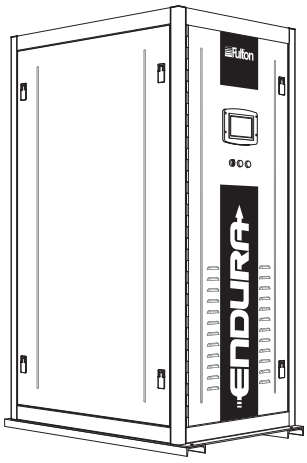
INSTALLATION AND OPERATION MANUAL

Endura (EDR)

Condensing Hydronic Boilers
1,000,000 - 2,000,000 BTU/HR



Serial/ National Board Number _____

Model _____

Fulton Order _____

Sold To _____

Job Name _____

Date _____

EDR-IOM-2014-0318

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Overview

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

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

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

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

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

Warnings & Cautions

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

- WARNINGS must be observed to prevent serious injury or death to personnel.
- CAUTIONS must be observed to prevent damage or destruction of equipment or loss of operating effectiveness.

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

Disclaimers and Local Codes

Installation of the equipment shall conform to all the requirements or all national, state and local codes established by the authorities having jurisdiction or, in the absence of such requirements, in the US to the National Fuel Gas Code ANSI Z223.1/NFPA 54 latest edition, and the specific instructions in this manual. Authorities having jurisdiction should be consulted prior to installation.

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

The boiler heat exchanger is manufactured and stamped in accordance with ASME Boiler and Pressure Vessel Code, Section IV for a maximum allowable working pressure and operating temperature of 160 psig and 210 F (99 C) respectively.

⚠ WARNING

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

⚠ CAUTION

This boiler is certified for indoor installation only. This boiler may not be field retrofitted.

This boiler is not designed for use in systems where water is continuously replenished. The warranty is valid for closed loop systems only.

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

Product Overview

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

The Fulton Endura hot water boiler is an automatic, fuel-fired, ultra high-efficiency boiler. The boiler can either be of the sealed combustion/direct vent type or utilize conventional combustion air intake and flue methods.

The boiler is capable of sidewall venting when the appropriate venting materials are used, and when permitted by local code requirements.

The Fulton Endura boiler is ETL-certified to Underwriters Laboratories (UL) Edition 7 UL Standard for Safety Commercial-Industrial Gas Heating Equipment, and bears the H stamp. The boiler heat exchanger is manufactured and stamped in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Section IV for a maximum allowable working pressure and temperature of 160 psi and 210 F (99 C) respectively. All Endura boilers are hydrostatically tested, test fired and shipped as a complete packaged unit.

Fuel, water and electrical connections are similar to other boilers of this type.

Please be aware of which burner and control configuration has been designed specifically for your application.

This Endura boiler is to be installed as part of a hydronic heating system. A qualified engineer must be consulted for the selection of the equipment and components of the heating system. Various system conditions can result in incorrect heat distribution to users of the heating system.

Each Endura Boiler is supplied with the following:

- Integrated combustion supervision and temperature operating control
- Operating and high temperature probe(s) in pressure vessel
- Low water probe(s) in pressure vessel
- ASME safety relief valve
- Installation and Operation Manual
- Test fire report
- Wiring diagram
- Temperature and pressure (T&P) gauge
- 1 can touch up paint

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

Placement & Rigging

Proper placement of your Fulton product is essential. Attention paid to the following points will save a great deal of difficulty in the future. Correct placement is the first step to trouble-free installation, operation, and maintenance.

Adhere to the following for placement and rigging:

1. Check building specifications for permissible floor loading. Use Table 1 for unit reference.
2. Conform to all the requirements of all national, state and local codes established by the authorities having jurisdiction and/or the U.S. to the National Fuel Gas Code, latest edition. Authorities having jurisdiction should be consulted before installations are made. Where required by local codes, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers (ASME CSD-1).
3. Since an external electrical source is utilized, the boiler, when installed, must be electrically ground in accordance with the National Electric Code, American National Standards Institute (ANSI) National Fire Protection Association (NFPA) 70, latest edition.
4. Standard Endura boilers are certified for indoor installation only.
5. Install so that all system components are protected from water (dripping, spraying, rain, etc.) and debris (dry wall dust, insulation particles, etc.) during boiler operation and service.
6. Install on a level, non-combustible surface in the vertical position. Concrete is strongly recommended. The surface must be elevated a minimum of 4" (102 mm) above the floor.
7. Provide combustion and ventilation air in accordance with applicable provisions of local building codes or: USA – NFPA 54/ANSI Z223.1, Section 5.3, Air for Combustion and Ventilation.
8. Locate the boiler so that the air supply and exhaust piping between the boiler and outside wall/roof are within the maximum lengths for horizontal or vertical venting if sealed combustion will be used. See **Clearances and Serviceability section** of this manual.

Clearances and Serviceability

Adhere to the following for clearances and serviceability:

1. All local and national codes (NFPA, ANSI, UL, CSA, ASME) must be followed for proper clearances and serviceability for your boiler or heater. Authorities having jurisdiction should be consulted before installations are made.
2. Appropriate front, back, side and top clearances must be maintained

⚠ WARNING

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

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

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

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

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

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

⚠ CAUTION

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

Do not use to directly heat swimming pool.

TABLE 1 - BOILER DIMENSIONS AND OPERATING REQUIREMENTS

MODEL EDR		1000	1500	2000
Input Million	BTU/Hr	1.0	1.5	2.0
	kW	293	411	549
Fuel Cons. @ rated cap. (Nat. Gas)				
	FT3/Hr	1000	1500	2000
	M3/Hr	28.32	42.5	56.7
Output at AHRI Test Condition				
	BHP	28.4	41.9	56
	KCal/h	239,396	353,424	472,240
Electrical Req. (Amps)* 120V, 60Hz, 1 Phase		10	20	20
Water Content	Gal	50	104	102
	Liters	189	394	386
Dry Weight	LBS	1430	2260	2360
	KG	649	1025	1071
Operating Weight	LBS	1848	3128	3210
	KG	838	1419	1456

MODEL EDR		1000	1500	2000
A. Boiler Width	IN	28	33.9	33.9
	CM	72	86	86
B. Overall Boiler Height	IN	68	80	80
	CM	172.7	203.2	203.2
C. Overall Boiler Depth	IN	49.75	60.6	60.6
	CM	126.4	153.8	153.8
D. Flue Outlet Diameter	IN	6	6	8
	CM	15.2	15.2	15.2
E. Water Inlet/Outlet Diameter	IN	2	4	4
	CM	5.08	10.2	10.2
F. Min. Clearance (top)	IN	18	18	18
	CM	46	46	46
G. Air Inlet Diameter (top access)	IN	6	8	8
	CM	15.25	20.3	20.3
Min. Clearance (sides)	IN	1	1	1
	CM	2.5	2.5	2.5

Alternate gas pressure arrangements may apply. Please verify gas pressure ratings for your boiler by viewing the boiler name plate.

Typical 120 VAC controls allow for a +10% and a -15% voltage fluctuation. Voltages lower than 120 V can result in slightly decreased available output.

*Standard configurations. Alternate voltages may be available as an option; please consult factory.

Note: All dimensions are approximate and are subject to change without notice.

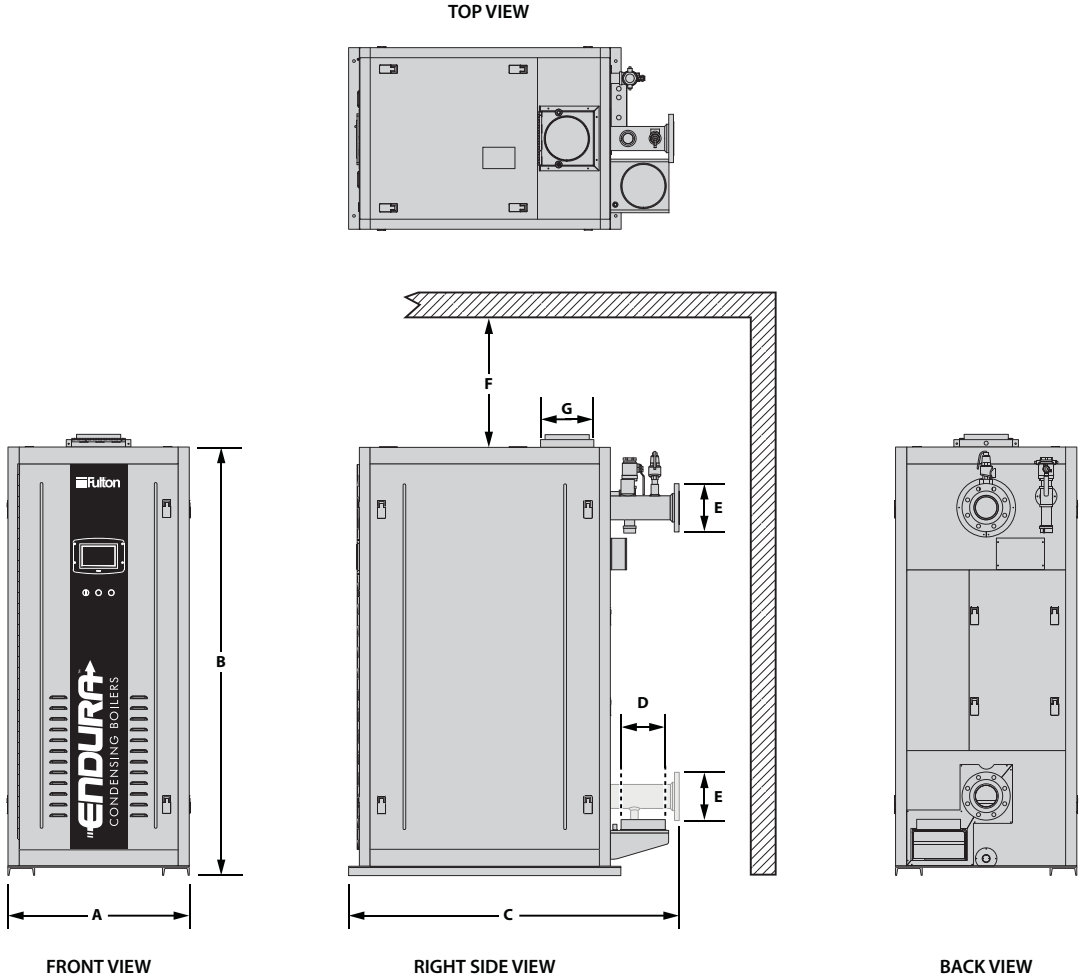

FIGURE 1 - VIEWS OF ENDURA HYDRONIC BOILER

(Figure 1). This will allow access around the equipment to facilitate maintenance and a safe work environment. An 1 inch (25.4 mm) side clearance is acceptable between any number of boilers. Custom configurations may not allow 1 inch (25.4 mm) side clearance. Although a 1 inch (25.4 mm) side clearance is permitted, allowing 24 inches (610 mm) will facilitate and expedite maintenance and any advanced troubleshooting.

➨ ***NOTE: Side panels are latched; however, maintenance and service does not require boiler access through side panels. All maintenance and service can be performed from front, rear, and top of boiler.***

3. Ensure all labels on the boiler will be fully visible for maintenance and inspection.
4. Do not place any boiler room accessories, or other components, on the Endura skid.

Install Boiler Trim

Each Endura boiler is supplied with a safety relief valve sized in accordance with ASME requirements. Adhere to the following installation requirements:

1. The safety relief valve (Figure 2) must:
   - » Be connected to the coupling located in the top of the boiler.
   - » Be installed in the vertical position.

➨ ***NOTE: Safety relief valve size is determined by trim pressure and is supplied in the trim kit along with appropriate bushing, inlet and outlet sizes. See Table 2. Standard trim pressure is 60 PSIG.***

2. The discharge pipe must:
   - » Not have a diameter less than the full area of the valve outlet.
   - » Be as short and straight as possible and so arranged as to avoid undue stress on the valve.
   - » Be supported by means other than the safety valve itself.
   - » Be piped to avoid danger of scalding personnel.

➨ ***NOTE: Each boiler is equipped with a pressure-temperature gauge to be installed in the outlet piping section of the boiler. Gauge must not be isolated from the boiler by any valve.***

TABLE 2 - SAFETY RELIEF VALVE INLET AND OUTLET SIZES

Model	Trim Pressure PSI (kPa)	Inlet Size inch (mm)	Outlet Size inch (mm)
EDR-1000	30 (206.84) through 160 (1103.16)	3/4 (19.05)	1 (25.4)
EDR-1500	30 (206.84)	1 (25.4)	1 1/4 (31.75)
	60 (413.69)	3/4 (19.05)	1 (25.4)
	100 (689.48)	3/4 (19.05)	1 (25.4)
	125 (861.84)	3/4 (19.05)	1 (25.4)
	160 (1103.16)	3/4 (19.05)	1 (25.4)
EDR-2000	30 (206.84)	1 1/4 (31.75)	1 1/2 (38.1)
	60 (413.69)	1 (25.4)	1 1/4 (31.75)
	100 (689.48)	3/4 (19.05)	1 (25.4)
	125 (861.84)	3/4 (19.05)	1 (25.4)
	160 (1103.16)	3/4 (19.05)	1 (25.4)

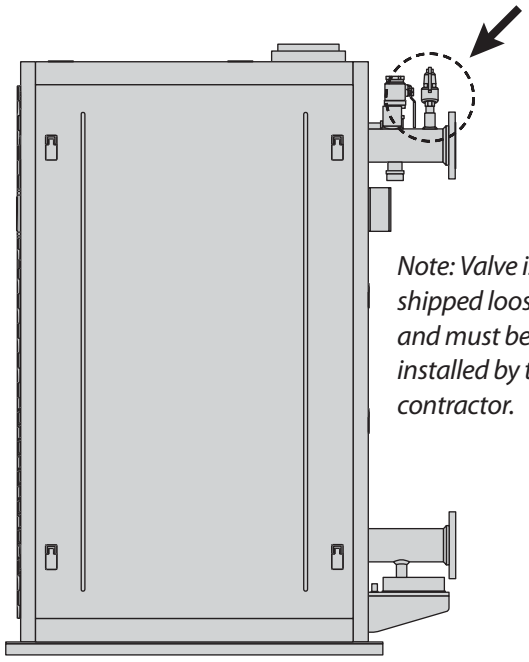

FIGURE 2 - SAFETY VALVE LOCATION

⚠ WARNING

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

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

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

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

Install Water Piping

All water supplies contain some solids, dissolved gases or dissolved minerals. These may cause corrosion, deposition and/or fouling of equipment. To prevent these contaminants from impacting boiler performance, valve operation and general pipe longevity, each location must be analyzed and treated accordingly.

Adhere to the following for water piping installation (See Figure 3):

1. Isolation valves are recommended on both water connections for ease of service.
2. Install piping so that the boiler is not supporting any additional piping.
3. Install manual purging valves in all loops and zones. Install a pressure-reducing (automatic fill) valve in the cold water fill line to the boiler system. Check that the proposed operation of zone valves, zone circulator(s) and diverting valves will not isolate air separator(s) and/ or expansion tank(s) from the boiler. Clearance from hot water pipes to combustibles must be at least 6 inches (152 mm).
4. When used in conjunction with a refrigeration system, install the boiler so that the chilled medium is piped in parallel with the boiler with appropriate valves to prevent the chilled medium from entering the boiler. If the boilers are connected to heating coils (located in air handling units where they may be exposed to refrigerated air circulation) such boiler piping systems must be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.
5. Include the following in the mechanical equipment in the hydronic heating system:
    - » *An automatic pressure activated water make up valve with back flow preventer.* It must be set to maintain required Net Positive Suction Head (NPSH) for re-circulating pumps, a positive system pressure at the highest point of at least 5-10 PSIG, and make up water valve should be designed to add water to the system at the outlet of the boiler and should not be fed directly into the boiler.
    - » *Air removal equipment, including an air separator and automatic breather valves, along with a functioning expansion tank* . Each must be designed to system specifications.

➨ ***NOTE: The upper water connection on the back of the boiler is the outlet connection. The lower water connection on the rear of the boiler is the inlet connection.***

➨ ***NOTE: The Fulton Endura boiler does not require a primary/secondary flow piping system. Although primary/secondary is an acceptable configuration, the boiler does not have a minimum return water temperature requirement and the heat exchanger will not be harmed by low flow or zero flow conditions. See Figure 3 for a sample piping layout.***

6. Install filtration to remove particulates if appropriate. A #10 mesh size is suggested.
7. Install bypass chemical feeder for corrosion inhibitor maintenance if appropriate.
8. Install corrosion coupon holder to assess corrosion inhibitor performance if appropriate.
9. Before installing a Endura boiler into a hydronic loop, be sure that the system piping and any other components of the system are clean and free of debris and any foreign matter. The hydronic system must be completely flushed prior to installing the boiler itself.

➨ ***NOTE: Although motorized isolation valves are not required in a primary only arrangement , they can help ensure system effectiveness. Proper control strategy must be used to ensure flow paths in the hydronic loop and residual heat in pressure vessel can be adequately dispersed when a boiler is disabled.***

Meet Water Chemistry Requirements

System water chemistry requirements are as follows:

- pH: Range of 8.5 - 10.5
- Oxygen: Less than 250 ppb (operating condition)
- Total Iron/Copper: Less than 5 ppm
- Corrosion Inhibitor: Capable of maintaining iron corrosion rates <2 mpy. Due to changing environmental restrictions a non-heavy metal ALL ORGANIC inhibitor is recommended which is designed for multi metal systems including ferrous metals and yellow metals such as copper and brass.
- Chloride: Less than 200 ppm

Adhere to the following:

1. Refer to your water conditioning or chemical treatment supplier for analysis and recommendations for proper system conditions.
2. Follow a program with appropriate monitoring and maintenance of system water conditions as provided by your water conditioning or chemical treatment supplier.
3. If RO/DI water is used as a source for hydronic loop water or makeup water, it must be neutralized to a pH of 8.5 - 10.5 prior to entering the boiler. Failure to neutralize the RO/DI water will void the pressure vessel warranty and may cause high general corrosion rates.
   - The system must have an automatic pH controller to monitor and log the levels. This must be independent of other chemical feed systems.

⚠ WARNING

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

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

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

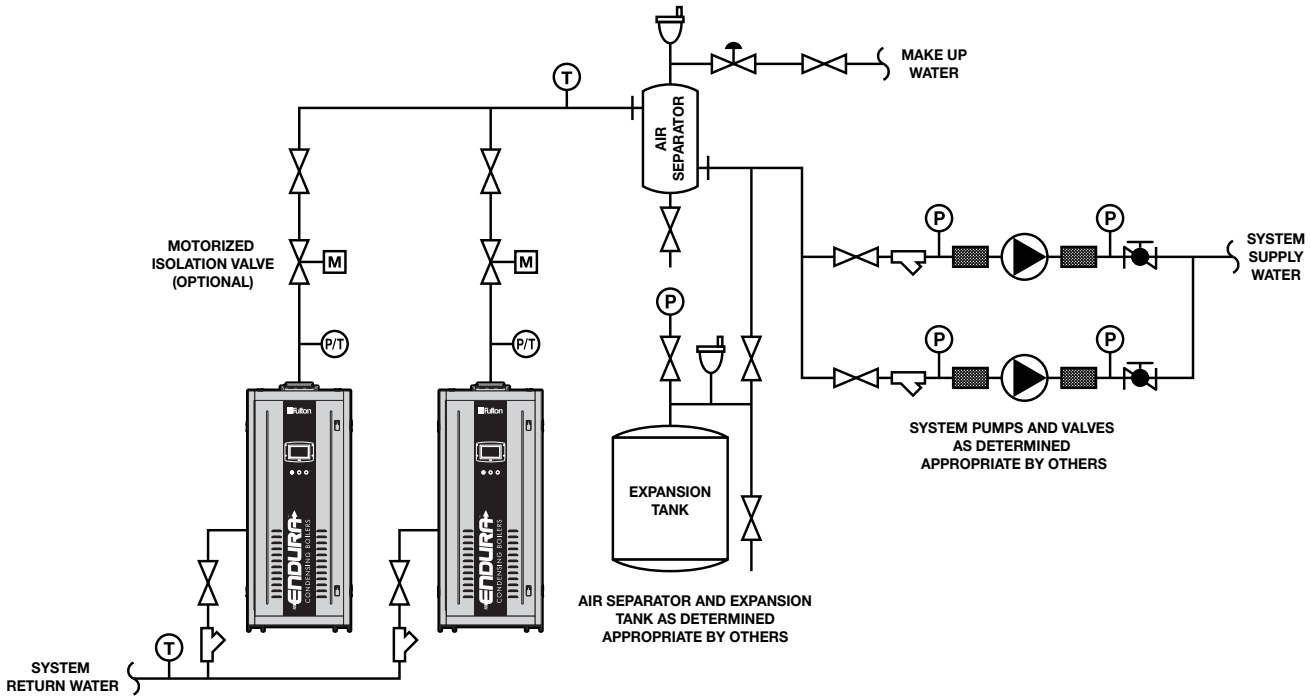


FIGURE 3 - SAMPLE PIPING LAYOUT

Note: Sample piping layout (P&ID) is a general representation of system installation. Good practice should be used in system design, including but not limited to adequate pipe/valve sizing and natural flow path for system water.

- Makeup water pH range must be 7.5 - 8.8; the boiler water must be maintained within pH range of 8.5 - 10.5.

4. Operate the boiler in a closed-loop system using water or water/glycol (not requiring a make-up water supply). A large amount of improperly treated make-up water can cause premature failure of the heat exchanger resulting from scale build up. Scale build up will reduce the efficiency and useful life of the boiler and is not covered under warranty.
5. For freeze protection an inhibited propylene glycol is recommended. Only use mixtures formulated for hydronic systems. Do not use automotive glycol.
6. At a minimum, the hydronic fluid should be checked for glycol concentration and pH once a year.

■ Prevent Oxygen Contamination

There are several ways to prevent boiler water oxygen contamination:

- Minimize system leaks to minimize make up water requirement
- Do not use open tanks or fittings
- Do not use oxygen permeable materials anywhere in the water system
- Repair leaks in the system quickly
- Eliminate fittings wherever possible
- Use air elimination devices in system piping

■ Eliminate System Air

➨ ***NOTE: There are no built-in boiler air eliminating features.***

Adhere to the following for air elimination:

1. The installation of an air separator and air eliminator (air vent) is required.
2. To prevent scale corrosion in boiler and associated piping, make up water must be kept to a minimum. This is best achieved by ensuring immediate repair of all leaks and that system pressure is maintained.
3. If a sealed diaphragm-type expansion tank is used, install an air eliminator in the hot water piping at the air separator.
4. If an air cushion type expansion tank is used, pipe tank directly into boiler supply.
5. On multi-zoned systems (or a system with both space and domestic water heating), air elimination must be provided either in the common piping or on every loop.
6. When the boiler is installed at a higher level than baseboard radiation (if used), air elimination must be provided directly above the unit.

Fill the Boiler With Water

To be sure that the boiler is not air-bound, open the pressure-relief valve located at the rear of the boiler. Leave the relief valve open until a steady flow of water is observed. Close the valve and finish filling the system.

Install Gas Piping

The Endura boiler is factory test fired and combustion is adjusted per the boiler data plate and test fire sheet.

The gas train components are configured to operate at specific gas pressure requirements. The specific requirements for each boiler are called out on the boiler nameplate, located on the back of the boiler.

Adhere to the following for gas piping installation:

1. See Table 3 for required natural gas pipe size, based on overall length of pipe from the meter plus equivalent length of all fittings. Approximate sizing may be based on 1,020 BTU for 1 cubic foot of natural gas.
2. Piping must be installed such that no piping stresses are transmitted to the boiler. The boiler cannot be used as a pipe anchor.
3. The boiler and all gas piping connections must be pressure-tested and checked for leaks before being placed into service. Test with compressed air or inert gas if possible.
4. The boiler must be disconnected at the boiler manual shutoff valve

⚠ CAUTION

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

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

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

⚠ WARNING

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

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

⚠ CAUTION

Some soap used for leak testing is corrosive to certain types of metals. Clean all piping thoroughly after completing the leak check.

(located at the end of the supplied gas train) from the gas supply piping system during any pressure testing of the system at pressures in excess of 2.0 psig (55 inch W.C.).

5. Gas Piping must be installed in accordance with National Fuel Gas Code, ANSI Z223.1 1991 or latest addenda and any other local codes, which may apply.
6. The pipe and the fittings used must be new and free of dirt or other deposits.
7. Piping must be of the proper size to ensure adequate gas supply. A drip leg and union connection must be installed upstream of the gas safety shut off valves and must be a 5 inch (127 mm) minimum length.
8. Connect gas supply line to the open end of the tee on which the drip leg is installed.
9. When making gas-piping joints, use a sealing compound resistant to liquefied petroleum gases. Do not use Teflon tape on gas line threads.
10. 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.
11. The boiler must be disconnected at the boiler shut off valve from the gas supply piping system during any pressure testing of the system.

➨ ***NOTE: In cases where a vent line connection must be used on the gas pressure regulator must be piped to outdoor air by the installer in accordance with the National Fuel Gas Code, ANSI Z223.1-1991 or latest addenda. In Canada gas installations must by in accordance with the current CAN/CSA B149.1 and 2 and/or local codes.***

■ Components Requiring Ventilation to the Outdoors

The following do not require ventilation to the outdoors, as there is a vent limiter in use:

- Gas valve on the main fuel train
- Lock-up regulator on the main fuel train
- Regulator on the ignition enrichment line

An authority having jurisdiction may not permit the use of a vent limiter. In this case, please use the following general guidelines:

- A parts kit must be ordered from your Fulton manufacturer's representative for plumbing the vent lines outside the cabinet. Improper plumbing will cause the cabinet to lose its sealing, which can lead to improper combustion and bypassing of the air filter. Instructions are included in the kit.
- Start with the vent and cabinet bulkhead size, and as soon as is practical increase the pipe size one diameter.

- For every ten feet of pipe run, increase the pipe size one diameter.
- Protect the vent termination from water, dust and insects.

Install Condensate Drain

A condensate drain kit is intended for use with the Fulton Endura boiler.

■ Single Boiler Drain Trap

The condensate drain kit is Fulton Part Number 4-57-005500. The drain kit must be configured one per boiler, with a maximum of 4.0 mm BTU total.

Adhere to the following for installation:

1. The 1 inch (25.4 mm) condensate drain will be reduced and connected to the 3/4 inch (19.05 mm) inlet on the base of the drain kit.
2. A condensate collecting tank and condensate pump will be required if a floor drain is not available to collect condensate (collecting tank and pump are not supplied with the boiler).
3. All piping (Figure 4) must be galvanized or stainless steel, and be free of leaks. Copper, carbon steel/iron pipe, PVC or CPVC are not acceptable.
4. The 3/4 inch (19.05 mm) drain outlet must remain below the 1 inch (25.4 mm) boiler condensate drain.
5. Connect the 3/4 inch (19.05 mm) drain outlet to an appropriate waste line following applicable codes. The 3/4 inch (19.05 mm) drain connection on the drain tank 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 drain tank. Slope the drain pipe away at a minimum pitch of 1 inch (25.4 mm) for every 12 feet (3.65 m).

■ Multiple Boilers Sharing A Common Drain Trap

The condensate drain kit is Fulton Part Number 4-57-000440. The maximum number of units to attach per condensate drain kit is 12mm BTU total.

Adhere to the following for installation:

1. The Fulton Endura boiler 1 inch (25.4 mm) condensate drain will be connected to the 1 inch (25.4 mm) inlet on the drain kit. One or more drain lines may be connected to this inlet (max of 12 MM BTU per drain).
2. If the water supply must be temporarily disconnected, the boilers must be turned off to prevent accidental flue gas emission into the boiler room.
3. The condensate drain cover must be kept on at all times, except during maintenance of the drain. This drain should be checked regularly in your boiler maintenance schedule.
4. A condensate collecting tank and condensate pump will be required if a fl oor drain is not available to collect condensate (collecting tank and pump

⚠ WARNING

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

If the water supply must be temporarily disconnected from the condensate drain trap, the boilers must be turned off to prevent accidental flue gas emission into the boiler room.

⚠ CAUTION

An uninterruptible water supply is required and shall be connected to the ¼" (U.S. only) compression fitting on the condensate drain. The water supply maintains a water level in the drain kit to prevent accidental flue gas emission into the boiler room.

FIGURE 4 - CONDENSATE DRAIN PIPING FOR ENDURA BOILERS

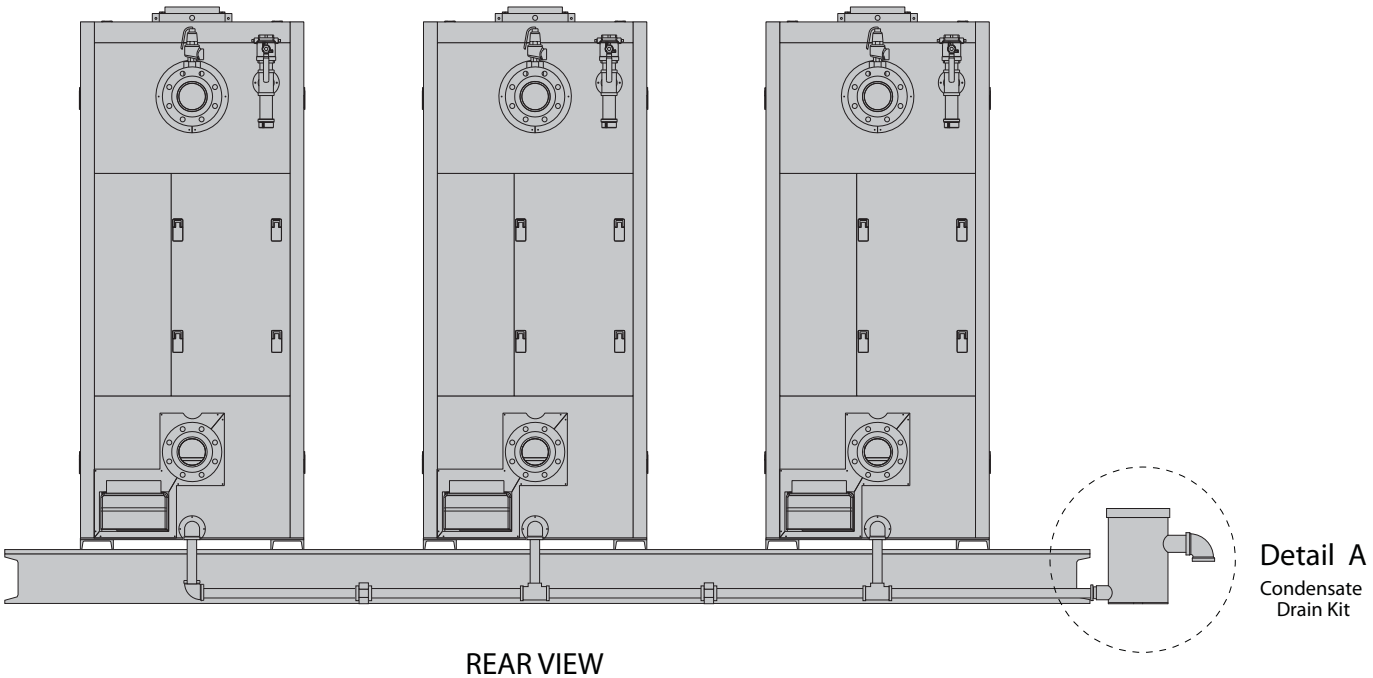
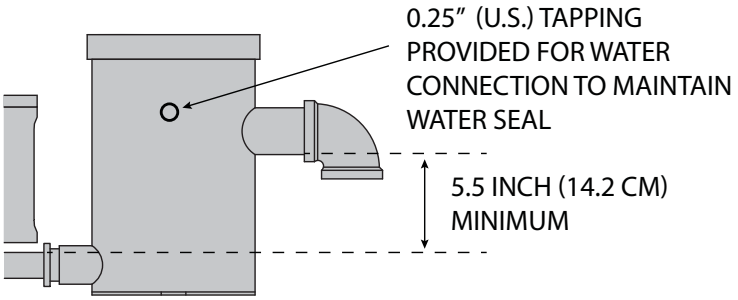


Figure 4 Notes:

- Header must be level or slightly pitched toward the drain.
- Header material to be galvanized steel or 316L stainless.
- Header should be taken to the lowest point possible and maintain a minimum 5.5 inch (14.2 cm) drop from 1.5 inch (38.1 mm) condensate drain kit/trap outlet. See Detail A.
- 1.5 inch (38.1 mm) condensate drain kit/trap outlet is never to be above 1 inch boiler condensate outlet.
- For multiple boiler installation, maintain and minimum pipe size of 1 inch (25.4 mm) for the header piping.
- The maximum capacity to attach per condensate drain kit is 12 MMBH total.



Detail A

TABLE 3 - NOMINAL PIPE SIZE

Nominal Pipe Size	**ID**	**Equivalent Pipe Length**		**Max Capacity in ft3 of natural gas per hour. Pressure drop of 0.5"wc/Equivalent length of pipe (feet)**						
Inch (mm)	Inch (mm)	90 Elb Feet (meter)	Tee Feet (meter)	20	40	60	80	100	150	200
1-1/4 (31.75)	1.380 (35.05)	3.45 (1.05)	6.9 (2.10)	950	-----	-----	-----	-----	-----	-----
1-1/2 (38.1)	1.610 (40.89)	4.02 (1.22)	8.04 (2.45)	1460	990	810	-----	-----	-----	-----
2 (50.8)	2.067 (52.50)	5.17 (1.57)	10.3 (3.13)	2750	1900	1520	1300	1150	950	800
2-1/2 (63.5)	2.469 (62.71)	6.16 (1.87)	12.3 (3.74)	4350	3000	2400	2050	1850	1500	1280
3 (76.2)	3.068 (77.92)	7.67 (2.33)	15.3 (4.66)	7700	5300	4300	3700	3250	2650	2280
4 (101.6)	4.026 (102.26)	10.10 (3.07)	20.2 (6.15)	15800	10900	8800	7500	6700	5500	4600
6 (152.4)	6.07 (154.17)	10.10 (3.07)	23.60 (7.19)	-----	-----	-----	-----	20200	16503	12766
8 (203.2)	7.98 (202.69)	13.30 (4.05)	29.10 (8.86)	-----	-----	-----	-----	41200	33660	29128

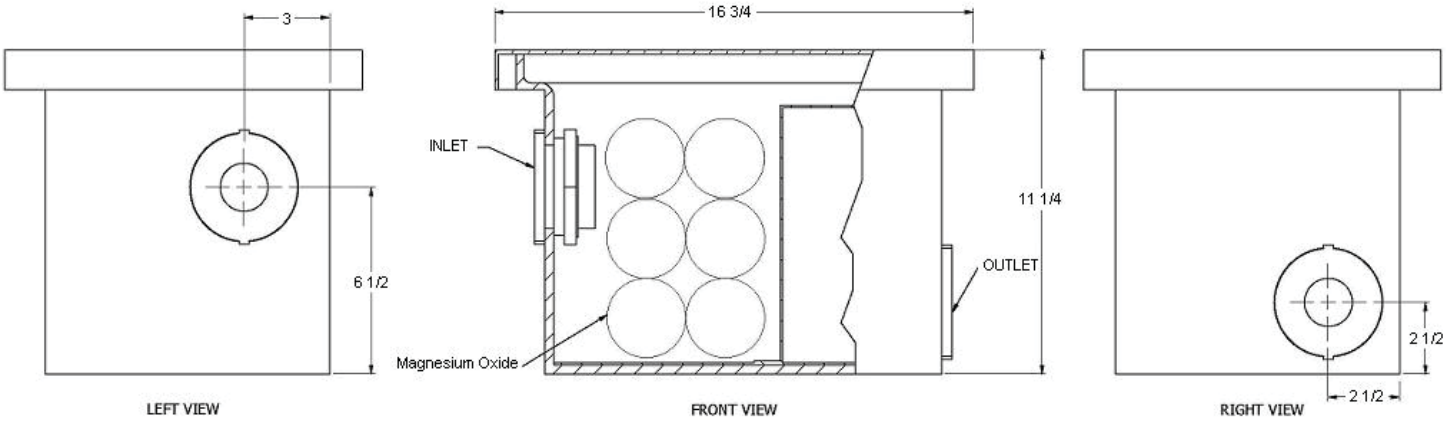


FIGURE 5 - FULTON PH NEUTRALIZING KIT (WITHOUT PUMP)

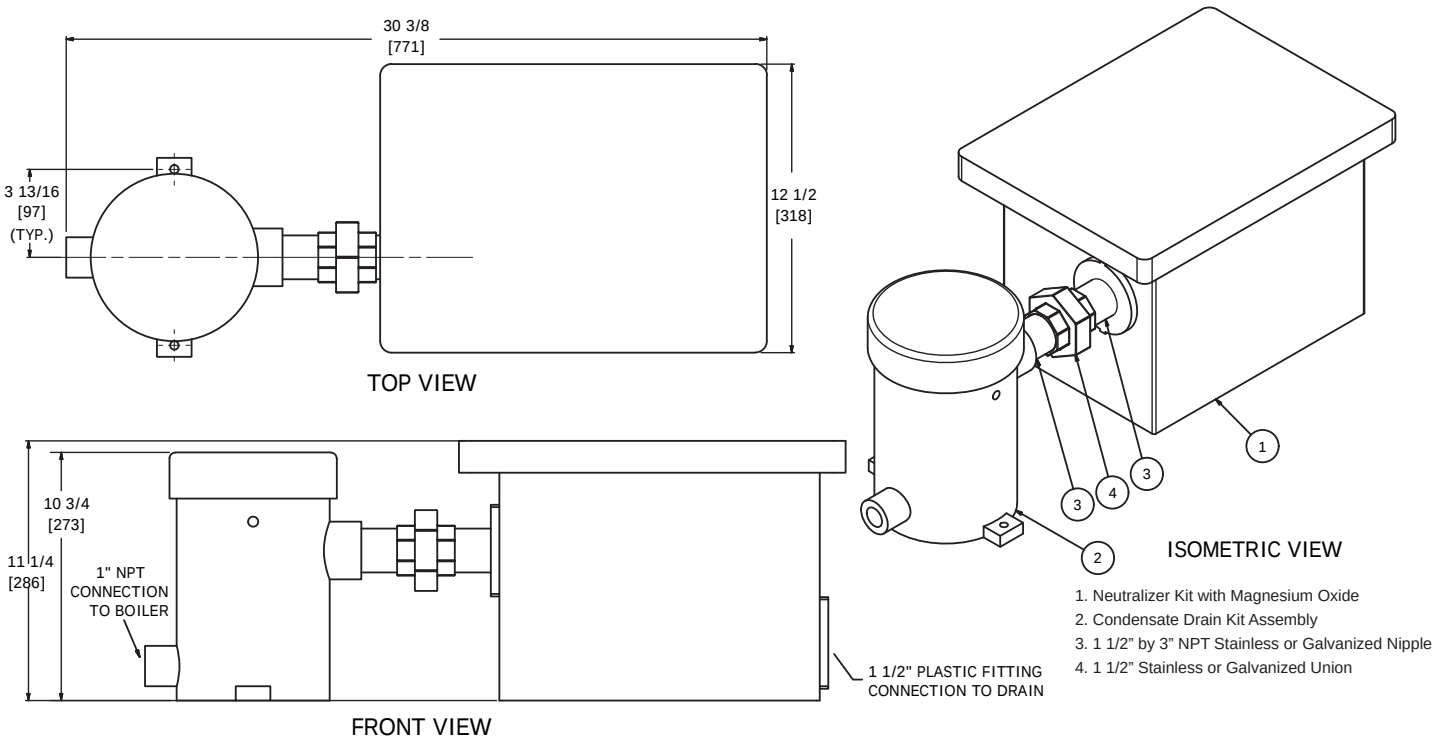


FIGURE 6 - FIELD CONNECTIONS FOR CONDENSATE DRAIN TO PH NEUTRALIZATION TANK

are not supplied with the boiler).

5. All piping (Figure 4) must be galvanized or stainless steel, and be free of leaks. Copper, carbon steel/iron pipe, PVC or CPVC are not acceptable.

6. Connect 1 inch (25.4 mm) condensate drain(s) (at the rear of the boiler), to the 1 inch (25.4 mm) inlet at the base of the drain tank. The header must be at least 5.5 inches (14.2 cm) below the condensate outlet of the individual boiler, and must remain fl ooded - achieved by ensuring it is at least 5.5 inches (14.2 cm) below the outlet of the condensate drain trap.

7. Connect the 1.5 inch (38.1 mm) drain outlet to an appropriate waste line following applicable codes. The 1.5 inch (38.1 mm) drain connection on the drain tank must be the highest point prior to going to the drain. Failure to keep drain piping lower than this point will result in overfl ow of the drain tank. Slope the drain pipe away at a minimum pitch of 1 inch (25.4 mm) for every 12 feet (3.65 m).

8. **(U.S. Only)** Attach a ¼" water supply to the compression fi tting on the float. The water line must be connected to an uninterruptible supply. Fulton recommends connecting it before the "fast fill" valve to the boiler supply but after the back fl ow preventer to avoid contamination of a potable water supply. Maximum allowable water pressure to the compression fitting is 100 PSI (689.5 kPa).

Install pH Neutralization Kit

The pH Neutralization Kit is a Fulton-provided kit designed to bring the pH level of the boiler's condensate to a neutral level. It is not a replacement or alternative for the Condensate Drain Trap. See Figure 5.

Adhere to the following for pH Kit installation:

1. Use stainless or galvanized pipe and fittings to connect condensate drain to kit.

2. Connect kit downstream of Condensate Drain Trap. See Figure 6.

3. Pipe outlet to appropriate drain.

4. Check condensate pH periodically.

➨ ***NOTE: Replacement bags are available from your Fulton local representative. The medium in the container will neutralize the condensate of 12 MM Btu's for approximately 6 months.***

Venting

Adhere to the following venting requirements:

1. The Endura boiler can operate to the combined intake and flue pressure drops without altering standard capacities: See Table 4.
2. The pressure drop readings at the boiler exhaust connection and air intake connection cannot exceed the maximum value stated in Table 4. This means that the combined pressure drop through the air intake venting (if installed) and exhaust venting cannot exceed the maximum value stated in Table 4; this is typically approximately 35 feet (10.6 m) with 4 elbows of connection size piping. Alternative distances and number of elbows may be appropriate if determined by the venting designer to be within the pressure drop ranges in Table 4. If pressure drop is exceeded, the boiler may have to be de-rated or operational issues will result. Also, the pressure at the boiler exhaust connection must not exceed a maximum negative value as stated in the table. This pressure must remain relatively constant throughout the operation of the boiler. Drastic draft changes during operation may result in generation of excessive carbon monoxide or soot. To decrease termination noise, increase the venting size at the termination points. This will slow the air velocity causing a reduction in noise. Do not terminate the venting in an enclosed area. Care must be taken when selecting the orientation of the terminations.

➨ ***NOTE: Consult your venting pipe supplier for assistance with sizing of vent materials and other potentially required accessories.***

3. Do not use boot tees or bullhead tees.
4. Barometric dampers should never be used in a condensing boiler application even if the draft is negative, this is because barometric dampers physically open to the mechanical room and it will be possible for flue gas condensate to drain down the outside of the stack.
5. The air intake system must be designed to prevent any moisture from draining to the boiler.
6. The layout of the piping used for air intake and exhaust must be done in a way that facilitates smooth travel and natural flow. Performing a pressure drop calculation isn't enough information to make sure a draft system will perform adequately. Good practice must be used by the designer and installer. Some recommendations:
    - Avoid sharp turns, boot tees, bullhead tees, back-to-back 90 degree elbows, short radius elbows especially right at the connections to the boilers
    - Avoid extensive direction changes (flue gases being required

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to turn around)

- Never direct flue stacks in a downward direction.

TABLE 4 - GENERAL VENTING REQUIREMENTS

Endura Model Number	Maximum Negative Draft	Maximum Positive Draft
EDR-1000	-0.04"W.C.	+1.50 " W.C.
EDR-1500	-0.04 " W.C.	+1.50 " W.C.
EDR-2000	-0.04 " W.C.	+1.50 " W.C.

7. It is the responsibility of the designer and installer of the venting system to guarantee the prevention of flue gas recirculation (flue gases being drawn into a boiler's combustion air supply, or flue gases moving backward through an idle boiler).

8. Make-up air ventilation openings are recommended for each installation size in Table 5.

TABLE 5 - MAKE-UP AIR VENTILATION OPENINGS

Total Input of Boiler 1000 BTU/HR (kW)	Free Area square feet (meters)
1000 (293)	3.5 (0.325)
1500 (439)	5.2 (0.48)
2000 (586)	6.9 (0.64)

9. For multiple boiler installations, multiply the number of boilers by required free area per boiler.

10. The installation of exhaust fans in a boiler room is not recommended.

11. An exhaust fan or similar equipment can create down draft in the stack or restrict the burner's air supply which will result in poor combustion. It is essential that only fresh air is allowed to enter the combustion air system. Foreign substances, such as combustible volatiles in the combustion system can create hazardous conditions. If foreign substances can enter the air stream, the boiler combustion air inlet must be piped to an outside location.

12. Particulate matter or chemicals (example: perchlorethylene, halogenated compounds) in the combustion air supply to the boiler will cause damage or failure to the burner. High-risk situations for particulate matter to be in the air include construction and maintenance activities. See Table 6.

13. In Canada, for recommended practice, refer to CSAB1.

■ Combustion Air Supply From the Boiler Room

Adhere to the following for installation:

1. Adequate combustion air and ventilation must be supplied to the boiler room in accordance with local codes and NFPA54/ANSI Z233.1, Section 5.3, Air for combustion and ventilation. Ensure space and nearby products are evaluated for the potential of combustion air contaminants. See Table 6.

TABLE 6 - PRODUCTS/CONTAMINANTS TO AVOID

Products to avoid	Products containing chloro/flouro-carbons; chlorine-based products; calcium chlroide products, sodium chloride products, paint and varnish removers, hydrochloric acid, muriatic acid, cements, glues, antistatic fabric softeners
Areas with the potential to have contaminants	Dry cleaning/laundry areas; swimming pools; repair shops; processing plants; manufacturing plants, new construction

2. The boiler room must meet the NFPA criteria for a non-confined space.

3. It is important to provide free access of air to the boiler. Per ASME Section VI Para. 6.04 and NBIC, unobstructed air ventilation openings (one near ceiling, one near floor) should be sized on the basis of one square inch free area per 2000 BTU/HR maximum fuel input of the combined burners located in the boiler room. This is subject to state and local regulations.

4. Consistent proper ventilation of the boiler room is essential for good combustion. Install two fresh air openings, one at a low level, 24" (610 mm).

5. Boiler room pressure must be neutral relative to the outdoors.

6. Ensure there is not negative pressure in the boiler room. If any negative pressure is present, sealed combustion to the outdoors must be ensured.

■ Air Piped From Outside Boiler Room

Adhere to the following for installation:

1. The combustion air supply can be piped directly to the

air inlet of the boiler.

2. The air intake must be piped out of the building if the boiler room contains contaminated air.
3. Air Intake pipes and fittings shall be Schedule 40 PVC pipe or galvanized steel. All Schedule 40 PVC pipe, fittings, primer and cement must conform to American National Standard Institute and the American Society for Testing and Materials (ANSI/ASTM standards) per pipe manufacturer's requirements.
4. Intake PVC piping must be assembled using cement. This will ensure that the intake is air tight and will not allow contaminates from the boiler room into the boiler. The cement must be free flowing and contain no lumps, undissolved particles or any foreign matter that adversely affects the joint strength or chemical resistance of the cement. The cement must not show gelation, stratification, or separation that cannot be removed by stirring.
5. Adhere to procedure for cementing joints (per ASTM D2855).

Air Filter

The air filter requires monthly maintenance. See **Maintenance** section of this manual.

Exhaust Venting

The Endura is equipped with a vent connection at the lower rear of the boiler.

Adhere to the following for installation:

1. The Endura is a Category II/IV appliance, thus venting material must be appropriate for condensing, positive pressure applications. Any venting material supplied for the Endura boiler must be AL29-4C or 316L SS, listed and labeled to UL1738, and guaranteed appropriate for the application by the manufacturer and supplier of the venting. It is also acceptable to vent the Endura Cat. II (negative pressure, condensing).
2. The exhaust line must be sloped down toward the drain with a pitch of at least 1/4" per foot (6.35 mm per .3 m). Failure to do so can result in a condensate pocket, which can result in an inoperative boiler. There must be no low spots in the exhaust pipe, as this can also result in a condensate pocket. A high spot is acceptable, provided the pitch from the high spot is maintained back to the boiler or to the outside point of the exhaust. Always avoid rigid connections between piping and structural members of the building.
3. Follow vent manufacturer's instructions for installation of exhaust venting. Refer to table for acceptable venting materials. Use of cellular core PVC (ASTM F891), cellular core CPVC , or Radel® (polyphenolsulfone) in venting systems is prohibited.

⚠ WARNING

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

Never install a barometric damper on flue systems designed with positive pressure.

Assure all electrical connections are powered down prior to attempting replacement or service of electrical components or connections of the boiler.

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

Particulate matter or chemicals in the combustion air supply to the boiler will cause damage or failure to the burner and is not covered under warranty.

Regular maintenance of the filter is required (as per the filter manufacturer's recommendations) to maintain the Endura warranty.

Negative pressure in the boiler room can cause operational issues and boiler damage.

⚠ WARNING

Do not terminate venting into an enclosed area.

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

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

Venting Material*	Max. Flue Temperature
PVC	200 F (93 C)
CPVC	200 F (93 C)
Polypropylene (InnoFlue)	248 F (120 C)

***PVC, CPVC and polypropylene are approved for EDR-1000 only.**

5. The condensate connection on the boiler should be piped into the stack drain piping. The pipe from the boiler directed to the drain should be installed at a slope of ¼" per foot (6.35 mm per .3 m).
6. Ensure that the condensate drain piping will not be exposed to temperatures where water/condensate will freeze in the lines.

■ Common Venting Layouts for Endura

It is possible to combine the air intake and/or exhaust piping for a number of Endura boilers. The pressure drop across the common system (combined total for air intake and exhaust) cannot exceed the pressure drop requirements for an individual boiler. See Table 4.

Adhere to the following for installation:

1. Consult your venting supplier for guidance in designing common vented installations. It is imperative to design such systems to prevent backflow of exhaust gases through idle boilers.
2. Endura boilers cannot be common vented with other equipment.

When designing a draft system for a quantity of two or more Endura boilers, the following items must be considered and addressed by the parties responsible for designing and providing that system:

▸ MULTIPLE BOILERS SHARING AN EXHAUST STACK, NEGATIVE PRESSURE IN THE COMMON HEADER:

1. Precautions must be taken to ensure that the negative pressure in the common header stays within the stated ranges (refer to table 4) at all possible conditions. This includes considering all possible operating conditions of the stack, including:
   - All boilers on at their maximum input rating capacity
   - One boiler in the system on at a low fire position
   - No boilers on, light off condition
2. Draft accessories, such as stainless steel dampers, may be required depending on the variety of conditions experienced in the draft system.

▸ MULTIPLE BOILERS SHARING AN EXHAUST STACK, POSITIVE PRESSURE IN THE COMMON HEADER:

1. Precautions must be taken to ensure the prevention of flue gases from

traveling back through idle boilers (flue gas recirculation, FGR). Looking at the condition of all boilers on at high fire condition will facilitate the selection of the diameter of the stack that is appropriate; however there is still a risk of FGR that needs to be managed. Options to consider for this management include the following:

- Mechanical draft assist systems (exhaust fans).
- Stainless steel dampers installed in the individual stack sections prior to the common header connection. Damper must be controlled so that it will close when a boiler is disabled or idle.
- Other solutions can be considered as long as the precautions to prevent FGR have been thoroughly evaluated.

➨ ***NOTE: Consider all possible draft conditions (based on the modulation and quantity of the boilers). When doing pressure drop calculations for a system of boilers sharing air intake or exhaust piping, it is important for the designer and provider of the draft system to consider the full scope of possibilities that can be experienced by that system. This includes looking at the condition of one boiler on at a low fire condition and all units on at a high fire condition.***

■ Venting Terminations

Adhere to the following for installation:

1. 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 Figures 8 and 9). The air space clearances should be observed to joists, studs, sub floors, plywood, drywall or plaster enclosures, insulating sheathing, rafters, roofing, and any other material classed as combustible.
2. The required minimum air space clearances also apply to electrical wires and any kind of building insulation.
3. Adequate provision must be made to support the weight of the exhaust venting. It cannot be supported by the boiler exhaust connection.
4. Listed termination parts must be used.
5. Select the air intake point of penetration where a minimum of 1/4" per foot (6.35 mm per .3 m) upward pitch can be maintained.
6. When penetrating a non-combustible wall, the hole through the wall must be large enough to maintain the pitch of the vent and provide sealing. Use adhesive material to seal around the vent on both sides of the wall. When penetrating a combustible wall, a wall thimble must be used. See Figure 7 for installation instructions. Minimum wall thickness through which vent system may be installed is 3.25 inches (8.26 cm). Maximum wall thickness through which vent system may be installed is 20 inches (50.8 cm).

⚠ WARNING

The exhaust vent installer should be familiar with Federal Codes as well as local codes and regulations.

⚠ CAUTION

To prevent the possible re-circulation of flue gases, the vent designer must take into consideration such things as prevailing winds, eddy zones, building configurations, etc. It is the responsibility of the installer to locate the exhaust duct in such a way that it does not become blocked due to snow, ice, and other natural or man-made obstructions.

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

It is the responsibility of the installer to ensure flue gas is not recirculated to the air inlet venting, as improper combustion will result.

⚠ WARNING

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■ Wall Thimble Installation

Adhere to the following for installation (see Figure 7):

1. The thimble is inserted through the wall from the outside.
2. Secure the outside flange to the wall with nails or screws, and seal with adhesive material.
3. Install the inside flange to the inside wall, secure with nails or screws, and seal with adhesive material.
4. 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.
5. 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. They will prevent the intake and vent pipes from being pushed or pulled.

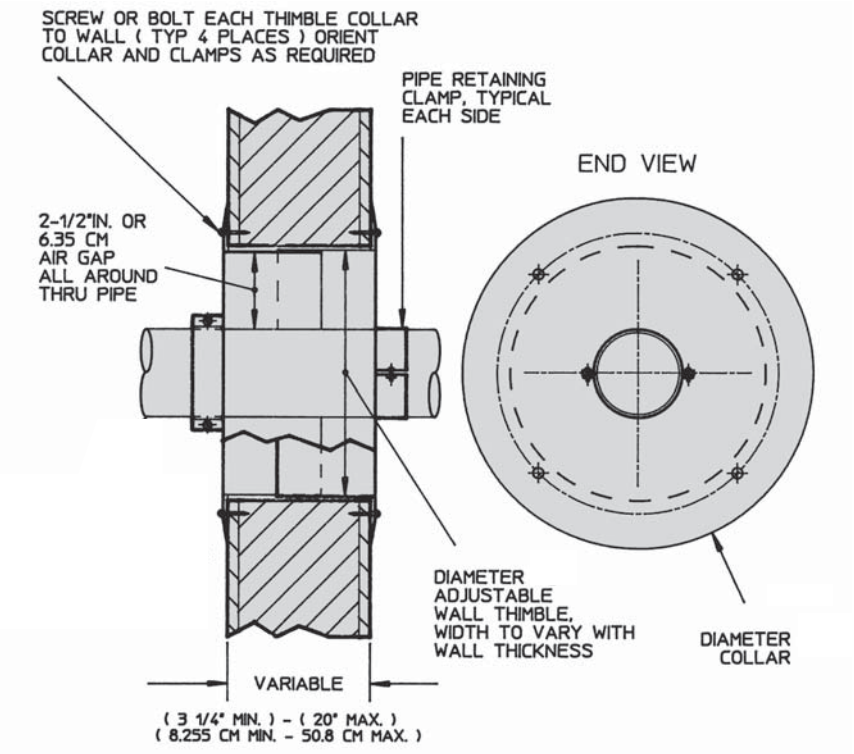
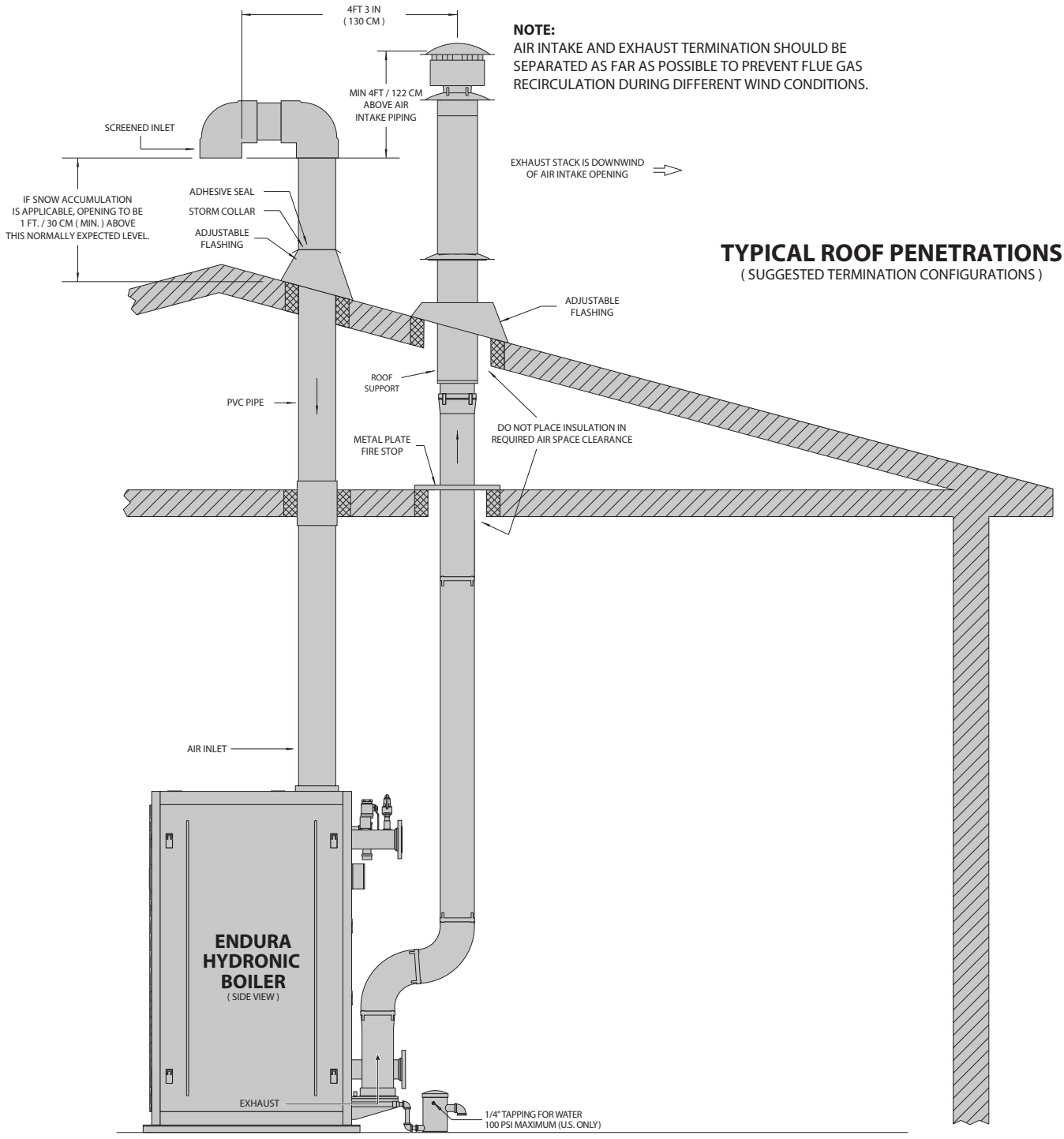


FIGURE 7 - WALL THIMBLE INSTALLATION

FIGURE 8 - ROOF PENETRATION DETAILS



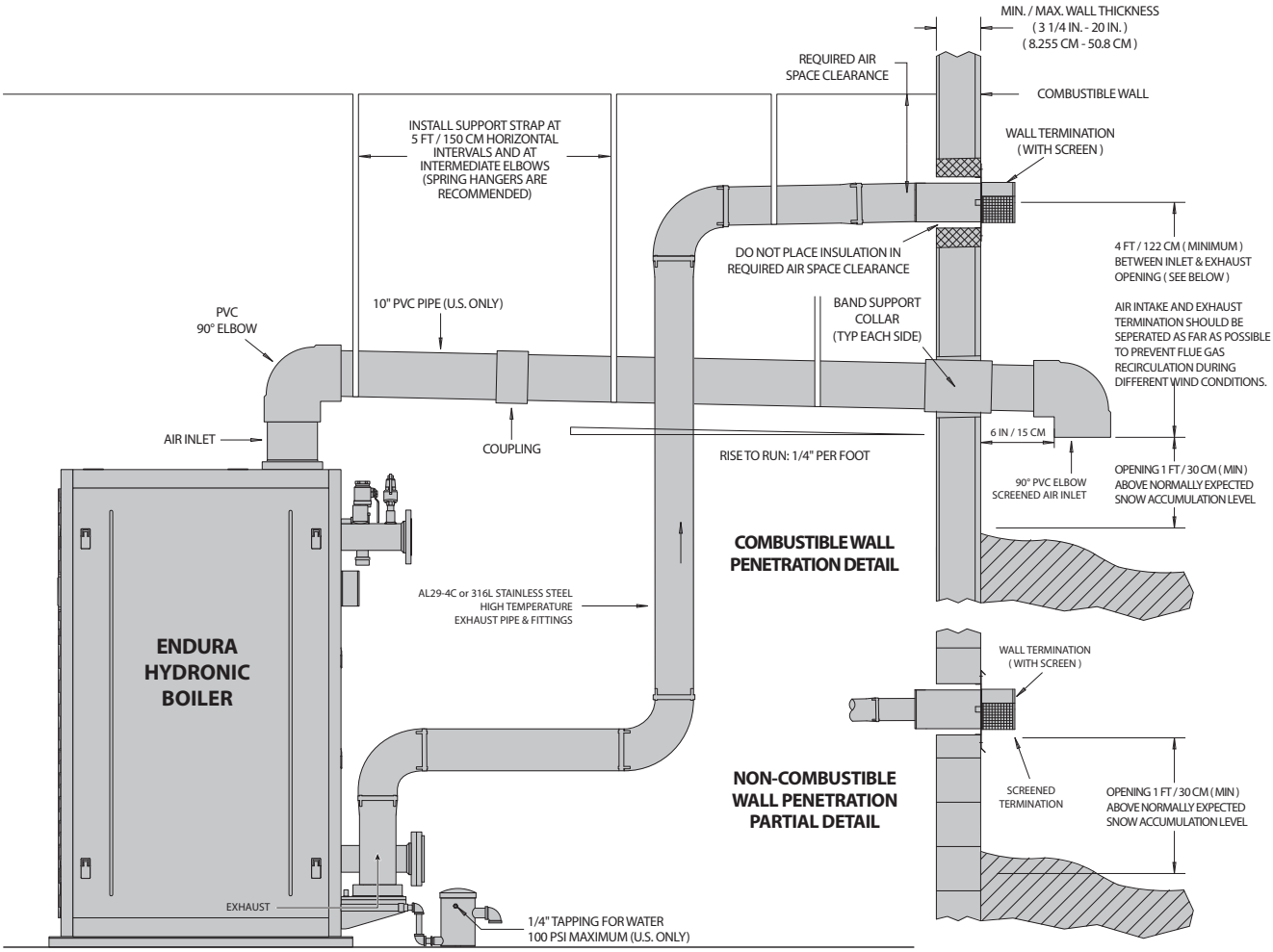
NOTE:
AIR INTAKE AND EXHAUST TERMINATION SHOULD BE SEPARATED AS FAR AS POSSIBLE TO PREVENT FLUE GAS RECIRCULATION DURING DIFFERENT WIND CONDITIONS.

TYPICAL ROOF PENETRATIONS

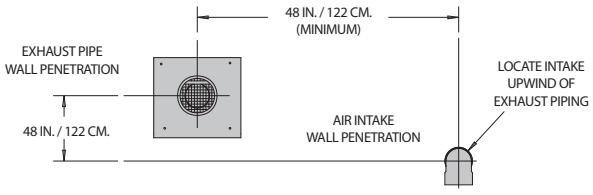
(SUGGESTED TERMINATION CONFIGURATIONS)

NOTE:
1.) When using horizontal runs follow a 1/4" per foot rise to run ratio
2.) Maintain minimum 9" / 22.86 cm air space clearances to combustables, wires and insulation
3.) Install support straps at 5 FT / 152 CM horizontal intervals and at elbows

FIGURE 9 - WALL PENETRATION DETAILS



AIR INTAKE & EXHAUST PIPES WALL PENETRATION CLEARANCES



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

NOTE:
MAINTAIN MINIMUM 9"/22.86 CM AIR SPACE CLEARANCES TO COMBUSTABLES, WIRES AND INSULATION

■ Horizontal Vent Termination

Adhere to the following for installation:

➨ ***NOTE: The vent termination is joined to the vent pipe outside the wall. Use the same joining procedures for vent pipe and fittings.***

1. The termination of the vent system must be at least 12 inches (30.48 cm) above the finished grade, or at least 12 inches (30.48 cm) above normal snow accumulation level (for applicable geographical areas).
2. The termination of the vent system shall not be located in traffic areas such as walk ways, adjacent buildings, operable windows and building openings unless the venting system is at least 7 ft (2.1 m) above finished grade, (National Fuel Gas Code, ANSI Z223.1).
3. The vent terminations must be at least 4 ft (1.22 m) horizontally from electric meters, gas meters, regulators, and relief equipment.
4. When installing inlet and exhaust terminations on the same wall, the exhaust outlet must be installed horizontally 4 ft (1.22 m) minimum above and downwind from air supply inlet to prevent exhaust recirculation.
5. Under certain wind conditions, some building materials may be affected by flue products expelled in close proximity to unprotected surfaces. Sealing or shielding of the exposed surfaces with a corrosion resistant material (such as an aluminum sheet) may be required to prevent staining or deterioration. Flue should be directed away from surfaces, if possible.
6. The minimum vent height should extend at least 3 feet (0.9 m) above the roof, or at least 2 feet (0.6 m) above the highest part of any structure within 10 feet of the vent.
7. If the exhaust vent terminates within 10 ft (3 m) horizontally of the air inlet, the exhaust vent must be at least 4 ft (1.2 m) above the inlet. Dimensions provided are minimum, and may or may not be sufficient for conditions at a specific job site.
8. To prevent the possible re-circulation of flue gases, the vent designer must take into consideration such things as prevailing winds, eddy zones, building configurations, etc. Fulton cannot be held responsible for the effects such adverse conditions may have on the operation of the boilers.
9. It is important to locate the exhaust duct in such a way that it does not become blocked due to snow, ice, and other natural or man-made obstructions. If terminating into a prevailing wind, direct elbow upward. Avoid areas (example: courtyards) where swirling high winds may be present.

Removing an Existing Boiler

When an existing boiler is removed from a common venting system, the common venting system is likely to be too large for proper venting of the appliances remaining connected to it.

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At the time of removal of an existing boiler, while the other appliances remaining connected to the common venting system are not in operation, the following steps should be followed with each appliance remaining connected to the common venting system placed in operation:

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine that there is no blockage or restriction, leakage, corrosion or other deficiency, which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliances not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place the appliance being inspected in operation. Follow the lighting instructions. Adjust the thermostat so that the appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Do not use the flame of a match or candle or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1. When resizing any portion of the common venting system, the common vent system should be resized to approach the minimum size as determined using the appropriate tables.

Electrical Connections

Motors are designed to operate within the following limits at the motor terminals:

- AC power supplied is within +/- 10% of the motor rated voltage with the rated frequency applied; or AC power supplied is within +/- 5% of the rated frequency and with the rated voltage; or a combined variation in voltage and frequency of +/-10% (sum of absolute values) of rated values provided the frequency variation does not exceed +/-5% of rated frequency.

The Endura units are to be powered with 120 VAC, single phase, 60 Hz power. The circuit should have a circuit breaker rated for 20A and the units will draw 15A (8A for EDR-1000) on a regular basis, with the fan at maximum speed.

A connection box has been provided on the back of the unit for high and low

voltage wiring. Do not run Building Management System (BMS) wiring into the same box as the power.

The Endura cabinet has removable panels to facilitate access. Do not run conduit through or over access panels.

Adhere to the following when making electrical connections:

1. Install wiring and ground in boiler in accordance with authority having jurisdiction or in absence of such requirements National Electrical Code, ANSI/NFPA 70.
2. Connect power to the boiler inside of the customer connection box using connectors rated for a minimum of 20 A and are compliant with local electrical codes.

Assembly of Fulton Multi-Skid Systems

Adhere to the following for multi-skid engineered systems:

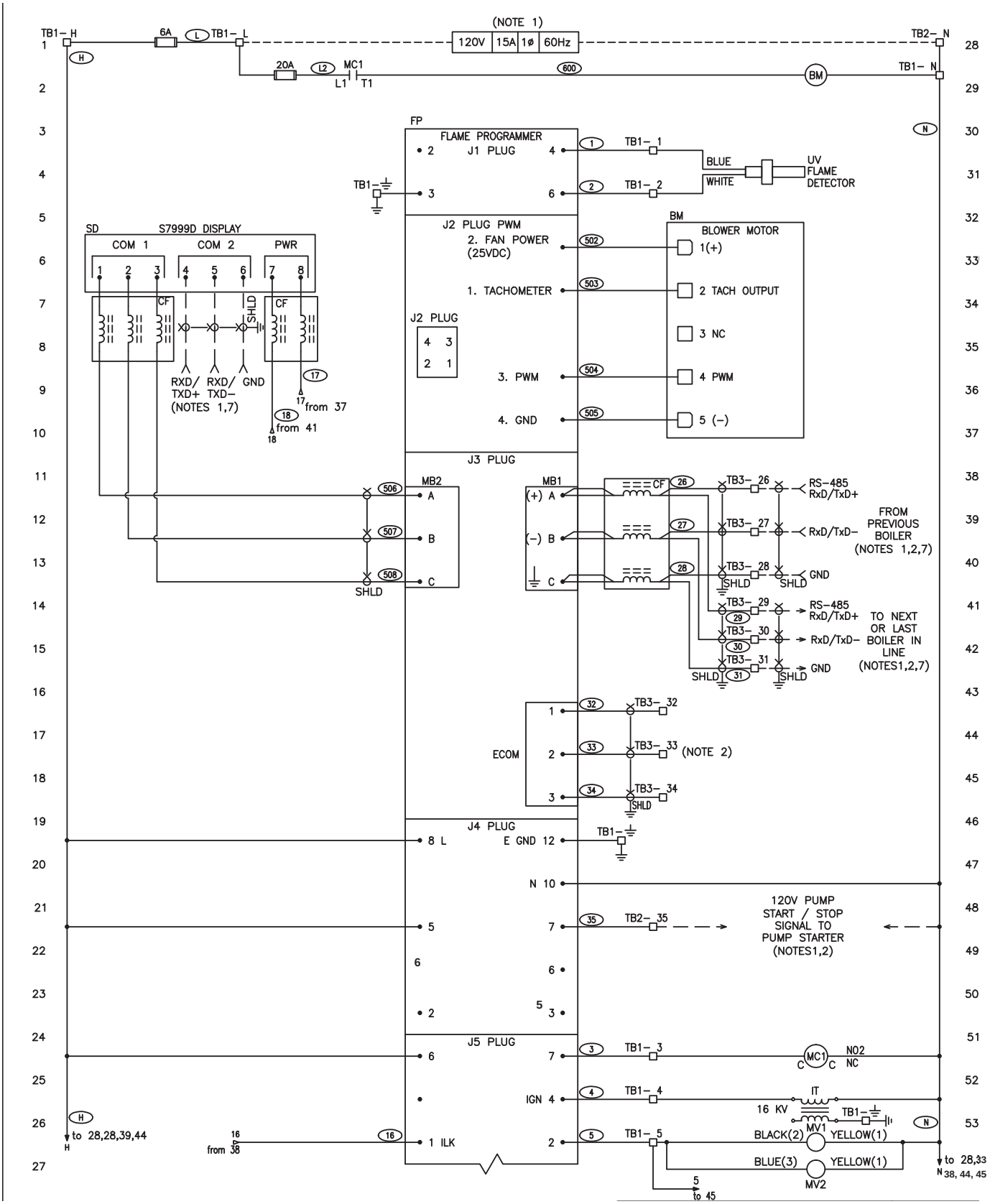
1. Refer to the Fulton mechanical/electrical drawings during assembly.
2. Ensure that equipment orientation allows for operation interface and maintenance.
3. Align the skids as shown on the drawings ensuring that skid fasteners (skid joint angles) are matched. The skid joint angles are a matched set and the edges of the fasteners should be exactly aligned.

➨ ***NOTE: Do not bolt the skids to the housekeeping pad/ floor until all of the piping has been reassembled and tightened.***

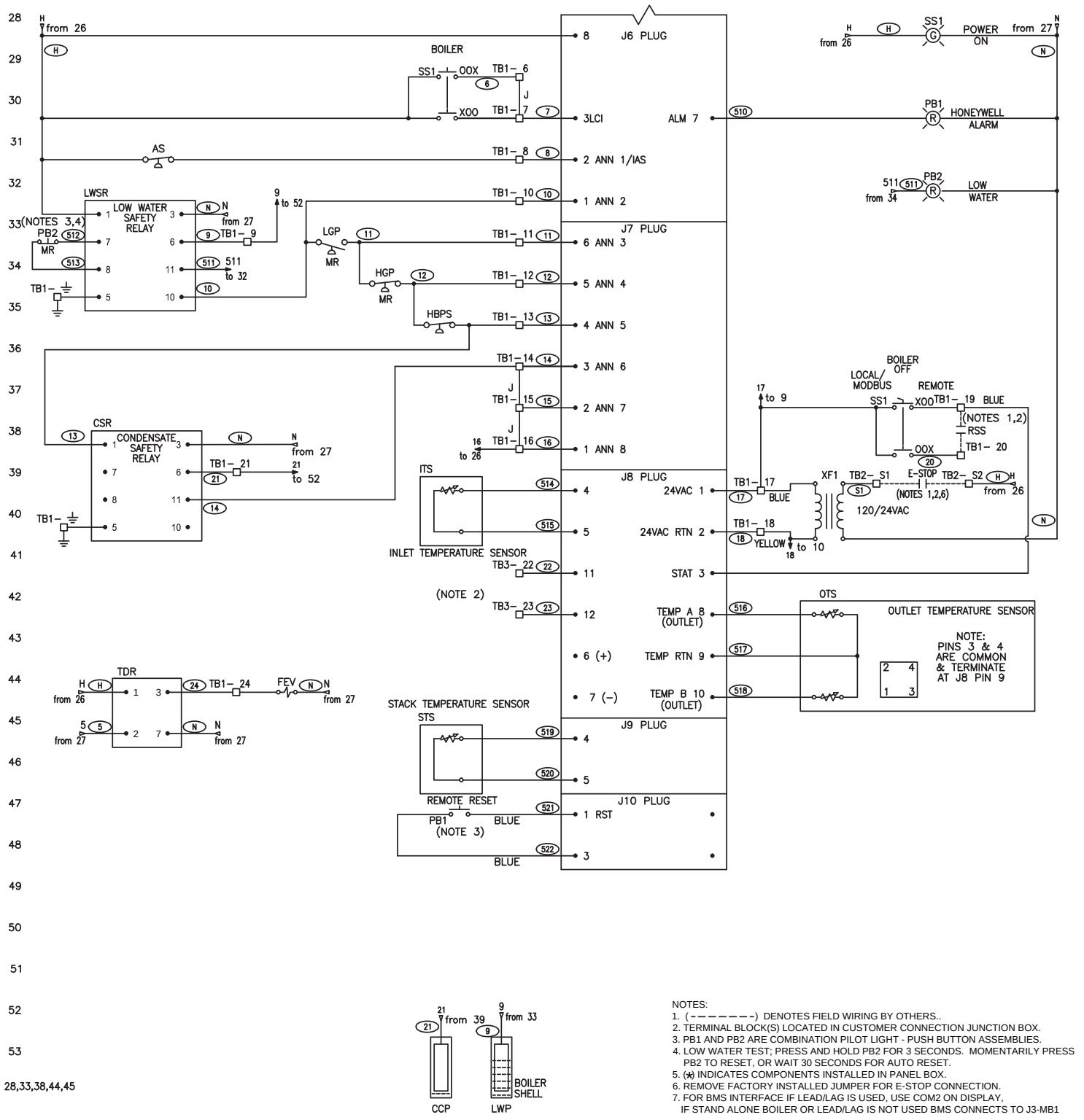
4. Ensure the skids are level and flat before fastening the skids together with the supplied bolts. The skids should be leveled front to back, side to side and corner to corner. Failure to properly level the skids will result in piping misalignment. A level or laser level should be used to verify skid alignment (when a standard level is used, the length should be appropriate for the skid). If assembling multi-component support stands, attach sections using the supplied bolts through the tank frame mounting plates. These should be hand tight until all of the piping is assembled. Note: skids are leveled at the factory using a laser level.
5. Connect the piping between the skids by matching the union connections and/or flange stamps and tightening. Refer to the mechanical drawing as necessary to confirm location of spool pieces etc. as the flange stamps are shown on the drawing in hexagonal callouts. The flange stamps should matched and aligned (the flange stamps should be directly across from one another. Rotating a flange will result in piping misalignment). Bolts should be hand tight until all of the piping is assembled. Refer to the appropriate instructions to tighten the flanges to the required torque specifications. Support pipe runs as required.
6. Ensure that a low point drain is installed in the piping.
7. Connect the conduit runs between the skids and tighten conduit connectors.
8. Locate the supplied wiring for the equipment and pull wiring through the appropriate conduit runs. Electrical wires are labeled for easy landing. Connect all wiring per the Fulton supplied electrical drawings.
9. If a header is supplied, mount the header as shown in the mechanical drawing.

➨ ***NOTE: For piping supplied in sections, make up and connect hand tight until all sections are in place to ensure sections align properly. Sections are match marked for reassembly.***

10. Tighten all connections.
11. Pneumatically test the piping (at 15 psig [103 kPa] maximum) prior to filling the systems.
12. Check bolts and connections for tightness after the first heat up cycle. Retorquing may be required.



EXAMPLE ELECTRICAL SCHEMATIC DIAGRAM



NOTES:
1. (– – – – – – –) DENOTES FIELD WIRING BY OTHERS..
2. TERMINAL BLOCK(S) LOCATED IN CUSTOMER CONNECTION JUNCTION BOX.
3. PB1 AND PB2 ARE COMBINATION PILOT LIGHT - PUSH BUTTON ASSEMBLIES.
4. LOW WATER TEST; PRESS AND HOLD PB2 FOR 3 SECONDS. MOMENTARILY PRESS PB2 TO RESET, OR WAIT 30 SECONDS FOR AUTO RESET.
5. (✲) INDICATES COMPONENTS INSTALLED IN PANEL BOX.
6. REMOVE FACTORY INSTALLED JUMPER FOR E-STOP CONNECTION.
7. FOR BMS INTERFACE IF LEAD/LAG IS USED, USE COM2 ON DISPLAY, IF STAND ALONE BOILER OR LEAD/LAG IS NOT USED BMS CONNECTS TO J3-MB1

EXAMPLE ELECTRICAL SCHEMATIC DIAGRAM (CONTINUED)

⚠ WARNING

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

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

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

Use only your hand to turn the valve handle. Never use tools. If the knob will not turn by hand, don't try to repair it. Call a qualified service technician. FORCE OR ATTEMPTED REPAIR MAY RESULT IN A FIRE OR EXPLOSION.

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

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

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

Perform Pre-Start-Up Inspection

Prior to start-up, perform the following:

1. Smell all around the boiler area for gas. Be sure to smell next to the floor, as some gas is heavier than air and will settle. If you smell gas:

- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone.

2. Ensure the boiler is located with the proper clearances as shown in the **Clearances and Serviceability** section of this manual.
3. Ensure that relief valves have been properly piped to floor drains.
4. Ensure flue gas from the boiler is properly vented.
5. Ensure the water system has been flushed and is free of debris.
6. Ensure combustion air openings are not obstructed in any way and have adequate capacity.
7. Ensure there are no flammable liquids, materials or hazardous fumes present in the environment.
8. Ensure nothing was damaged or knocked loose during installation and/or shipment.
9. Inspect the main gas train and trim assembly to be sure they were not damaged during shipment and/or installation.

Fill and Purge the System

Completely fill and purge the heating system as follows:

1. Close combination shutoff/purge valve in supply, all drain cocks, the shutoff valve for the pressure reducing (fill) valve, and all manual air vents.
2. Open a system valve, or fill through a drain connection.
3. Water will now begin to fill the system. Open the safety relief valve. Continue filling until a constant stream of water (no bubbling) is discharged from the safety relief valve.
4. At this point, the system has been initially filled. However, air pockets may still remain at high points in the system and in heating loops above the level of the safety relief valve valve. It is quite possible, depending on the particular system that all piping above the safety relief valve still contains air. If manual vents are installed on the system high points, these should be opened to vent these locations. When only water is discharged from all vents, the initial purging is complete.
5. With the gas shutoff valve closed, turn on power to the boiler and operate

the circulator. Circulate the system water for approximately 30 minutes to move all air to the automatic air separation point.

6. Check temperature/pressure indicator reading, which should equal the pressure-reducing (fill) valve set pressure. No more water should be entering the system. Close the shutoff valve on the cold-water fill line.
7. 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 watertight.
8. When purging is completed, make sure the following are open—combination shut-off/purge valve, shutoff valve to pressure reducing (fill valve), shutoff valve in cold water fill line, and shutoff valve in return line.
9. Make sure the following are closed - all drain cocks, the vent on the combination shutoff-purge valve, & all manual vents. Reset zone valves to normal mode of operation and turn off power to boiler.
10. Open fuel shutoff valve, allowing fuel to flow to boiler.

Commission The Boiler

Adhere to the following when commissioning the boiler:

1. Verify with authorized personnel that the gas lines have been purged. Do not proceed without verification.
2. Familiarize all personnel on all aspects of boiler use, safety, and contents of this manual. This includes, but is not limited to, the use of the controls, lighting, and shutdown procedures.
3. Review the unit-specific burner and control schematics, and follow appropriate instructions.

■ System Design and Boiler Operation

The Endura boiler must be installed in an appropriately designed system per **Installation** section of this manual. The boiler shall be operated/controlled to ensure the boiler does not cycle more than 12,000 times per year and the temperature differential across the boiler does not exceed 100°F (38°C).

Commission The Boiler: Dungs Zero Governing Gas Valve

➨ ***NOTE: In areas where NOx emission regulations apply, the O2 level should be set so that the NOx level does not exceed local code at any point during operation. As a general guide, the combustion will be approximately 5.1 % O2 across the firing range. In areas where NOx emission regulations do not apply, the 02 level can be set as low as 3% 02 at high fire and 5% 02 at low fire. Low fire combustion should always be set after high fire.***

⚠ WARNING

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

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

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

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

△ CAUTION

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

⚠ WARNING

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⚠ CAUTION

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

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

When commissioning is complete, Sola control must be placed into automatic mode.

➨ ***NOTE: Perform the following steps for field commissioning with the Dungs Gas Valve (Figure 10).***

➨ ***NOTE: A combustion analyzer will be required when making changes to the Dungs valve settings.***

1. Follow the steps in the **SOLA Hydronic Controller** section of this manual to access the parameters to run the boiler in manual mode.
2. Turn the boiler on and make sure that there is a call for heat. If the unit does not go directly to pre-purge, there is not a call for heat or there is an interlock open. If all interlocks are closed, the unit will drive to the max RPM for pre-purge and begin countdown.
3. When pre-purge is finished, the unit will go to the light-off point.
4. From the test fire sheet verify what was used for a low fire RPM setting. Input this setting into the Sola manual firing rate (Figure 14). Once the boiler is at this RPM check combustion. Unless the combustion is way out of the range from the test fire sheet proceed slowly to the high fire RPM point. Once at high fire take a combustion reading.

➨ ***NOTE: Gas Valve adjustments will change combustion. Only minor changes should be required due to the boiler being fully test fired at the factory. Gas valve adjustments should only be made at high fire and low fire. If an adjustment is made at low fire it will effect high fire, and vice versa. Always adjust high fire before low fire.***

5. To increase the O2 level at high fire, turn the Valve Adjustment (Gas valve shutter on the downstream side of the gas valve, see Figure 10) slotted screw counter-clockwise. To decrease O2 level, turn the Valve Adjustment screw clockwise. Once the correct O2 level is reached slowly go back to low fire and check combustion.
6. When you have reached low fire RPM and if O2 adjustments are required the Valve Offset Adjustment (allen screw on the side of the valve, see Figure 10) will need to be rotated. To increase O2 turn the Valve Offset Adjustment screw counter-clockwise, turn in the opposite direction to decrease O2.
7. Making changes to either adjustment on the valve will change the combustion through the range. When any adjustments are made the combustion should again be checked at high and low fire.
8. Verify combustion settings are in the range specified by Table 9.

➨ ***NOTE: Proper set up of the Ignition Enrichment gas is crucial to the "light-off" of the boiler and requires verification in the field during initial commissioning. Fulton recommends the Ignition Enrichment setting is verified during the yearly preventative maintenance.***

9. Once final field combustion is completed at low and high fire, the ignition enrichment setting requires verification. Use the factory test fire sheet to determine the factory test fire light-off rpm's. Input this setting into the

SOLA "manual firing rate" screen (Figure 14).

10. Connect an inches of water column measuring device (i.e., manometer) to the Enrichment gas valve test port (Figure 10). Insert combustion analyzer probe into the flue gas outlet port.

11. Open the front access door and locate the Enrichment test button located at the top of the electrical box. Turning the Enrichment test button on activates a "1-shot relay" allowing 30 seconds to measure the Enrichment gas valve outlet pressure and stable O2%. Use the factory test fire sheet to reference the Enrichment gas valve outlet pressure and O2%. (site conditions will ultimately determine specific settings).

    » Table 8 provides approximate valve outlet pressure ranges.

    » Typical O2 percentage is 1.8 to 2.5%.

    » Button should only be pushed ONCE during this exercise.

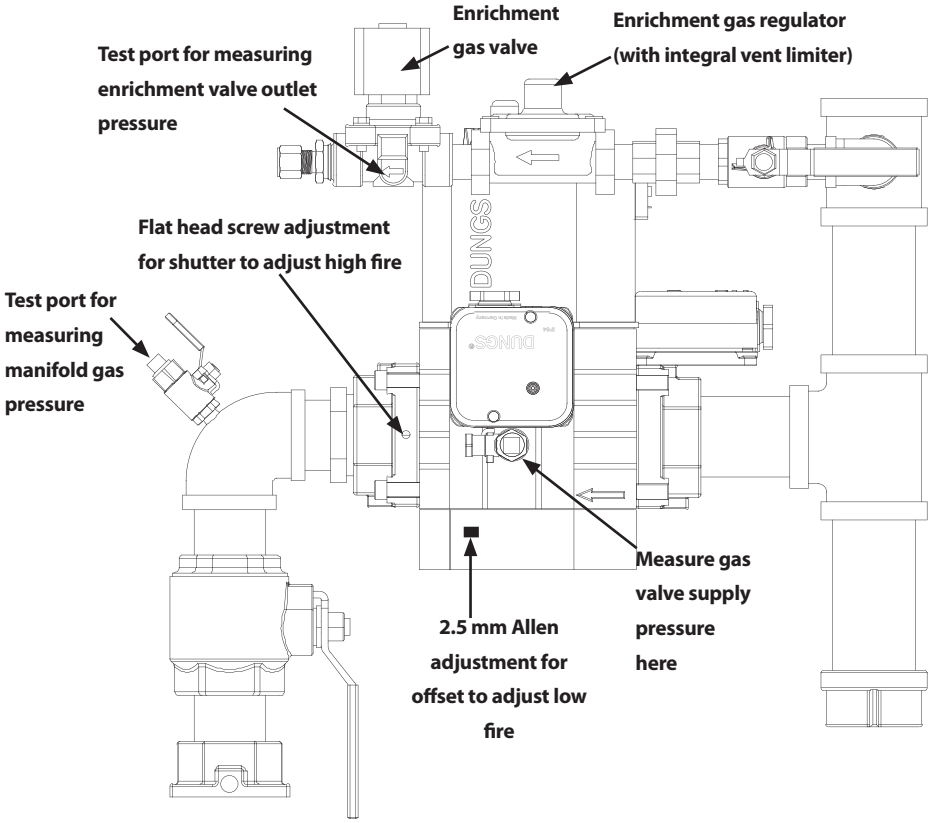

FIGURE 10 - DUNGS GAS VALVE

12. The enrichment gas regulator (Figure 10) may be used to increase or decrease the valve outlet pressure as required.

➨ ***NOTE: The field O2% at low fire impacts the Enrichment O2%. Always set field combustion at low and high fire prior to completing the above steps!***

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⚠ CAUTION

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

⚠ WARNING

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

13. Once combustion is checked and verified with a combustion analyzer place the control back into automatic mode and check all boiler safeties.

TABLE 8 - VERIFICATION OF IGNITION ENRICHMENT

Model Size	Spring Color	Enrichment Valve Outlet Pressure
1000	silver	4 - 5"w.c.
1500	brown	2.5 - 3.8" w.c.
2000	brown	2.5 - 3.8" w.c.

TABLE 9 - VERIFICATION OF COMBUSTION SETTING

	Low Fire	High Fire
O2	5.0 - 5.4%	3.0 - 5.5%
CO2	8.7 - 9.0%	8.0 - 10.0%

■ Turndown

EDR-1500 and EDR-2000 boilers leave the factory with a default setting of 5:1 turndown; however, 8:1 may be allowable if site conditions permit. EDR-1000 boilers have a default setting of 10:1 turndown.

Please consult a factory-trained representative for guidance.

SOLA Hydronic Controller for Endura

The screen shots and information in this section will help you navigate through display parameters that would be used for initial startup.

FIGURE 11 - THE SOLA CONTROLLER HOME SCREEN

■ Status Summary Screen

From this screen you will be able to access any of the parameters (Figure 12) by tapping on the controller in Figure 11. You can see if the unit Demand is on and the status of the boiler from Burner State. The firing rate will show you the RPM firing rate output. Also you can see the setpoint desired.

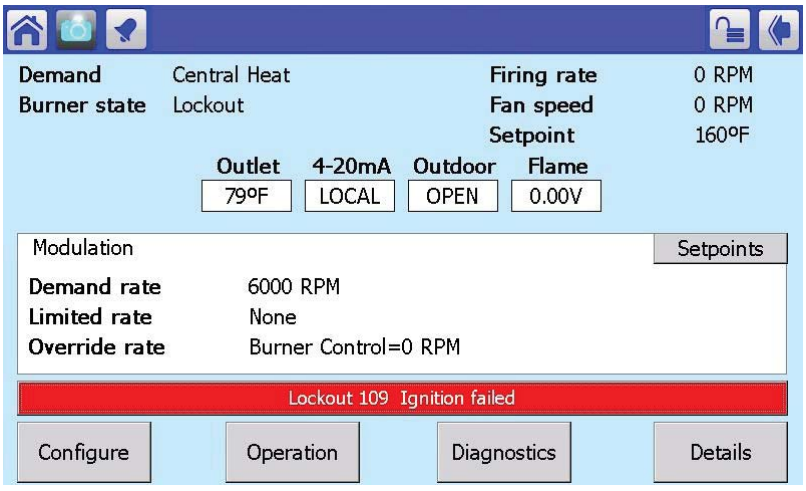

FIGURE 12 - STATUS SUMMARY SCREEN

■ Central Heat Operation Screen

1. Access this screen (Figure 13) by pressing the Operation button from the Status Summary Screen. From the Central Heat Operation screen you will be able to change the boilers Setpoint by pressing the yellow box next to Normal. If the firing rate needs to be changed from auto to manual

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for maintenance and/or commissioning purposes (to be able to run the boiler anywhere in the firing range) you would press the yellow block next to Firing Rate. Pressing Firing Rate will put you into the screen shown in Figure 14. When the Setpoint or Firing Rate requires changing, a password is required. Once the password is entered correctly, the top right section of the screen will show the padlock unlocked as shown in Figure 13. See Figures 14 and 15 for changing the Setpoint and Firing Rate.

➨ ***NOTE: If the boiler is not placed back in automatic mode following maintenance, the boiler will not operate properly.***

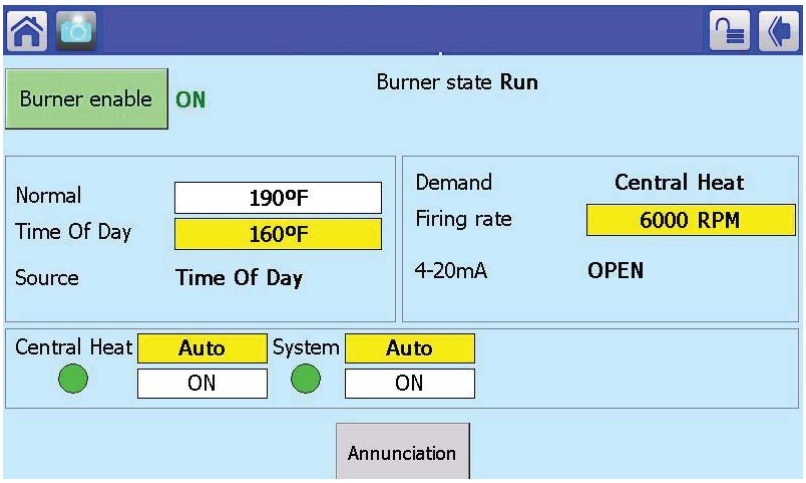

FIGURE 13 - CENTRAL HEAT OPERATION SCREEN

■ Central Heat Operation - Firing Rate Screen

In this screen (Figure 14) the control can be changed from Automatic to Manual. When in Automatic, the control will go to the firing rate necessary to achieve the setpoint. When in Manual, the control will go to the point that is entered into the Manual Firing Rate box; specific RPMs can be entered. After a firing rate is entered, press OK and the Firing Rate Screen will close and the boiler will go that selected firing rate. When finished with maintenance, return to this screen and place the boiler back into Automatic mode.

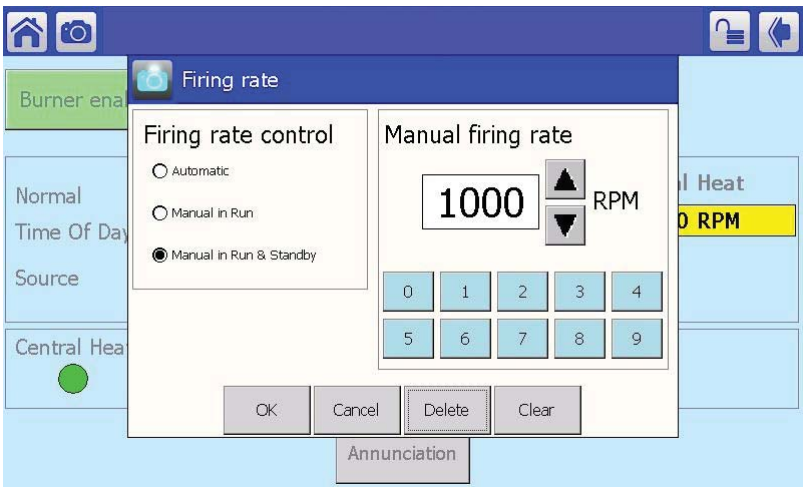

FIGURE 14 - CENTRAL HEAT OPERATION - FIRING RATE SCREEN

■ Central Heat Operation - Setpoint Screen

In this screen (Figure 15) the Setpoint can be changed. Press the up and down arrow or press Clear and enter the desired Setpoint. Then press OK.

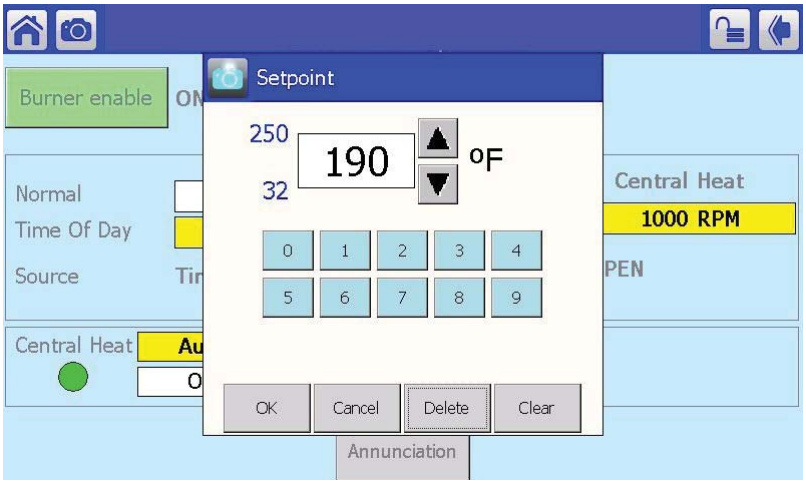

FIGURE 15 - CENTRAL HEAT OPERATION - SETPOINT SCREEN

■ Central Heat Configuration – Setpoint Screen

From the Status Summary Screen press Configure. There will be a list of Parameters, press the CH – Central Heat Configuration. You will now be in the Central Heat Configuration Screen, Central Heat screen. Press the upper right black arrow until you are in the Setpoint Screen (Figure 16). From this screen you can see this is another location where the Setpoint can be changed, but this is the only location that the on/off Hysteresis around Setpoint can be changed. To change any of these settings the **sola** password must be entered.

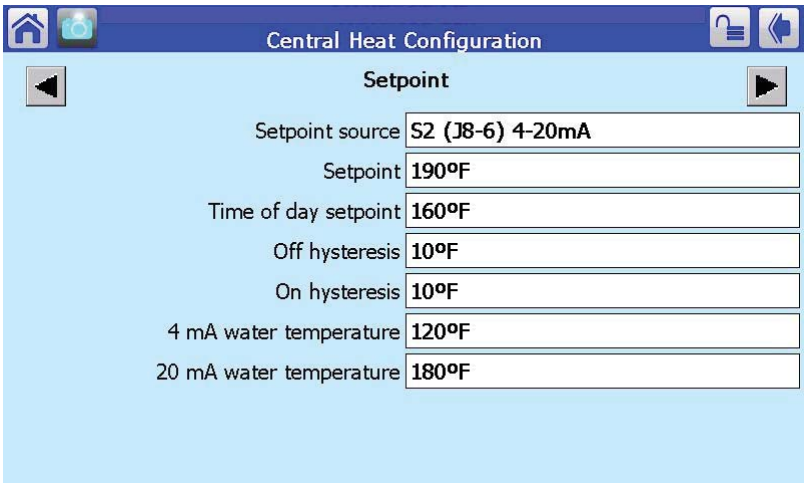

FIGURE 16 - CENTRAL HEAT CONFIGURATION - SETPOINT SCREEN

■ Central Heat Configuration – Modulation Screen

By pressing the black arrow on the top of the page you will be able to move from

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the previous Setpoint screen to the Modulation Screen (Figure 17). This screen provides access to the PID (Proportional, Integral and Derivative) of the control. The **sola** password is also required to change these parameters.

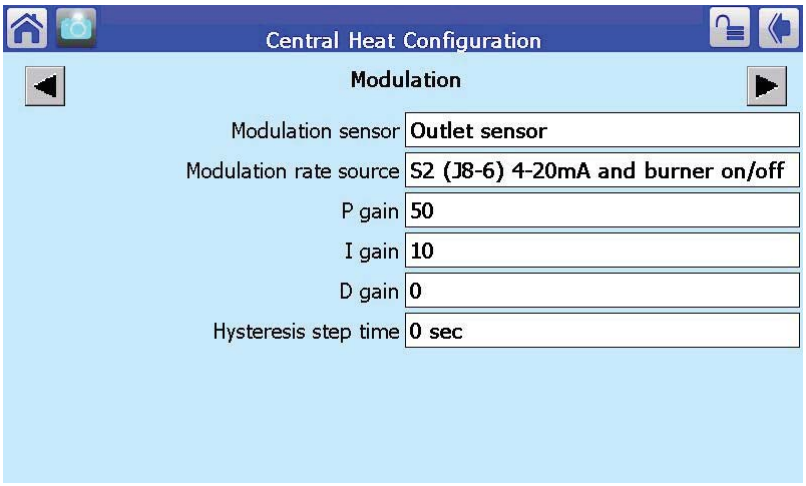

FIGURE 17 - CENTRAL HEAT CONFIGURATION - MODULATION SCREEN

■ Changing High Limit Setpoint and Verifying Change

From the Status Summary Screen press Configure, then High Limits; this screen will be used to set and/or test the Outlet High Limit Setpoint (Figure 18). The **sola** password must be entered. By touching the Setpoint next to Outlet High Limit Setpoint you can adjust the temperature up and down for the Setpoint you desire or lower it for testing purposes. This change will require Verification. Verify as follows:

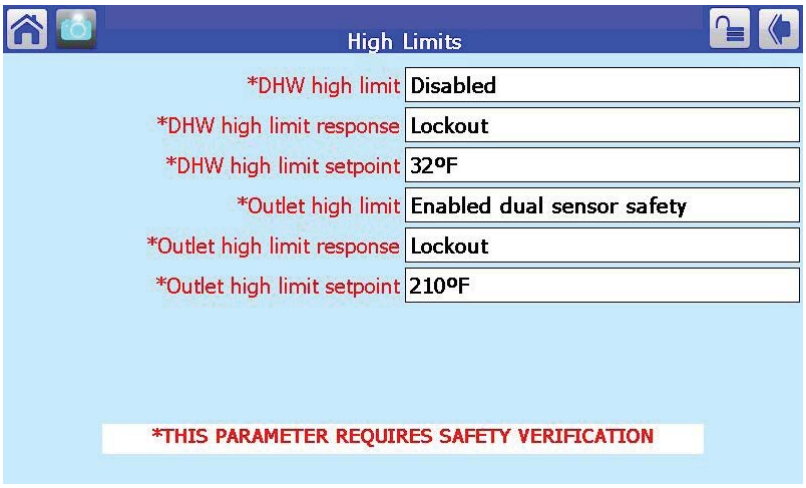

FIGURE 18 - HIGH LIMITS SCREEN

1. Arrow back to the Configuration Menu and press Verify down in the lower right hand corner. Figure 19.

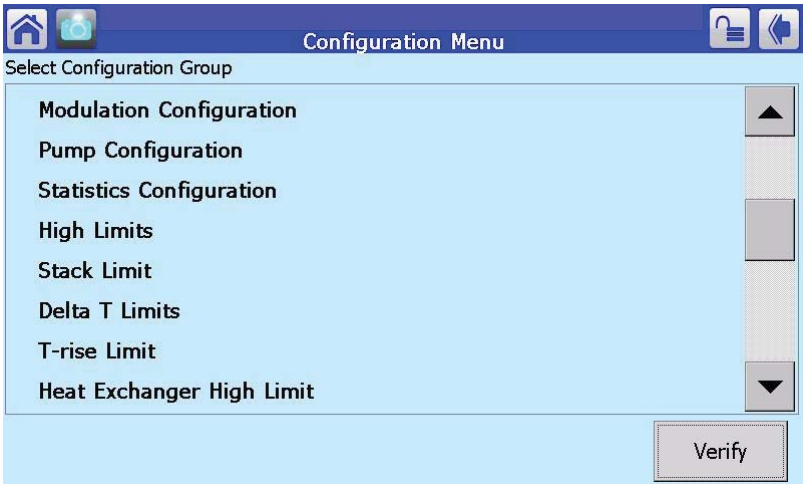

FIGURE 19 - VERIFICATION PROCEDURE

2. Press the Padlock in the upper right hand corner and enter the password **sola** (if not already unlocked) then press **Begin** down in the lower right hand corner. Figure 20.

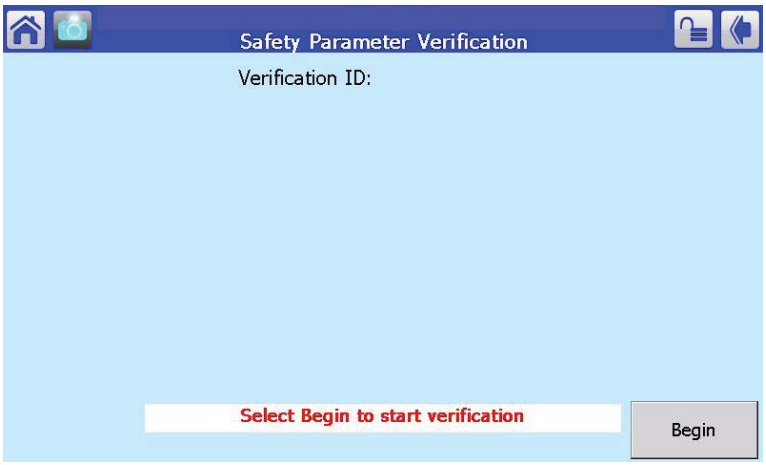

FIGURE 20 - VERIFICATION PROCEDURE

3. The parameters that you changed will appear; verify the change you made is correct. Then press Yes. Figure 21.

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⚠ CAUTION

*A temperature exceeding 120°F** (48 C) in the boiler room may cause premature failure of electrical components. Provisions should be made to maintain an ambient temperature of 120°F** (48 C) or less (the panel box interior should not exceed 125°F** [51 C]).*

***Pumps, PLC or ModSync panels may require lower ambient temperatures or additional cooling.**

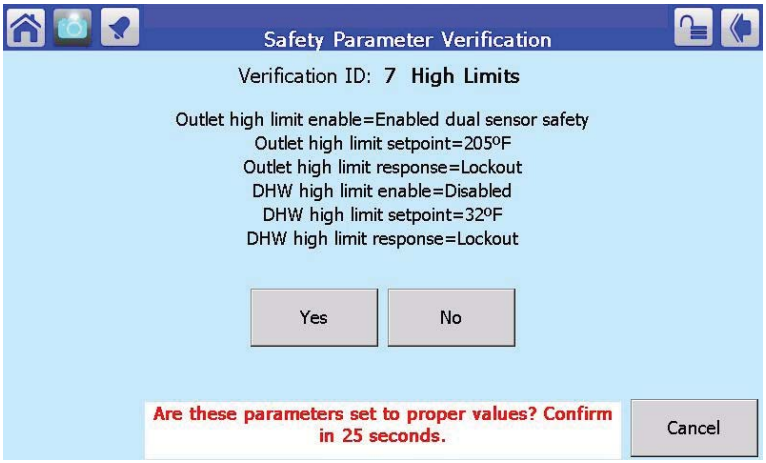

FIGURE 21 - VERIFICATION PROCEDURE

4. If there are no more changes the control will ask for a reset (Figure 22). This can be done by pressing the reset button on the front of the Sola control (the base) for 1 to 2 seconds.

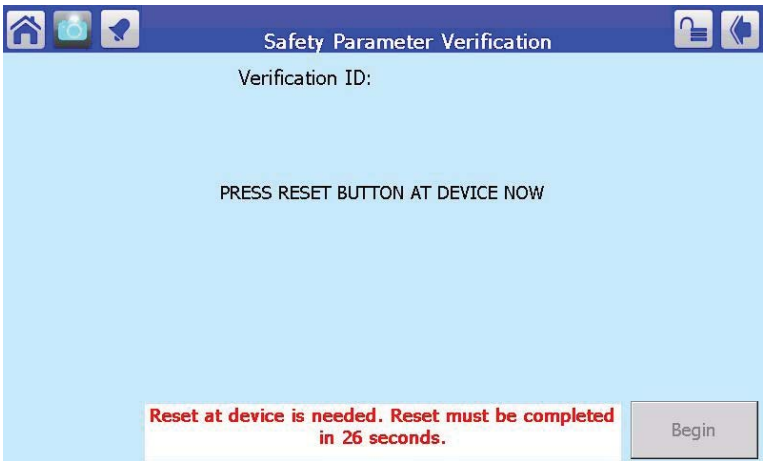

FIGURE 22 - VERIFICATION PROCEDURE

■ Reviewing Statistics

From the Configuration Menu (Figure 23), press Statistics Configuration.

From this screen (Figure 24) cycles and hours of the boiler can be viewed. Please note that they can be cleared by pressing Clear All. This is not recommended.

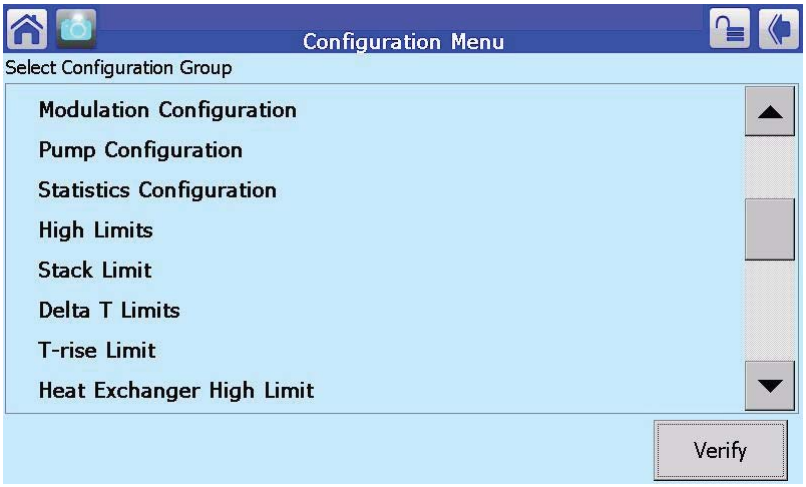

FIGURE 23 - ACCESSING STATISTICS CONFIGURATION SCREEN

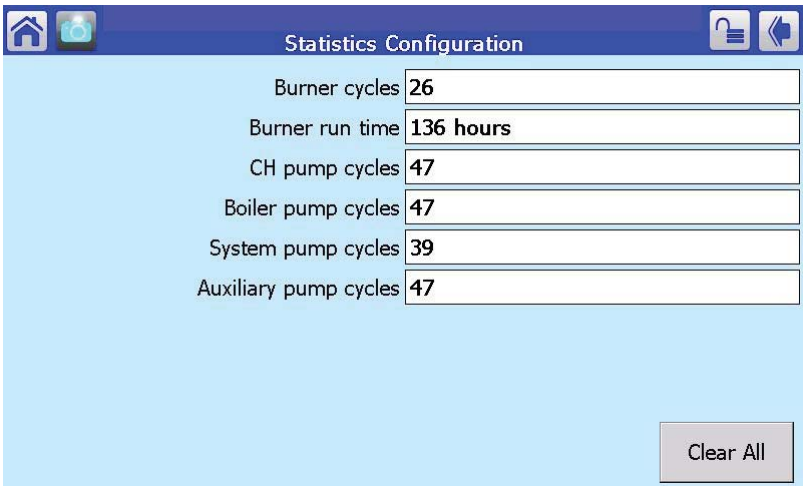

FIGURE 24 - STATISTICS CONFIGURATION SCREEN

■ Accessing Lockout History

From the Main Menu screen resetting the lockout or viewing the lockout history can be accessed by pressing where Figure 25 is showing a Lockout. If there is no lockout that same bar will display History. If the control is in lockout another sub screen will be displayed and you will have the option for Ok, Lockouts, Alerts and Silence. Pressing Lockouts will display the Lockout History screen.

After the Lockout is pressed you will be placed into the Lockout History screen (Figure 26). Time and date stamp of the last fifteen lockouts is displayed. Pressing Clear Lockout will clear the current lockout. By pressing the specific lockout more information on the lockout will be displayed (Figure 27).

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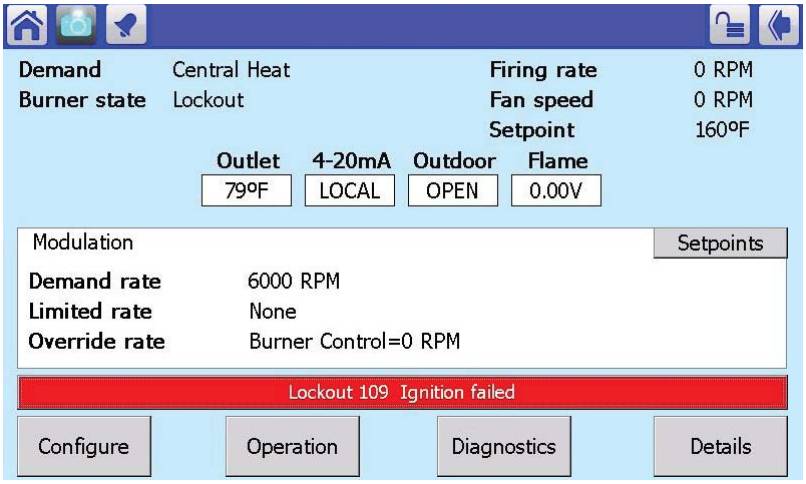

FIGURE 25 - VIEWING LOCKOUT

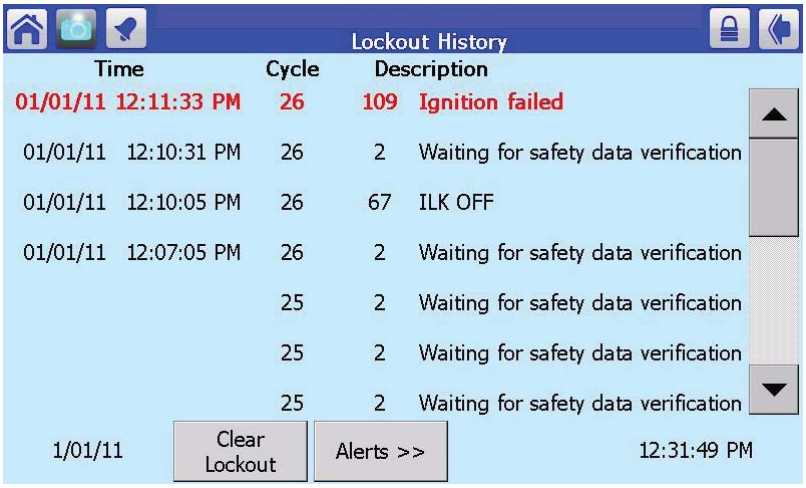

FIGURE 26 - CLEARING LOCKOUT

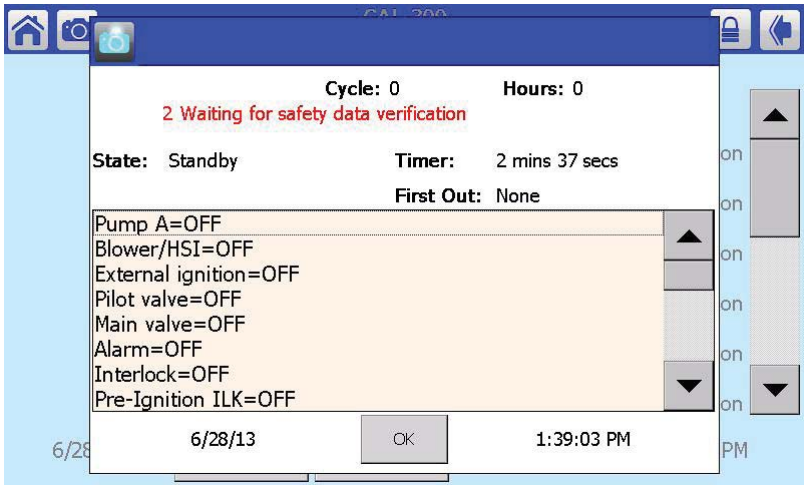

FIGURE 27 - LOCKOUT INFORMATION

■ SOLA Diagnostics

From the Status Summary screen (Figure 28), press Diagnostics.

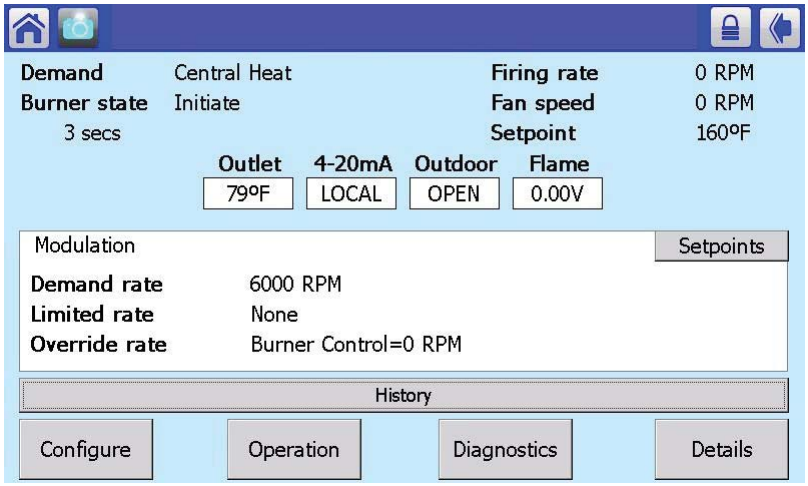

FIGURE 28 - ACCESSING DIAGNOSTICS

Pressing Burner Control I/O will place you into the I/O Status screen (Figure 29). From here you can see what the control is receiving from its inputs. A green light next to the input indicates the control's input is made or satisfied. A gray circle indicates the input is not satisfied. This is a helpful trouble shooting screen.

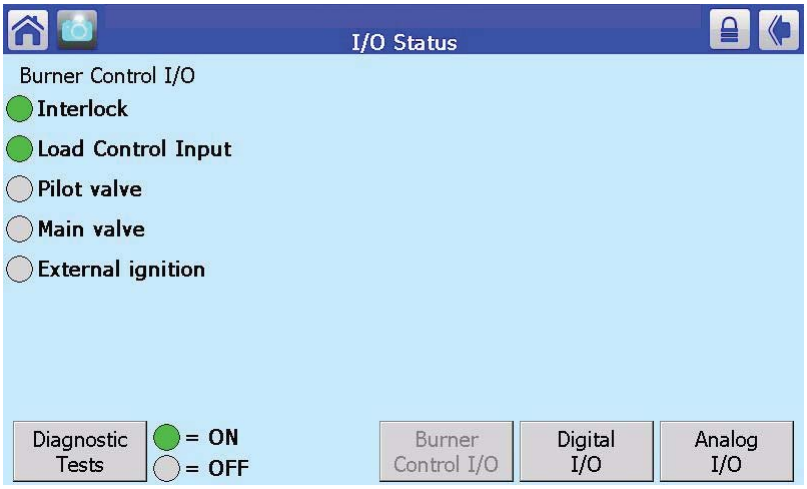

FIGURE 29 - BURNER CONTROL I/O

Pressing Digital I/O will place you into the Digital I/O screen (Figure 30). From here you can see what the control is receiving from its inputs. A green light next to the input indicates the control's input is made or satisfied. A gray circle indicates the input is not satisfied. This is a helpful trouble shooting screen.

⚠ WARNING

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

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

⚠ WARNING

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

⚠ CAUTION

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

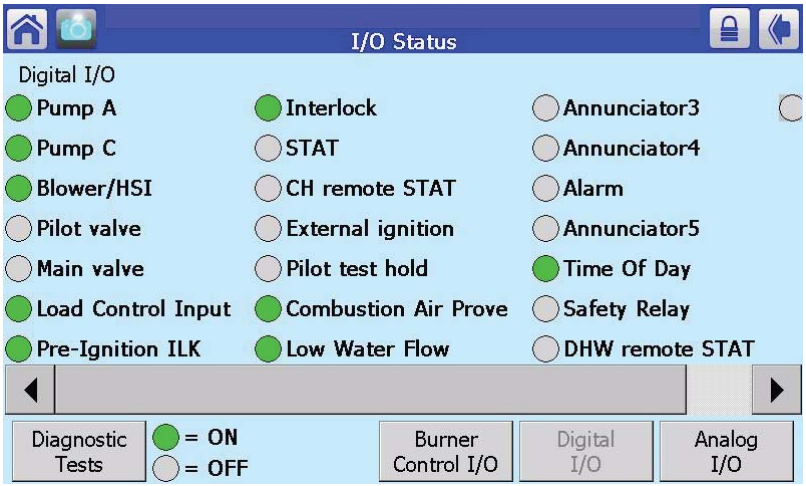

FIGURE 30 - DIGITAL I/O

Pressing Analog I/O will place you into the Analog I/O screen (Figure 31). Specific information on temperature, firing rate, flame signal and fan speed may be viewed.

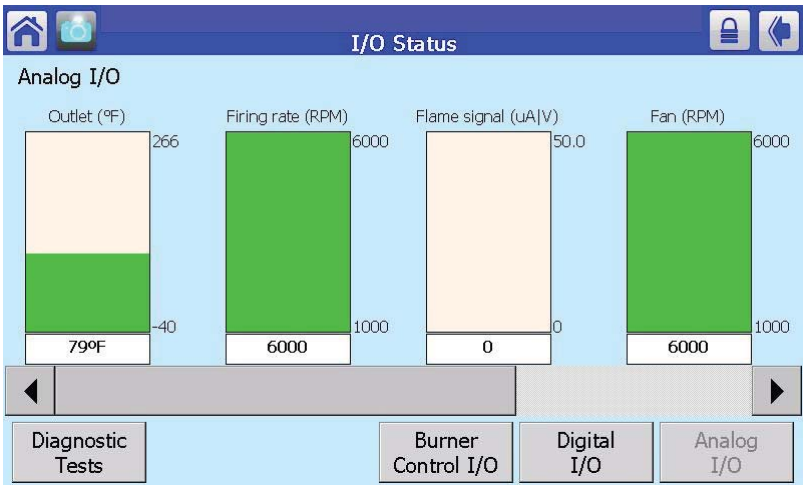

FIGURE 31 - ANALOG I/O

Perform Test of Low Water Cut Off

Once the boiler is full of water the following test can be accomplished:

1. Turn the boiler on, this will start the Call for Heat sequence.
2. Press and hold the Low Water Test button for 3 seconds. The Low Water light should illuminate and the boiler should shut down the Call for Heat sequence.
3. Reset the Low Water condition by pressing the Low Water reset button and reset the Sola control. Boiler should start the Call for Heat sequence again.
4. Perform appropriate test for any secondary Low Water controls.

Perform Test of Limit Controls

Fire the boiler and test the high limit control as follows:

1. Alter high temperature limit to a value lower than the anticipated loop temperature. Turn the boiler on. Water temperature will rise until the boiler locks out. This condition has to be manually reset.
2. Alter the high limit cut off temperature to normal level, typically 10-20 degrees above set point.

Perform Test of Low Gas Pressure Switch

Test the low gas pressure switch as follows:

1. With the boiler running turn up the low gas pressure switch until a lock out is annunciated.
2. Reset the switch to normal level, re-start the boiler.

Perform Test of High Gas Pressure Switch

Test the high gas pressure switch as follows:

1. With the boiler running turn down the high gas pressure switch until a lock out is annunciated.
2. Reset the switch to normal level, re-start the boiler.

General Operation of the Boiler

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

⚠ WARNING

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

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

⚠ WARNING

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

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

Follow all proper lockout/tagout procedures for service.

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

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

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

⚠ CAUTION

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

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

General

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

Daily, Weekly and Monthly Maintenance and Inspection (Fulton considers the following to be good practice for any boiler, and is applicable to the full line of Endura boilers). It is also good practice for any boiler installation to perform a thorough review of the overall system on a regular basis, and after any maintenance procedures. Any potential issues should be noted and followed up on to ensure safety and reliability of all relevant equipment. System review items may include:

- Looking for discoloration of any painted equipment, boiler jacket panels, and/or insulation used in system piping
- Looking for evidence of leaks including the air intake/exhaust systems, boilers, hydronic system piping, pumps, valves and other system components
- Once boilers are running, making sure there are no flue gases around the boilers, or in the boiler room

Daily Maintenance and Inspection Schedule

Daily maintenance and inspection must include the following:

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

Weekly Maintenance and Inspection Schedule

Weekly maintenance and inspection must include the following:

1. Observe the conditions of the main flame. Correct air adjustment is essential for the efficient operation of this boiler. If an adjustment to the combustion is necessary, the flue gas composition should be checked with a carbon dioxide (CO2) or oxygen (O2) analyzer to set conditions.

Monthly Maintenance and Inspection Schedule

Monthly maintenance and inspection must include the following:

1. Test high-limit control by reducing setting below the operating temperature. Burner should shut off. After readjusting the setpoint, press the button to reset the Sola control.

2. Test operating temperature control by reducing temperature setting as necessary to check burner operation.
3. Check flue gas temperature at outlet. If there is a temperature increase over previous readings, the probable cause is soot or water-scale build-up on the tubes. Consult Fulton Heating Solutions immediately if there is a concern.
4. Test low gas pressure switch and high gas pressure switch utilizing the procedure in operation section.
5. Inspect the air inlet filter. If any dust, lint or debris has accumulated, clean or replace the filter.

Procedure for Cleaning the Air Inlet Filter

Proceed as follows:

1. Remove the filter. The filter sits in a custom slot on the air inlet connection to the boiler.
2. Remove all debris and dirt from the filter using a non-corrosive soap and water. If debris is not easily removeable from the filter, replace the filter. It is imperative that the same type/style/size filter is used (available from Fulton).
3. Return the filter to its original position in the slot.

Annual Maintenance and Inspection Schedule

Annual maintenance and inspection must be performed prior to each heating season, and includes but is not limited to the following tasks, which must be done by a factory trained technician:

1. Inspect the fuel train, burner and control panel to be sure components are free of debris and are properly attached to the boiler.
2. Examine the venting system (air intake and exhaust piping).
    - Check all joints and pipe connections for tightness.
    - Check piping for corrosion or deterioration.
    - Check that the piping is clear of debris.
    - Check that the condensate drain system is functioning.
3. Inspect the hydronic heating system for other problems.
4. Perform combustion analysis and adjust if necessary. A low O2 level can indicate a need for burner service.
5. Leak test the gas valves.
6. Clean the low water cut-out probe on the water outlet pipe. This can be

⚠ WARNING

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

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

△ CAUTION

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

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

⚠ WARNING

Personnel performing burner assembly maintenance must wear appropriate respiratory protection. Failure to do so may result in the inhalation of refractory ceramic fibers.

⚠ CAUTION

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

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

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

Burner gaskets should not be reused. Gasket is designed for one-time use only.

Using nuts and washers not provided by Fulton can lead to flue gas leakage and cause damage to the studs.

Follow proper safety precautions when using a ladder.

accessed via the top removable panel.

7. Clean the venturi with a clean cloth to remove dust build up.
8. Remove and inspect burner. Clean as necessary. See **Removing and Cleaning Burner** section of this manual.
9. Check the cabinet for leaks that would allow unfiltered combustion air to enter the cabinet. Any leaks should be taped or caulked. Damaged gaskets must be replaced.
10. Test relief valve per manufacturer instructions by lifting the lever for 5 seconds and allowing the valve to snap shut. Please see the manufacturer's recommendations on the relief valve tag.

Removing and Cleaning Burner Assembly

Proceed as follows:

1. Remove power and turn off gas supply.
2. With the door open, place a ladder in front of the unit. The top of the electrical panel is able to support up to 200 lbs, and should not be used to support a person's entire weight.
3. Remove wires from ignition assembly.
4. Remove ignition assembly. Check that the insulators are clean and there is a gap of 1/8 inch (3.175mm).
5. Remove UV Scanner.
6. Remove the (4) bolts between the fan transition and the premix elbow.
7. Remove the (8) bolts and washers on burner flange.
8. Remove premix elbow.
9. Remove top gasket.
10. Remove burner by pulling up, making sure not to scrape the sides of the burner. Place burner aside, flange side down.
11. Vacuum any visible debris inside the burner. Compressed air may also be used, in moderation, to clean the pores of the woven material. Use the following guidelines:
    - Dislodge any particulate matter from the burner surface matrix, keeping the air nozzle about 2" from the burner's surface and blowing straight down the surface. Gently move the nozzle back and forth length-wise above the surface. Avoid blowing air tangentially across the surface as this may cause damage to burner surface. Allow particulate matter to fall from the burner through the air/gas inlet. A vacuum may be used at the air/gas inlet to assist in removing particulate matter.
12. If any burner damage is detected, contact your Fulton Sales Representative.

13. Reassemble in reverse order. Apply anti-seize to ignitor screws prior to reassembly. Be sure to use new gaskets for reassembly.
14. Ensure o-ring is positioned properly between premix elbow and burner transition. Clean and apply o-ring lubricant, as necessary.
15. Apply belleville washers so that they crown in middle; do not use nuts or washers that are not provided by Fulton.
16. Apply anti-seize to burner flange studs and retorque to 23 ft-lbs.
17. Torque nuts under the premix elbow using a torque adaptor at 90 degrees from the wrench handle.
18. Ensure door and all latches are closed when complete. The louvers in the door provide cooling air to the electrical panel. The door must be completely closed to prevent unfiltered air leaking into the cabinet.

After All Repairs and Maintenance

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

Troubleshooting

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

PROBLEM	CAUSE	CHECK
Control does not illuminate	24 VAC Power Supply	Check fuse or circuit breaker. Reset or replace as necessary.
Fan will not start	High temperature is tripped	1. Check sensor wiring connector. 2. Check resistance. 3. Replace sensor if faulty.
	Low gas is tripped	1. Reset switch, making sure to listen for audible click. 2. Replace switch if setting is below actual pressure.
	High gas is tripped	1. Reset switch, makiing sure to listen for audible click. 2. Replace switch if setting is above actual pressure.
	Flame detector has detected light/scanner	1. Identify light source, remove 2. Replace flame detector
	Air switch is made when fan is not on	1. Adjust, if necessary. 2. Reset switch 3. Replace switch
	Blower contactor made when fan not on	Replace motor contactor
	Gas valve proof of closure defective	Replace valve
	Loose wire connection	Check wiring
Interrupted Air Switch Not Made	Interrupted Air Switch is annunciated if the airflow switch detects low airflow during purge.	The air switch has been factory set and should not be adjusted in the field. An extended low air indication does not mean that the low air switch is defective. 1. Check that current setting matches factory setting. 2. Check that the burner is clean. Check the blower purge speed and low fire speed is correctly displayed on the touch screen. 3. Check for obstructions in the air inlet path.
High Back Pressure Switch trip/boiler shutdown	Excessive Vent Pressure	This condition will automatically recycle, so the boiler will try to relight. The venting exchanger should be checked for obstructions and cleaned. Check switch setting.
Main flame failure during firing period	Main gas control valve is de-energized and the control goes into “lockout” mode. Flame failure occurs and the indicator is illuminated.	The programmer must be manually reset. Check wire connections.
Ignition Failure	If UV scanner does not detect the flame during the 4-second trial-for-ignition period, the gas valve and spark ignition are de-energized. At this time a safety lockout occurs.	Identify and correct.

PROBLEM	CAUSE	CHECK
Main flame fails	Ignition issue	1. Visually verify spark. 2. Replace igniter or transformer, as needed.
	Gas valve not set properly	Verify the last elbow gas pressure matches the start up report.
	Enrichment issue	Verify the pressure of the regulator matches the report.
	Flame detector failure	1. Visually verify the flame through the sight glass. 2. Remove flame detector and visually verify the flame through the scanner tube. 3. Verify the flame detector eye is not dirty. 4. Replace scanner.
	Insufficient Gas Supply	1. Verify the manual shut down valves are open, allowing gas flow through the gas train. 2. Adjust incoming gas pressure to match the start up report.
	Gas Filter Blocked	Replace gas filter.
	Air supply blocked	Verify venting is not obstructed and filter is not plugged.
Boiler fails while modulating	Gas valve not set properly	Verify the last elbow matches the start up report.
	Air supply blocked (direct vent only)	Verify venting is not obstructed.
Poor combustion	Gas valve not set properly	Adjust gas valve settings.
Manual Reset limit device trips	Manual Reset Limits include: Flame safeguard, high or low gas pressure, high temperature limit	DO NOT reset without determining and correcting the cause.
Power outage to the boiler room	Entire boiler system is disabled and de-energized.	When power has returned, the boiler will have to be manually reset, as it will be in the lockout position
Gas Pressure alarm is annunciated	Either insufficient gas pressure or the gas pressure to the manifold is too high for safe and proper operation of the boiler. This shuts down the burner. When gas pressure is restored, the annunciated alarm will remain on and the boiler will remain locked out until the gas pressure switch is manually reset.	Locate cause and correct. In the event of a high gas manifold pressure condition, qualified service personnel must correct the problem before restarting the boiler.
High water temp alarm is annunciated	Boiler water has exceeded both the operating and high-limit temperature. When the water temperature falls below the high-limit temperature, the boiler will remain locked out until the controller is manually reset.	Locate cause and correct. Once the control is reset, the sequence returns to normal operation provided that the other limits are satisfied.

Standard Warranty for Fulton Endura Hydronic Boilers

TEN (10) YEAR THERMAL SHOCK WARRANTY

The Endura pressure vessel is warranted against failure due to thermal shock for ten (10) years, provided the boiler is installed, controlled, operated and maintained in accordance with the Installation, Operation and Maintenance Manual. This warranty does not cover damage due to corrosion, scaling, sooting and/or improper installation, operation and maintenance. Thermal shock is defined as a pressure vessel failure determined, by Fulton Heating Solutions, to be caused by uneven expansion of the materials of construction.

FIVE (5) YEAR PRESSURE VESSEL WARRANTY

The pressure vessel and heat exchanger is covered against failures resulting from flue gas corrosion (when firing on natural gas), and/or defective material or workmanship for a period of five (5) years from the date of shipment from the factory. Waterside corrosion or scaling is not covered. Fulton Heating Solutions (Fulton) will repair, replace, exchange or credit at our option, FOB factory, the pressure vessel as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with the Installation, Operation and Maintenance Manual.

PARTS WARRANTY

Fulton will repair or replace any part of the Endura boiler 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). Fulton shall be notified in writing as soon as any defect becomes apparent. Defective parts must be returned to Fulton for evaluation and warranty consideration.

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. 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 Fulton has been advised of the possibility of such damages. Fulton's liability shall never exceed the amount paid to Fulton for the original equipment found to be defective.

CONDITIONS OF WARRANTY

Warranties are only valid if the boiler is installed, operated and maintained as outlined in the Installation, Operation and Maintenance Manual. Fulton shall accept no responsibility if the equipment has been improperly installed, operated or maintained or if the buyer has permitted any unauthorized modification, adjustment, and/or repairs to the equipment. The use of replacement parts not manufactured or authorized by Fulton will void any warranty express or limited.

Warranty coverage for all components and equipment in said warranty are not valid unless the boiler is started up by a factory certified technician. The commissioning agency must successfully complete and return the equipment Installation and Operation Checklist to Fulton's Service department within twelve (12) weeks of startup.

The boiler must be maintained in accordance with the product manual and annual combustion and maintenance reports must be produced for warranty consideration. The warranty is valid for the original installation and original owner only.

Effective 07/01/2013

Fulton®

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Parts

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

⚠ WARNING

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

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

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