 3. A functioning expansion tank designed to system specifications.
- 4. Filtration to remove particulates installed inline with the suction side of the recirculating pump.
- Bypass chemical feeder for corrosion inhibitor maintenance.
- Optionally a water meter could be installed in series with the automatic pressure activated water make up valve to monitor any make up water.
- 7. Ensure water quality meets the following:

- Oxygen less than 250 ppb (operating condition)
- pH must be in the range of 8-10
- Total Iron & Copper less than 25 ppm
- Corrosion Inhibitor level capable of maintaining iron corrosion rates < 2 mpy. Due to changing environmental restrictions, a non-heavy metal, all organic inhibitor is recommended, which is designed for multi-metal systems including ferrous metals and yellow metals such as copper and brass.
- Chlorides less than 250 ppm as Cl. Limit applicable only to installations utilizing duplex steel pressure vessel components.

Install Water Piping

The bottom connection to the boiler is the INLET and must be connected as the return from the system. The top connection on the boiler is the OUTLET and must be connected as the supply to the system.

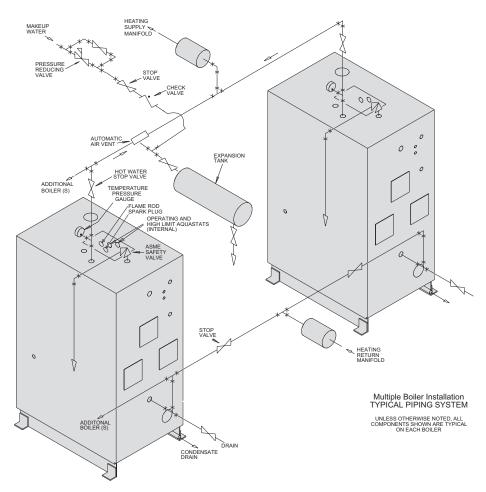


FIGURE 6 - TYPICAL PIPING (MULTIPLE BOILER SYSTEM)

∕ MARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/ professional codes and regulations.

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

If the water supply must be temporarily disconnected from the condensate trap, the boilers must be turned off to prevent accidental flue gas emission into the boiler room. An uninterruptible water supply is required and shall be connected to the 1/4" compression fitting on the condensate drain. The water supply maintains a water level in the drain kit to prevent accidental flue gas emission into the boiler room.

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.

CAUTION

Some soap used for leak testing is corrosive to certain types of metals. Clean all piping thoroughly after completing the leak check. Adhere to the following for water piping installation (Figure 6):

- 1. Connect hot water supply to heating system feed line.
- 2. Connect expansion tank.
- 3. Connect return water to boiler return water connection.
- 4. Install an air separator and air eliminator (air vent) which is necessary as there is no built in boiler air eliminating feature.
- 5. If a sealed diaphragm-type expansion tank is used, install air eliminator in hot water piping at air separator.
- 6. If an air cushion type expansion tank is used, pipe tank directly into boiler supply.
- 7. 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. When the boiler is installed at a higher level than baseboard radiation, air elimination must be provided directly above the unit.
- 8. 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.
- NOTE: For all models, a no flow condition will not damage the heat exchanger, however, adequate flow should be provided to prevent tripping the boiler on high temperature limit.
- 9. For boilers with carbon steel or duplex steel heat exchangers, the maximum allowable temperature differential across the heat exchanger is 100 degrees F. Minimum outlet temperature for carbon steel units must be 120 degrees F or greater. Maximum allowable working temperature for carbon steel units is 240 F. High limit is set at 230 F, therefore operating at a temperature greater than 220 F is not recommended. For duplex steel units, maximum allowable working temperature is 210 F. High limit is set at 200 F, therefore operating at a temperature greater than 190 F is not recommended.
- 10. 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.
- 11. 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.
- 12. Clearance from hot water pipes to combustibles must be at least 6".
- 13. 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.

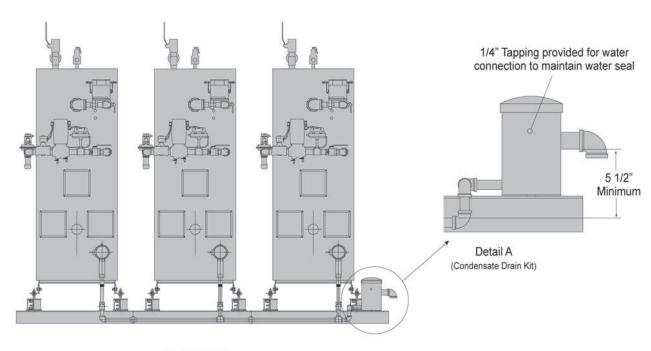
- 14. The boiler is furnished with a probe type low water cutoff. No field piping is required. If the probe does not sense water, the boiler will shut down and a red indicator will be illuminated on the control panel.
- 15. The boiler is not provided with external drain connections. A drain valve must be installed near the inlet connection to the boiler and piped to a suitable floor drain. A Boiler Drain Assembly can also be purchased from Fulton. This Boiler Drain Assembly must be installed near the inlet connection to the boiler.
- 16. 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.

Install Condensate Drain

The condensate drain kit is intended for use 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 12 MM BTU/hr) through a common header. See Figure 7.

Adhere to the following for installation:

- An uninterruptable 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.
- Keep the cover on at all times, except during maintenance of the drain. This drain should be monitored and checked regularly in your Pulse maintenance schedule.
- 3. A condensate collecting tank and condensate pump



BACK VIEW

For multiple boiler installation, maintain a minimum pipe size of 1" for the header piping.

(12 MM BTUs maximum, per drain kit)

FIGURE 7 - MULTIPLE BOILER CONDENSATE DRAIN INSTALLATION

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WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.

DO NOT USE GASOLINE, CRANKCASE OIL OR ANY OIL CONTAINING GASOLINE. If in doubt, contact your Fulton representative prior to operation.

Do not store or use gasoline or other flammable vapors and liquids or corrosive materials in the vicinity of this or any other appliances. Cements for plastic pipe 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.

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.

\triangle CAUTION

The vent line connection on the gas pressure regulator must be piped in accordance with National Fuel Gas code, latest addenda. In Canada, gas installations must be in accordance with current CAN/CGA, and/or local codes.

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

Install Condensate Drain Piping

Adhere to the following when installing condensate drain piping:

- 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. The header must be at least 5 ½" below the condensate outlet of the individual boiler and must remain flooded by being at least 5 ½" below the outlet of the condensate drain trap..
- 5. Connect 1½" drain outlet to an appropriate waste line following applicable codes. The 1½" 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.

Install pH Neutralization Kit

The pH Neutralization Kit is a Fulton-provided kit designed to bring the pH level of the boiler's condensate to a neutral level. It is not a replacement or alternative for the Condensate Drain Trap. See Figure 8.

Adhere to the following for installation:

- 1. Use stainless or galvanized pipe and fittings to connect condensate drain to kit.
- 2. Connect kit downstream of Condensate Drain Trap. See Figure 9.
- 3. Pipe outlet to appropriate drain.
- NOTE: Replacement bags are available from the Fulton Parts Department. The medium in the container will neutralize the condensate of 12 MM Btu's for approximately 6 months.

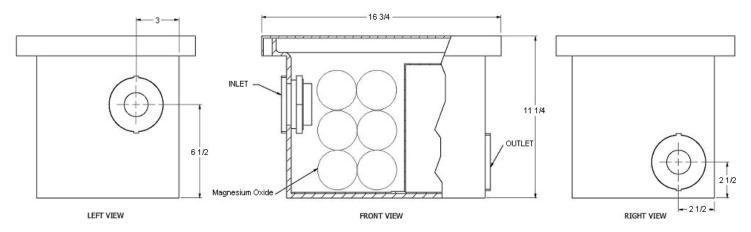


FIGURE 8 - FULTON PH NEUTRALIZING KIT (WITHOUT PUMP)

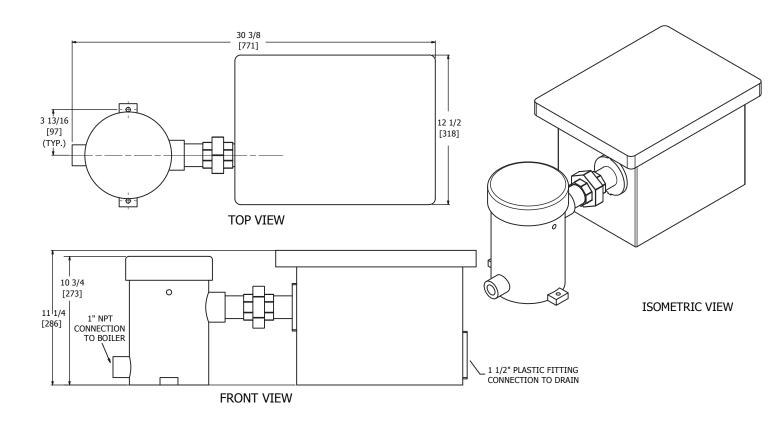


FIGURE 9 - FIELD CONNECTIONS FOR CONDENSATE DRAIN TO PH NEUTRALIZATION TANK

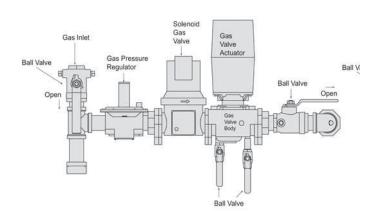


FIGURE 10 - GAS VALVE CONFIGURATION

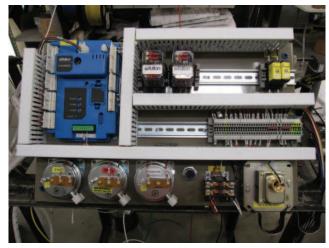


FIGURE 11 - FIELD WIRING

Install Gas Piping

Adhere to the following for gas piping installation:

- 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.
- 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.
- NOTE: Do not use the boiler's gas train inlet size as a gauge for inlet piping size. Always refer to appropriate gas piping charts.
- ► NOTE: Full port ball valves approved for gas should be used for gas isolation to reduce pressure drop.
- Gas pressure to inlet of gas train should be 7"WC for natural gas and 11"WC for propane (PHW2000LE requires 11"WC on natural gas). Connect gas supply line to the open end of the tee on which the drip leg is installed. See Figure 10.
- 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.

- 6. 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 more than 1/2psi (3.5kPa).
- 7. Gas vents to outdoor air must be provided for the gas pressure regulator. Restricting orifices or bleed orifices should not be used at anytime. The vent line connection on the gas pressure regulator must be piped to outdoor air by installer in accordance with the National Fuel Gas Code, ANSI Z223- 1-1991 or latest addenda.
- 8. In Canada gas installations must be in accordance with the current CAN/CGA B149.1 and .2 and/or local codes.

► HONEYWELL PRESSURE SWITCH

The Honeywell C6097 pressure switch is designed with internal vent limiters to meet UL 353 requirements and are CSA certified, UL listed, FM approved, and CSD-1 acceptable. Local codes may not permit a gas device (pressure switch) without an external vent line connection. If that is the case, a vent line must be added.

Install Field Wiring

Adhere to the following for field wiring installation (see Figures 11 and 52):

 An independent power supply line is recommended for the boiler. Connect one 120 volt (60Hz) fused power line to terminal block to hot, or marked terminal per electrical diagram. Connect applicable wires to neutral and ground. Connect a ground wire to green colored ground lug in electrical control box.

- 2. Ensure gas ignition system components are protected from water (dripping, spraying, rain, etc.) during boiler operation and service.
- 3. Any attempt to start the boiler to test wiring prior to filling and purging may result in a dry fire and void the warranty.

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 respectively. See Figure 12. Air supply is on the top. 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. 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.

- 1. For sealed combustion applications, 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).
- 2. For applications using make up air from the boiler room, a minimum of 10' of venting including the intake muffler must be installed. Per ASME Section VI Para. 6.04, an unobstructed air ventilation opening should be sized on the basis of one square inch free area per 2000 BTU/HR maximum fuel input of the combined burners located in the boiler room. This is subject to state and local regulations. The installation of exhaust fans in a boiler room is not recommended.

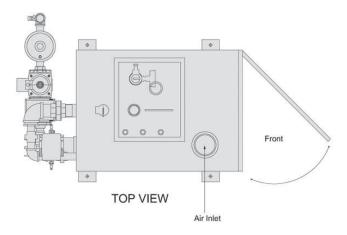


FIGURE 12 - AIR INLET LOCATION



WARNING

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Do not attempt to start boiler to test wiring before filling and purging the boiler. A dry fire may cause injury, boiler damage, and/or property damage, and is not covered by warranty.

Do not use the boiler/burner as support for ducted air piping.
Ducted piping must be supported independently of the boiler.

Do not terminate venting into an enclosed area.

Never use open flame or smoke from a cigarette, cigar, or pipe as a testing method during boiler installation, operation, or maintenance.

Foreign substances, such as combustible volatiles in the combustion system can create hazardous conditions. If foreign substances can enter the air stream, the boiler combustion air inlet must be piped to an outside location.

Particulate matter or chemicals in the combustion air supply to the boiler will cause damage to air flapper gaskets, could cause the unit to fail to light, and is not covered under warranty.

\triangle CAUTION

Intake PVC piping must be assembled using cement. This ensures that the intake is air tight and will not allow contaminants to enter the boiler from the boiler room. Cement must 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 must show no gelation, stratification, or separation that cannot be removed by stirring.

Cements for plastic pipe are flammable and should be kept away from all sources of ignition. Proper ventilation must be maintained to prevent cement vapor hazards. Avoid contact with skin and eyes.

- 3. All alternative individual venting arrangements must result in an intake pressure drop not to exceed 2.5" w.c. (Consult factory for assistance.)
- 4. All common venting arrangements must result in a pressure drop of less than 0.1" w.c. in the common header. (Consult factory for assistance.)
- 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.

Cementing Joints

Adhere to the following procedure (per ASTM D2855) (see Figure 13):

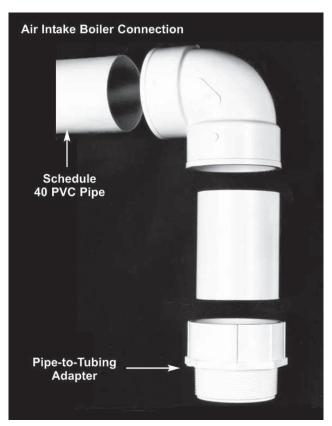


FIGURE 13 - AIR INTAKE BOILER CONNECTION

- 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.

INSTALLATION

- 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. 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.

Install Intake Muffler

To install intake muffler, cement joints as indicated in previous section. For best noise attenuation, the muffler should be installed as close to the boiler as possible, and can be horizontal or vertical in orientation.

Preparing to Install Exhaust Vent Piping

A Fulton Pulse boiler should not be connected to a common venting system with other types of gas appliances. Adhere to the following when preparing to install vent piping:

- The boiler is equipped with an exhaust vent connection located at the rear of the boiler. For models PHW300 up through the PHW1400, the connection is 4" NPT threaded female. Model PHW2000, the connection is 6" NPT threaded female.
- 2. The exhaust line must be sloped down toward the boiler 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 or 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.
- 3. All alternative individual venting arrangements must result in an exhaust pressure drop not to exceed 2.5" w.c. (Consult factory for assistance.)

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WARNING

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WARNING

Crystalline silica may be present in components of this equipment. Exposure to crystalline silica may pose significant health hazards, including but not limited to eye and respiratory system damage. Per the Centers for Disease Control and Prevention (CDC) and Occupational Safety and Health Administration (OSHA), appropriate Personal Protective Equipment must be worn to minimize exposure to hazardous substances. Refer to most current guidelines offered by the CDC and OSHA for more information, including Personal Protective Equipment recommendations.

\triangle CAUTION

To prevent potential water damage, never leave an open manual air vent unattended.

- 4. All common venting arrangements must result in a pressure drop of -0.1" to 0.0" w.c if not using a draft assist fan. (Consult factory for assistance.)
- 5. All common venting arrangements must result in a pressure drop of 0.0" to 0.75" w.c. with the use of a draft assist fan. (Consult factory for assistance.)
- Variable speed exhaust fan pressure setting should be no more than 0.1" w.c.
- 7. Flue vent pipes and fittings for all Pulse boilers must be UL listed for use with Category IV, positive pressure, condensing equipment. Specifically this material is AL294C. Stainless Steel 316L piping is also acceptable. 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 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 any local codes and regulations that may apply. The procedure for adhesive joining stainless steel pipe and fittings follows:
 - Do not mix stainless steel pipe with galvanized or other alternatives for the entire length of the system.
 - 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.
 - 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.
 - Fully insert the male end of the section into the female fitting of the section below. Attach the sections together. 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.
 - See specific manufacturers instructions for complete installation details.

Exhaust Muffler Installation

Adhere to the following for muffler drain installation:

- For mufflers installed in the **vertical** configuration the drain can be plugged.
- For mufflers installed in the **horizontal** configuration, the drain opening should be at the down slope (6 o'clock) position, and should be piped to the drain line between the boiler and the condensate drain. For best sound attenuation, the muffler should be installed as close to the boiler as possible.

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Air Intake & Exhaust Piping Requirements for the Pulse Boiler

Adhere to the following for air intake and exhaust piping:

- 1. Use piping that matches the inlet/outlet connection sizes for the first 35 feet and 4 elbows closest to the boiler. See Tables 2 and 3.
 - The piping can be extended to 100 feet and 6 elbows by increasing the pipe size to 6" for the PHW300 PHW1000, and to 8" for the PHW2000.
 - For the PHW1400, the air intake and exhaust piping must be 4" for the first 10 feet and then piping must be upsized to 6" for up to 40 feet. If going beyond 40 feet, instead of upsizing to 6" after the first 10 feet, upsize to 8".
 - It is acceptable to extend the piping up to 100 feet and 6 elbows with proper sizing.
- A minimum of 10 feet of piping is required on the air intake (even if taking combustion air from the boiler room) or exhaust. This creates the appropriate amount of backpressure for pulse combustion to operate properly.
- 3. If air intake or exhaust layouts require upsizing, keep the first 10 feel closest to the boiler matching the outlet connection size of the boiler.
- 4. If utilizing a common header pipe for multiple pulse boilers, the pressure drop across a common intake pipe must be neutral. The pressure drop across a common vent pipe must be between -0.1 and 0"W.C. if not utilizing a mechanical draft system.
 - 5. Exhaust runs should, individually, not have pressure drops of more than 3.0"WC. Intake is +2.0"WC.

TABLE 2 - AIR INTAKE PIPING REOUIREMENTS

Model PHW	Туре	Base Diameter (inches)	Length (feet)	Number of 90-degree Elbows
300	PVC	3	10 minimum	0
		3	35 maximum	4
500	PVC	3	10 minimum	0
		3	35 maximum	4
750	PVC	4	10 minimum	0
		4	35 maximum	4
1000	PVC	4	10 minimum	0
		4	35 maximum	4
1400*	PVC	4	10 minimum	0
		6	35 maximum	4
2000	PVC	6	10 minimum	0
		6	35 maximum	4

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WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.

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.

Operating the boiler beyond its design limits is dangerous and may also cause boiler damage. Do not attempt to upgrade boiler performance with unapproved modifications.

TABLE 3 - EXHAUST VENT PIPING REQUIREMENTS

Model PHW	Туре	Base Diameter (inches)	Length (feet)	Number of 90-degree Elbows
300	Stainless Steel	4	10 minimum	0
	AL294C	4	35 maximum	4
500	Stainless Steel	4	10 minimum	0
	AL294C	4	35 maximum	4
750	Stainless Steel	4	10 minimum	0
	AL294C	4	35 maximum	4
1000	Stainless Steel	4	10 minimum	0
	AL294C	4	35 maximum	4
1400*	Stainless Steel	4	10 minimum	0
	AL294C	6	35 maximum	4
2000	Stainless Steel	6	10 minimum	0
	AL294C	6	35 maximum	4

^{*}A minimum 10 feet of 4 inch air intake and exhaust is required for the PHW-1400. Air intake and exhaust configurations over 10 feet in length will require 4 inches for the first 10 feet from the boiler, and then 6 inches up to an additional 40 feet, and four elbows.

Air Intake Supply and Exhaust Vent Installation

Adhere to the following for 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.
- 2. 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 14. 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.
- 4. 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 15). 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.

- 5. Pass the vent pipe through the opening in the fire stop. If used as a support, install the support ring around the vent pipe above the fire stop. Slide the support ring down to the top of the fire stop and tighten it securely to the vent pipe. Firestop supports can support up to 10 feet of vent pipes and are recommended at all floor and ceiling penetrations. Figure 16. Air intake supply and exhaust vent pipes and fittings must be securely supported.
- 6. Horizontal sections require supports every 5 feet and at elbows. From the boiler, all horizontal sections must rise at leas 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.
- 7. 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.
- **■** NOTE: All venting must be mounted using spring isolators.

Vertical Vent Flashing and Installation

Adhere to the following for vent flashing 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. See Figure 17
- 2. 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

Adhere to the following for vertical vent termination:

- 1. The vent pipe must extend through the flashing to a height above the roof as required in Figure 18. A storm collar is installed on the vent pipe over the opening between pipe and flashing.
- 2. Adhesive material is used over the joint between the vent pipe and the storm collar. Figure 18. The vent termination is joined to the end of the vent pipe.
- 3. 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. 18. These minimum heights may be used provided the vent is not less than 8 feet from any vertical wall.

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All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.

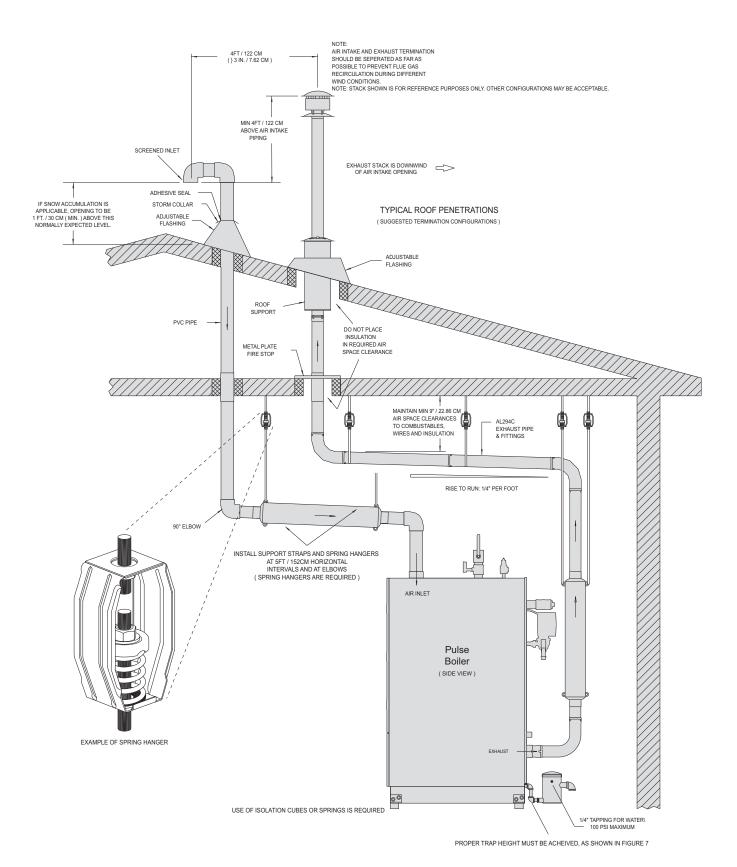
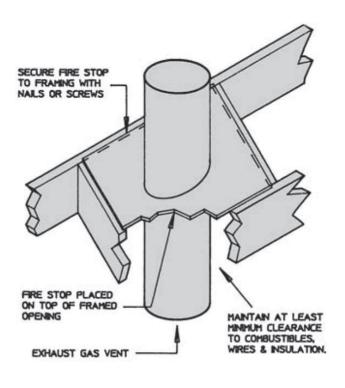


FIGURE 14 - TYPICAL CEILING AND ROOF PENETRATION DETAIL



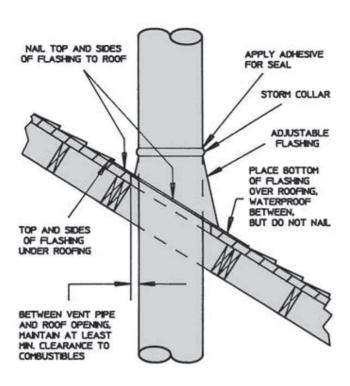


FIGURE 15 - FIRE STOPPING REQUIRED FOR ALL CEILING/FLOOR INSTALLATIONS

FIGURE 17 - CORRECT ROOF FLASHING INSTALLATION

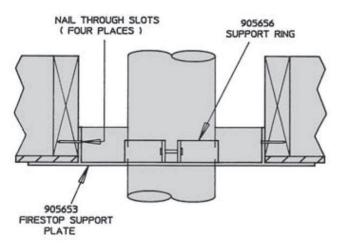
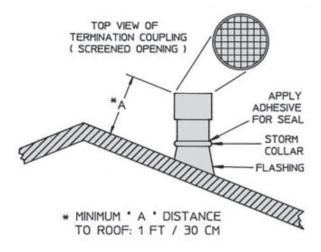


FIGURE 16 - FIRE STOPPING

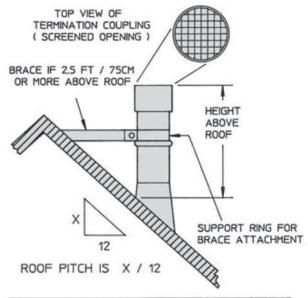
For Roof Pitch of Flat to 7/12



ROOF PITCH	HEIGHT ABOVE ROOF		
(RISE OVER RUN)	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	HEIGHT ABOV		
(RISE OVER RUN)	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

FIGURE 18 - ROOF PITCH

Horizontal Installation Wall Penetrations

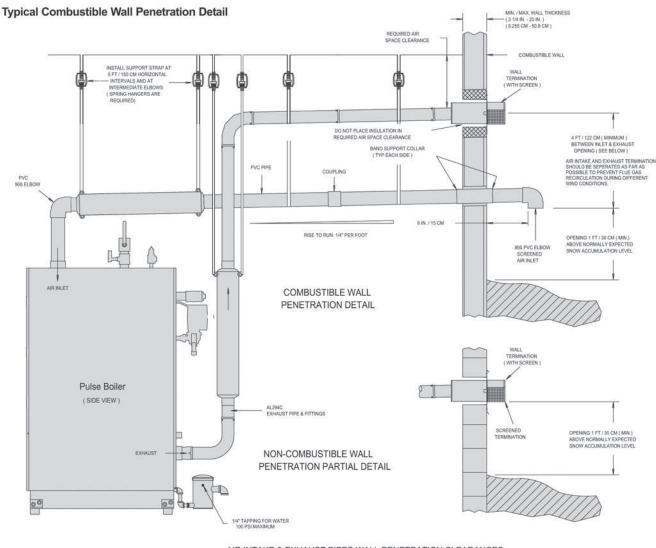
Adhere to the following for horizontal wall penetrations:

- 1. Select the point of penetration where a minimum of 1/4" per foot upward pitch can be maintained.
- 2. 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 Figure 19 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

Adhere to the following for wall thimble installation:

- 1. Insert a 9" diameter thimble through the wall from the outside. Secure the outside flange to the wall with nails or screws, and seal with adhesive material.
- 2. 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. See Figure 20.
- 4. 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



AIR INTAKE & EXHAUST PIPES WALL PENETRATION CLEARANCES

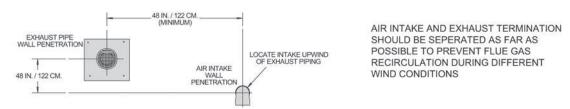


FIGURE 19 - HORIZONTAL INSTALLATION WALL PENETRATIONS

intake and vent pipes are passed, then tighten securely. They will prevent the intake and vent pipes from being pushed or pulled.

Horizontal Vent Termination

Adhere to the following for horizontal vent terminations:

1. Join the vent termination to the vent pipe outside the

- wall. Use the same joining procedures for vent pipe and fittings.
- 2. Ensure the termination of the vent system is at least 12" above the finished grade, or at least 12" above normal snow accumulation level (for applicable geographical areas). Refer to Figure 19. 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

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WARNING

Do not attempt to start the boiler before filling and purging the boiler system. A dry fire may cause injury, may seriously damage the boiler, may result in property damage, and will void the warranty.

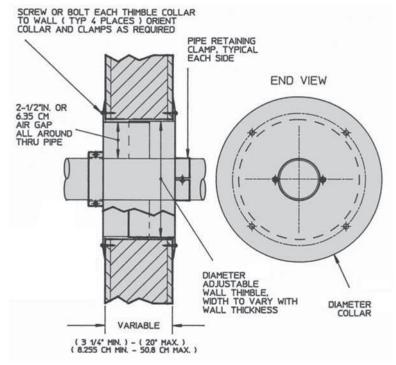


FIGURE 20 - WALL THIMBLE INSTALLATION

7 feet above finished grade, (National Fuel Gas Code, ANSI Z223.1).

- 3. 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.
- 4. The air supply inlet and exhaust outlet must be separated from 4 ft. minimum to 10 ft. maximum on the same wall. The exhaust outlet must be installed 4 ft. minimum above and downwind from air supply inlet to prevent exhaust recirculation.
- 5. 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

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 21.
 - 1. Close combination shutoff/purge valve in supply, all drain cocks, the

INSTALLATION

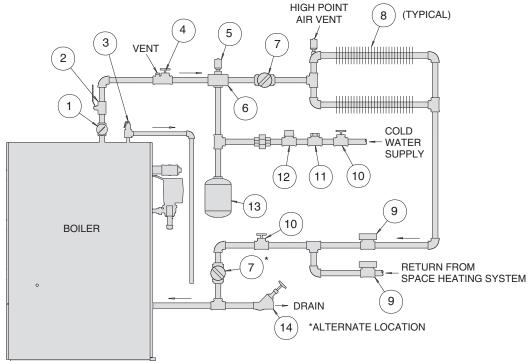


FIGURE 21 - PURGE EXAMPLE

Legend:

- 1. Temperature/ Pressure Indicator
- 2. Hot Water Outlet Stop Valve
- 3. Safety Valve
- 4. Combo Shutoff/ Purge Valve
- 5. Auto 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

shutoff valve for the pressure reducing (fill) valve, and all manual air vents.

 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.

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- 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.
- 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.
- 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.
- 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



CAUTION

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

- system may be considered water tight.
- 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.
- 12. Open gas shutoff valve, allowing gas to flow to boiler.

Installation Checkpoints

- Do not turn on the boiler unless it is filled with water as shown by indicating light on panel box.
- 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.
- Set the temperature control to the desired setting. Refer to Operation section of this manual for setting the setpoint.
- Open the manual shut off gas valve.
- Close the circuit breaker or the fuse disconnect.
- Turn the on-off switch to "ON."

Testing Ignition Safety Shut Off

Perform the following:

- 1. Open gas shut off valve, allowing gas to flow to boiler.
- 2. Close gas shut off valve.
- 3. Reset low gas pressure switch.
- 4. 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.
- 5. Open the gas shut off valve.
- 6. Restart the boiler.

Measure Gas Flow Rate

Perform the following:

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

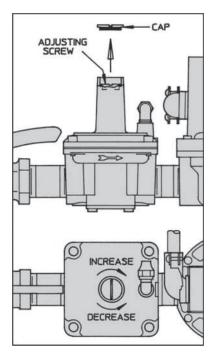


FIGURE 22 - REMOVING CAP FROM REGULATOR

- 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.
- Inlet Pressure for Natural gas fired units should be a minimum of 7"WC while running. Inlet pressure for Propane should be a minimum of 11"WC while running. See factory test fire sheet for manifold operating pressures.

■ To Correct Input — Adjust Gas Pressure Regulator

Perform the following:

- 1. Turn boiler off and remove cap from regulator. (Figure 22).
- Turn adjusting screw clockwise to increase gas flow.
 Turn adjusting screw counter-clockwise to decrease gas flow.
- 3. Always replace cap before turning on boiler.
- 4. Regulator vent must terminate outdoors.
- 5. A flow restricting bleed valve shall not be used on the regulator vent.

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.

To Check for High Gas Pressure

Adhere to the following:

- 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).
- 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 Using Fisher Regulators

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. At a minimum, it should be 10 feet from boiler.
- 2. When stepping down from more than 5 psig to 14"WC, the stepdown should be done in two steps:
 - Reduce the pressure to 5 psig
 - Reduce the pressure from 5 psig to 14"WC
- The preferred stepdown regulator for this application is manufactured by Fisher. 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 Fisher regulators operate the most satisfactorily.

- 4. Recommendations for installing step down regulators:
 - There must be a minimum of 10 pipe diameters of straight pipe before the inlet and after the outlet of the regulator.
 - Vent pipe must not be reduced to a smaller size than the opening size of the regulator vent. Use the next size pipe for every ten inches of pipe.
 - Install a union close to the outlet of the regulator for ease of removal and maintenance.
 - Vent to a safe area.

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.

INTRODUCTION

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INSTALLATION

2

OPERATION

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MAINTENANCE

4

WARRANTY & PARTS

5

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WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations. Failure to follow instructions may result in a fire or explosion, causing property damage, personal injury, or loss of life.

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

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

Use only your hand to turn the valve handle. 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.

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. -A qualified installer, service agency or the gas supplier, must perform installation and service.

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 impacted part of the control system.

Before Start Up

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 start up, perform the following safety checks:

- 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.
- Ensure no part of this boiler 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.
- Ensure you have read and followed all previous safety information.
- Turn off all electric power to the boiler.
- Turn gas cock handle clockwise to "OFF". Figure 23. (This gas cock handle is also the emergency shut-off device.) Use only your hand to turn the gas cock handle. Never use tools. If the handle will not turn by hand, don't try to repair it. Call a qualified service technician. FORCED OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.

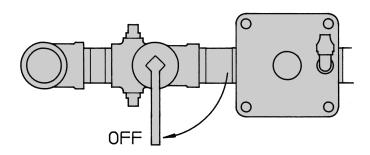


FIGURE 23 - GAS COCK HANDLE IN OFF POSITION

Start-Up

Perform the following to start boiler:

- 1. Open the main gas cock handle counter clockwise 1/4 turn to "ON" position (Figure 24).
- 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 allowed number of retry attempts is not exceeded.
- 5. If the gas valve opens but the boiler does not start, check the spark plug to be sure it is working properly.
- 6. The plug may be bad or the plug wire may be loose. Check gap of plug. It should be .050" to .060". When replacing the spark plug be sure to use *Never Seize* on threads of plug.
- 7. When the unit fires and pressure is sensed in air valve housing and the flame rod senses flame, 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) and the flame rod senses flame, the assist fan and spark will turn off.
- 8. Do not change flame pressure switch settings.
- 9. Should overheating occur, or the gas supply fails to shut off, shut off the gas supply at a location external to the boiler.

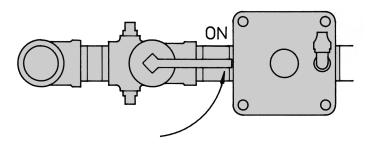


FIGURE 24 - GAS COCK HANDLE IN ON POSITION

■ Linkage Adjustment for Pulse Modulated Boilers

The following 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, ensure both the gas and exhaust butterfly valves are in the closed position with the boiler off.

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.



WARNING

Do not attempt to start the boiler for any testing 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.

Before commissioning the boiler, verify with authorized personnel that the gas lines have been purged.

Never attempt to operate a boiler that has failed to pass all the safety checks.

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



CAUTION

Do not use this equipment if any part has been under water (or subjected to heavy rains/water if the equipment does not have NEMA 4 wiring, controls and instrumentation). Immediately call a qualified service technician to inspect the equipment and to replace any part of the control system and/or gas control(s) which have been under water.

Commissioning/Start up by a non-Fulton authorized person will void the product warranty.

Please read these instructions and post in an appropriate place near the equipment. Maintain in good legible condition.

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WARNING

Non-Fulton product information is for reference purposes only. No Fulton document should substitute for full review of documentation available from the component manufacturer.

\triangle CAUTION

After checking controls by manual adjustment, make sure they are always reset to their proper settings.

When making changes to the controls profile, a combustion analyzer is required.

Check daily that the equipment area is free and clear of any combustible materials, including flammable vapors and liquids.

Water chemistry in the boiler must be kept within required limits. Failure to do so may cause premature pressure vessel failure and will void the warranty.

▶ 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

- 1. 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.
- 3. 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.
- 4. 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.
- 5. Before the boiler fires at high fire:
 - Access Status screen on SOLA Control and press Operation.
 - Press yellow box next to Firing Rate.
 - Change Automatic to Manual in Run, and key in 100%. Press OK. Refer to Figure 25.

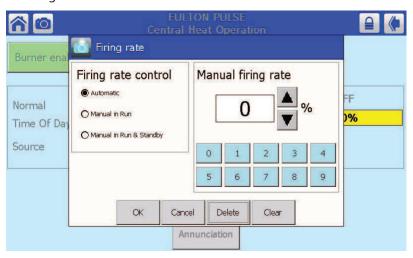


FIGURE 25 - EDIT THE FIRING RATE

- Check combustion at high fire. Make adjustments to air flapper, and incoming gas. Air flapper adjustments are to be made at high fire only.
- NOTE: At high fire, the gas and exhaust butterfly valve will be full open in the horizontal position.

▶ LOW FIRE SETTINGS

- 1. 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.
- 2. 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.
- 3. 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.
- 4. 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 steps are performed 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 switch to Off position and power down the boiler.
- 2. Disconnect (-) and (+) from the mod motor. Tape or wire bug the loose electrical wires.
- 3. Using a 4-20 mA source, connect (+) lead to (+), and (-) lead to (-) on the mod motor.
- Adjust the start potentiometer fully clockwise (maximum zero) and the span potentiometer fully counterclockwise (minimum span).
- 5. Reapply power to the boiler.

- 6. Set the 4-20 mA source to 4 mA to drive the motor to the closed position.
- 7. Turn the start potentiometer slowly counterclockwise until the motor begins to open. This is defined as the **start** or **zero** position.
- 8. Set the 4-20 mA source to 20 mA to drive the motor to the fully open position. The motor will open.
- 9. Turn the span potentiometer clockwise until the motor starts to close. The difference between the fully open span position current and the zero position current is defined as the operating span.
- 10. Recheck the start and readjust the span potentiometer if necessary. Turn the start potentiometer clockwise to increase the zero position.
- Recheck the span and readjust the span potentiometer if necessary. Turn it clockwise to increase the full span position.
- 12. Power down 4-20 mA source and boiler.
- 13. Remove 4-20 mA source, and rewire the mod motor.
- 14. Power boiler up, and turn switch to On.

■ If the Boiler Doesn't Start

Proceed as follows:

- 1. Adjust blocked air intake switch (BIS)
- 2. Screw the switch fully in. Do not over tighten the screw.
- 3. With the boiler running in manual and 100% high fire, back the switch out until the boiler switches off.
- 4. Turn the BIS in one full turn.
- 5. Re-start the boiler.
- NOTE: Do not change the Flame Pressure Switch settings.
- 6. 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. Check for proper water level in the boiler (low water cutoff).
- 8. If the boiler still does not operate, follow these

- instructions to shut off the gas and call your service technician and/or gas supplier:
- 9. Turn off all electric power to the boiler if service is required.
- 10. Turn gas cock handle clockwise to "OFF".

Sequence of Operation for Modulated Pulse Hydronic Boilers

The following is a typical sequence of operation:

- 1. When the boiler receives a call for heat, the prepurge cycle is initiated.
- 2. The mod motor is driven to high fire.
- 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.
- 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.

General Operation of the Boiler

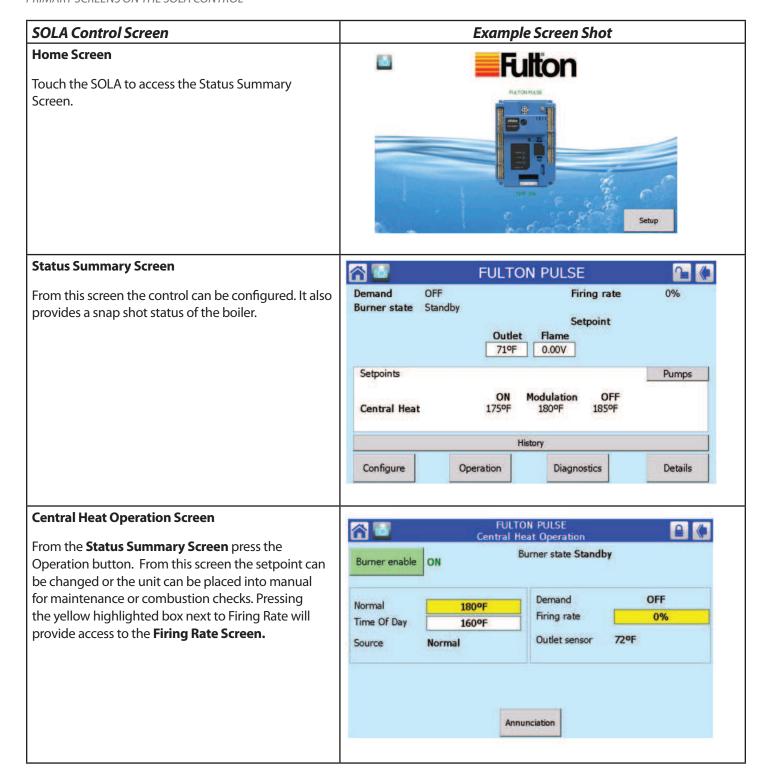
Excessive cycling will reduce the useful life of any piece of mechanical equipment. Pulse boilers should be operated and controlled so the boiler cycles less than 12,000 times per year. Pulse boilers should be operated and controlled so that the temperature differential across the boiler does not exceed 100 F (38 C).

Programming Instructions for the SOLA Control

The SOLA control has been factory-programmed and requires no alteration of program presets. Only factory trained personnel should attempt to alter password protected presets. Primary screens are shown on the following pages.

OPERATION

PRIMARY SCREENS ON THE SOLA CONTROL



SOLA Control Screen

Firing Rate Screen

In this example screen, the boiler is in automatic. By pressing the circle next to Manual in Run, the unit will go to manual. Pressing Clear will remove the current firing rate percentage and permit you to enter a new percentage. Press OK. The boiler will go to that firing rate.

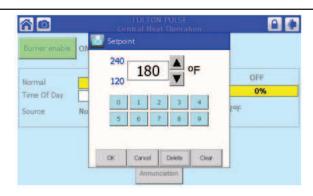
Firing rate Firing rate control Manual firing rate

Example Screen Shot

合回 Normal Time Of Day O Minual in Run & Standay Carroel Delete Clear

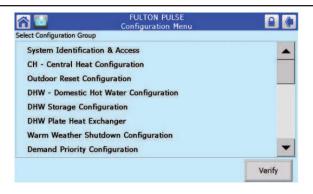
Setpoint Screen

Access this screen by pressing the yellow highlighted box next to Normal from the **Central Heat Operation Screen**. From here you can press clear, enter the required setpoint, then press OK.



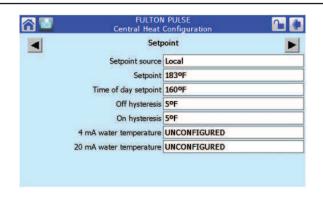
Configuration Menu Screen

Access this menu screen by pressing Configure in the Status Summary Screen.



Central Heat Configuration – Setpoint Screen

From the list of Parameters, press the CH – Central Heat Configuration. You will now be in the Central Heat Configuration Screen, Central Heat page. Press the upper right black arrow until you get to the Setpoint Screen. From this screen you can see this is another location where the Setpoint can be changed but this is the only location that the Hysteresis (on/off around setpoint) can be changed. To change any of these settings the **sola** password must be entered.



SOLA Control Screen Example Screen Shot Central Heat Configuration – Modulation Screen FULTON PULSE Central Heat Configuration By pressing the black arrow on the top of the page Modulation you will be able to move from the previous Setpoint Modulation sensor Outlet sensor screen to the Modulation Screen, In this screen you Modulation rate source Local will have access to the PID (Proportional, Integral P gain 60 and Derivative) of the control. The **sola** password is I gain 20 required to change these parameters. D gain 0 Hysteresis step time 1 min FULTON PULSE Statistics Configuration **Statistics Screen** 合圖 **1** From this screen you can view cycles and hours of the Burner cycles 0 boiler. It is accessed from the **Configuration Menu** Burner run time 0 **Screen**. Please note that they can be cleared by Boiler pump cycles 0 pressing Clear All. This is not recommended. Clear All

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Changing/Testing SOLA High Limit Setpoint

Perform the following to change the High Limit Setpoint and verify the change:

- 1. From the Status Summary Screen press Configure then scroll down to and press High Limits, this screen will be used to set and/or test the Outlet High Limit Setpoint. See Figure 26.
- 2. Enter the SOLA password by pressing the padlock icon and typing sola.
- 3. By touching the Setpoint next to Outlet High Limit Setpoint, you can adjust the temperature up and down for the Setpoint you desire or lower it for testing purposes. A change will require Verification (see below).

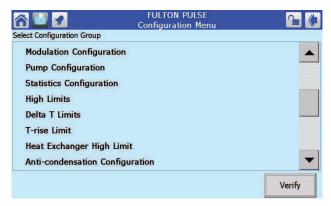


FIGURE 26 - HIGH LIMIT SETPOINT

■ Verifying Changes to High Limit Setpoint

4. Arrow back to the configuration menu and press Verify in the lower right hand corner. See Figure 27.



FIGURE 27 - HIGH LIMIT SETPOINT

- Press the Padlock in the upper right hand corner and enter the password sola (if not already unlocked) then press Begin down in the lower right hand corner. See Figure 28.
- 6. The parameters that you changed will appear, verify the change you made is correct. Then press Yes. See Figure 29.
- 7. If there are no more changes the control will ask you for a reset. This can

be done by pressing the reset button on the front of the Sola control (the base) for 1 to 2 seconds. See Figure 30.



FIGURE 28 - VERIFICATION



FIGURE 29 - VERIFICATION



FIGURE 30 - VERIFICATION

Accessing Lockout History and Clearing Lockouts

- 1. From the Status Summary screen resetting the lockout or viewing the lockout history can be accessed by pressing where Figure 31 is showing a Lockout. If there is no lockout, that same bar will display History.
- If the control is in lockout another sub screen will be displayed and you will have the option for Ok, Lockouts, Alerts and Silence. Pressing Lockouts will display the screen shown in Figure 32. This will provide the time and date stamp of the last fifteen lockouts. By pressing the specific lockout more

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information on the lockout can be displayed. This expanded annunication will assist in troubleshooting. Pressing Clear Lockout will clear the current lockout. See Figure 32.

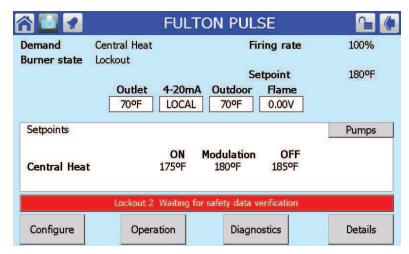


FIGURE 31 - CONTROL LOCKOUT



FIGURE 32 - CONTROL LOCKOUT HISTORY SCREEN

Procedure for Remote Firing Rate Using a 4-20mA Signal (Single Boiler)

- From the Status Summary Screen press Config, arrow down to and press Sensor Configuration. Choose S2 (J8-6) Sensor, this will require the sola password. Choose 4-20mA. See Figure 33. This will also require a verification. See High Water Temperature Limit section for verification steps.
- 2. Back out to the Config screen and go to CH Central Heat Configuration. Arrow over to Modulation. See Figure 34.
- 3. Press Modulation Rate Source and pick S2 (J8-6) 4-20ma with sensor on/off. With an external 4-20mA, 4mA will equal Low Fire, and 20mA will equal High Fire.
- 4. Choosing sensor on/off will require setting the internal setpoint higher

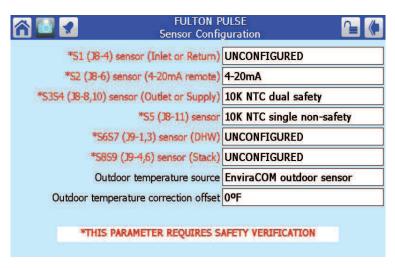


FIGURE 33 - SENSOR CONFIGURATION SCREEN

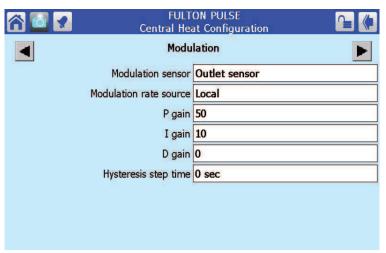


FIGURE 34 - MODULATION

than what may be required. The boiler will shut off at this setpoint if remote contacts are not opened.

■ NOTE: Selecting Burner On/Off will require remote on/off (stop/start) contacts.

Procedure for Remote Setpoint Using a 4-20mA Signal (Single Boiler)

- From the Status Summary Screen press Config, arrow down to and press Sensor Configuration. Choose S2 (J8-6) Sensor, this will require the sola password. Choose 4-20mA. See Figure 33. This will also require a verification. See High Water Temperature Limit section for verification steps.
- 2. In Central Heat Configuration in the Modulation screen, the Modulation Rate Source must be Local. See Figure 34.
- 3. In Central Heat Configuration in the Setpoint screen, change Setpoint source to S2 (J8-6) 4-20mA; and change the 4mA Water Temperature and 20mA Water Temperature to the required setting. See Figure 35.

A CAUTION

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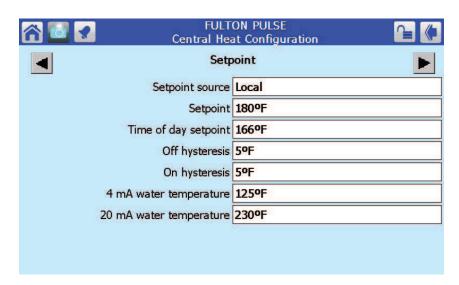


FIGURE 35 - CHANGING SETPOINT IN CENTRAL HEAT CONFIGURATION SCREEN

Procedure for Lead/Lag with Outdoor Reset with Multiple Boilers

Items required:

- One Supply Header Sensor Kit. Kit to include Thermowell, 2x4" Handy Box and clip to attach thermowell to handy box
- One Outdoor Sensor and Interface Module Kit. Kit to include outdoor sensor, NEMA 4 box, squeeze connector for sensor and interface Module. Interface Module must be mounted on the other side of the wall (inside the building) from outdoor sensor this will ensure it is as close to the sensor as possible.
- 4. Specific parameter changes that are required will prompt you for a password, the password is sola. Also some of the changes will require a Verification of your change. The Verification process can be accomplished after all the changes are made.
- ► NOTE: See Figure 51 for diagram of boilers in a lead/lag outdoor reset application.

Proceed as follows:

- 1. From the Status Summary page press Configure to access the Configuration Menu. See Figure 36.
- For the Master Boiler in the Configuration Menu select Lead Lag Master Configuration. Press Master enable and select Enable. Then select Advanced Settings in the lower right of this screen. See Figure 37.
- 3. Master Boiler In the Advanced Settings of Lead Lag Master Configuration arrow over to Outdoor Reset. Press Enable and select Enabled. Also in this screen there are 3 of your 4 points that can be chosen for your outdoor reset curve. Maximum outdoor temperature relates to low water

temperature. Minimum outdoor temperature relates to Central Heat Setpoint. See Figure 38. Minimum boiler water temperature should be the lowest temperature at which you want the boiler to function.

4. Master Boiler – While still in the Advanced Settings Screen, arrow over to Central Heat and Select your Setpoint. This is what your Minimum outdoor temp will relate to on the curve. Once all 4 numbers are entered

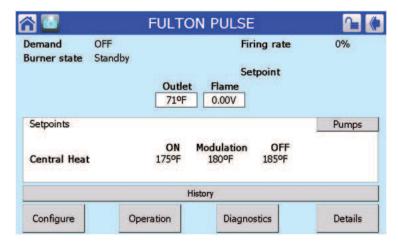


FIGURE 36 - ACCESSING THE CONFIGURATION MENU

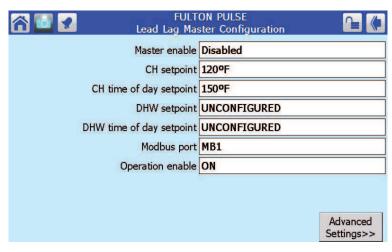


FIGURE 37 - ADVANCED SETTINGS

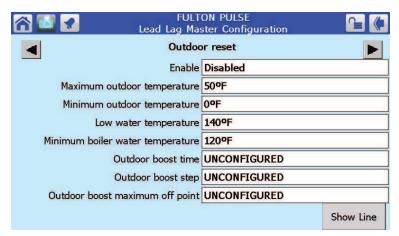


FIGURE 38 - OUTDOOR RESET

\triangle

WARNING

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Operating this equipment beyond its design limits can damage the equipment and can be dangerous. Do not operate the equipment outside of its limits. Do not try to upgrade the equipment performance through unapproved modifications. Unapproved modifications may cause injury, equipment damage, and will void the warranty.



Do not operate, or allow others to operate, service or repair this equipment unless you (they) fully understand all applicable sections of this manual and are qualified to operate/maintain the equipment.

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you can look at your curve in the previous screen, press Show Line. See Figure 39.

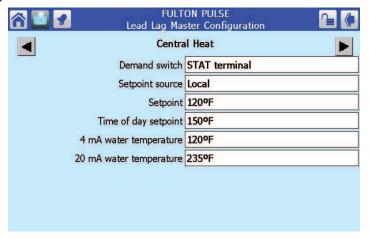


FIGURE 39 - SELECTING CENTRAL HEAT SETPOINT

5. Master Boiler – While still in the Advanced Settings Screen arrow over to Warm Weather Shutdown. If required, Select Enable and press Shutdown after demand ends. Then select the Setpoint (outside air temperature) at which you want the system to shut down. See Figure 40.

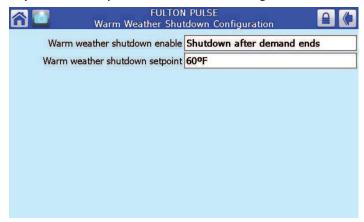


FIGURE 40 - WARM WEATHER SHUTDOWN

6. For the Master Boiler, back out to the Configuration Menu, select Lead Lag Slave Configuration and select Slave Enable - Enable slave for built-in Lead Lag Master. See Figure 41.

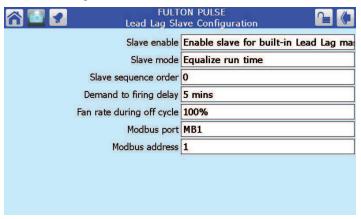


FIGURE 41 - LEAD LAG SLAVE CONFIGURATION

7. For the Slave Boiler(s), go to the Configuration Menu, select Lead Lag Slave Configuration and select Slave Enable - Enable slave for built-in Lead Lag Master. See Figure 41.

8. Master Boiler - Sensor Selection: In the Configuration Menu go to Sensor Configuration. Press sensor Outdoor temperature source, select Enviracom Outdoor Sensor. Also change S5 (J8-11) sensor to 10K NTC single nonsafety, this is your header sensor. See Figure 42.

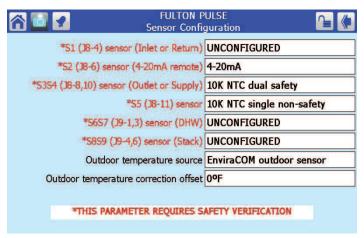


FIGURE 42 - SENSOR CONFIGURATION

9. Master and Slave Boiler - Back out to the Configuration Menu and select System Identification and Access. See Figure 43. This is where the address of each boiler will be selected at MB1 Modbus Address. The boilers will be daisy chained to each other through MB1 on the base of the

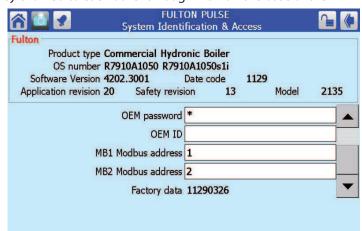


FIGURE 43 - SYSTEM IDENTIFICATION AND ACCESS

control. The master boiler will be address 1 as shown in Figure 42. The next "slave" boilers will be 2,3,4... depending on the amount of boilers. Each boiler will have its own address.

10. Perform verification of changes. See Figure 44.



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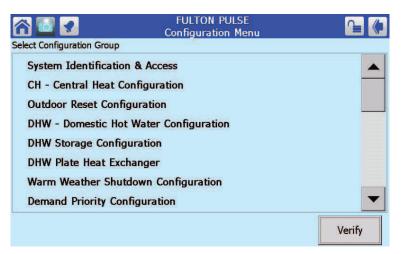


FIGURE 44 - VERIFICATION OF CHANGES

■ Single Boiler Outdoor Reset Programming

1. From the status summary screen press Configure. Press CH- Central Heat Configuration. See Figure 45.



FIGURE 45 - ACCESSING CENTRAL HEAT CONFIGURATION

- 2. Arrow over to Setpoint and verify that the Setpoint is the desired temperature in relation to the Minimum outdoor temperature (see Figures 46 and 47).
- 3. Arrow over to the Central Heat page (Figure 47). In this screen 3 of your 4 points that can be chosen for your outdoor reset curve. Maximum outdoor temperature which relates to your Low water temperature and your Minimum outdoor temperature relates to your Central Heat Setpoint in the setpoint screen. Your Minimum boiler water temperature should be the lowest temperature at which you want the boiler to operate.

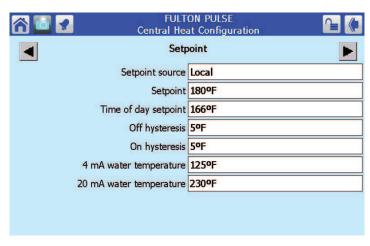


FIGURE 46 - VERIFYING SETPOINT

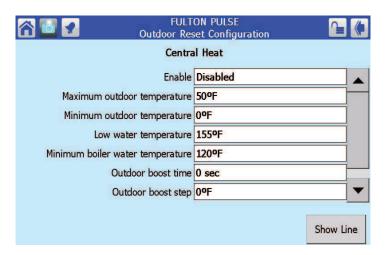


FIGURE 47 - OUTDOOR RESET CONFIGURATION

4. By pressing Show Line in the Outdoor Reset Configuration screen you can see outdoor temperatures in relation to your water temperatures in a linear format. See Figure 48.

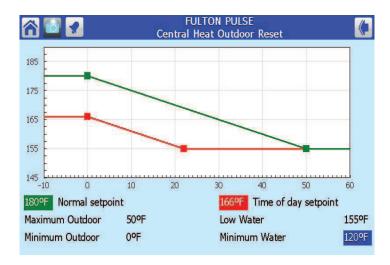


FIGURE 48 - CENTRAL HEAT OUTDOOR RESET

⚠ WARNING

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- 5. Back out to the Configure Screen and press Sensor Configuration. The "sola" password will need to be entered. Press the Outdoor temperature source and choose EnviraCOM outdoor source. See Figure 49.
- ► NOTE: The 1ea (KIT) 2-40-001072, outdoor sensor and Interface Module is required, wired to the Sola base ECOM terminals 1,2, and 3.

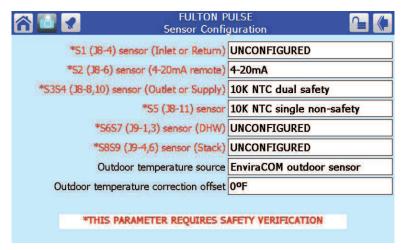


FIGURE 49 - SENSOR CONFIGURATION

6. Back out to the Configure menu and press Verify and complete the verification process. See Figure 50.

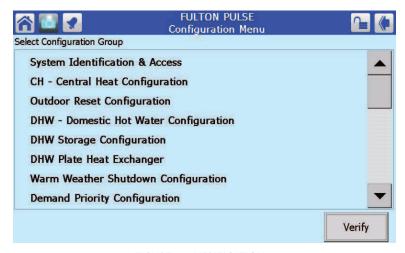


FIGURE 50 - VERIFICATION

Third Party SOLA Control

The Pulse SOLA Control provides the capability of control and/or monitoring by a third party. The standard SOLA control protocol is Modbus.

Lead/Lag Outdoor Reset Configuration Using Communication Port 2

If the boilers are set up to be lead/lag with outdoor reset all the communication connections on the J3 plug of the SOLA control will be used. Third party control can be wired to the SOLA display on communication port 2. If requested at the time of the boiler order, the communication port will be activated at the factory. Only the baud rate may have to be changed in the field. When the boilers are configured for lead/lag outdoor reset, only the master boiler needs to have the third party connection. Multiple points of the lag boilers can be viewed from the Master boiler. Refer to Figure 52. Figure 52 shows wiring connection to the display's communication port 2. Use the website link and/or QR code in this section of the manual to access additional information on setting up the communication port 2.

Stand Alone Boilers Controlled by a Third Party Control

If the boilers are not set up to be lead/lag outdoor reset, a third party control can land connection to J3, MB1 on the SOLA control. If this is known at the time the boiler order is entered, the control will be set up for this type of control. Please refer to Figure 52 for J3, MB1 connections. The communication wires can be daisy chained to each boiler. Use the website link and/or QR code in this section of the manual to access additional information on setting up the MB1.

Gateways

Fulton offers (as an option) a Modbus to Bacnet gateway. The gateway will come pre-programmed and wired in one, or if desired, all of the boilers. If the boilers are daisy chained together through J3, MB1 one gateway can be used on the master boiler which will be wired to communication port 2 of the master display. Use the website link and/or QR code in this section of the manual to access additional information on pre-programmed gateway information (read and write addresses) and setup instructions.

■ NOTE: Although there are many points that are available through Modbus, special care must be taken when writing to them. There are specific write addresses that will utilize an internal Sola control EEPROM. The Sola control requires a write command only when the user intends to change a value. Continuously writing to the control will fill the SOLA's EEPROM memory, causing various non-safety parameters to change. All of the information out of the control is in Celsius; this may have to be converted to Fahrenheit if desired. Firing rate also requires a conversion. Please refer to the website link and QR code for more information.



► WEB ADDRESS FOR FURTHER INFORMATION

http://goo.gl/O817U

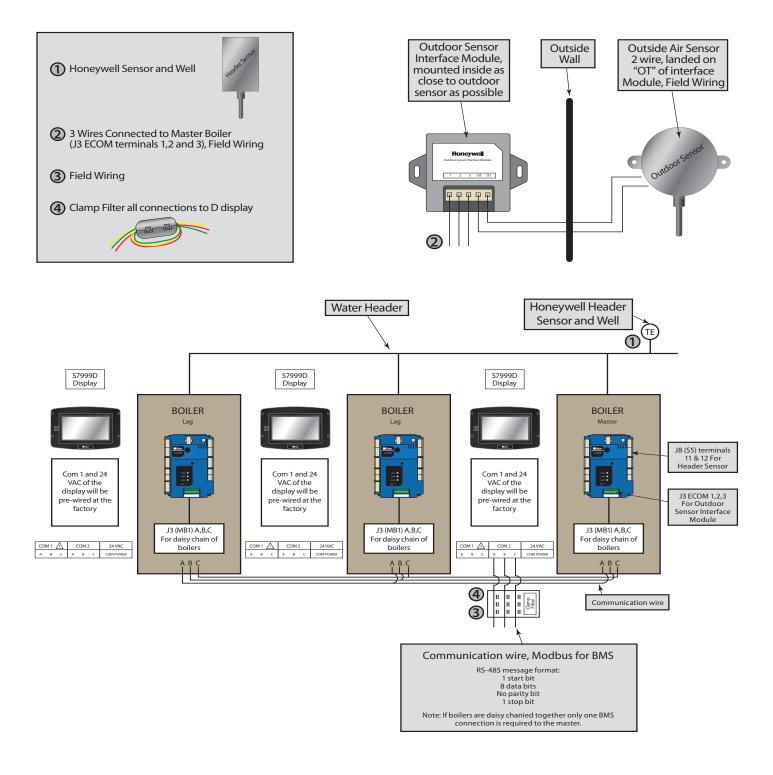
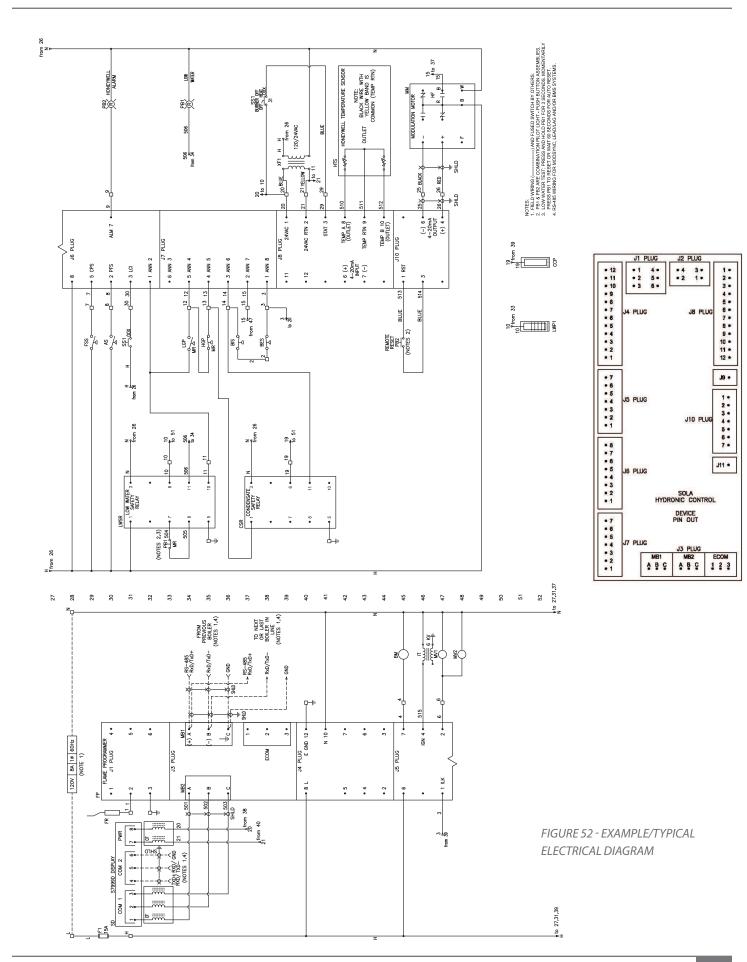


FIGURE 51 - LEAD/LAG OF HYDRONIC BOILERS USING THE SOLA CONTROL (MAXIMUM OF 8 BOILERS)



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WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.

Prior to any maintenance concerning electrical components of this equipment, ensure electrical supply to the equipment is disconnected. Label all wires prior to disconnection; wiring errors may cause improper and hazardous operation.

Follow all proper lockout/tagout procedures for service.

Before beginning any maintenance, ensure area is free of any combustible materials and other dangers.

What to do if you smell gas:
Do not try to light the appliance.
Do not touch any electrical switch.
Do not use any phone in the building.
Leave building and contact gas
supplier from neighbor's phone. If you
cannot reach gas supplier, phone the
fire department.

After initial start-up by qualified personnel, linkage, control settings, and fuel pressures should not be readjusted.

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CAUTION

All maintenance procedures should be completed by trained personnel. Appropriate training and instructions are available from the Fulton Service Department at (315) 298-5121 or your local Fulton Thermal Representative.

In order to meet warranty conditions, ensure all appropriate maintenance activities are performed.

General

Your Pulse boiler has been designed to provide years of trouble free performance. To ensure continued safety and efficiency of the boiler, please follow the maintenance and inspection directions outlined in this section of the manual.

Daily, Weekly and Monthly Maintenance and Inspection (Fulton considers the following to be good practice for any boiler, and is applicable to the full line of Pulse boilers).

- 1. **Before each heating season,** check the following:
 - Air intake and exhaust vent outlet for blockage or restrictions
 - Exhaust piping for leaks
 - Heating system or boiler piping for leaks
 - Air intake and exhaust vent piping for sagging
- 2. Follow the purge procedure outlined in this manual.
- 3. Follow the Start-Up Procedure outlined in this manual.
- 4. With the boiler running, check for cracks at fittings and joints.

Daily Maintenance and Inspection Schedule

Daily maintenance and inspection must include the following:

- 1. Observe operating temperature and general conditions.
- 2. Make sure that the flow of combustion and ventilating air to the boiler is not obstructed.
- 3. Make sure boiler area is free and clear of any combustible materials, including flammable vapors and liquids.

Monthly Maintenance and Inspection Schedule

Monthly maintenance and inspection must include the following:

- 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.
- 5. To prevent scale or corrosion in boiler and associated piping, make up water must be kept to a minimum. This is best achieved by ensuring:

- Immediate repair of all leaks.
- Maintenance of system pressure.
- 6. Check condensate trap to be sure it is clear of debris. Also ensure condensate is not backing up into the boilers.

Annual Maintenance and Inspection Schedule

Annual maintenance and inspection must include the following:

- 1. On units utilizing a flame rod, the flame rod should be changed. The flame rod is located in the top of the boiler for PHW-300-1400, and inside the injector on PHW-2000.
- 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. Change the spark plug (see Figures 53 and 54).
- 7. Check air intake and exhaust vent outlet for any blockage or restrictions.
- 8. Check for any leaks in exhaust piping.
- 9. Check for any leaks in the heating system or boiler piping.
- 10. Check the air intake and exhaust vent piping for sagging.
- 11. Follow purge procedure outlined in this manual.
- 12. Follow start up procedure outlined in this manual.
- 13. With the boiler running, check for visible cracks at fittings and joints.
- 14. Check for any blockages in condensate lines, and condensate trap. If a pH Neutralization Kit has been installed, check quantity of media in kit.
- NOTE: Should you suspect that the boilers flue passage ways have become blocked, contact your 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, which is supplied with each PHW2000.
- 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.

<u>^</u>

WARNING

All information in this manual is for reference and guidance purposes, and does not substitute for required professional training, conduct, and strict adherence to applicable jurisdictional/professional codes and regulations.

Never use open flame or other sources of ignition to check for gas leaks.

A defective boiler can cause injury. Do not operate a boiler that is defective, or has any missing parts. Do not attempt repairs or any other maintenance work that you do not understand.

Never store or use gasoline or other flammables in the vicinity of this appliance.

Do not use this boiler if any part has been under water. Immediately call a qualified service technician.



CAUTION

Use caution when using any cleaning solutions. Refer to local regulations for proper cleaning solution disposal.

Do not allow oil leaks, dust, or dirt to accumulate around the boiler.

\triangle CAUTION

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In order to meet warranty conditions, ensure all appropriate maintenance activities are performed.

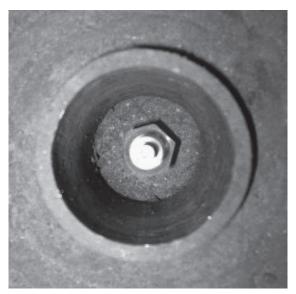
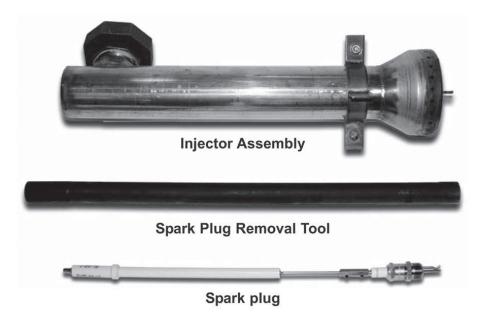


FIGURE 53 - PULSE SPARK PLUG



(Typical for PHW2000 only)

FIGURE 54 - PULSE MAINTENANCE

After All Repairs and Maintenance

- 1. Follow "Pre-Start Check List" provided with the unit, and all Safety Checks.
- 2. Fire the Boiler and perform combustion check.
- 3. Make any necessary adjustments.

MAINTENANCE

Troubleshooting

Use the following table as a guide to troubleshooting your boiler.

Problem	Cause	Check
Starting or Purge Failure	Power Supply	Check fuse or circuit breaker. Reset or replace, as neces-
		sary.
	On/Off Switch	For all models check to see if on/off switch has loose wires.
	Bad Air Switch	Try adjusting sensitivity of switch or replace.
	Bad Fan	Check fan for operation. Replace if necessary.
	Flame Rod	Check for carbon buildup, cracks in porcelain.
	Main Control	Check for bad ground, or bad control. Replace control.
	Plugged Air Inlet	Check for blockage of air inlet line and remove.
	Spark Plug	Check for carbon buildup, moisture, cracks in porcelain. Check for proper gab (.050"060" for Champion spark plug). Clean or replace as necessary.
	Loose Wire Connection	Check connections to all components.
	Setpoint	Check that the setpoint 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.
Flame Failure	Power Supply	Check fuse or circuit breaker. Reset or replace, as necessary.
	Main Control	Check for bad ground, or bad control. Replace control.
	Proof of Flame Switch	Check adjustment of pressure switch number 2. It should be set at 1.5" w.c. Replace if necessary.
	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 blockage in exhaust piping and remove.
	In all Cases:	Reset main control panel box on flame failure.
Poor Combustion	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 in air inlet line and remove.

[■] NOTE: If air or gas flapper material is excessively dirty, they may stick in one position. Replace if excessively dirty.

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In order to meet warranty conditions, ensure all appropriate maintenance activities are performed.

Reviewing Diagnostics on SOLA Control

From the Status Summary screen press Diagnostics (see Figure 55).

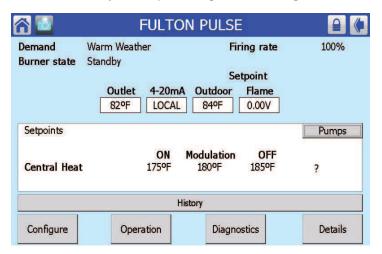


FIGURE 55 - ACCESSING DIAGNOSTICS

 Pressing Burner I/O will place you into screen shown in Figure 56. From here you can see the inputs being made and/or are open. A green light next to the input indicates the control's input is made or satisfied, a gray circle indicates the input is not satisfied. This is also a helpful trouble shooting screen.

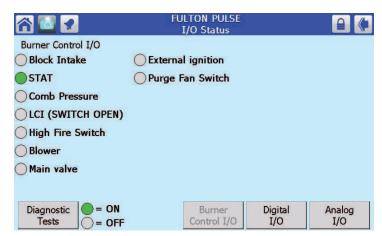


FIGURE 56 - I/O STATUS SCREEN

2. Pressing Digital I/O will place you into screen shown in Figure 57. From here you can see specific information what inputs are/are not being made.

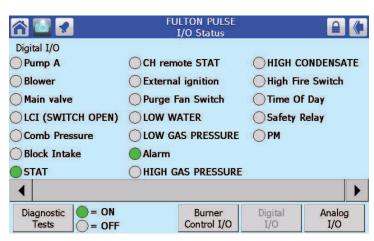


FIGURE 57 - I/O STATUS DETAIL

■ Taking Screen Shots

Using the Screen Shot function of the SOLA control can be a useful tool for troubleshooting. A USB port in the back of the display will accept a small memory stick or thumb drive for transferring screen shots from the display.



FIGURE 58 - ACCESSING SETUP

At most locations in the display parameters, there is an icon of a camera in the upper left of the screen. By pressing this icon, a snapshot of the screen is captured and saved to the display. To transfer these snapshots to a memory stick or thumb drive, perform the following:

- 1. From the Home Screen, press Setup in the lower right hand corner. See Figure 58.
- 2. Press Display Diagnostics. See Figure 59.
- 3. Press Screen Snapshot. See Figure 60. This is the screen from which you can copy screen shots to a thumb drive.

\triangle caution

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4. Select an existing screen shot in the list and then select Copy to USB. Selecting View allows you to look at a particular screen shot before you copy it. See Figure 61.

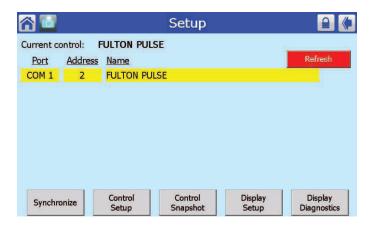


FIGURE 59 - SETUP SCREEN

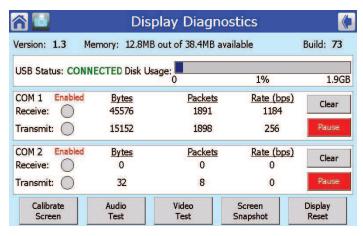


FIGURE 60 - DISPLAY DIAGNOSTICS SCREEN

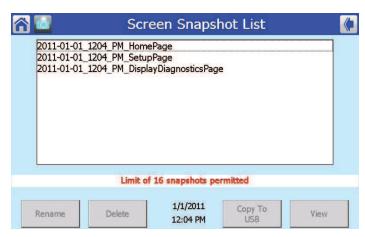


FIGURE 61 - SCREEN SNAPSHOT LIST SCREEN

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Standard Warranty for Fulton Pulse Boilers Models PHW with Carbon Steel Exhaust Pipes

Ten (10) Year (120 Month) Thermal Shock Warranty

Fulton Heating Solutions guarantees the Pulse hot water pressure vessel against thermal shock for a period of ten (10) years when the boiler is installed as a closed loop hot water boiler and is operated per the Installation and Operation Manual. This guarantee will cover damage due to thermal shock, such as leaks in the heat exchanger. This guarantee does not cover damage due to corrosion, scaling, sooting or improper installation or operation. The inlet and outlet water temperature differential across the boiler cannot exceed 100°F.

Ten (10) Year (120 Month) Prorated Flue Gas Condensate Corrosion and Material and Workmanship Warranty

The pressure vessel is covered against flue gas condensate corrosion and defective material or workmanship for a period of ten (10) years from the date of shipment from the factory according to the schedule below. Fulton will repair or replace F.O.B. factory any part of the equipment, as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by Fulton. The commissioning agency must also successfully complete and return the equipment Installation and Operation Checklists to Fulton's Quality Assurance department. This warranty covers any failure caused by defective material or workmanship; however, waterside corrosion or scaling is not covered. Therefore, it is imperative that the boiler be installed in a closed loop as outlined in the Installation and Operation Manual.

Year	Prorated Schedule	
0-7	100%	
8	50%	
9	30%	
10	20%	

Parts Warranty

Fulton will repair or replace F.O.B. factory any part of the equipment of our manufacture that is found to be defective in workmanship or material within 18 months of shipment from the factory or 12 months from start-up (whichever comes first), provided the equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by both Fulton and the component manufacturers and the commissioning agency has successfully completed and returned the equipment Installation and Operation Checklists to Fulton's Quality Assurance Department.

General

Fulton shall be notified in writing as soon as any defect becomes apparent. This warranty does not include freight, handling or labor charges of any kind. These warranties are contingent upon the proper sizing, installation, operation and maintenance of the boiler and peripheral components and equipment. Warranties valid only if installed, operated, and maintained as outlined in the Fulton Installation and Operation Manual. No Sales Manager or other representative of Fulton other than the Quality Manager or an officer of the company has warranty authority. Fulton will not pay any charges unless they were pre-approved, in writing, by the Fulton Quality Manager. This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Fulton shall in no event be liable for any consequential or incidental damages arising in any way, including but not limited to any loss of profits or business, even if the Fulton Companies has been advised of the possibility of such damages. Fulton's liability shall never exceed the amount paid for the original equipment found to be defective. 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 this manual. To activate the warranty for this product, the appropriate commissioning sheets must be completed and returned to the Fulton Quality Assurance department for review and approval.

2013-0214

Standard Warranty for Fulton Pulse Boilers Models PHW with Duplex Stainless Steel Exhaust Pipes

Ten (10) Year (120 Month) Thermal Shock Warranty

Fulton Heating Solutions guarantees the Pulse hot water pressure vessel against thermal shock for a period of ten (10) years when the boiler is installed as a closed loop hot water boiler and is operated per the Installation and Operation Manual. This guarantee will cover damage due to thermal shock, such as leaks in the heat exchanger. This guarantee does not cover damage due to corrosion, scaling, sooting or improper installation or operation. The inlet and outlet water temperature differential across the boiler cannot exceed 100°F.

Ten (10) Year (120 Month) Prorated Flue Gas Condensate Corrosion and Material and Workmanship Warranty

The pressure vessel is covered against flue gas condensate corrosion and defective material or workmanship for a period of ten (10) years from the date of shipment from the factory according to the schedule below. Fulton will repair or replace F.O.B. factory any part of the equipment, as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by Fulton. The commissioning agency must also successfully complete and return the equipment Installation and Operation Checklists to Fulton's Quality Assurance department. This warranty covers any failure caused by defective material or workmanship; however, waterside corrosion or scaling is not covered. Therefore, it is imperative that the boiler be installed in a closed loop as outlined in the Installation and Operation Manual.

Year	Prorated Schedule
0-7	100%
8	50%
9	30%
10	20%

Parts Warranty

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

General

Fulton shall be notified in writing as soon as any defect becomes apparent. This warranty does not include freight, handling or labor charges of any kind. These warranties are contingent upon the proper sizing, installation, operation and maintenance of the boiler and peripheral components and equipment. Warranties valid only if installed, operated, and maintained as outlined in the Fulton Installation and Operation Manual. No Sales Manager or other representative of Fulton other than the Quality Manager or an officer of the company has warranty authority. Fulton will not pay any charges unless they were pre-approved, in writing, by the Fulton Quality Manager. This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Fulton shall in no event be liable for any consequential or incidental damages arising in any way, including but not limited to any loss of profits or business, even if the Fulton Companies has been advised of the possibility of such damages. Fulton's liability shall never exceed the amount paid for the original equipment found to be defective. 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 this manual. To activate the warranty for this product, the appropriate commissioning sheets must be completed and returned to the Fulton Quality Assurance department for review and approval.

2010-0311



WARNING

Use of non-factory authorized replacement parts is not recommended for this equipment. Use of non-factory authorized parts may jeopardize safety and system performance, and voids the product warranty.

Parts

Spare and replacement parts may be ordered from your local representative or through the Fulton Companies. When ordering replacement parts, please have the model number and serial number of your Fulton boiler ready. Factory-direct replacement parts must be used to ensure proper equipment operation and adherence with warranty requirements. Contact Fulton Companies at (315) 298-5121 for further information.

Parts list and availability subject to change without prior notice.

■ PARTS

PHW Part #	Description	300	500	650	750	950	1000	1400	2000
2-30-000232	Air switch-purge fan	X	X	X	X	X	X	X	X
2-30-001334	Air switch -proof of flame	X	X	X	X	X	X	X	X
2-30-000290	Blocked intake switch							X	X
2-30-000291	Blocked intake switch	X	X		X		X		
2-30-001360	Blocked exhaust switch	X	X	X	X	X	X	X	X
2-12-000551	Air flapper gaskets (replaced 2-12-553)	X	X	X	X	X	X	X	
2-12-000554	Air flapper gaskets								X
2-22-000181	Air flapper spacer030	X	X	X	X	X			
2-22-000182	Air flapper spacer050						x/LP		
2-22-000183	Air flapper spacer040								
2-22-000186	Air flapper spacer060							X	LP
2-22-000187	Air flapper spacer060								X
2-22-000188	Air flapper spacer070								
2-22-000125	Air flapper screw 8-32 x 1-1/4	X	X	X	X	X	X	X	X
2-22-000085	Air flapper nuts 8-32	X	X	X	X	X	X	X	X
2-22-000038	Air flapper lock washer	X	X	X	Х	X	X	X	Х
2-22-000083	AVK Nut for air flapper assy	X	X	X	X	X	X	X	X
2-12-000900	Air flapper mounting gaskets								Х
7-37-000120	Air flapper metering plate assy	X							
7-37-000150	Air flapper metering plate assy		X	X					
7-37-000124	Air flapper metering plate assy				X				
7-37-000123	Air flapper metering plate assy					X			
7-37-000125	Air flapper metering plate assy						X	X	
7-37-000008	Air flapper metering plate assy								X
2-11-000089	Air flapper housing only - 3" hub	X	X						
2-11-000090	Air flapper housing only - 4" hub			X	X	X	X	X	
5-11-000095	Air flapper housing only								X
2-12-000556	Air flapper housing o-ring	X	X	X	X	X	X	X	X
2-40-000251	Aquastat Operating	X	X	X	X	X	X	X	X
2-40-000250	Aquastat Hi Limit w/MR 130-270 Deg F	X	X	X	X	X	X	X	X
2-30-000205	Aquastat immersion well - #121371A	X	X	X	X	X	X	X	X
2-40-000274	Aquastat Hi Limit w/MR 100-240 Deg F	X	X	X	X	X	X		X
2-40-000294	Aquastat Hi Limit w/MR 100-200 Deg F	X	X	X	X	X	X		Х
2-40-000220	Gas valve actuator w/P.O.C #V4055D1043	X	X	X	X	X	X	X	X
2-40-000214	Gas valve actuator - #V4055A1031	X	X	X	X	X	X	X	X
2-30-000310	Gas valve - motorized - 1" - #V5055A1004	X	X	X	Х				
2-30-000311	Gas valve - motorized - 1-1/4" - #V5055A1012					X	X		
2-30-001143	Gas valve - motorized - 1-1/2" - #V5097A1004							X	X
2-30-001145	Gas valve - motorized - 1-1/2" - #V5097C1000							X	X

PHW Part #	Description	300	500	650	750	950	1000	1400	2000
2-40-000253	Gas valve w/P.O.C motorized - 1-1/2" - #V5055C1059							X	
2-30-000306	Gas solenoid valve - 1" ASCO #8040C4	X	X	X	X				
2-30-000307	Gas solenoid valve - 1-1/4" ASCO #8040C5					X	X		
2-30-000304	Gas solenoid valve - 1-1/2" ASCO #821470							X	
2-30-001147	Gas solenoid valve - 1" #V4297A1005	X	X		X				
2-30-001141	Gas solenoid valve - 1-1/2" #V4297A1013								X
2-40-000533	Hi-Low Gas Pressure Switch #804111701								Λ
2-30-001139	High Gas Pressure Switch - #C6097B1028	X	X	X	X	X	X	x	X
2-30-001140	Low Gas Pressure Switch - #C6097A1020	X	X	X	X	X	X	X	X
2-30-003002	Gas butterfly valve - 1" - Eclipse	X	X	X	X	Α.	A		
2-30-003003	Gas butterfly valve - 1-1/4" - Eclipse					X	X	X	
2-30-003020	Gas butterfly valve - 2" - Eclipse								X
2-30-000750	Gas pressure regulator - 1" RV61 - Pre 3/10	X	X	X	X				
2-30-000105	Gas pressure regulator - 1-1/4" RV61 -Pre 3/10					X	x		
2-30-000515	Gas pressure regulator - 1-1/4" RV81 -Pre 3/10							Х	
2-30-000516	Gas pressure regulator - 1-1/2" RV81 -Pre 3/10							Х	X
2-30-000800	Gas pressure regulator - 1" 210D - Post 3/10	X	x	х	X				
2-30-000678	Gas pressure regulator - 1-1/4" 210D-Post 3/10						X	x	
2-30-001023	Gas pressure regulator -1-1/2" 210E-Post 3/10								х
2-30-000174	Gas pressure gauge 0-15" W.C.	X	X	X	X	X	X		
7-37-000201	Gas flapper valve - in union	X	X	X	X	X	x	X	X
2-22-000130	Gas flapper spacer .060 (brass)	X	X	X	X	X	x	X	X
2-12-000552	Gas flapper gaskets	х	х	Х	X	х	x	х	X
7-57-000126	Gas decoupler	x	Х	х					
7-57-000125	Gas decoupler				х	X	x	Х	
2-20-000204	Gas orifice 3/4" x .312	LP							
2-20-000130	Gas orifice 3/4" x .437		LP						
2-20-000209	Gas orifice 3/4" x .460	x							
2-20-000208	Gas orifice 3/4" x .485	x							
2-20-000131	Gas orifice 3/4" x .500	x							
2-20-000201	Gas orifice 3/4" x .525		x	LP	LP				
2-20-000205	Gas orifice 3/4" x .540					LP			
2-20-000212	Gas orifice 3/4" x .570			X					
2-20-000202	Gas orifice 3/4" x .593				X				
2-20-000206	Gas orifice 3/4" x .625								
2-20-000214	Gas orifice 3/4" x .651					X	x		
2-20-000132	Gas orifice 3/4" x .690					X			
2-20-000203	Gas orifice 3/4" x .718								
2-20-000650	Gas orifice 2" x .312	LP							
2-20-000651	Gas orifice 2" x .437		LP						
2-20-000652	Gas orifice 2" x .460	Х							
2-20-000652	Gas orifice 2" x .460 (post 05/2003)	X	х						
2-20-000653	Gas orifice 2" x .485	X							

WARRANTY & PARTS

PHW Part #	Description	300	500	650	750	950	1000	1400	2000
2-20-000655	Gas orifice 2" x .500								
2-20-000656	Gas orifice 2" x .540		х						
2-20-000656	Gas orifice 2" x .540 (post 05/2003)		X			LP	LP		
2-20-000657	Gas orifice 2" x .525				LP				
2-10-400211	Gas orifice 2" multi-port			LP					
2-10-400219	Gas orifice 2" multi-port				х				
2-10-400212	Gas orifice 2" multi-port					х			
2-10-400217	Gas orifice 2" multi-port						х		
2-10-400218	Gas orifice 2" multi-port							LP	
2-10-400216	Gas orifice 2" multi-port (factory)							Х	
2-10-400222	"New style" gas orifice 2" multi-port							х	
5-10-400207	Blank brass orifice slug 2"								
7-52-002000	Gas injector assy (need stamped series "letter" to order)								х
7-52-002001	Injector assembly - all fuels								LP
7-20-006000	4" Butterfly valve assembly - exhaust modulated			х	х	х	х	х	
7-20-006010	6" Butterfly valve assembly - exhaust modulated								х
7-20-006005	6" Exhaust butterfly assy - PHW2000 QT model								X
2-12-000701	Exhaust butterfly gasket 9" OD x 6-9/16" ID - QT model								х
2-40-000722	Mod motor - M7284Q1009	X	x	x	х	х	х	Х	X
2-40-000863	Mod temp control - UT32A			x		х		х	X
2-40-000801	Type "J" Thermocouple 4" probe								
2-40-000830	Type "J" Thermocouple wire per Ft.								
2-40-000384	Siemens temp control - RWF40								
2-40-000386	Siemens outdoor sensor for RWF40 control								
2-40-000425	Mod Temp control - #T771J1050 outsideRS	X	х	х	х	х	х	Х	
2-40-000941	Outdoor Air Temp Sensor								
2-30-000201	Press/temp gauge 0-100psi-70-320F	X	x	х	х	х	х	Х	
2-30-000203	Press/temp gauge 0-300psi-70-320F	X	х	х	х	х	х	Х	
2-30-000445	Purge blower motor/fan	X	х	х	х	х	х	Х	
2-30-001337	Purge fan-G185								х
2-40-002000	Purge fan motor-1/2HP, 115/230/60/1, 3450rpm								х
2-40-000321	RM7865C1007 Programmer	X	х	x	х	х	х	х	х
2-40-000268	R7847A1041 Amplifier	X	x	x	х	х	х	х	х
2-40-000270	Base for RM7865 Programmer - #Q7800A1013	x	х	Х	х	х	х	х	Х
2-40-000272	Display module for RM7865 Programmer - #S7800A1019	х	х	x	х	x	x	x	х
2-40-000923	SOLA Flame Control	X	х	х	х	х	х	х	X
2-40-000932	SOLA Display	X	х	х	х	Х	Х	х	х
2-40-000931	SOLA Flame Rod							X	
2-45-000914	Plug Set for SOLA	x	X	X	X	X	X	X	X
2-40-000908	10K ohm Sensor	x	X	X	X	X	X	X	X
2-40-000625	24v Power Supply / Transformer	X	X	X	X	X	X	X	X
2-45-000060	4" x 4" Handy Box	X	X	X	X	Х	X	X	X
2-30-000120	Safety Valve 3/4" X 1" 30#	X	X	X	X	X	X		
2-30-000121	Safety Valve 3/4" X 1" 60#	X	X	X	X	X	X	X	

PHW Part #	Description	300	500	650	750	950	1000	1400	2000
2-30-000145	Safety Valve 3/4" X 1" 100#	X	x	x	x	х	x	x	
2-30-000020	Safety Valve 3/4" X 1" 125#	X	x	х	x	х	x	x	х
2-30-000166	Safety Valve 3/4" X 1" 160#	X	x	x	X	х	x	x	X
2-30-000851	Safety Valve 1" X 1-1/4" 30#							x	
2-30-000951	Safety Valve 1" X 1-1/4" 60#							X	X
2-30-000269	Safety Valve -1 1/4" X 1-1/2" 160#								
2-30-000266	Safety Valve 1-1/4" X 1-1/2" 60#								
2-30-000200	Safety Valve 1-1/4" X 1-1/2" 30#								X
2-20-000221	Spark plug	X	x	X	X	X	X	X	X
2-20-000090	Gasket for spark plug -								
2-45-000017	Spark plug & Flame Rod wire per foot	X	X	X	X	X	X	X	X
		X	X	X	X	X	X	X	X
2-45-000149	Wire heat cover per foot	X	X	X	X	X	X	X	X
2-45-000159	Plastic wrap per foot	X	X	X	X	X	X	X	X
2-20-000047	Spark plug boot - orange silicone	X	X	X	X	X	X	X	
2-45-001200	Spark plug crimp on connector	X	X	X	X	Х	X	X	X
2-45-001124	Spark plug terminal connector								X
2-30-002330	Spark plug boot w/centering ring								X
4-57-000520	Spark plug connector retrofit kit								X
5-11-400090	Spark plug bushing 3/4" NPT, brass	X	X	X	X	х	X	X	X
2-40-001011	Flame rod - #C7009A1009	X	X	X	X	X	X	X	X
2-35-000879	Flame rod bushing 1/2" x 1/8"	X	X	X	x	X	X	X	X
3-20-000090	Spark plug assembly								Х
2-20-002000	Porcelain ext. rod for spark plug assy								x
5-10-001821	Connector for spark plug assy								X
5-10-001822	Connector for flame rod	X	x	X	x	X	X	x	X
2-30-000234	Grommet - spark plug wire	X	X	X	X	X	X	x	
2-40-000082	Ignition transformer 115/60 - #A06SC2	X	x	x	x	X	x	x	X
2-40-000151	Time delay relay - #KRDB420	X	x	x	x	X	x	x	x
2-45-000469	Time delay relay base	X	х	x	х	Х	x	x	X
2-45-000468	Time delay relay 5 min. 120V - #HRDM415M	X	x	x	x	х	x	x	x
2-40-000153	8 sec TDR relay (flame rod) - #KRDM418S	X	x	x	x	x	x	x	x
2-40-000121	Time delay relay, .1-10 sec. 120V - #KRD1420	X	х	x	х	х	х	x	х
2-45-000101	Terminal block	X	x	x	x	x	х	x	
2-40-000880	Terminal block - Type "J" Thermocouple	X	x	x	x	х	х	x	x
2-45-000020	Din rail - per foot	X	x	х	х	х	х		
2-40-000131	Ice cube relay 120V - #700HA32A1	X	х	х	x	х	х	x	x
2-40-000096	Base for ice cube relay - #700HN125	X	х	x	x	х	х	х	х
2-40-000562	Ice cube relay 24V - #700HA32A24								
2-40-000200	Motor starter relay - #R4242B1005	X	х	Х	х	х	х	X	X
2-40-000421	Fulton burner LWCO Relay 120V	x	X	X	X	X	X	X	
2-40-001021	Fulton burner LWCO Relay w/ test function	x	X	X	X	X	X		X
2-40-000423	Base for LWCO relay - #OT11-PC	X	X	X	X	X	X	X	X
2-12-000090	Retainer spring for LWCO relay	X	X	X	X	X	X	X	X
2-40-000418	MM750P-MT-120 LWCO with 3/4" NPT, Test & Reset							-	-
2-40-000419	MM LWCO w/MR 120v								
2-40-000419	IVIIVI LVV CO W/IVIN 12UV								

WARRANTY & PARTS

PHW Part #	Description	300	500	650	750	950	1000	1400	2000
2-20-000023	Low water probe 3"	х	х	х	х	х	X	х	х
2-20-000108	Water probe for exhaust decoupler-13"								
2-20-000012	Water probe for exhaust decoupler - 11-1/4"	x	X	X	X	х	x		
2-20-000109	Water probe for exhaust decoupler-15"							X	X
2-45-000091	On/off toggle switch	X	X	X	X	X	X	X	
2-45-000339	Green 3-position switch light	X	X	X	X	X	X	X	X
2-45-000307	Green 2-position on/off switch light	X	X	X	X	X	X	X	X
2-45-000022	Green 3-position switch (post 2/2010)	X	X	X	X	X	X	X	x
2-45-000314	Black 4-position switch	X	x	х	Х	X	x	x	х
2-45-000300	N/O contact block - #3SB3400-0B	X	X	X	X	X	X	X	х
2-45-000269	N/C contact block - #3SB3400-0C	X	x	X	Х	X	x	x	х
2-45-000700	Double contact block (1) N/O and (1) N/C	X	x	X	Х	X	x	x	х
2-45-000701	Double contact block (2) N/O - #3SB3400-0D	X	X	X	X	X	X	X	X
2-45-000702	Double contact block (2) N/C - #3SB3400-0E	x	X	X	X	Х	X	X	Х
2-45-000305	Red pushbutton low water reset light	x	х	X	х	X	X	X	x
2-45-000411	Red flame failure pilot light - #3SB3248-6BA20	х	x	x	х	х	х	x	x
2-45-000412	Green call for heat pilot light - #3SB3248-6BA40	х	x	x	х	х	x	x	х
2-45-000203	Light bulb only S&S - 120v	х	х	х	х	х	X	х	х
2-45-000212	Black 3-position switch	х	х	х	х	х	X	х	х
2-35-000850	Black panel latch	X	Х	х	х	Х	Х	х	Х
2-20-000079	Magnesium Anode 3/4" (All PDWH)								
	Accessories								
5-60-000130	Instruction Manual	X	X	X	X	X	X	X	X
4-57-000440	Condensate drain kit	X	X	X	X	X	X	X	x
2-10-000168	Condensate drain float assembly	X	X	X	X	X	X	X	x
5-20-000614	Condensate drain TEE assembly - mod	X	X	X	X	X	X	X	x
2-35-000863	Isolation cube 3" x 2" x 2"	X	X	X	X	X	X		
2-35-000835	Isolation cube 3" x 4" x 2"							X	X
2-35-000864	Isolation spring - green	x	X	X					
2-35-000865	Isolation spring - grey				X	X	x	x	
2-30-000651	Isolation spring - red								X
2-35-000989	Isolation spring - brown QT model only							x	X
2-35-000612	Seismic iso spring - green	x	x	x					
2-35-000611	Seismic iso spring - grey				X	X	X	X	
2-30-000653	Seismic iso spring - red								Х
2-12-001007	Air Decoupler Door Gasket 16-1/2" 16-1/2" x 3/8"	x	x						
2-12-001006	Air Decoupler Door Gasket 15-1/2" x 3/8"			X		х		X	
2-12-001010	Air Decoupler Door Gasket 13-7/8" x 3/8"				X		x	х	
2-12-001014	Air Decoupler Door Gasket 21-7/8" x 16-7/8" x 2"								X
2-12-000555	Front Panel Door Gasket	х	х	X	х	х	X	x	X
2-35-000861	2" x 14" flex connector - water	x	X	X	X	X	X		
2-35-000862	2-1/2" x 16" flex connector - water							X	
2-30-000550	4" x 16" flex connector water - flanged								х
2-35-000531	1" x 16" gas flex connector	x	X	X	X				

PHW Part #	Description	300	500	650	750	950	1000	1400	2000
2-35-000532	1-1/4" x 16" gas flex connector					x	х		
2-35-000801	1-1/2" x 16" gas flex connector							x	X
2-30-000836	Steam hose - 1-1/4" ID x 1-3/4" OD - con drain								X
2-12-001000	Insulation - 2" x 24"W x 48"L/sheet								
2-30-000498	MM flow switch - #FS-4-3-P	x	x	x	Х	х	x	x	X
2-45-000040	1/2" Knockout plug	X	х	х	Х	x	х	x	X
4-57-000500	Air spacer kit (old style)	X	х		х		х		
4-50-RK0420	Air flapper repair kit	X	х	Х	х	Х	х	X	Х
8-00-002000	Spark plug removal tool - black								Х
8-00-002001	Flame rod removal tool - smoky ash								х
8-00-000048	Orifice removal tool for 2" NPT multi-port orifice	X	x	X	Х	x	X	x	Х
8-00-000049	Air flapper housing removal tool	x	х	Х	х	х	x	X	
2-40-000302	Display case for S7800A module - #206311	x	х	Х	х	х	x	X	х
2-23-000295	Spray Paint - Smoky Ash - 6oz can - (post 2009)	x	х	х	х	x	х	x	Х
2-23-000172	Spray Paint - Tech Tan - 6 oz can	x	х	х	х	Х	х	X	X
4-23-000016	Liquid Paint - Tech Tan - quart	x	х	х	х	х	х	x	Х
2-35-000799	4" PVC adaptor - air intake			x	х	х	x	x	
2-35-000819	6" PVC adaptor								X
5-10-CH2765	4" C.S. muffler - intake	X	x	x	X	x	x	x	
5-10-CH2755	4" S.S. muffler - exhaust	X	x	x	X	x	x	x	
5-10-CH2780	6" C.S. muffler - intake								X
5-10-CH2775	6" S.S. muffler - exhaust								X
2-35-000033	3" x 3" Fernco coupling -intake - #105633	x	x						
2-35-000061	4" x 3" Fernco coupling - intake - #105643	X	х						
2-35-000827	4" x 4" Fernco coupling - intake - #105644	X	х	X	х	х	X	X	
2-35-000796	4" x 3" Adaptor for exhaust	X	х	X	х	х	X	X	X
2-35-000855	4" x 3" PVC reducer	x	x	x	X	x	x	x	X
4-57-000510	Panel retrofit kit for vibration control				X		x		
2-12-000200	Strip-N-Stick (Gray) - Door Seal 1"	x	х	x	х	х	х	x	Х
2-60-000114	High Temp Red Silicone Sealant 10oz. RTV736	x	х	x	х	х	х	x	Х
8-00-000101	Material Handling Tool							x	
2-12-001020	Air decoupler insulation set (foil-faced)	x	X						
2-12-001021	Air decoupler insulation set (foil-faced)				X		X		
2-12-001022	Air decoupler insulation set (foil-faced)							X	
2-12-001023	Air decoupler insulation set (foil-faced)								X
4-50-000004	Pulse QT 4" McGill Air Flow Kit								
4-50-000005	Pulse QT 6" McGill Air Flow Kit								
4-50-000006	Pulse QT 8" McGill Air Flow Kit								
4-50-000008	PH Neutralization Kit	x	X	X	X	Х	x	X	Х
2-30-001580	Magnesium oxide/per bag	x	х	Х	х	х	x	X	Х
4-50-SP0401	Standard spare parts kit	x	х	X	х	Х	X	X	
4-50-SP0402	Extended spare parts kit	x	х	X	х	х	X	X	
4-50-SP0405	Standard spare parts kit								X
4-50-SP0406	Extended spare parts kit								X
NOTES:									

SECTION 5

PHW-IOM-2013-0214

WARRANTY & PARTS

PHW Part #	Description	300	500	650	750	950	1000	1400	2000
Standard spare parts	Standard spare parts kits include (1) air flapper gasket set, (1) gas flapper gasket set, (1) spark plug and (1) flame rod.								
Extended spare parts	Extended spare parts kits include (1) air flapper gasket set, (1) gas flapper gasket set, (1) spark plug, (1) flame rod, and								
(1) programmer con	trol.								
Heat Fab venting ma	Heat Fab venting material available - consult factory								

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