

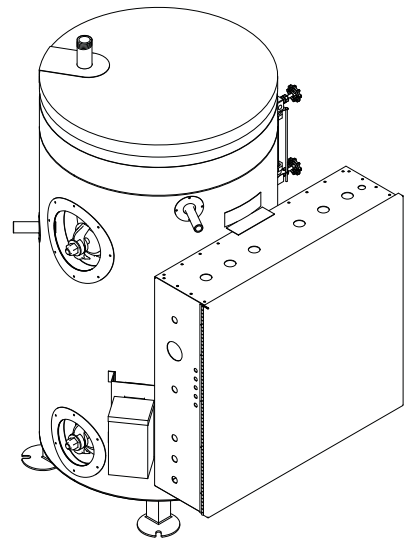


INSTALLATION AND OPERATION MANUAL

Electric Hot Water Boiler (FB-W)

12 to 700 kW

1.2 to 70 HP



Serial/National
Board # _____

Model _____

Fulton Order _____

Sold To _____

Job Name _____

Date _____



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Overview

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

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

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

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

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

Warnings & Cautions

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

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

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

Disclaimers and Local Codes

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

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

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.

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 **WARNING**

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

 **CAUTION**

This boiler is certified for indoor installation only.

Product Overview

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

The following specifications, equipment and operating descriptions apply to typical Fulton Electric Hot Water Boilers. This section is provided for general reference purposes only, and may not reflect specific details for your boiler.

The Fulton Electric Hot Water Boiler pressure vessel assembly consists of an annular jacket with a tangential inlet to provide rising spiraling flow across the elements. It is ASME constructed and stamped.

Forced even circulation of water is achieved by a design that ensures the water spins upward in the water vessel. The spinning water is evenly mixed and heated, eliminating stratification. This unique circulation method achieves an even flow of water across the elements. It is heated uniformly while it washes each element. This results in low flux temperatures and long element life.

Multiple vertically oriented stainless steel or Incolloy elements discourage build-up because element expansion and contraction causes mineral or lime deposits to flake off and drop to the bottom of the boiler, thus assuring longer element life.

Low element heat flux (watt density) promotes uniform heating and long element life. Symmetric element placement stabilizes water level.

Four (4) inches (2" for models FB-012-W through FB-070-W) of high temperature glass fiber insulation is wrapped around the boiler vessel. A neatly finished steel jacket encloses the insulation. The top of the unit is encased in a screen material for venting.

Review Shipment Contents

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

■ Boiler Storage Prior To Installation

If it is necessary to store the boiler for a prolonged period of time prior to installation, the boiler should be stored at a minimum 40 F ambient temperature in an environment in which excessive moisture cannot damage the controls or jacket.

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. Locate in dry surroundings on a solid level base. Take note of the dimensions given in Table 1.
2. Since an external electrical source is utilized, the boiler must be electrically grounded in accordance with the National Electrical Code, ANSI/NFPA 70-latest edition.
3. Ensure that there is sufficient room around the boiler to enable the operator and the maintenance engineer to gain access to all parts of the boiler.
4. Check location for ease of water supply and electrical connections. UL requires at least 36" clear space be maintained in front of any electrical panel.
5. Unit is crated for forklift transport. Do not allow weight to bear on any equipment components.

Clearances and Serviceability

Adhere to the following for clearances and serviceability:

1. All local and national codes (NFPA, ANSI, UL, ETL, 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. This will allow access around the equipment to facilitate maintenance and a safe work environment. UL requires at least 36" clear space be maintained in front of any electrical panel.
3. Ensure all labels on the boiler will be fully visible for maintenance and inspection.

Boiler Trim

Each boiler is supplied with the following (supplied standard or fitted to boiler). Additional trim may be provided as ordered.

- Temperature/Pressure Gauge
- Low Water Cut Off (Probe Type)
- Water Relief Safety Valve (ASME Rated)
- Operating Aquastat
- High Limit Aquastat



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.

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.

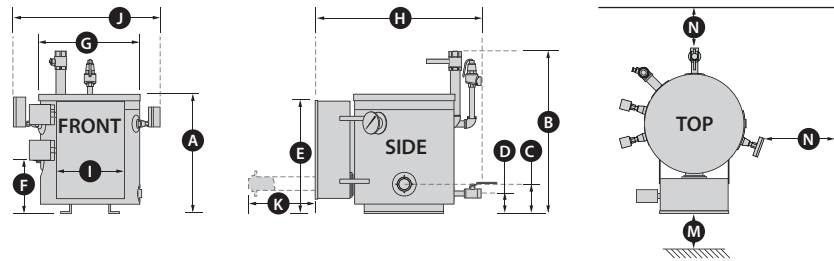
TABLE 1A- BOILER DIMENSIONS

Model FB-W		012	015	018	024	030	036	050	070	105	140	175	210	280	350	420	490	560	630	700	
Unit Size	kW	12	15	18	24	30	36	50	70	105	140	175	210	280	350	420	490	560	630	700	
	HP	1.2	1.5	1.8	2.4	3	3.6	5	7	10.5	14	17.5	21	28	35	42	49	56	63	70	
Height																					
(A) Heater Overall	IN	24	24	24	24	24	24	55	55	55	55	55	55	55	55	55	55	55	55	55	55
	MM	610	610	610	610	610	610	1397	1397	1397	1397	1397	1397	1397	1397	1397	1397	1397	1397	1397	1397
(B) Hot Water Outlet	IN	18	18	18	18	18	18	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5	45.5
	MM	457	457	457	457	457	457	1156	1156	1156	1156	1156	1156	1156	1156	1156	1156	1156	1156	1156	1156
(C) Return Water Inlet	IN	4.25	4.25	4.25	4.25	4.25	4.25	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
	MM	108	108	108	108	108	108	241	241	241	241	241	241	241	241	241	241	241	241	241	241
(D) Drain Outlet	IN	4.25	4.25	4.25	4.25	4.25	4.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
	MM	108	108	108	108	108	108	159	159	159	159	159	159	159	159	159	159	159	159	159	159
(E) Electric Control Box	IN	20.5	20.5	20.5	20.5	20.5	20.5	47	47	47	47	47	47	48	48	52	49	49	54	60	60
	MM	521	521	521	521	521	521	1194	1194	1194	1194	1194	1194	1219	1219	1321	1245	1245	1372	1524	1524
(F) Hand Hole	IN							9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5	9.5
	MM							241	241	241	241	241	241	241	241	241	241	241	241	241	241
Width & Depth																					
(G) Heater Diameter	IN	20	20	20	20	20	20	17	17	24	24	28	28	36	40	40	44	44	50	50	50
	MM	508	508	508	508	508	508	432	432	610	610	711	711	914	1016	1016	1118	1118	1270	1270	1270
(H) Overall Depth Electric Panel to Drain	IN	34	34	34	34	34	34	31	31	38	39	43	43	54	59	59	60	67	67	70	70
	MM	864	864	864	864	864	864	787	787	965	991	1092	1092	1372	1499	1499	1524	1702	1702	1778	1778
(I) Electric Panel Width	IN	22	22	22	22	22	22	22	22	32	32	32	32	40	40	40	44	44	44	44	60
	MM	559	559	559	559	559	559	559	559	813	813	813	813	1016	1016	1016	1118	1118	1118	1118	1524
(J) Heater Width Overall	IN	30	30	30	30	30	30	23	23	32	32	37	40	41	53	53	53	58	64	64	64
	MM	762	762	762	762	762	762	584	584	813	813	940	1016	1041	1346	1346	1346	1473	1626	1626	1626
Minimum Clearances																					
(K) Horizontal to remove Elements	IN	15	15	15	15	15	15														
	MM	381	381	381	381	381	381														
(L) Floor to Ceiling to Remove Elements	IN							95	95	95	95	95	95	95	95	95	95	95	95	95	95
	MM							2413	2413	2413	2413	2413	2413	2413	2413	2413	2413	2413	2413	2413	2413
(M) Front of Heater (min. to open door)	IN	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36	36
	MM	914	914	914	914	914	914	914	914	914	914	914	914	914	914	914	914	914	914	914	914
(N) Sides and Rear of Heater	IN	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24
	MM	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610	610

All dimensions are approximate. Fulton reserves the right to change dimensions and/or specifications without notice.

*For unspecified voltages, consult factory.

Models FB-W 012-036
12 kW to 36 kW (1.2 to 3.6 BHP)



Models FB-W 050-700
50 kW to 700 kW (5 to 70 BHP)

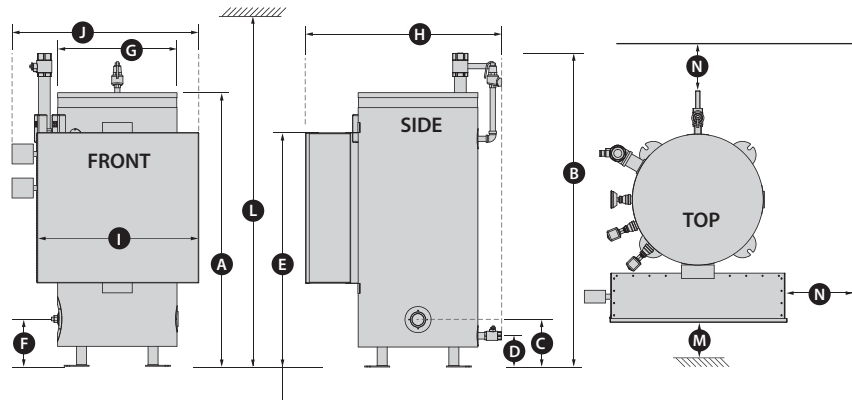


FIGURE 1 - BOILER DIMENSIONS

TABLE 1B - SPECIFICATIONS

Model FB-W	012	015	018	024	030	036	050	070	105	140	175	210	280	350	420	490	560	630	700	
Number of Elements	1	1	1	2	2	2	2	2	3	4	5	6	4	5	6	7	8	9	10	
Output	1000 BTU/HR	41	51	62	82	103	124	172	241	362	483	603	724	966	1207	1449	1690	1932	2173	2415
	1000 KCAL/HR	10	13	16	21	26	31	43	61	91	122	152	182	243	304	365	426	487	548	609
Approx. Shipping Weight	LB	420	420	420	450	450	450	580	580	950	1088	1225	1225	1380	1615	1850	2039	2150	2320	2660
	KG	191	191	191	204	204	204	263	263	431	494	556	556	626	733	839	925	975	1052	1207
Water Capacity	GALLONS	13	13	13	13	13	13	21	21	51	51	68	68	132	133	133	169	169	234	234
	LITERS	49	49	49	49	49	49	79	79	193	193	257	257	500	503	503	640	640	886	886
Heater Connection Sizes																				
Hot Water Outlet	IN	1.25	1.25	1.25	1.25	1.25	1.25	2	2	2	2	2	2	2	2	2.5	3	3	3	3
	MM	32	32	32	32	32	32	51	51	51	51	51	51	51	51	64	76	76	76	76
Hot Water Inlet	IN	1.25	1.25	1.25	1.25	1.25	1.25	2	2	2	2	2	2	2	2	2.5	3	3	3	3
	MM	32	32	32	32	32	32	51	51	51	51	51	51	51	51	64	76	76	76	76
Drain Outlet	IN	1	1	1	1	1	1	1	1	1	1	1.25	1.25	1.25	1.25	1.5	1.5	1.5	1.5	1.5
	MM	25	25	25	25	25	25	25	25	25	25	32	32	32	32	38	38	38	38	38
Safety Valve Inlet (160 PSIG)	IN	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
	MM	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19
Safety Valve Outlet (160 PSIG)	IN	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	MM	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Electrical Power Requirements (Amps)																				
208V 3 Phase		34	42	50	67	84	100	139	195	292	389	486	583	778	Consult Factory					
230V 3 Phase		31	38	46	61	76	91	126	176	264	352	440	528	703	879	1055	1231	Consult Factory		
460V 3 Phase		16	19	23	31	38	46	63	88	132	176	220	264	352	440	528	616	703	791	879
575V 3 Phase		13	16	19	25	31	37	51	71	106	141	176	211	282	352	422	493	563	633	703

Specifications are approximate. Fulton reserves the right to change dimensions and/or specifications without notice. Voltage applied higher than the above ratings will result in higher amp draws. 160 PSIG design boilers operate up to 130 psi, 230 F.

- Drain Valve
- PID Type Temperature Controller
- Boilers 100kW and larger: staged element sequencer for modulation of output

Temperature Control

Temperature control is achieved via an operating and high limit temperature controller. The high limit temperature controller is a temperature switch that is set to shut the boiler off if the water temperature exceeds the set point. For ASME Section IV hot water boiler, the high limit must be below 250 F.

The operating controller is a temperature sensor and PID Type controller that converts a temperature measurement into a 4-20 ma signal. The signal, which is proportional to the temperature of the water in the boiler, is used to energize/de-energize the contactors or step controller. The step controller (power modulation) will energize/de-energize each element based on a preset sequence to maintain the outlet water at a preset temperature.

Step Controllers

At start up stage number one is first "on" with additional

stages added as demanded. When set point is reached, the first "on" stage is removed followed by the next stage "on". Where control is a fraction of the total load, a sequence of on-steps will advance through the total number of stages, trailed by a sequence of "off" steps. In this way all contactors and heaters tend to operate equally.

A back up operating temperature switch is supplied on each boiler and will act to energize/de-energize all elements simultaneous based on boiler water outlet temperature.

Water Supply

Water Quality

The quality of the water used in the boiler will affect the life of the elements and pressure vessel and it is strongly recommended that a competent water treatment concern be consulted prior to the operation of the boiler. Boiler internals damaged due to adverse water conditions cannot be replaced under warranty.

Water Specification

All water supplies contain some amount of solids, dissolved gases and dissolved minerals. These materials may promote corrosion, deposition and/or fouling of equipment. To prevent

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 downsize safety valve discharge piping below safety valve discharge connection size. This is code violation.

CAUTION

Do not install this boiler on carpeting.

Boiler room temperatures greater than 100 F may cause premature failure of the control panel electrical components.

This boiler is equipped with a door safety switch, which will de-energize the boiler when the panel door is opened.

these contaminants from impacting on boiler performance, valve operation and general pipe longevity, each location must be analyzed and treated accordingly. The following are installation recommendations for “closed-loop” recirculating hot water heating systems.

1. Automatic pressure activated water make up valve with backflow preventer providing water to the system, not fed directly to the boiler, set to maintain:
 - Required NPSH for recirculating pump(s).
 - A positive system pressure at the highest point of 5 to 10 psi.
 - Make up water valve should be designed to add water to the system at the outlet of the boiler and should not be fed directly into the boiler.
 - Air removal equipment, including air separator and automatic air breather valves.
 - A functioning expansion tank designed to system specifications.
 - Filtration to remove particulates installed inline with the suction side of the recirculating pump.
 - Bypass chemical feeder for corrosion inhibitor maintenance.
 - Optionally a water meter could be installed in series with the automatic pressure activated water make up valve to monitor any make up water.
2. Ensure water quality meets the following:
 - Oxygen - less than 250 ppb (operating condition)
 - pH: 8 -10.5
 - Total Iron & Copper - less than 25 ppm
 - Corrosion Inhibitor - level capable of maintaining iron corrosion rates < 2 mpy. Due to changing environmental restrictions, a non-heavy metal, all organic inhibitor is recommended, which is designed for multi-metal systems including ferrous metals and yellow metals such as copper and brass.
 - Chlorides - less than 250 ppm.
3. Maintenance: To prevent scale or corrosion in boiler and associated piping, make up water must be kept to a minimum. This is best achieved by ensuring immediate repair of all leaks and maintenance of system pressure.

► **NOTE:** *There is a low water cut-off furnished as standard on all boilers.*

▪ **Water/Mechanical Installation**

Adhere to the following for water supply installation:

1. Pipe the supply water and return lines to the openings on the boiler. Water stop valves should be in line between the boiler and the first piece of

equipment.

2. Install the water safety valve into the opening on the boiler, piping the outlet of the valve to a safe blow-off point.

► **NOTE:** *Unless otherwise specified, the safety valve supplied with the boiler is pre-set. This valve is provided as a safety device for the boiler and should not be used as the sole protection for other equipment.*

3. Install the water temperature / pressure gauge assembly.
4. The drain valve is connected to the lowest opening at the bottom rear of the boiler. Pipe from the outlet of the valve to a safe drain point. Provision should be made to allow easy access to the drain valve.

Electrical Installation

Adhere to the following for electrical installation:

1. Connect wiring as shown in wiring diagram which is furnished inside the electrical control panel. Be sure to install a fused switch for the contactors and a separate fused switch for the circulating pump(s).
2. A correctly sized fused disconnect should be fitted as close to the boiler as possible and connections made to the boiler panel in compliance with NEC (National Electrical Code) and local codes.
3. Typical 120VAC controls allow for a +10% and a -15% voltage fluctuation.

■ Motors

1. 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.
2. For 3 phase motors, the line to line full load voltage must be balanced within 1% of the rated motor voltage. If the motor is rated 208-230V, the voltage deviations must be calculated from 230V. Operation outside of the above limits will degrade motor performance. 575V rated motors cannot be operated at voltages above 600V. Depending on the motor manufacturer, a 208V rated motor may not be able to run below the design voltage.



WARNING

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.

■ Electric Elements

Electric elements will have an increase in watt density if the applied voltage is higher than the element design voltage. Therefore, electric elements have a 0% tolerance for operation over design voltage. Electric elements can tolerate a lower than design voltage but the kW must be derated accordingly.

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WARNING

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

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

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

Before turning on this boiler, ensure all electrical connections in the boiler control panel are tight and ensure all sections of this manual have been read and are understood.

When shutting the boiler down for any extensive repairs, shut off main power switch and main disconnect switches on both the boiler side as well as the supply water side.

Never tamper with the safety features of the low water safety cutoff.

Before Start Up

Before start up, ensure you have read and followed all previous safety information.

Start-Up

Perform the following to start boiler:

1. Close drain valve.
2. Open water stop valve at top of boiler. (Water Supply to System).
3. Open water feed valve on boiler. (Water Return to Boiler).
4. Open valves in makeup water line.
5. Fill the boiler and system with water. (While filling the unit and system a bleed valve must be open at the highest point to allow air to escape). When the unit is full, close the bleed valve.
6. If the heating element is equipped with a thermostat, the dial should be set at number 11 at all times.
7. Activate the main power fused switch.
8. Activate the boiler power on switch, located on the top of the panel box (Figure 2).
9. With the unit full of water (which activates the low water probe), the low water relay is enabled. Push manual reset button on panel box.
10. If, for any reason, the water leaves the low water cut-off probe, the unit will automatically shut down.

Boiler Controls

Once fully operational the boiler will be automatically controlled as follows:

- Pressure and Temperature Gauges – reads pressure and water temperature of boiler.
- Low Water Cut-Off – Probe Type – Shut down the unit when the water level is too low. A low water cut-off condition will require pushing the manual reset button on the panel box.
- Water Relief Valve (ASME Approved) – releases extra pressure.
- Water Outlet Valve – allows water to circulate through system.
- Operating Aquastat – controls operating temperature.
- High Limit Aquastat – high temperature safety lock out.
- PID type temperature controller will control operating temperature set point.

- The element sequencer will energize/de-energize elements in sequence to maintain outlet temperature.

■ Circulating Pump Switch (if supplied with the boiler)

The fused switch that controls the circulating pump should be kept in the "on" position at all times during the boiler operation as well as during the non-operating period of the boiler. This should be turned "off" only when repairs or adjustments should be made.

■ Thermostat (optional)

An element thermostat may be supplied with your boiler. The thermostat is located on one of the heating elements and is preset from the factory. This should not be readjusted without consulting factory or your local Fulton representative.



FIGURE 2 - PANEL BOX (EXTERIOR)

Legend:

- A Runtime Meter (optional)
- B. Alarm Horn
- C. Temperature Controller
- D. Various Lights/Alarms
- E. Multimeter

WARNING

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

CAUTION

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

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.

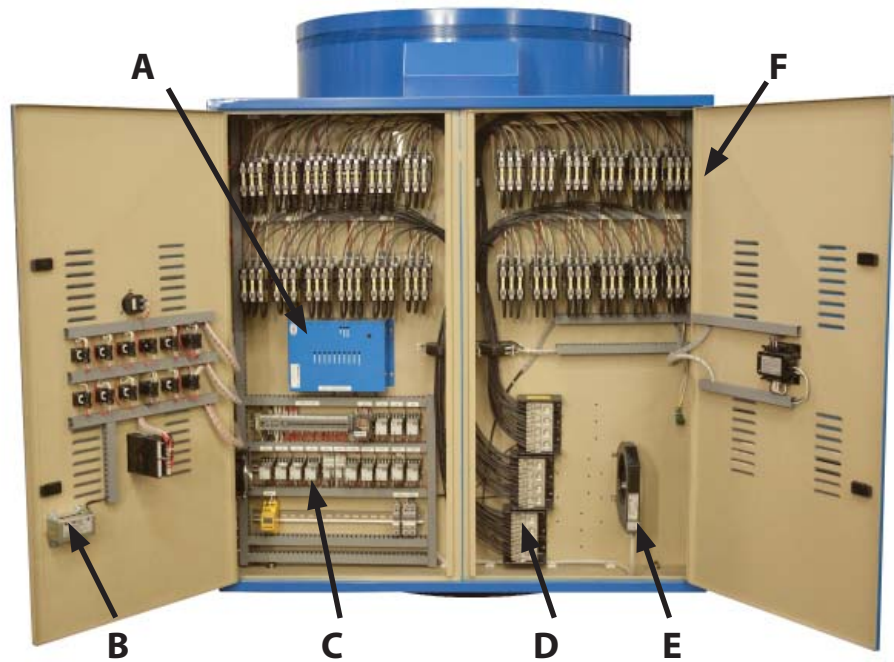


FIGURE 3 - PANEL BOX (INTERIOR)

Legend:

- A Element Sequencer
- B. Door Interlock Switch
- C. Various Relays
- D. Main Power Connections
- E. Ground Fault Monitor (optional)
- F. Element Contactors

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WARNING

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

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

Follow all proper lockout/tagout procedures for service.

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

Do not use harsh cleaning compounds that could damage this equipment.

CAUTION

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

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

General

Your 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 Maintenance and Inspection Schedule

Daily maintenance and inspection must include the following:

1. Check all valves for proper opening and closing.
2. Check supply water pump for proper operation.
3. Check make-up air water meter reading to verify no excessive leakage from hot water loop has occurred.

Monthly Maintenance and Inspection Schedule

Monthly maintenance and inspection must include the following:

1. Check safety valve for proper operation.
2. Check low-water cut-off relay for proper operation.

Annual Maintenance and Inspection Schedule

Annual maintenance and inspection must include the following:

1. Inspect bottom of boiler for scale and lime by removing heating element. Clean/replace as needed. It is critical to perform this when boiler is cool and is vented to the atmosphere.
2. When the water level drops, the low water relay will shut off the contactor. This shows that the relay is working properly.
3. Check for loose terminals and wiring connections.
4. Remove and clean the water electrode probe in the boiler.
5. Inspect boiler shell for possible mineral build-ups and clean if necessary.
6. Inspect elements on top of boiler for leaks, or loose flange bolts and nuts.
7. Check elements for correct amp rating.
8. Provide annual inspection by qualified ASME boiler inspector.
9. See **Handhole Gasket Installation** section for correct hand hole gasket installation.
10. Check temperature/pressure gauge periodically to verify compatibility with the operating aquastat/controller.

■ Handhole Gasket Installation

1. Remove old gasket and thoroughly clean the surface on boiler and on plate.
2. Place neoprene gasket on handhole plate. Be sure the gasket is pushed down tight on the plate. Do not use any grease, lubricant or adhesive.
3. After plate is in boiler and gasket is in place, set yoke and tighten nut only enough to provide a snug fit. See Figure 4. Make it hand tight then snug with wrench about ¼ turn. Do not compress excessively as neoprene gaskets should never be compressed as much as the old asbestos type.
4. If gasket leaks while pressure is being built up, tighten only enough to stop leakage. Never tighten more than necessary to prevent leakage. Excessive tightening may shorten life of gasket.

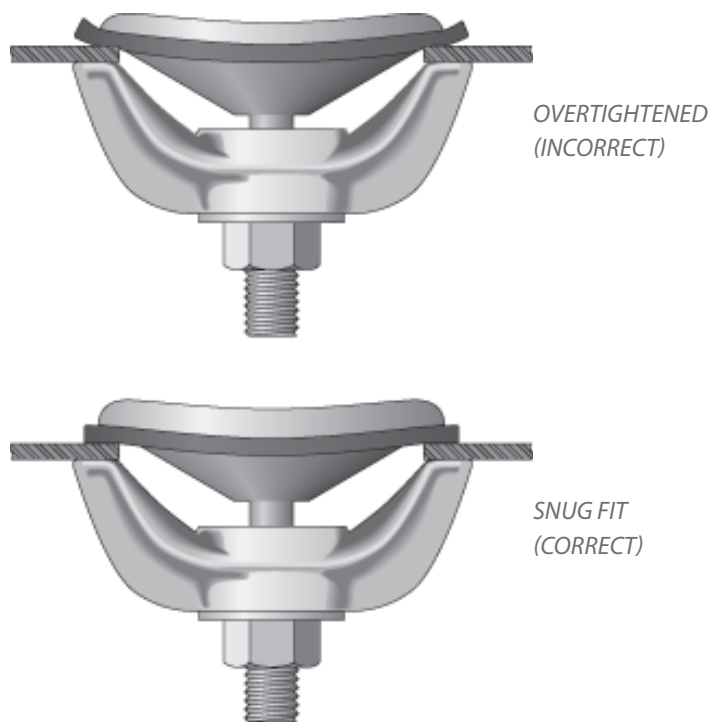


FIGURE 4 - GASKET INSTALLATION

■ Scale Formation

The dangers of scale to the life of the element cannot be overstressed. Scale possesses excellent insulating qualities and its formation on the element prevents the heat generated by the element from being transferred to the water, causing the element to overheat and burn out. Loose powdery formations can be removed with a wire brush. Hard scale may be removed using a mild chemical cleaning agent followed by a neutralizing agent.

Elements, if stored correctly, have an indefinite shelf life. However, problems will arise if they are stored in damp or humid conditions. Moisture can be absorbed by the insulation as the elements are fitted with a breathing seal.



WARNING

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

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

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

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

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



CAUTION

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

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

To protect unit components and prolong equipment life, it is essential that regular inspections are carried out. The most common causes of failure are excessive scale build-up and corrosion.

Troubleshooting

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

Problem	Check
Unit Does Not Run	Check fuse or circuit breaker. Use a multimeter to check voltage across the fuse. If power is off, remove fuse from fuse holder and check with multimeter or continuity light to see if there is a break in the fuse.
	Reset or replace, as necessary.
	Ensure unit is on.
	Water Level too low. Check supply water.
Fuse is Blown	1. If power is on use a multi meter to check voltage across the fuse.
	2. If power is off remove fuse from fuse holder and check with a multi meter or continuity light to see if there is a break in the fuse.
	3. If a break is detected – shut off power and remove fuse with a fuse puller. Replace with a new fuse of the same voltage and amps. Turn power on.
	1. If control circuit failure is suspected, trace the wiring diagram through each component with a multi meter to verify power in each stage or that component is supplied.
Control Circuit Failure	2. If part of the voltage is stopped at any point, replace that component and continue the test until all circuits test clear.
	1. Turn off power. 2. Remove all wires from switch terminals. 3. Check all terminals for looseness or corrosion. 4. To test for proper make or break of circuit, use a multimeter or continuity light. If bad, replace using adjustable wrench and screwdriver.
Control Switch Fails to Operate	1. With a multi meter check power on #1 terminal to see if power is coming to the relay. If it is, continue through the relay verifying circuit power to each part of the control. 2. If it is faulty, replace.
Faulty Low Water Safety Relay	1. Check wire to probe. If the wire is suspected to be bad, shut off the power and check the wire with a continuity light. 2. If probe is dirty, clean with very fine sandpaper or emery paper and replace into boiler.
Faulty Probe	1. If power is on, check across thermostat with a volt meter to verify power going through the switch on all points. 2. If power is off, read across contactors on switch with a continuity light to verify switch is not breaking down. 3. If the thermostat is bad replace it by using a flat-head or Phillips head screwdriver.
Faulty Element Thermostat	

<p>Faulty Wiring Connections</p>	<ol style="list-style-type: none"> 1. With power off, check continuity of circuit through each point in the circuit. 2. If a break in the circuit is found, the connection should be repaired use the following tools: wire cutters, wire strippers, flat-head screwdriver, Phillips head screwdriver, crimping pliers, needle nose pliers, tape, connectors, or wire splice connectors. 3. After the break has been corrected recheck it with a continuity light with the power off. Then turn off power on and check with multi-meter.
<p>Faulty Contactor Contact Points</p>	<ol style="list-style-type: none"> 1. If a contactor has burned or dirty contacts, they should be brushed clean with a fine sandpaper or emery paper. 2. If they are burned through, the contactor should be replaced. 3. If they do not engage completely, the contactor coil may be weak and the contactor should be replaced. 4. An amp meter may be used to check amp draw through each leg of the contactor. 5. With power off an ohm meter can be used to check the contactor points between the contactor supply and contactor feed to verify the contactor is pulling in. A visual inspection on the side of the contactor can be made to see if the contactor is engaging. 6. All power coming into the contactor should be checked with a volt meter to verify proper feeding of contactor to eliminate possible overload. 7. If a contactor is in need of replacement, mark each wire and remove with a flat-head screwdriver; remove the base screws and replace with new contactor.
<p>Faulty Elements</p>	<ol style="list-style-type: none"> 1. With the power off, a continuity tester can be used to see if an element is burned out between each point. 2. If the power is on, a volt meter can be used to check power between each point on the elements. 3. If an element is bad, it will require a flat-head screwdriver to remove wires. Two crescent or adjustable wrenches to remove bolts from element face. A new gasket and gasket seal should be used when replacing the element. 4. Be sure to check incoming voltage and amperage to each element to avoid overloading the element. 5. If the elements are dirty and not burned out, they may be cleaned by using caustic soda or soda ash in a combined solution.

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Standard Warranty for ICS/FB-A, ICW, ICX/FB-F, VMP, VMPW, FB-S, FB-L, FB-W, ICT

Effective Date: 2010-09-01

Five (5) Year (60 Months) Material and Workmanship Warranty

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

Parts Warranty

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

General

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

Parts

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

 **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.

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The Fulton Companies
972 Centerville Road, Pulaski, NY 13142
Call: (315) 298-5121 • Fax: (315) 298-6390



www.fulton.com

FBW-IOM-2014-0311