Installation, Operation And Maintenance Manual

Fulton Gas Fired Pulse Commercial Water Heaters

December 2009
Rev. C June 2011

PDWH750*
PDWH1000

*Model PDWH750 is no longer offered but is kept in this manual for reference purposes on previous equipment purchases.

Fulton Pulse Water Heaters. . .The Modern Approach to Commercial Water Heating

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

Today…advanced pulse technology has finally found and proven its way to the water heater industry. Fulton has brought pulse combustion applications out of the residential and light commercial application to larger commercial/industrial heating uses.

Benefits of Gas Pulse Combustion:

Reliability
Flame sensing by pressure, no constant blower required.

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

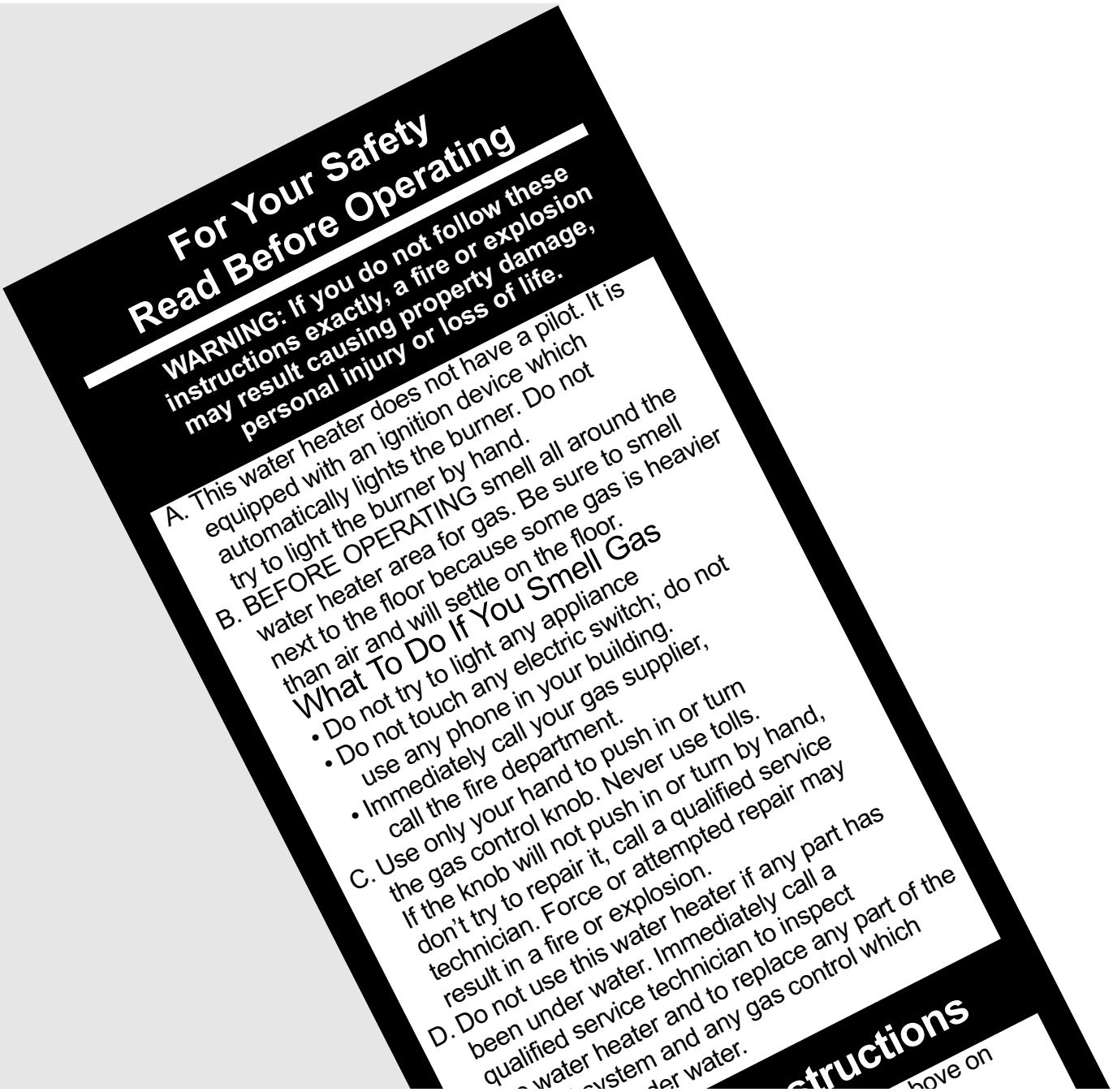
No Expensive Chimney Needed
The pulse combustion system is self-venting through an AL29-4C stainless steel vent. Sidewall venting does not require a draft inducing fan.

Highest Efficiency Possible
Water heater efficiency is up to 99% depending on water temperature.

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

Gas and Pulse Combustion
Our country's most abundant natural resource...gas... combined with modern-day pulse combustion is the cleanest most efficient combination for commercial/industrial applications today.
NOx (Nitrogen Oxides) commonly referred to as “smog” is a prime contributor to acid rain. Environmental control agencies are beginning to deal with this pollution problem. The Fulton self-venting pulse combustion water heaters already meet or exceed most new emission standards being set.

Contents


For Your Safety
Read Before Operating
WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.
A. This water heater does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.
B. BEFORE OPERATING smell all around the water heater area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.
What To Do If You Smell Gas
• Do not try to light any appliance
• Do not touch any electric switch; do not use any phone in your building.
• Immediately call your gas supplier, call the fire department.
C. Use only your hand to push in or turn the gas control knob. Never use tolls. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
D. Do not use this water heater if any part has been under water. Immediately call a qualified service technician to inspect the water heater and to replace any part of the system and any gas control which
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Section 1 Safety Warnings and Precautions

For Your Safety

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

WARNINGS must be observed to prevent serious injury, or death to personnel.

CAUTIONS must be observed to prevent damage or destruction of equipment or loss of operating effectiveness.

NOTES must be observed for essential and effective operating procedures, conditions, and as a statement to be highlighted.

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

WARNING

HOTTER WATER CAN SCALD: Water heaters are intended to produce hot water. water heated to a temperature which will satisfy clothes washing, dish washing, and other sanitizing needs can scald and permanently injure you upon contact. Some people are more likely to be permanently injured by hot water than others. These include the elderly, children, the infirm, or physically/mentally handicapped. If anyone using hot water fits into one of these groups or if there is a local code or state law requiring a certain temperature water at the hot water tap, then you must take special precautions. In addition to using the lowest possible temperature setting that satisfies your hot water needs, some type of tempering device, such as a mixing valve, should be used at the hot water taps used by these people or at the hot water heater. Mixing valves are available at plumbing supply or hardware stores. Follow manufacturer's instructions for installation of the valves. Before changing the factory setting on the thermostat, read the "Temperature Regulation" section in this manual.

CAUTION

Do not install the water heater in an uncontrolled environment where the condensate will be subject to freezing temperatures. Section 2.

NOTE

The water heater must not be installed on carpeting. Section 2.

NOTE

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

NOTE

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

CAUTION

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

WARNING

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

NOTE

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

WARNING

HYDROGEN GAS: Hydrogen gas can be produced in a hot water system that has not been used for a long period of time (generally two weeks or more). Hydrogen gas is extremely flammable and explosive. To prevent the possibility of injury under these conditions, we recommend the hot water faucet be opened for several minutes at the kitchen sink before any electrical appliances which are connected to the hot water system are used (such as a dish washer or washing machine). If hydrogen gas is present, there will probably be an unusual sound similar to air escaping from the pipe as the hot water faucet is opened. There must be no smoking or open flame near the faucet at the time it is open.

NOTE

See table on Page 13 for required pipe size, based on overall length of pipe from meter plus equivalent length of all fittings. Approximate sizing may be based on 1 cubic foot of natural gas per 1,000 BTU/Hr. input. Section 2.

NOTE

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

CAUTION

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

WARNING

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

NOTE

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

WARNING

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

NOTE

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

NOTE

Time is critical at this stage. Do not allow primer to dry before applying cement. Section 2.

NOTE

Assembly should be completed within 20 seconds after last application of cement. Do not use hammer to insert pipe. Section 2.

WARNING

Do not attempt to start water heater before filling and purging water heater heating system. A dry fire will seriously damage the water heater and may result in property damage or personnel injury and is not covered by warranty. Section 2.

NOTE

The following purge procedure is applicable to the recommended piping configuration only. See Figure 15. Section 2.

WARNING

This water heater shall not be connected to any heating systems or component(s) previously used with a non-potable water heating appliance.

If this water heater is also used for space heating applications, all piping and components connected to the water heater shall be suitable for use with potable water.

If a water heater is installed in a closed water supply system, such as one having a back-flow preventer, check valve, water meter with check valve, etc... in the cold water supply, means shall be provided to control thermal expansion. Contact the water supplier or plumbing contractor on how to control this situation.

WARNING

Toxic chemicals such as used for treatment of boilers or non-potable water heating appliances shall never be introduced into a potable water space heating system.

WARNING

Never leave an opened manual air vent unattended. In the event an opened vent is left unattended, water damage could occur. Section 2.

NOTE

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

WARNING

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

NOTE

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

NOTE

Prior to starting, make sure the procedure for purging the heating system has been accomplished as detailed in section 2. Section 3.

CAUTION

Should overheating occur or the gas supply fail to shut off, shut off the gas supply at a location external to the water heater. Section 3.

NOTE

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

NOTE

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

WARNING

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

NOTE

To prevent against untimely corrosion of hot and cold water fittings, it is strongly recommended that di-electric unions or couplings be installed on this water heater when connected to copper pipe.

The following are copies of safety labels and warnings which are affixed to the Fulton Pulse Water heaters. They are reproduced here as a further safety precaution and as a reminder to quickly identify them on the water heater.

For Your Safety Read Before Operating

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

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

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

What To Do If You Smell Gas

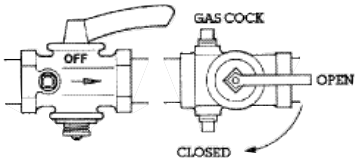
- Do not try to light any appliance.
- Do not touch any electric switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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

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

Operating Instructions:

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



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

To Turn Off Gas To Water heater

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

Warning

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

This Water heater Must

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

For Your Safety

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

This Water heater Requires

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

This Unit Must

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

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

Fulton Gas Fired Pulse Water Heater

Type of Gas: ☐ Natural ☐ Propane

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

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

Fulton

Manufactured by
The Fulton Boiler Companies
Pulaski, New York 13142

Section 2

Installation

Installation

General specifications and information about Fulton Pulse Potable Water Heaters:

Models	PDWH750	PDWH1000
BTU/HR. Input	750,000	1,000,000
BTU/HR Output*	660,000	880,000
Fuel	NG/LPG	NG/LPG
Approx. Dry Weight	1,800 lbs.	1,400 lbs.
Approx. Operating Weight	2,150 lbs.	2,150 lbs.
Floor Loading	300 lbs/ft2	300 lbs/ft2
Power Required	120/60/1	120/60/1
Min. Required Gas Pressure	7" W.C.NG 11" W.C. LPG	7" W.C. NG 11" W.C. LPG
Max. Amp Draw (F L.A.)	4.0	4.0
MAWP	160 PSI	160 PSI
Water heater Width	27.5 IN	27.5 IN
Water heater Height	76 IN	76 IN
Water heater Depth	37.8 IN	37.8 IN
GPH @100°F Temperature Rise	790	1055

Note: *Based on 40°F in -140°F out.

Introduction

The Fulton Pulse water heater is an automatic gas fired, direct vent water heater. This water heater utilizes the pulse combustion principle. It requires no conventional burner controls, no pilot and no flue or chimney. The combustion components are of integral design with the heat exchanger. For combustion, the water heater uses 100% outside air supplied through schedule 40 PVC pipe.

The products of combustion are vented outdoors through non-corrosive venting materials which will withstand 480°F (249°C) temperatures. These pipes can be routed either through a roof or through the side wall of a building. Each water heater is built to ASME and CSD-1 Codes, hydrostatically tested, test fired, and shipped as a complete packaged unit. Gas, water, and electrical connections are similar to conventional water heaters.

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 water heater, when installed, must be electrically grounded in accordance with the National eectrical Code, ANSI/NFPA 70-latest edition.

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

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

The following items are standard trim for Fulton Pulse water heaters:

- Full Modulation with a 5:1 turndown ratio
- Fully Insulated
- Microprocessor Based Control - 120 volt
- Low Water Cutoff (Probe Type)
- Control Panel Completely Wired with Diagram
- Operating Temperature Control
- Hi-Limit Temperature Control w/ Manual Reset
- Air Pressure Switch
- Spark Ignition
- Main Motorized Gas Valve
- Main Gas Pressure Regulator
- Manual Lubricated Gas Cock
- Second Gas Valve (Solenoid)

Included with and packaged separately with each water heater are the following components:

- ASME Pressure Relief Valve
- Pressure-Temperature Gauge
- Air Intake and Exhaust Pipe Adaptors
- Installation, Operation, and Maintenance Manual
- Elastomer Coated Fiberglass Cubes
- Gas and Water Flex Connectors
- Intake and Exhaust Mufflers

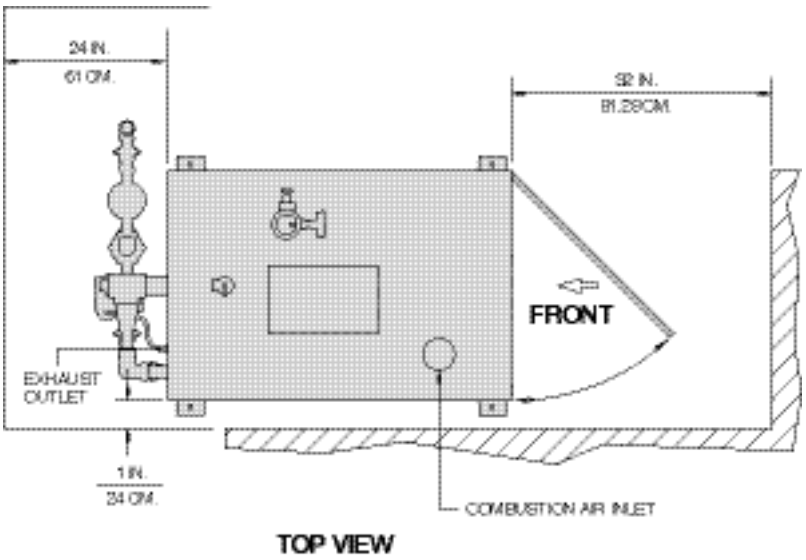
Optional Accessories

Condensate Liquid Drainer
Flex Connectors
Spring Mounts

Installation

Figure 1

*Clearence from top of water heater to combustables must be no less than 12”.



TOP VIEW

AIR INTAKE PIPING

Model No.	Type	Diameter/In.	Number of Length/Ft.	90 Degree Elbows
PDWH750	PVC	4	10 Minimum	0
		4	35 Maximum	4
PDWH1000	PVC	4	10 Minimum	0
		4	35 Maximum	4

EXHAUST VENT PIPING

Model No.	Type	Diameter/In.	Length/Ft.	Number of 90 Degree Elbows
PDWH750	Stainless Steel	4	10 Minimum	0
		4	35 Maximum	4
PDWH1000	Stainless Steel	4	10 Minimum	0
		4	35 Maximum	4

Installation

Locating The Water Heater:

The water heater should be located so that the air supply and exhaust piping between the water heater and outside wall/roof are within the minimum and maximum lengths for horizontal or vertical venting. (Page 9) See Figure 1 for minimum clearances between the water heater and any combustible surfaces.

CAUTION

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

NOTE

The water heater must not be installed on carpeting.

NOTE

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

NOTE

All Pulse water heaters **must** be installed with vibration isolators. No Pulse water heater shall be lagged directly to the concrete floor due to the transfer of vibration. In the box of trim shipped with each pulse water heater, Fulton supplies 4 elastomer coated fiberglass cubes used for vibration isolation. **(Figure 2a) For all non-critical installations these cubes must be under each foot of the water heater.** White lines on blocks should be in “up” position. Flex connectors must be installed on the water inlet and outlet lines. **For installations near “sensitive” areas such as offices, classrooms, or hospital rooms, spring mounts—which fit under the comer of each water heater—must be used instead of the cubes,** and flex connectors must be installed on the water inlet and outlet lines. Flex connectors must be installed on the gas inlet. Spring loaded pipe hangers should be used on the air inlet, water inlet and outlet, and the flue gas outlet pipes. Contact your Fulton Representative for vibration isolation packages designed specifically for your application.

Installing Spring Isolation Mounts (Figure 2b)

1. Thread the leveling bolt into the top load plate of the spring until the head of the bolt is within 1/8" of the top load plate of the spring.
2. Coordinate the location of each isolator.
3. Remove the small cap screw and washer. Raise the water heater with jacks or similar tools (Do not attempt to raise the water heater via one (1) lifting point, but lift evenly around the perimeter of the boiler). Slide the spring isolator under the water heater 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 water heater (evenly) onto the spring isolators. Do not overload any one isolator and take care not to push the water heater 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 water heater is at its height. When the water heater is filled with water, the springs will compress approximately 1-2".
8. Tighten the small cap screw, thus securing the spring isolator to the supported equipment and locking the leveling bolt against turning.
9. Do not attempt to move the water heater laterally while it is supported on the isolators. If it is necessary to move the water heater remove the weight from the isolators by raising the water heater 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.

Installing Seismic Spring Isolation Mounts (Figure 2c)

1. Thread the leveling bolt 1/2" into the top of the load cap.
2. Remove the lock nut and one washer from the top of the leveling bolt. Locate leveling nut as far down on leveling bolt as it will travel.
3. Coordinate the location of each isolator.
4. Place a one inch shim next to each

Figure 2a

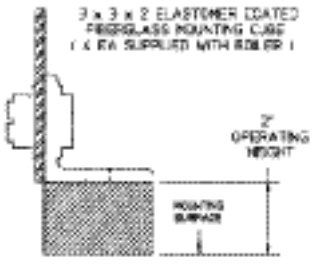
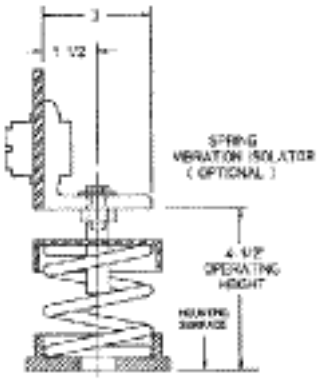


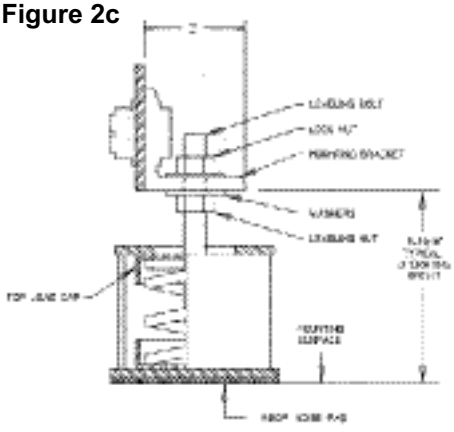
Figure 2b



bracket between the water heater and the housekeeping pad or structural floor. If an operating clearance of other than one inch is desired, use an appropriate size shim.

5. Raise the water heater 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 water heater onto the spring isolators taking care not to overload any one isolator and taking care not to push the water heater sideways.
7. Install second washer and lock nut one inch down from top of leveling bolt.
8. Grasp top of leveling bolt with vice grip and turn leveling nut in a counter-clockwise rotation until the water heater 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 water heater and locking the leveling bolt against turning.
10. Do not attempt to move the isolators laterally with the weight of the water heater on them. If it is necessary to move the boiler, remove the weight from the isolators by raising the equipment before moving.

Figure 2c



Installation

Installing Water Heater Trim

1. Each water heater is supplied with a safety relief valve sized in accordance with ASME requirements.The safety relief valve shall be connected to the coupling located in the top of the water heater (Figure 3a). The safety relief valve must be installed with a 6" nipple between the water heater and the safety valve. The safety relief valve must always be installed in the vertical position. The discharge pipe shall be not less than the full area of the valve outlet. The discharge pipe shall be as short and straight as possible and so arranged as to avoid undue stress on the valve.

CAUTION

The discharge from safety relief valve shall be so arranged that there will be no danger of scalding of personnel. When the safety relief valve discharge is piped away from the water heater to the point of discharge, there shall be provisions made for properly draining the piping.

WARNING

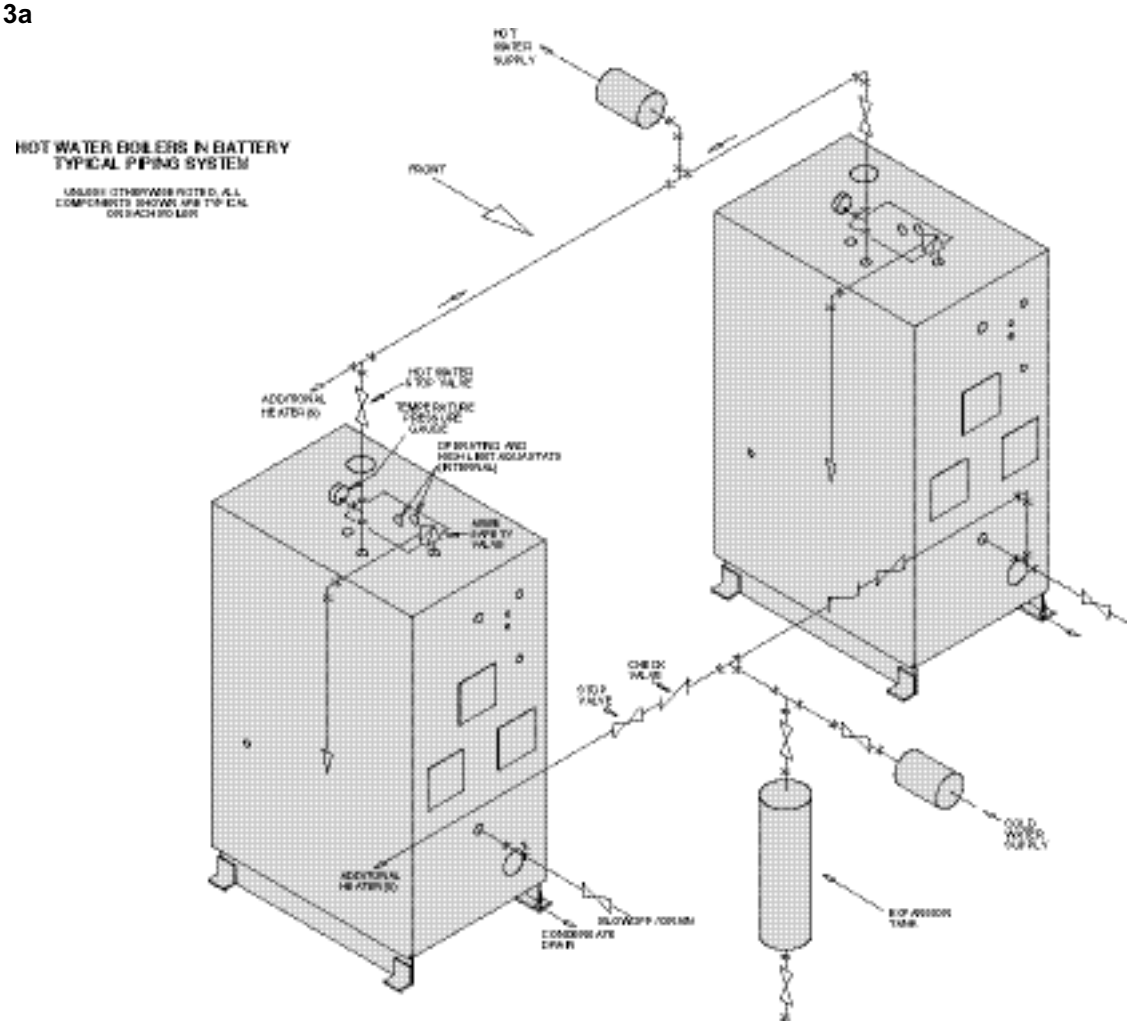
No shutoff of any kind shall be placed between the safety relief valve and the water heater or on the discharge pipe between such valve and the atmosphere. Doing so can cause an accidental explosion from overpressure.

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

Installing Water Piping

1. The bottom connection to the water heater is the INLET and must be used for the return from the system.
2. The top connection on the water heater is the OUTLET and must be connected as the supply to the system.
3. Connect hot water supply to heating system feed line.
4. Connect expansion tank.
5. Connect cold water supply to water heater inlet connection.
6. Install expansion tank
7. Clearence from hot water pipes to combustibles must be at least 6”.
8. The water heater is furnished with a probe type low water cutoff. No field piping is required. If the probe does not sense water, the water heater will shut down and a red indicator will be illuminated on the control panel.
9. The water heater is not provided with external drain connections. A drain valve must be installed near the inlet connection to the water heater and piped to a suitable floor drain.
10. Before filling the water heater clean and flush the system to remove any debris. Clean and flush old piping thoroughly before installing the water heater. Consider installing a strainer ahead of the water heater.

Figure 3a



Installation

Condensate Drain Kit

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

An 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 purge during startup or normal operation. The 1-1/2” connection shall be piped to an appropriate drain for disposal. If the water supply must be temporarily disconnected, the water heater(s) must be turned off to prevent accidental flue gas emission in the utility room.

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

Model Part Number 4-57-000440	
Recommended Operating Temp. 175ºF max.	
Capacity	4 QT
Inlet Size:	1”
Outlet Size	1-1/2”
Water Supply	1/4” COMP.
Max. units to attach to drain	8

Installing Condensate Drain Piping

Figure 3b

A condensate collecting tank and condensate pump will be required if an in the floor drain is not available to collect condensate (Collecting tank and pump are not supplied with the water heater). Complete condensate liquid drainer kits are available from Fulton.

1. All piping must be galvanized, PVC 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 water heater.
3. Install the condensate liquid drainer to the condensate drain in the lower right hand side of the water heater.
4. Connect 3/4" condensate drain(s), maximum of 8 water heaters per drain kit, to the 1"inlet at the base of the drain tank. The bottom of the drain kit must be a **minimum of 5-1/2"** lower than the bottom of the exhaust decoupler when connected in a manifold as shown in Figure 3c, the manifold must be 5 1/2" below c ondensate outlet and must remain flooded.
5. Connect 1 1/2" drain outlet to an appropriate waste line following applicable codes. The 1 1/2" drain connection on the drainer 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 drainer. 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 water heater 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.

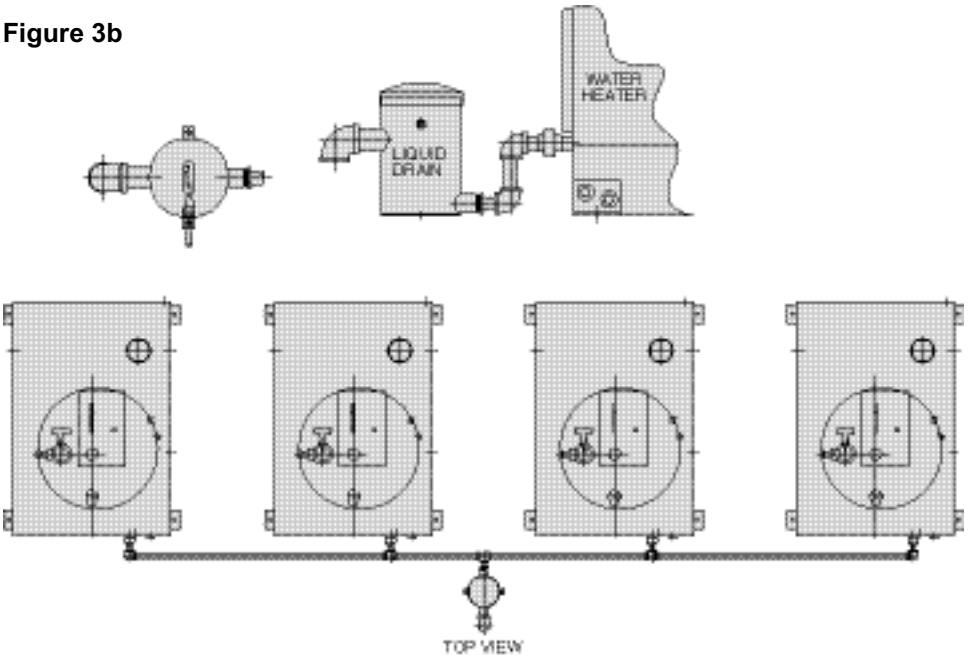
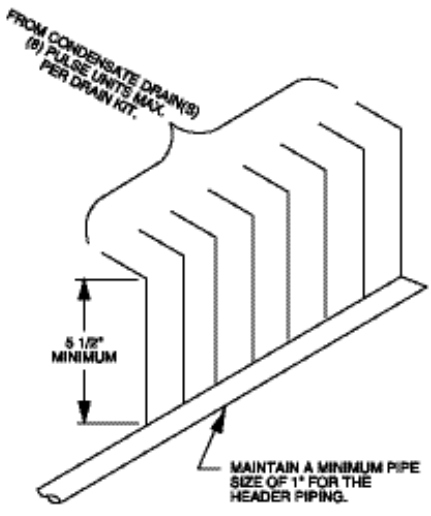


Figure 3c



IMPORTANT

Installation

Pipe Capacity For Natural Gas

Nominal Iron Pipe Size Inches	Internal Diameter Inches	Equivalent Pipe Length 90Þ Elbow Feet	Tee Feet	Maximum Capacity in Cubic Feet of Natural Gas Per Hour Pressure Drop of 0.5" W.C. Equivalent Length of Pipe in Feet 20	40	60	80	100	150	200
1.25	1.38	3.50	6.90	950	—	—	—	—	—	—
1.50	1.61	4.00	8.00	1460	990	810	—	—	—	—
2.00	2.07	5.20	10.30	2750	1900	1520	1300	1150	950	800
2.50	2.47	6.20	12.30	4350	3000	2400	2050	1850	1500	1280
3.00	3.07	7.70	15.30	7700	5300	4300	3700	3250	2650	22780
4.00	4.03	10.10	20.20	15800	10900	8800	7500	6700	5500	4600

Installing Gas Piping

Figure 4

NOTE

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

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

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

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 ensure adequate gas supply.

3. Gas pressure to inlet of gas train should be 7" WC. for natural gas and 11" WC. for propane. Connect gas supply line to the open end of the tee on which the drip leg is installed.

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

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

CAUTION

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

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

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

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

WARNING

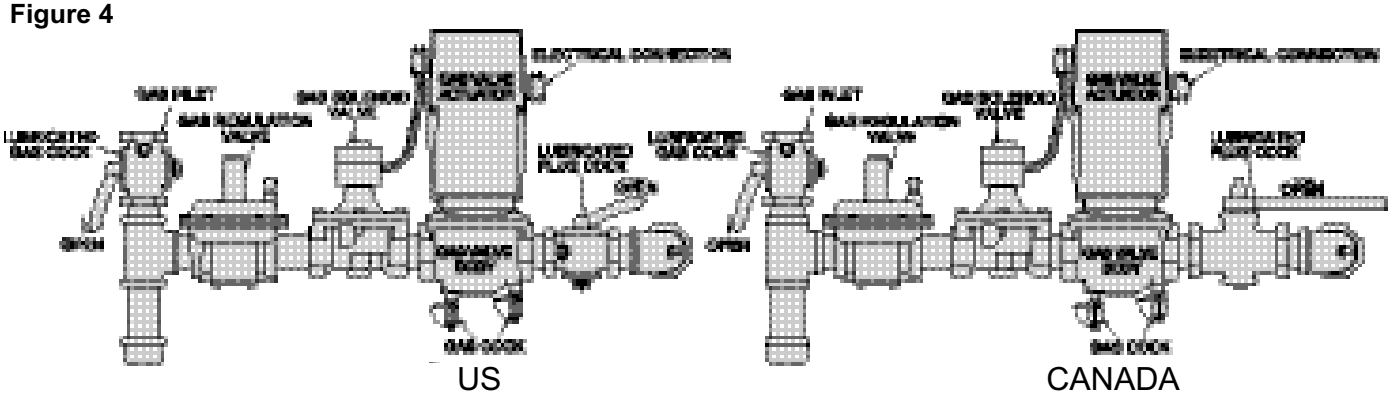
Do not use matches, candles, flame or other sources of ignition to check for gas leaks.

NOTE

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

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

Figure 4



US CANADA

Installation

Installing Field Wiring

Figure 5

It is recommended that an independent power supply line be provided for the water heater. Connect one 120 volt (60Hz) fused powerline to terminal block as shown in Figure 5a. Connect applicable wires to neutral and ground. Connect a ground wire to green colored ground lug in electrical control box.

WARNING

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

CAUTION

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

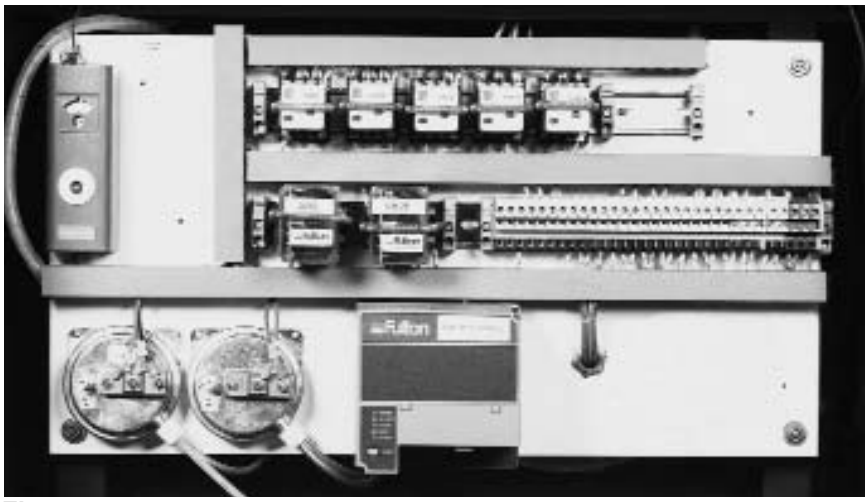


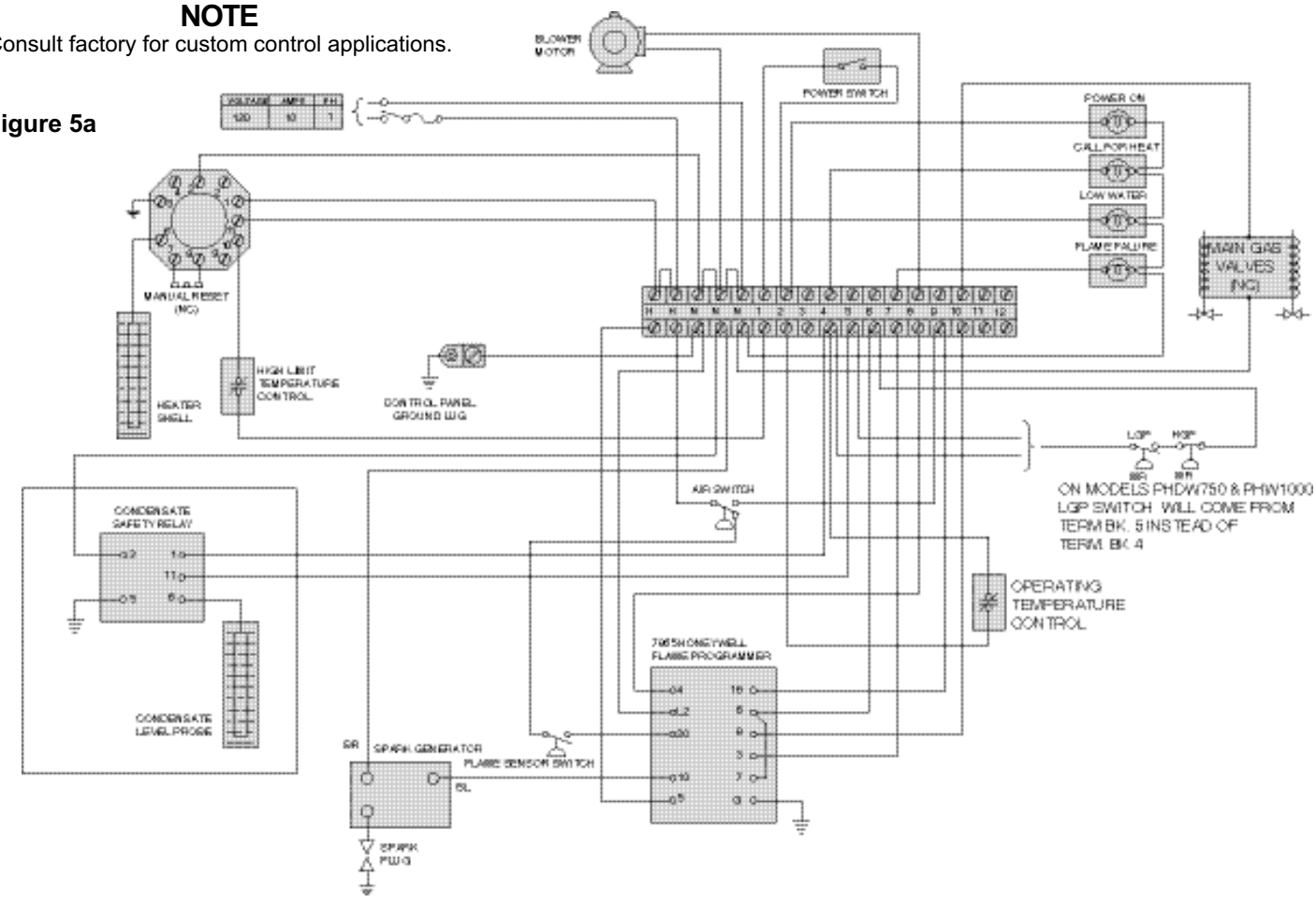
Figure 5

Electrical Schematic

NOTE

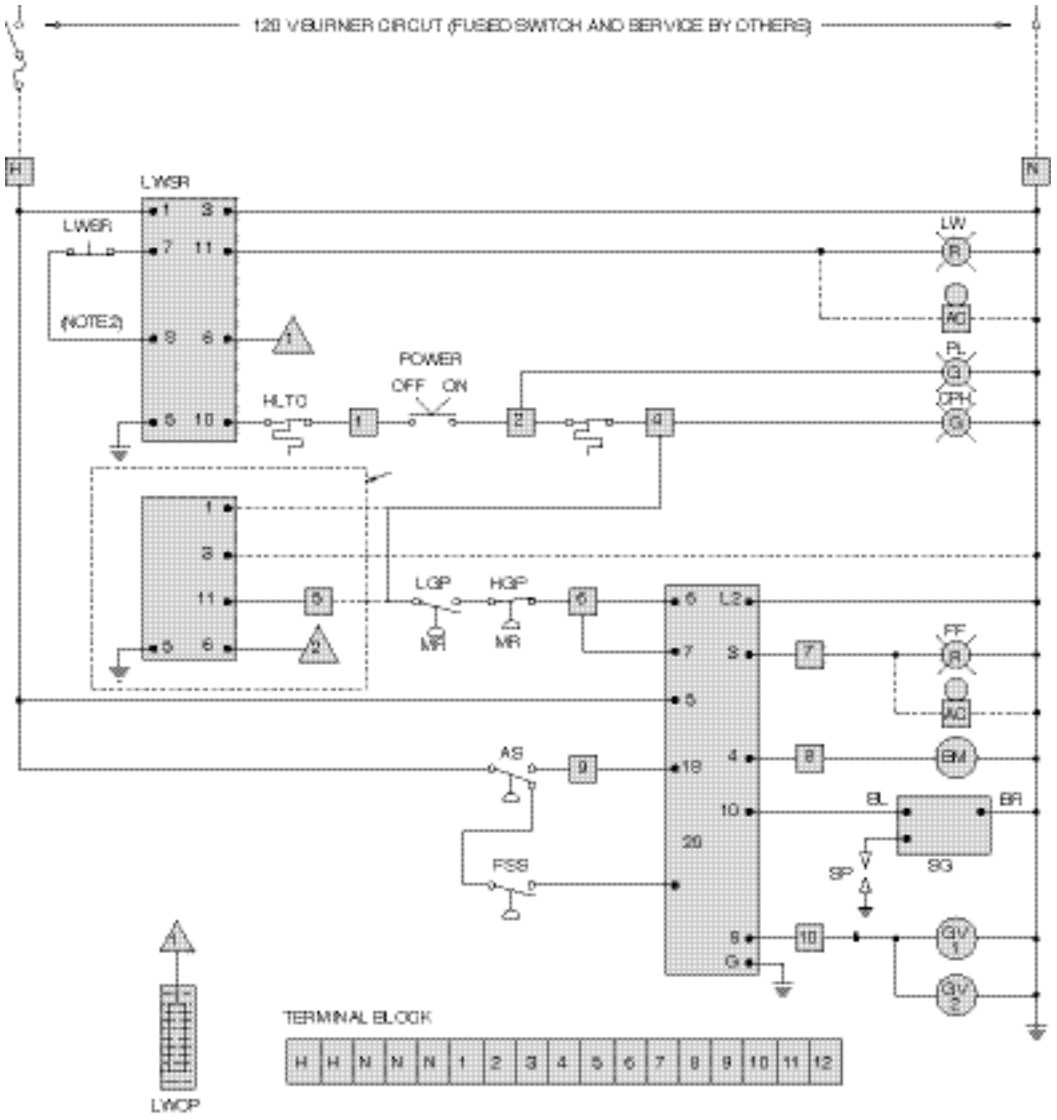
Consult factory for custom control applications.

Figure 5a



Installation

Figure 5b



Sequence of Operation

1. Turn on main breaker.
2. Low water safety relay (LWSR) is energized when the main breaker is turned on. (Red light on the water heater panel is lit and if the optional alarm is provided, alarm will go off. Current is not allowed to pass to the high limit temperature control until a) the probe in the water heater shell senses the water and b) the manual reset switch is reset. If a and b are both satisfied, the red light is turned off.
3. High limit temperature control allows current to pass to the next control if the temperature in the water heater water is not causing the control to open the circuit.
4. Burner switch is then closed to energize the operating temperature control. (Green light on the panel is lit).
5. Operating temperature control allows current to pass to the automatic control relay if the temperature of the water is not causing the control to open the circuit.
6. 120V power is input to the automatic control relay (RM7865A).
7. Purge blower is energized for 35 seconds.
8. Purge fan switch is made, signaling the control to proceed.
9. Spark plug is energized.
10. Gas valve is energized.
11. Pressure sensing switch is made (proof of flame) allowing sequence to continue.
12. Pulse combustion will continue until one or more of the following things happen:
    A. Operating temperature control is satisfied.
    B. High limit temperature control is satisfied.
    C. Low water safety relay loses water on probe.
    D. Burner switch is turned off.
    E. Main breaker is turned off.

Glossary

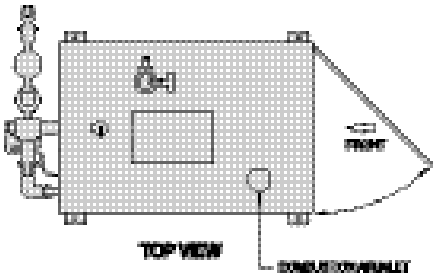
AC	— Audible Alarm Control (Optional)
ACR	— Automatic Control Relay (7800 series)
BM	— Purge Fan Motor
BS	— Burner Switch
CR	— Control Relay
HLTC	— Hi Limit Temp. Control
LW	— Panel Light (Low Water Indicator)
LWCP	— Low Water Cutoff Probe
LWRS	— Low Water Reset Switch
LWSR	— Low Water Safety Relay
GV	— Main Gas Valve
OTC	— Operating Temp. Control
PFS	— Purge Fan Switch
PL	— Panel Light (Power On Green)
PSS	— Pressure Sensor Switch No. 2
RC	— Relay Coil
SP	— Spark Generator
S.P.	— Spark Plug
TB-H	— Terminal Block (Hot)
TB-N	— Terminal Block (Neutral)

Installation

Air Intake Supply Piping Installation Preparation

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

Figure 6

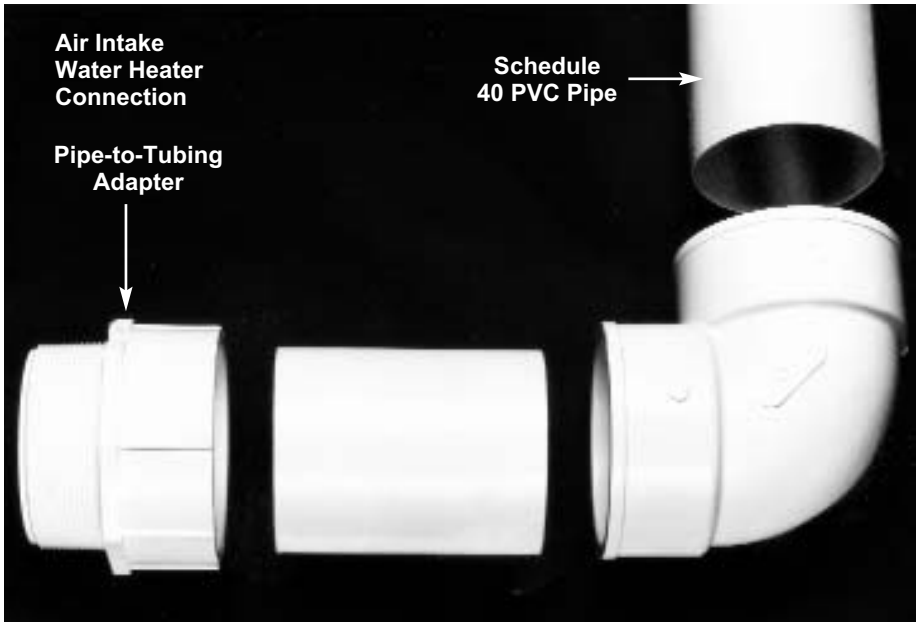


Air supply is on the top. See Figure 6. For Models PDWH750 & PDWH1000, the connections are 4" NPT thread female fittings. These fittings will accept 3" and 4" male/female pipe to tubing adaptors respectively. This line must be sloped down toward the unit with a pitch of at least 1/4" per foot. Failure to do so can result in a condensate pocket which can result in an inoperative water heater. A high spot is acceptable, provided the pitch from the high spot is maintained back to the water heater and to the outside point of air intake.

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

NOTE

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



WARNING

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

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

Step 1
Measure and cut PVC pipe to desired length.

Step 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.

Step 3
Clean and dry surfaces to be joined.

Step 4
Test fit joint and mark depth of fitting on pipe outside.

Step 5
Uniformly apply liberal coat of primer to inside socket surface of fitting and male end of pipe to depth of fitting socket.

Step 6
Promptly apply solvent cement to end of pipe and inside socket surface of fitting. Cement should be applied lightly—but uniformly—to inside of socket. Take care to keep excess cement out of socket. Apply second coat to pipe end.

NOTE

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

Step 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.

Step 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.

Step 9
Handle joints carefully until completely set.

Intake Muffler Installation - Figure 7

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

Installation

Exhaust Vent Piping Installation Preparation

NOTE: A Fulton PDWH water heater should not be connected to a common venting system with other types of gas appliances.

The water heater is equipped with an exhaust vent connection located at the rear of the water heater. (Figure 6) For Models PDWH750 & PDWH1000 the connections are 4" NPT threaded female fittings.
The exhaust line must be sloped down toward the unit with a pitch of at least 1/4" per foot. Failure to do so can result in a condensate pocket which can result in an inoperative water heater. 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 water heater 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 transmission of pulsations. Always avoid rigid connections between piping and structural members of the building. Flue exhaust pipes and fittings for all models shall be stainless steel. The stainless steel shall be UL temperature rated at minimum air clearance to combustibles. At 480° F temperature rating, a 5" minimum air space clearance to combustibles is required. Fulton pulse combustion hydronic heating water heaters require a special venting system. Applicable Federal Codes are NFPA 54/ANSI Z223.1 National Fuel Gas Code and NFPA/ANSI 211 Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances. In Canada refer to the venting section of CAN/CGA B149.1 and .2. These codes contain information on special gas vents. The gas vent installer should be familiar with these Federal Codes as well as local codes and regulations.

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

Step 1
Do not mix stainless steel pipe with galvanized or other alternatives for the entire length of the system.

Step 2
All joints between sections of the vent connector and the vertical conduit must be sealed with a high temperature sealant to prevent any possible leakage of flue gas.

Step 3
Apply a bead of sealant, about 1/4 inch in diameter, completely around the male (without tabs) end of each conduit section or elbow, between 1/4 and 3/8 inch 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.

Step 4
Fully insert the male end of the section into the female fitting of the section below. Spread any sealant that squeezes out around the circumference of the joint. Attach the sections together with the locking ring and tabs. Again spread any extruded sealant around the joint. Inspect the joint to ensure that flue gases will not escape. If necessary, apply additional sealant to any voids. Allow the sealant 24 hours to cure before operating the water heater.

Step 5
All pipes, elbows, and fittings used in condensate piping from liquid drain to floor drain shall be high temperature plastic or stainless steel.

Exhaust Muffler Installation

Follow steps 1-5 above to join the fittings.
For muffler drain installation:
1. For mufflers installed in the vertical configuration the drain can be plugged.
2. For mufflers installed in the horizontal configuration, the drain should be piped to the drain line between the water heater and the liquid drainer.
For best noise attenuation, the muffler should be installed as close to the water heater as possible.

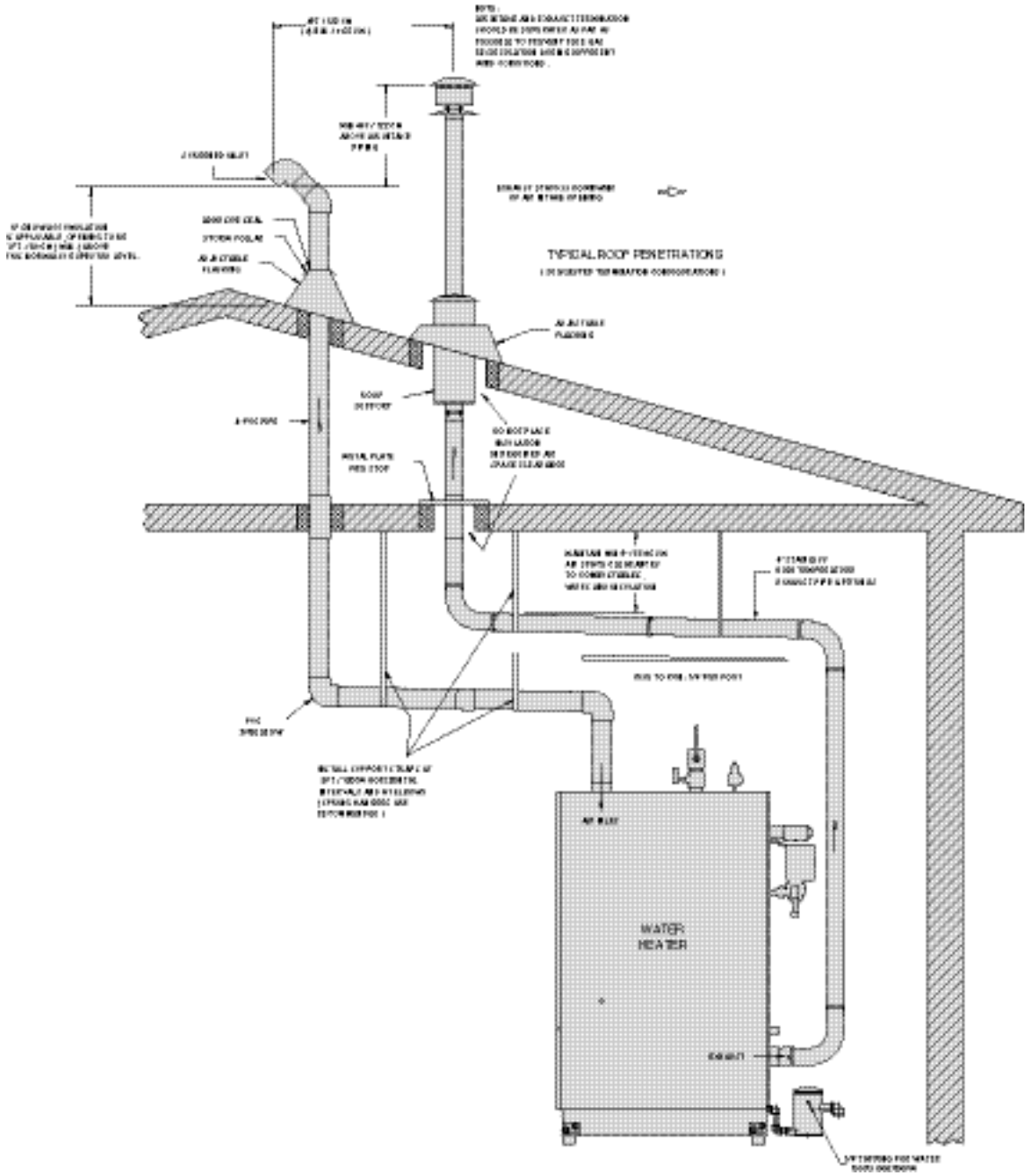
Installation

Air Intake Supply and Exhaust Vent Installation

Air intake supply and exhaust vent pipes and fittings are suitable for vertical, through-the-roof or horizontal through-the-wall installation. The vent system must be installed in accordance with the manufacturer's instructions. All vent pipes and fittings must be installed with appropriate air space clearances to combustibles. These air space clearances apply to indoor or outdoor vents—whether they are open, enclosed, horizontal or vertical or pass through floors, walls, roofs, or framed spaces. See Figure 8. The air space clearances should be observed to joists, studs, subfloors, plywood, drywall or plaster enclosures, insulating sheathing, rafters, roofing, and any other material classed as combustible.

The required minimum air space clearances also apply to electrical wires and any kind of building insulation away from gas vent and out of the required air space clearance. Vertical runs or vent pipes and fittings passing through floors, ceilings, or in framed walls must be fire stopped at floors and ceilings. The fire stop must close in the area between the outside of the vent and the opening in the structure. Figure 9. When passing through a floor or ceiling, frame in an opening providing 5" or 9" air space clearance to vent pipe as applicable. The fire stop fits to the bottom of a framed opening 13¼" square. Nail into the inside of the framed opening

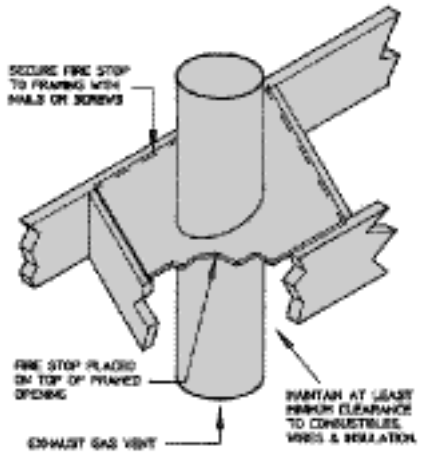
Figure 8



Typical Ceiling and Roof Penetration Detail

Installation

Figure 9
Fire Stopping Required For All Ceiling/Floor Penetrations



through the four holes in the ring. The fire stop is placed on top of a framed opening 14¼" square with the dished position down. Nail the flange to the top of the framing. For pitched roofs refer to figure 12.

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 10. Air intake supply and exhaust vent pipes and fittings must be securely supported. For pitched roofs refer to figure 12.

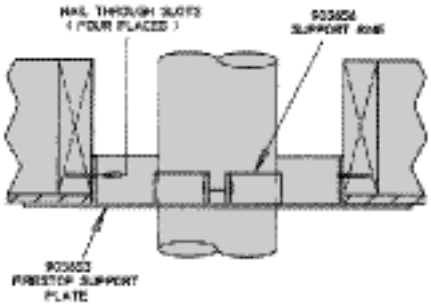
Horizontal sections require supports every 5 feet and at elbows. From the water heater, all horizontal sections must rise at least ¼" per foot, and there must be no sags or dips where condensate could collect. The upward pitch is required so condensate will run back to the water heater for collection and disposal.

For vertical through the roof installations all gas vents extending above the roof by more than 2-½ feet must be securely guyed or braced—inside and outside wall—2 clamps. Use a support ring to attach guys or braces to the vent pipe.

Vertical Vent Flashing and Installation:

The roof opening should be located and sized such that the vent is vertical and has the required air space clearance. The roof flashing is positioned with the lower portion of the base flange over roofing material. Figure 11.

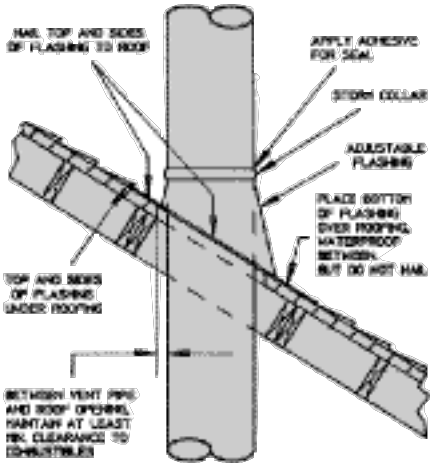
Figure 10
Fire Stop



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 that flashing, covering the sides and upper flange with roofing material.

Figure 11
Elements For Correct Roof Flashing Installation



Vertical Vent Termination:

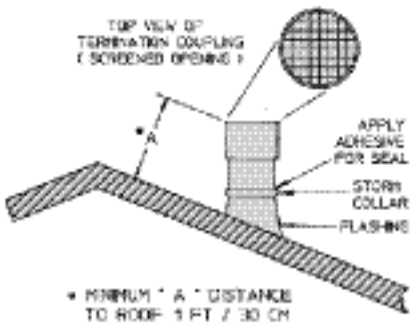
The vent pipe must extend through the flashing to a height above the roof as required in Figure 12.

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

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

Figure 12

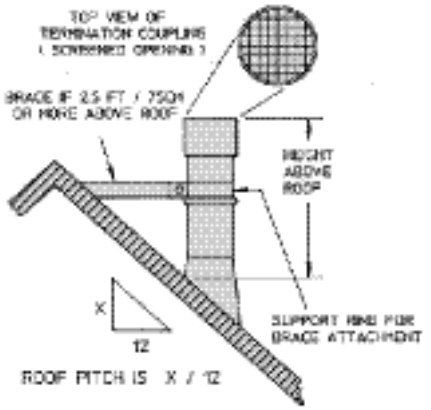
FOR ROOF PITCH OF FLAT TO 7/12



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

[1] BRACE TO ROOF AT TOP

FOR ROOF PITCH OF 7/12 OR MORE



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

[2] BRACE TO ROOF AT TOP AND MID POINT

Installation

Horizontal Installation Wall Penetrations

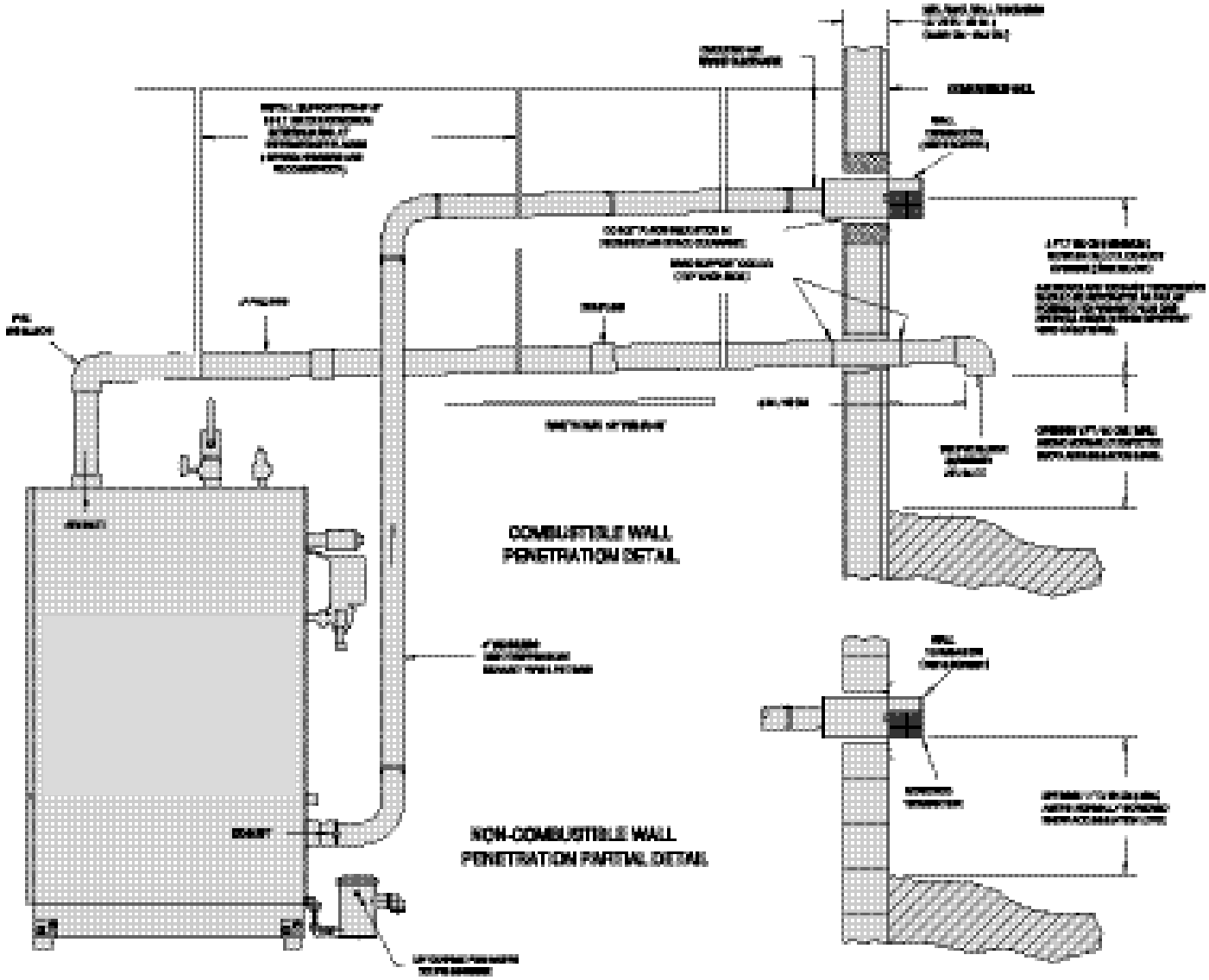
Figure 13
Select the point of penetration where a minimum of 1/4" per foot upward pitch can be maintained.

When penetrating a non-combustible wall, the hole through the wall must be large enough to maintain the pitch of the vent and provide sealing.
Use adhesive material to seal around the vent on both sides of the wall.
When penetrating a combustible wall, a wall thimble must be used. See next page Figure 14 for installation instructions.

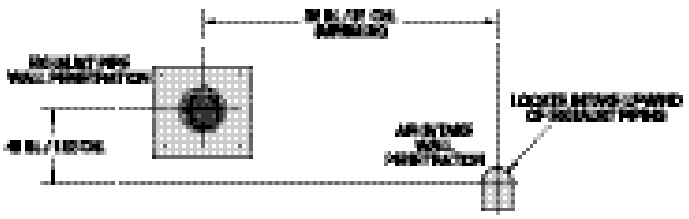
Minimum wall thickness through which vent system may be installed is 3 1/4".
Maximum wall thickness through which vent system may be installed is 20 inches.

Figure 13

Typical Combustible Wall Penetration Detail



AIR INTAKE & EXHAUST PIPES WALL PENETRATION CLEARANCES

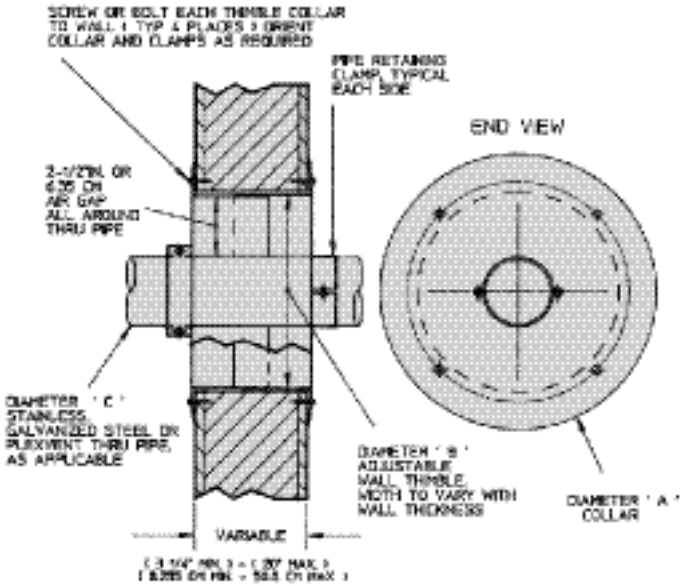


AIR INTAKE AND EXHAUST TERMINATION SHOULD BE SEPERATED AS FAR AS POSSIBLE TO PREVENT FLUE GAS RECIRCULATION DURING DIFFERENT WIND CONDITIONS

Installation

Figure 14

Nominal Pipe & Thimble Diameters			
Pipe Size (in.)	A ⌀	B ⌀	C ⌀
3"	6 7/8"	5 7/16"	3 5/16"
4"	9 3/8"	8 1/2"	4 3/16"
6"	8 1/8"	Fixed	6 1/8"
Pipe Size (cm)	A ⌀	B ⌀	C ⌀
7.62	17.46	13.81	8.41
10.16	23.81	21.59	10.63
15.24	20.64	Fixed	15.56



Wall Thimble Installation

A 9" diameter thimble is inserted through the wall from the outside. Secure the outside flange to the wall with nails or screws, and seal with adhesive material. Install the inside flange to the inside wall, secure with nails or screws, and seal with adhesive material. Pass the vent pipe through the thimble from the outside and join to the rest of the vent system. Seal the pipe to the thimble flange with adhesive material. Figure 14. Install two pipe retaining clamps around the intake as well as vent pipes on both ends of the wall thimble (on the inside and outside of the wall) through which intake and vent pipes are passed when tightened securely. They will prevent the intake and vent pipes from being pushed or pulled.

Ensure wall thimble for 6” exhaust vent contains internal insulation prior to installation.

Horizontal Vent Termination

The vent termination is joined to the vent pipe outside the wall. Use the same joining procedures for vent pipe and fittings. The termination of the vent system must be at least 12" above the finished grade, or at least 12" above normal snow accumulation level (for applicable geographical areas). Refer back to previous page Figure 13. The termination of the vent system shall not be located in traffic areas such as walk-ways, adjacent buildings, openable windows and building openings unless the venting system is at least 7 feet above finished grade, (National Fuel Gas Code, ANSI Z223.1). The vent termination must be at least 4 feet (1.22m) horizontally from, and in no case above or below, unless a 4-foot 1.22m) horizontal distance is maintained from electric meters, gas meters, regulators, and relief equipment. The air supply inlet and exhaust outlet must be separated from 3ft. minimum to 10ft. maximum on the same wall. The exhaust outlet must be installed 2ft. minimum above and downwind from air supply inlet to prevent exhaust recirculation. Under certain wind conditions, some building materials may be affected by flue products expelled in close proximity to unprotected surfaces. Sealing or shielding of the exposed surfaces with a corrosion resistant material (such as aluminum sheet) may be required to prevent staining or deterioration.

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

After Installation/Prior to Start-Up

WARNING

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

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

NOTE

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

a. Close combination shutoff/purge valve in supply, all drain cocks, the shutoff valve for the pressure reducing (fill) valve, and all manual air vents.
b. Open all other system shutoff valves and open a faucet or other water discharge source.
c. Water will now begin to fill the system. Continue filling until a constant stream of water (no bubbling) is discharged.
d. When all air has escaped and only water is discharged, close faucet or water discharge source
e. At this point, the system has been initially filled. However, air pockets may still remain at high points in the system. It is possible, depending on the particular system that faucet used for filling still contains nothing but 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.

WARNING

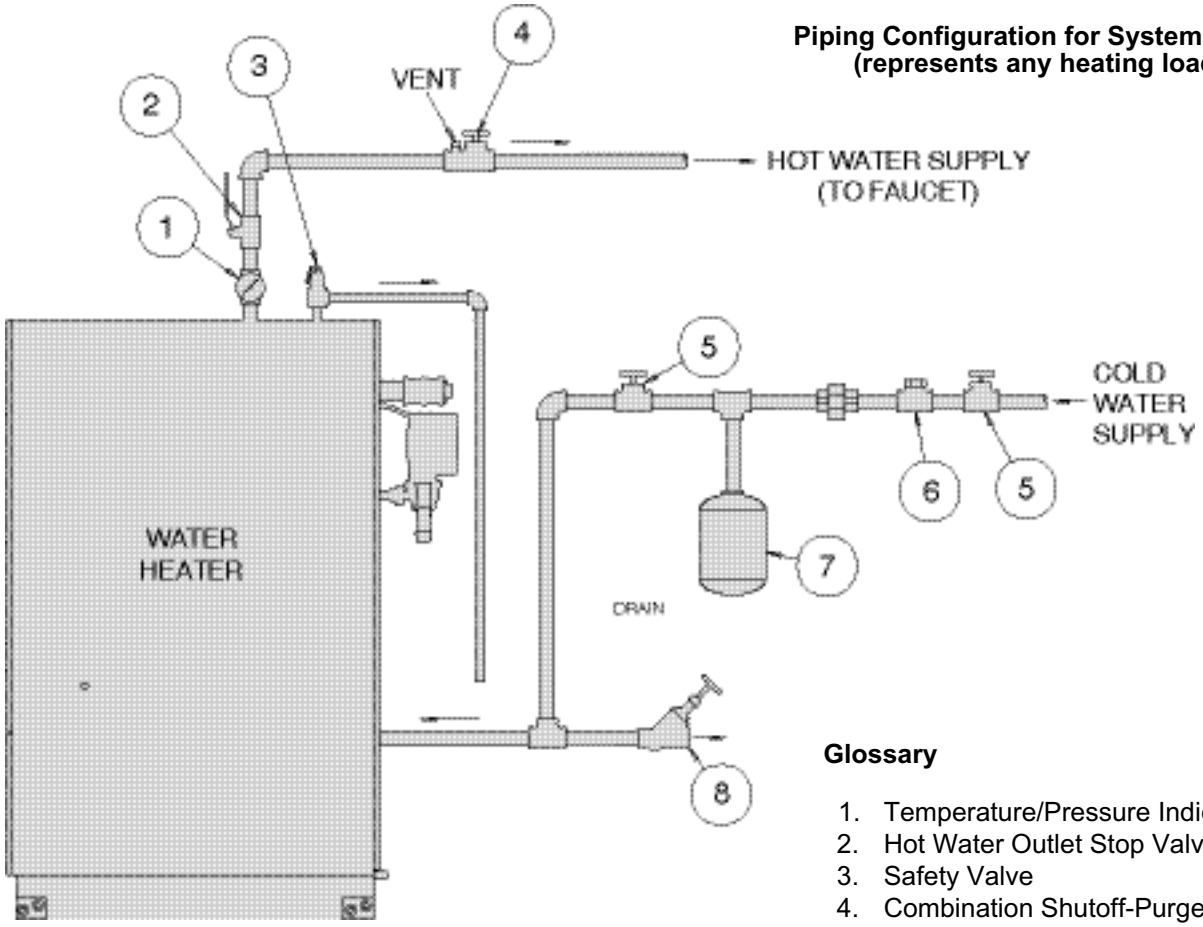
Never leave an opened manual air vent unattended. In the event an opened vent is left unattended, water damage could occur.

f. Visually inspect all pipe joints and equipment connections for leaks. If necessary, drain system, repair leaks and refill/purge the system. If no pressure drop is detected for a period of two hours under pressure, the system may be considered water tight.
g. When purging is completed, make sure the following are open—shutoff valve in cold water fill line, and shutoff valve in return line.
h. Make sure the following are closed--all drain cocks and all manual vents.

2. Open gas shutoff valve, allowing gas to flow to water heater.

Figure 15

Piping Configuration for System Purge (represents any heating load)



Piping Configuration for System Purge (represents any heating load)

Glossary

1. Temperature/Pressure Indicator
2. Hot Water Outlet Stop Valve
3. Safety Valve
4. Combination Shutoff-Purge Valve
5. Stop Valve
6. Check Valve
7. Diaphragm Expansion Tan
8. Drain Valve

Installation

Installation Guidelines

Pipe Material: Fulton recommends stainless steel (300 or 400 series), galvanized steel, or copper piping for potable water systems incorporating a PDWH. Local code requirements may also dictate feasible materials.

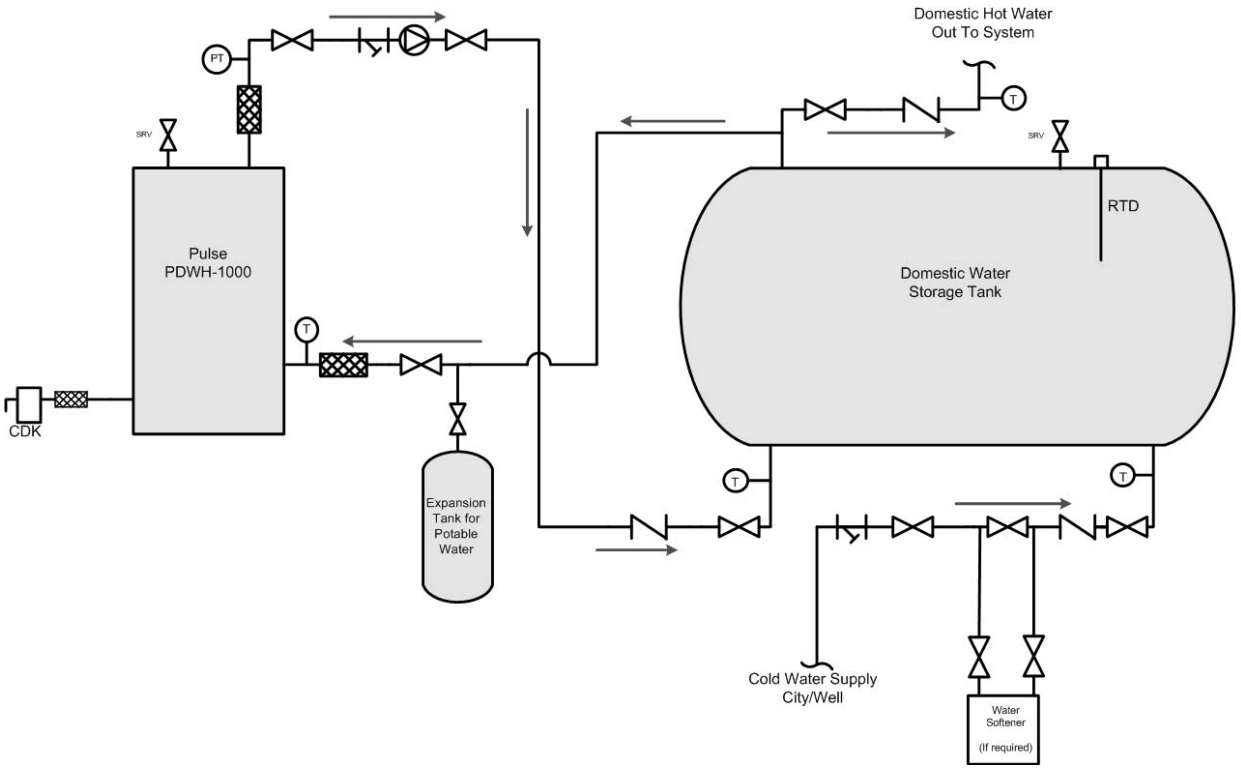
Water Quality: Failure to maintain appropriate water chemistry and quality will void the factory warranty on the heater. Water must be treated if it is not in compliance with the guidelines below.

Hardness: 5-25 grains per gallon
Total Dissolved Solids: < 350ppm
PH: Shall not be aggressive and corrosive
Chlorides: <250 ppm

System Requirements: Each PDWH-1000 must be configured so the temperature differential across the unit should be no greater than 100 degrees F. We recommend to those personnel designing systems with a PDWH incorporate a factor of safety to ensure that the temperature differential will not be greater than 100 degrees F at any operating condition. Failure to remain within this 100 degree temperature differential will void the factory warranty on the water heater.

Example Piping Systems: Typical layout: Single heater piped with storage tank. This is recommended for installations where the user capacity is greater than the output of the heater, or where incoming water from the city or where the difference between inlet and outlet temperature is above 100 degrees F.

If excessive cycling is expected to occur (greater than 1,000 cycles per month), a storage tank system or other custom engineered solution is required. Fulton is not responsible for system designs that cause the unit to excessively cycle or have any parameters that are outside the warranty.



Installation

Installation Checkpoints

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

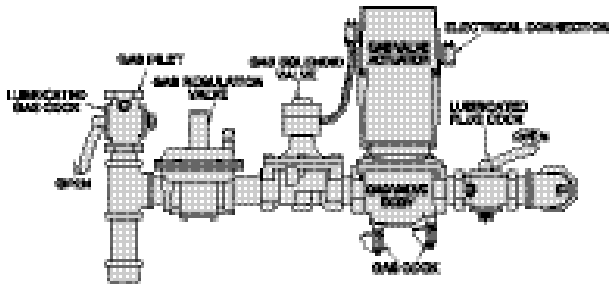
2. Check that the front door of the air decoupler box is closed. Door must be closed before starting the water heater. DO NOT OPEN DURING OPERATION.

3. Adjust temperature to proper set-point.

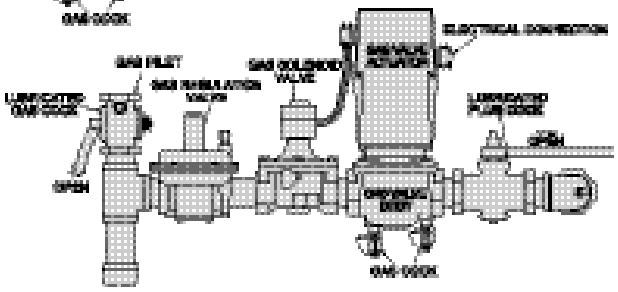
4. Open the manual shut off gas valve.

5. Close the circuit breaker or the fuse disconnect.

6. Turn the on-off switch to "ON"



CGA



Rating The Water heater

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

WARNING

HOTTER WATER CAN SCALD: Water heaters are intended to produce hot water. water heated to a temperature which will satisfy clothes washing, dish washing, and other sanitizing needs can scald and permanently injure you upon contact. Some people are more likely to be permanently injured by hot water than others. These include the elderly, children, the infirm, or physically/mentally handicapped. If anyone using hot water fits into one of these groups or if there is a local code or state law requiring a certain temperature water at the hot water tap, then you must take special precautions. In addition to using the lowest possible temperature setting that satisfies your hot water needs, some type of tempering device, such as a mixing valve, should be used at the hot water taps used by these people or at the hot water heater. Mixing valves are available at plumbing supply or hardware stores. Follow manufacturer's instructions for installation of the valves. Before changing the factory setting on the thermostat, read the "Temperature Regulation" section in this manual.

Testing Ignition Safety Shut Off

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

Measure Gas Flow Rate:

Turn off the water heater and the manual gas shutoff valve. Remove manifold (down-stream) pressure test plug from the 90 degree elbow.

Installation

Figure 16

Figure 16. Replace the plug with a 1/4 N.P.T. to 1/4" compression (or flare) adaptor and a short piece of tubing. Connect one piece of rubber hose from tubing to a manometer. Open the gas shutoff valve (gas cock) and turn on water heater. **The following pressures are for reference only. Depending on the calorific value of the gas, and length of intake and vent piping, the actual pressure can be significantly higher or lower.**

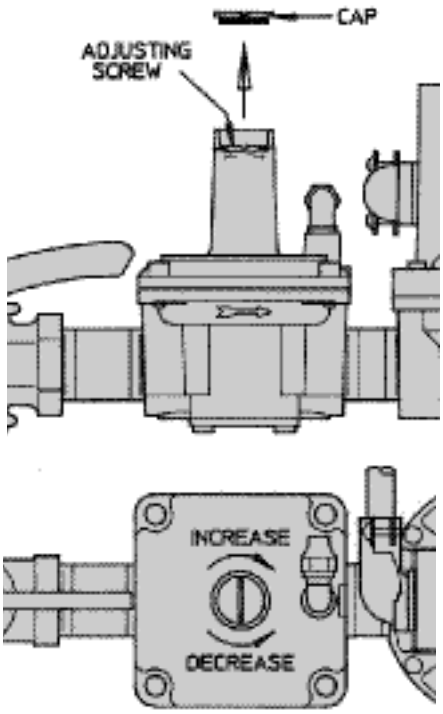


Figure 17

NOTE

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

Pressure for Natural gas should measure 1 to 3" WC at the last elbow on the gas train at high fire, or full rate on on/off units. For more specific information, consult the test fire report which is included in the User Manual. There should be 7" WC at the inlet of the train.
Pressure for propane should be 11" WC at inlet to the gas train.

To Correct Input—Adjust Gas Pressure Regulator

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

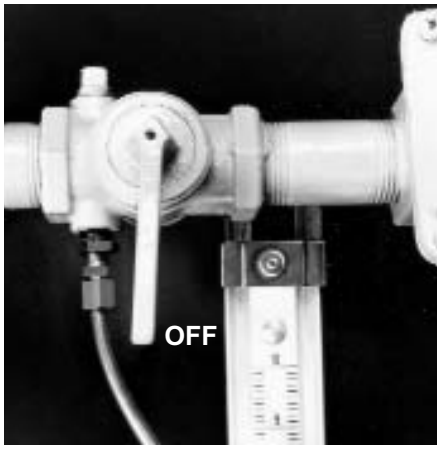
For High Gas Pressure Installations

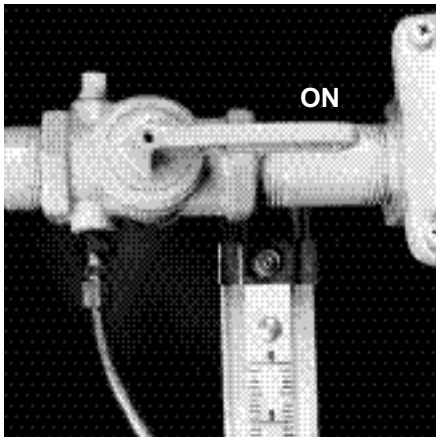
In high gas pressure areas, it is good practice to step the pressure down as described below.

1. Locate the stepdown regulator as far away from the pulse water heater as possible.
2. When stepping down from more than 2 psig to 7" WC, the stepdown should be done in two steps:
a) Reduce the pressure to 2 psig.
b) Reduce the pressure from 2 psig to 7" WC
3. The preferred regulator for this application is the Fisher S Series with lock up capability.
4. Consult your Authorized Fulton Representative for selection.

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

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





To Check for High Gas Pressure

1. The water heater and its individual shut-off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig (3.5 kPa).

2. Turn off water heater 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 one side of manometer.

3. Open gas supply to manual gas shutoff valve and turn on water heater. After combustion starts, manometer should read 7" WC (178mm) minimum for natural gas and 1" WC (25mm) minimum for propane.

4. If reading exceeds 7.0" WC. (178mm) install regulator upstream of gas valve to reduce pressure.

Before Leaving The Installation

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

Make sure installation complies with all applicable codes.

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Section 3 Operation

Operation

Post these instructions in an appropriate place near the water heater and maintain in good legible condition.

WARNING

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

Fulton Pulse water heaters do not have a pilot. They are equipped with an ignition device which automatically lights the water heater. Do not try to light the water heater by hand.

BEFORE OPERATING:

Smell all around the water heater area for gas. Be sure to smell next to the floor as some gas is heavier than air and will settle.

IF YOU SMELL GAS:

Do not light any appliance.
Do not touch any electric switch.
Do not use any phone in your building.
Immediately call your gas supplier from a neighbor's phone, and then follow your gas supplier's instructions. If you cannot reach your gas supplier, call the fire department.
Use only your hand to turn the gas cock knob. Never use tools. If the knob will not turn by hand, don't try to repair it. Call a qualified service technician. FORCE OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.

NOTE

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

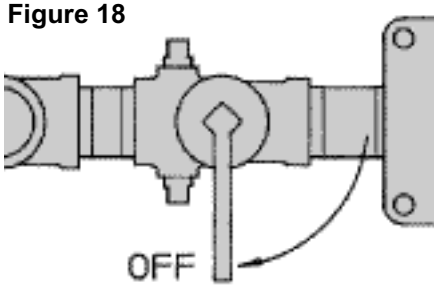
Before operating your Fulton Pulse Water Heater:

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

1.Set the water temperature to desired setting.

2.Turn off all electric power to the water heater.

Figure 18



3.Turn gas cock knob clockwise to "OFF". Figure 18. (This gas cock knob is also the emergency shut-off device.)

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

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

Starting the Fulton Pulse Water Heater

NOTE

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

Open the main gas cock knob counterclockwise 1/4 turn to "ON".

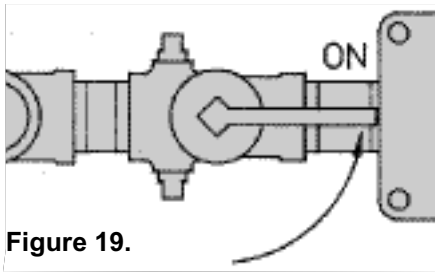
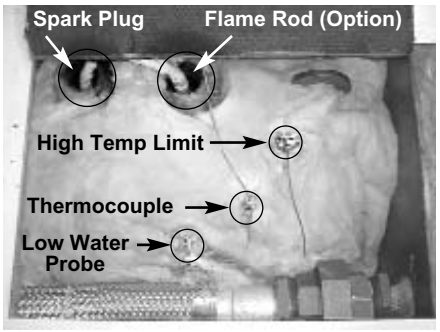


Figure 19.

Turn on all electric power to the water heater. Turn operating switch on water heater to "ON" position. The water heater is energized and the 35 second prepurge begins. After 35 seconds the spark ignitor and gas valves (2 seconds later) are energized. If combustion is not sensed within 4 seconds, gas and spark are de-energized. The control will recycle to prepurge, only if the selected number of retry attempts is not exceeded.

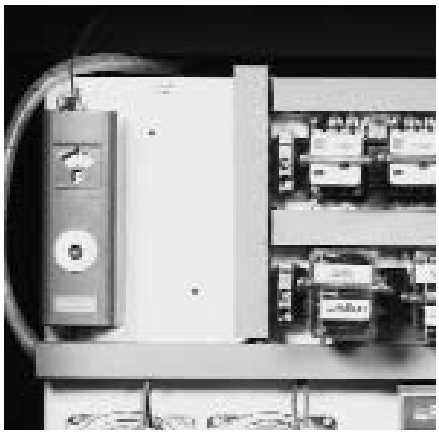


If after 37 seconds the gas valve opens but the water heater does not start, check the spark plug to be sure it is working properly.

The plug may be bad or the plug wire may be loose. Check gap of plug It should be .050" to .060". When replacing plug be sure to use Never Seize on threads of plug.
When the unit fires and pressure is sensed in air valve housing, the unit will continue to operate until main power is shut off to the controller either through the temperature switch or main power switch. Once the pressure is sensed in the air valve housing (proof of flame), the blower and spark will turn off.

Operation

DO NOT CHANGE THE PRESSURE SWITCH SETTINGS.



CAUTION

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

If The Water Heater Does Not Start

Check that the temperature control is set higher than water temperature in the water heater. 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 reset switch. Check for proper water level in the water heater (low water cutoff).

If the water heater still does not operate, follow these instructions to shut off the gas and call your service technician.

Turn off all electric power to the water heater if service is required. Turn gas cock knob clockwise to “OFF” a quarter of a turn. (Figure 18, Page 26)

Emergency Shut Down

1. **Shut off electric power to the water heater.**
2. **Shut off the main gas valve.**

Sequence of Operation

INITIATE

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

Causes for hold conditions in the INITIATE sequence are:

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

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

STANDBY

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

NORMAL START-UP
PREPURGE

The RM7865 provides a PREPURGE timing of 35 seconds with power applied and the RM7865 operating control indicating a call for heat.

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

b. The fan motor output, terminal 5, is powered to start the PREPURGE sequence.

c. The purge fan switch ILK input must close within three seconds to start the 35 second PRE-PURGE; otherwise, lockout occurs.

Operation

IGNITION TRIALS
(Without Flame Rod Option)
a. Combustion Pressure Establishing Period (CPEP):
1. The ignition transformer, terminal 10, is energized two seconds prior to opening of the main fuel valve.

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

Ignition Trials (RM7865B) with Flame Rod Option (Natural Gas Only)
a. Main Flame Establishing period (MFEP)
1. The ignition transformer, terminal 10, is energized for two seconds prior to opening of the main fuel valve.
2. The Main Fuel valve, terminal B, is energized for four seconds. Flame signal must be proven and the Purge Fan switch must be proven Off (open) by the end of the six seconds of MFEP to allow the sequence to continue to the main Flame Stabilization Period. If the flame signal is not proven or the Purge Fan switch is on, the RM7865 will recycle to PREPURGE, if the selected number of retry attempts is not exceeded. If the retry attempts exceed the limit, lockout occurs.

b. Main Flame Stabilization Period (MFSP), The RM7865 enters an eight-second Main Frame Stabilization Period. If the Flame signal is lost or the Purge Fan switch closes during this time, the RM7865 will recycle to PREPURGE, if the selected number of entry attempts is not exceeded. If the retry attempts exceed the limit, lockout occurs,

Run
After the CPSP/MFSP, the RM7865 will enter into the RUN sequence. The RM7865 will remain in RUN until the controller input, terminal 6, opens indicating that the demand is satisfied or that the limit has opened. If the Combustion Pressure Switch Interlock opens(RM7865A) or the flame signal is lost (RM7865B), the RM7865 will enter the POSTPURGE period. The fan motor is de-energized during RUN.

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

Operation

Sequence of Operation for Modulated Pulse Water Heaters

1. When the water heater receives a call for heat, the prepurge cycle is initiated.

2. The mod motor is driven to high fire.

3. After the high fire switch in the mod motor is closed, the prepurge count begins.

4. Following prepurge, the spark generator energizes and the gas valves open.

5. Upon proof of flame, the fan and spark are turned off.

6. At this point, the modulation temperature controller controls the mod motor and firing rate of the water heater.

7. When the water heater outlet temperature reaches set point, the water heater is turned off and prepurge begins.

8. The water heater control then monitors the outlet temperature and waits for the next call for heat.

NOTE

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

Programming Instructions for Yokogawa UT320 Standard Program

1. Hold SET/ENT key until control is in Operator mode. PV display will show **oppa.**

2. Press Down Arrow key until control is in Set Up mode. PV display will show **stup**.

3. Press SET/ENT key <u>twice</u> until control is in Function mode. PV display will show **func.**

4. Press Down Arrow key until control is in Input/Output mode. PV display will show **I/o.**

5. Press SET/ENT key to bring you to the first parameter in the Input/Output mode.

<u>Parameter Setting Procedure:</u> The values for each parameter that are shown in the PV display should match the values entered at the factory. If they differ, press the Up Arrow key or Down Arrow key until the factory value is displayed. Some values, such as High Temperature Range **(rh)**, can be adjusted according to system design. Once the desired value is displayed, press the SET/ENT key to maintain it in the control's memory.

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

NOTE

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

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

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

7. After the Function values have been confirmed or entered, hold the SET/ENT key until the Setpoint Temperature appears in the PV Display.

8. Repeat the last step until the control is in Operator mode. The PV Display will show **oppa**. Repeat Parameter Setting Procedure.

9. When the **PID** parameter appears in the PV Display, press one of the Arrow keys until **(1)** appears in the SP Display, press SET/ENT--this will take you to a subset of parameters. Repeat Parameter Setting Procedure.

10. After confirming or entering the **PID** value **(1.MR)**, the control automatically returns to the remaining Operating parameters. Repeat Parameter Setting Procedure.

11. When finished, hold SET/ENT key to return to Setpoint Temperature. Water heater is ready for operation.

NOTE

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

Worksheets

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

Advanced Programming Features

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

1. Under the Functional Parameters menu, scroll to **HY1** and set the value to 20.

2. When the process temperature is within 10°F of the setpoint temperature, scroll to **AT** in the Operating Parameters menu and set the value to 1.

3. **AT** or Auto-Tune will increase the modulation (mod) motor output to 100% until the process temperature is 2% of input span above setpoint. The output will go to 0% until the process temperature decreases to 2% of input span below setpoint.

4. The control will increase the mod motor again to 100% until the process temperature is 2% of input span above setpoint. During this time the manual mode light on the temperature control will be flashing until completed.

5. If the three samples are not the same, an error message will be displayed and the temperature will drop out of Auto-Tune mode. Reset the zero and span adjustments on the mod motor and/or adjust modulation linkage accordingly.

6. PID values will be set when this procedure is successfully completed.

7. Repeat Step 1 and change the **HY1** value back to 10 (standard).

8. Scroll under Operating Parameters to **SC** (Super Function) and adjust the value to "on". This parameter works with Auto-Tune in calculating the target setpoint.

9. Return to Auto mode.

Operation

Worksheets for Yokogawa UT320/UT350 Temperature Control Program for Pulse Modulating Water Heaters

Input/Output Menu

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

Note: Parameters with bold values only will be used.

Functional Parameters

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

Note: Parameters with bold values only will be used.

Operation

Operating Parameters

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

Note: Parameters with bold values only will be used.

PID Functions

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

Note: Parameters with bold values only will be used.

Operation

Linkage Adjustment for Pulse Modulated Water Heaters

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

Prior to Start-Up

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

Setting High Fire

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

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

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

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

Linkage Relationships

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

Gas Butterfly Valve Side

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

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

Exhaust Butterfly Valve Side

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

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

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

- The gas pressure regulator is the only means for adjusting High Fire input to the factory test fire values.

After the water heater is operated at High Fire to the desired settings, proceed to operate at Low Fire.

Low Fire Settings

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

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

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

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

Procedure to Zero and Span the Modulation Motor

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

1) Turn water heater OFF.

2) Put the temperature control in manual mode (press the A/M key once – the SP display will show a value between 0 and 100).

3) Follow the electrical drawing and remove the connection between (F) and (-) on the mod motor. Disconnect relay CR3 for safety.

4) Contact point 16(+) on the temperature control is wired through CR1 normally closed to contact point (+) on the mod motor.
Contact point 17(-) on the temperature control must be disconnected. Install a jumper from 17(-) to contact point (-) on the mod motor.
This will provide a direct connection between (+) and (-) on the temperature control to (+) and (-) on the mod motor.

5) Refer to the zero and span adjustment information for the mod motor (Pages 5 and 10). Follow steps 1 through 8 on page 10 of the mod motor brochure included in the Pulse Operation and Maintenance manual.

6) Be sure the linkage does not bend or catch in any position during travel.

7) When zero and span are complete, scroll the input rate to 100% - this will drive the burner to high fire and purge any left over combustibles- and adjust the blue cam, if necessary, until the high edge of the cam pushes against the end switch.

8) Remove the jumper and install the wire on contact point 17(+) of the temperature control. Connect relay CR3.

9) Test the mod motor signal by manually setting the output signal from zero (low fire – 4 mA) to 100 (high fire – 20 mA). At high fire, the slot in the shaft of the mod motor should be horizontal in orientation.

NOTE

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

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

Section 4 Maintenance

Maintenance

NOTE

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

At Start-Up

Check air intake and exhaust vent outlet for any blockage or restrictions.

Check for any leaks in exhaust piping.

Check for any leaks in the water piping.

Check the air intake and exhaust vent piping for sagging.

Follow purge procedure outlined in Section 2 of this manual.

Follow start up procedure outlined in Section 3 of this manual.

With the water heater running, check for visible cracks at fittings and joints.

WARNING

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

Check anode and replace as necessary.

NOTE

The anode is crucial to maximizing the life of the water heater.

Recommended Monthly Maintenance

Inspect the air intake and exhaust vent pipes for broken seals at the joints. 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.

Check air intake and exhaust vent outlet for any blockage or restrictions.

Check for any leaks in exhaust piping.

Drain water heater completely and flush to remove any sediment in the tank.

IMPORTANT

Check and record the number of operating cycles. In a properly designed system a heater with modulation should not cycle more than 2,000 times per month. If your water heater is cycling more than 2,000 times per month please contact your local service representative. **Excessive cycling will reduce the life of ANY water heater.**

Recommended Annual Maintenance

1. Change the spark plug.

2. Clean/replace flapper valves.

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 water heater.

NOTE

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

NOTE

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

Maintenance

Troubleshooting

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

Problem	Cause	Check
Starting or Purge Failure	Power Supply	Check fuse or circuit breaker. Reset or replace, as necessary.
	On/Off Switch	For all models check to see if on/off switch is illuminated.
	Bad Air Switch	Try adjusting sensitivity of switch or replace.
	Bad Fan	Check fan for operation. Replace if necessary.
	Flame Rod (Option)	Check for carbon buildup, cracks in porcelin.
	Main Control	Check for bad ground, or bad control. Replace control.
	Plugged Air Inlet	Check for blockage of air inlet line and remove.
	Spark Plug	Check for carbon build up, moisture, cracks in porcelain. Check for proper gap (.050" to .060" for Champion sparkplug). Clean or replace as necessary.
	Loose Wire Connection	Check connections to all components.
	Temperature Control	Check that the operating temperature control is set higher than temperature of the water heater 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 if necessary.
	Proof of Flame Switch	Check adjustment of pressure switch No. 2. It should be set at 1.5" W.C. Replace if necessary.
	Flame Rod (Option)	Check for carbon buildup, cracks in porcelin.
	Loose Wire Connection	Check connections to all components.
	Air Flappers	Check to see if the flappers on the air valve plate are placed correctly (covering the holes).
	Gas Flappers	Check to see if the flappers on the gas valve plate are placed correctly (covering the holes).
	Plugged Exhaust Line	Check for a blockage of the exhaust piping and remove.
	In All Cases:	**Reset main control in 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 of air inlet line and remove.

Maintenance

Troubleshooting--Fault Code Diagnosis

Fault Code	System Failure	Recommended Troubleshooting
Fault 02 *AC Frequen/Noise*	Excess noise or device running on slow AC.	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3. Check the 7800 power supply to assure that both frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 03 *AC Line Dropout*	AC Line dropout detected.	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3. Check the 7800 power supply to assure that both frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 04 *AC Frequency*	Device running on fast AC.	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3. Check the 7800 power supply to assure that both frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 05 *Low Line Voltage*	Low AC line detected.	1. Check the relay module and display module connections. 2. Reset and sequence the 7800. 3. Check the 7800 power supply to assure that both frequency and voltage meet specifications. 4. Check the backup power supply as appropriate.
Fault 32 *Airflow Switch*	Combustion airflow interlock fault.	1. Check wiring--correct any errors. 2. Inspect the fan, assure that there is no blockage of the air intake and that it is supplying air. 3. Assure that the Airflow Interlock switches are functioning properly and that their contacts are free from contaminants. 4. Reset and sequence the 7800 to Prepurge. Measure the voltage between terminal 7 and G (ground). 120 Vac should be present.
Fault 47 *Jumpers Changed*	The configuration jumpers differ from the sample taken at startup.	1. Inspect the jumper connections. Assure that clipped jumpers have been completely removed. 2. Reset and sequence the 7800. 3. If fault persists, replace the relay module.
Fault 54 *Comb. Pressure*	Combustion pressure switch fault	1. Check wiring; correct any errors. 2. Inspect the Combustion Pressure Switch to assure that it is functioning properly. 3. Reset and sequence the 7865.During standby or prepurge, measure the voltage between terminal 20 and G (ground). 120 Vac should be present. If not, the combustion pressure switch may be defective and need replacement. 4. If fault persists, replace the relay module.
Fault 55 *Purge Fan Sw. On*	Purge fan switch is on when it should be off.	1. Check wiring; correct any errors. 2. Inspect the Purge Fan Switch terminal 18 and connections. Assure that the switch is functioning correctly and is not jumpered or welded. 3. Reset and sequence the 7865. 4. If the fault persists, replace the relay module.
Fault 57 *Purge Fan Sw. Off*	Purge fan switch is off when it should be on.	1. Inspect the Purge Fan Switch terminal 18 and connections. Assure that the switch is functioning correctly. 2. Reset and sequence the 7865. 3. If the fault persists, replace the relay module.
Faults 105-127	Call Service.	1. Replace 7865 controller.

Section 5 Parts and Warranty

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Replacement Parts (available from authorized Fulton Representatives)

Part Number	Description	Models PDWH 750	1000
2-30-000232	Air switch-purge fan	x	x
2-30-001334	Air switch-proof of flame	x	x
2-12-000551	Air flapper gaskets	x	x
Air Flapper Spacers and Valve Assemblies*			
7-37-000124	Air flapper valve assy w/o housing	x	
7-37-000123	Air flapper valve assy w/o housing		x
2-40-000251	Aquastat-operating temp.	x	x
2-40-000250	Aquastat-high limit-m/r	x	x
2-40-000220	Gas valve actuator w/P.O.C. (IRI)	x	x
2-40-000214	Gas valve actuator (CSD-1)	x	x
2-30-000310	Gas valve—1” body	x	
2-30-000311	Gas valve—1-1/4” body		x
2-30-000306	Gas solenoid valve-1”	x	
2-30-000307	Gas solenoid valve- 1-1/4”		x
2-30-000750	Gas pressure regulator-1” RV61	x	
2-30-000105	Gas pressure regulator-1-1/4” RV61		x
7-37-000201	Gas flapper valve assy	x	x
2-12-000552	Gas flapper gaskets	x	x
2-35-000687	Gas decoupler compression ell	x	x
Gas Orifices--Call local representataive for specific orifice.			
2-30-000201	Pres.Temp.Gauge 0-320 0F 0-75PSIG	x	x
2-30-000203	Pres.Temp.Gauge 0-3200F 0-200PSIG	x	x
2-30-000445	Purge blower motor/fan	x	x
2-40-000271	RM7865A Programmer	x	x
2-40-001010	RM7865B Programmer (Flame Rod)	x	x
2-40-000268	Amplifier for RM7865B	x	x
2-40-000270	Base for RM7865	x	x
2-40-000272	Display Module for 7865	x	x
2-30-000285	T&P Safety valve 3/4” x 1” 150#		x
2-20-000090	Spark plug	x	x
2-40-000980	Spark plug wire	x	x
2-40-001011	Flame Rod	x	x
5-11-400090	Spark plug bushing	x	x
2-40-000082	Spark generator	x	x
2-45-000101	Terminal block	x	x
2-40-000131	Ice cube relay	x	x
2-40-000096	Base for ice cube relay	x	x
2-40-000421	Low water safety relay	x	x
2-40-000423	Base for LWCO relay	x	x
2-12-000090	Retainer spring for LWCO relay	x	x
2-45-000304	Remote/off/local switch light 3 position	x	x
2-45-000307	On/off switch light - green	x	x
2-45-000305	Low water reset push button light - red	x	x
2-45-000411	Flame failure light-red	x	x
2-45-000412	Call for heat light - green	x	
2-45-000203	Light bulb only	x	x
2-45-000306	Flame failure light	x	x
2-40-000153	Time Delay Relay (Flame Rod)	x	x
2-20-000047	Spark Plug Boot	x	x
2-45-001200	Spark Plug Connector	x	x

Replacement Parts (available from authorized Fulton Representatives)

Part Number	Description	Models PDWH 750	1000
Accessories			
2-45-000212	H-O-A Switch	x	x
5-60-000130	Instruction Manual	x	x
4-57-000440	Condensate drain kit	x	x
2-10-000168	Condensate drain float assembly	x	x
2-35-000863	Isolation cube	x	x
2-35-000865	Isolation spring-grey	x	x
2-35-000611	Seismic iso spring	x	x
2-35-000861	2" x 14" flex cont.-water	x	
2-35-000862	2-1/2" x 16" flex cont.		x
2-35-000531	1" gas flex cont.	x	
2-35-000532	1-1/4" gas flex cont.		x
2-30-000498	FS 43 MM Flow switch	x	x
2-45-000040	Knockout cover	x	x
2-23-000170	Paint-Tech Tan spray-4 oz.	x	x
4-23-000016	Paint-Tech Tan -quart	x	x
2-35-000799	PVC Air-intake adaptor - 4"	x	x
5-10-002765	4" S.S. muffler-intake	x	x
5-10-002755	4" S.S. muffler-exhaust	x	x
2-35-000059	4" flex connector-intake	x	x
4-57-000168	4" PVC term. w/screen-coupling	x	x
4-57-000164	4" PVC term. w/screen 45 deg. elbow	x	x
4-57-000170	4" PVC term. w/screen-90 deg. elbow	x	x

*Air flapper spacers, air flapper valve assemblies, and gas orifices must be requested by contacting your authorized Fulton representative. Please advise serial number on purchase order or quote request.

Replacement Parts (available from authorized Fulton Representatives)

Part Number	Vent Material - 4" Single Wall Stainless Steel
2-35-000987	Roof sup/jack assy-5480C1
2-35-000812	Vent termination-5490C1
2-35-000571	4” Pulse adapter-7401FUL
2-35-000810	3” x 4” increaser-7374GC
2-35-000583	4” x 3” decreaser-7473
2-35-000983	Rain cap-7400GC
2-35-000980	4” x 6” vent-7401GC
2-35-000981	4” x 12” vent-7402GC
2-35-000582	4” x 18” vent-7404GC
2-35-000573	4” x 24” vent-7405GC
2-35-000982	4” x 36” vent-7407GC
2-35-000574	4” x 48” vent-7408GC
2-35-000575	4” 45° elbow-7411GC
2-35-000576	4” 90° elbow-7414GC
2-35-000577	4” vent tee-7416GCD
2-35-000962	4” boot-tee-7416GCB
2-35-000960	4” drain cover-7417GCD
2-35-000985	4” support clamp-7423GC
2-35-000572	4” x18” adjustable-7424GC
2-35-000984	4” strm/spt collar-7426GC
2-35-000961	4” boot tee w/3” take-off-7443GCB
2-35-000813	4” horizontal termination-7490GC
2-35-000986	16” x 16” cover plate-7473GC
2-35-000971	3” Rain cap-7300GC
2-35-000811	3” Pulse adapter-7301FUL
2-35-000972	3” x 6” vent-7301GC
2-35-000973	3” x 12” vent-7302GC
2-35-000974	3” x 18” vent-7304GC
2-35-000975	3” x 24” vent-7305GC
2-35-000976	3” x 36” vent-7307GC
2-35-000977	3” x 48” vent-7308GC
2-35-000991	3” 45 deg. elbow-7311GC
2-35-000992	3” 90 deg. elbow-7314GC
2-35-000993	3” vent tee-7316GC
2-35-000994	3” vent boot tee-7316GCB
2-35-000995	3” vent tee cover w/drain 7317GCD
2-35-000997	3” x 18” adjustable-7324GC
2-35-000998	3” horizontal termination-7390GC
2-35-000996	3” horizontal support-7323GC
2-60-000114	Hi temp. sealant-10 oz.
2-Misc	7000RTV Sealant-5 oz.
2-Misc	7000RTVL Sealant-10 oz.

*Contact Fulton for 6” venting material
Any venting material must be listed by a recognized testing agency

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Warranty

Standard Warranty for Fulton Pulse Domestic Boilers

Warranty Valid for Models PDWH

Ten (10) Year 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 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.

Five (5) Year (60 Month) Material and Workmanship Warranty
The pressure vessel is covered against defective material or workmanship for a period of five (5) years from the date of shipment from the factory. Fulton will repair or replace F.O.B. factory any part of the equipment, as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with approved practices and recommendations made by Fulton. The commissioning agency must also successfully complete and return the equipment Installation and Operation Checklists to Fulton's Quality Assurance department. This warranty covers any failure caused defective material or workmanship; however, waterside corrosion or scaling is not covered. Therefore, it is imperative that the boiler be installed as outlined in the Installation and Operation Manual.

Five (5) Year (60 Month) Prorated Flue Gas Condensation Corrosion Warranty
The pressure vessel, combustor and exhaust pipes are covered against corrosion form flue gas condensation for a period of five (5) years according to the schedule below. This warranty covers nay failure caused by flue gas corrosion, however, water-side corrosion, scaling, or excessive cycling is not covered.

Year	Prorated Schedule
0-3	100%
4	70%
5	40%

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.

Fulton®

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A global manufacturer of steam, hot water and thermal fluid heat transfer products.

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