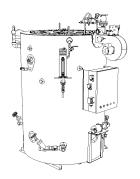


INSTALLATION AND OPERATION MANUAL

Vertical Multi-Port (VMP)
Oil-Fired Steam Boilers

Model VMP
40-150 HP



Serial/ National Board Number	
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 jursidictional authorities prior to installation.

Warnings & Cautions

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

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

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

Disclaimers and Local Codes

Installation of the equipment shall conform to all the requirements or all national, state and local codes established by the authorities having jurisdiction or, in the absence of such requirements, in the US to the National Fuel Gas Code ANSI Z2231/NFPA 54 latest edition, NFPA 31 (Standard for the Installation of Oil Burning Equipment), and the specific instructions in this manual. Authorities having jurisdiction should be consulted prior to installation.

The boiler heat exchanger is manufactured and stamped in accordance with ASME Boiler and Pressure Veseel Code, Section I or Section IV.

INTRODUCTION

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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.

Unless otherwise noted, this boiler is certified for indoor installation only.

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.

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

Installation must be carried out by qualified personnel only. All aspects of the installation must comply with applicable codes.

\triangle

CAUTION

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

Under no circumstances may shipping legs be used to mount or anchor boiler. Shipping legs are for shipping purposes only.

Placement & Rigging

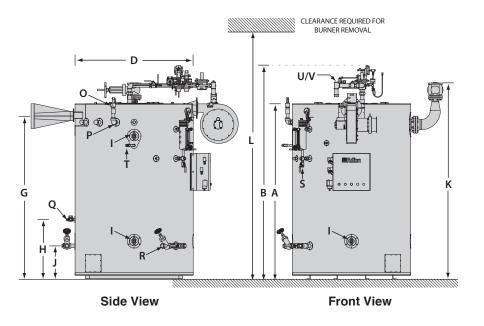
Proper placement of your Fulton Product is essential. Attention paid to the following points will save a great deal of difficulty in the future. Correct placement is the first step to trouble-free installation, operation and maintenance.

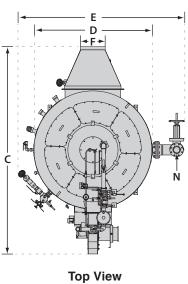
Adhere to the following for equipment placement and rigging:

- Consult authorities with jurisdiction over any national or local codes (including but not limited to National Fire Protection Agency (NFPA), American National Standards Institute (ANSI), Underwriters Laboratories (UL), SCA, and ASME, which might be applicable to boiler applications before beginning.
- 2. Make appropriate determinations for placement, based on the following:
- Check building specifications to ensure permissable floor loading requirements are met.
- Ensure the equipment is to be placed on a dry, non-combustible level base with adequate clearances from combustible materials. See Clearances & Serviceability section.
- Locate boiler as close as possible to the place where the heat will be used in order to keep pipe work costs to a minimum.
- Ensure that there is adequate clearance around the unit to provide access for operators and maintenance personnel to all parts of the equipment. Ensure also that clearance provides for component removal for maintenance. See Clearances & Serviceability section. The equipment should be placed in a suitable boiler house or well ventilated separate room through which personnel do not normally pass. The layout should eliminate traffic in potentially hazardous areas. For instance, the service engineer or the operator should not have to pass exposed, hot pipe work to make adjustments to the boiler controls.
- Ensure the equipment is to be placed in such a way that the electrical components are protected from exposure to water or excessive humidity.
- Ensure the boiler is located a safe distance from the fuel oil tank (if applicable).
- 3. Determine rigging procedure, based on the following:
- If means of lifting are not available, place rollers beneath the frame of the equipment for guidance to the installation position.
- Under no circumstances allow weight to bear on the jacket, control panel, burner, fuel train or fan housing of any Fulton boiler.
- Shipment legs on boiler, when applicable, are for shipping purposes only.
 These must be removed at time of installation, and may not be used to mount or anchor boilers.

INSTALLATION

Sta	ndard Models VMP		40	49.5	50	60	80	100	130	150
Jni	t Size	BHP	40	49.5	50	60	80	100	130	150
Hei	ght									
(A)	Boiler Overall	IN	84	91	88	94	100	102.5	114	113.5
Α)	Boiler Overali	MM	2133	2312	2235	2388	2540	2603	2895	2883
B)	Boiler Height w/Trim* & Fuel Train Assembly		98	112	102	116	122	124	138.5	138.5
D)	Boiler Height W/ I'llin & Fuel Irain Assembly	MM	2489	2832	2591	2946	3099	3150	3518	3518
Nic	lth & Depth									
C)		IN	97.5	100	101.5	101	115	120	129	131
(C)	Overall Depth Stack to Burner Fan Housing		2476	2540	2578	2565	2921	3048	3277	3327
D)) Boiler Diameter		51	55	54.5	54.5	62.5	69	76.5	76.5
(U)	Boiler Diameter	MM	1295	1397	1384	1384	1587	1753	1943	1943
(E)	Overall Width with Water Column	IN	80	62	82.5	82.5	94.5	99.5	107	107
L)		MM	2032	1575	2095	2095	2400	2527	2718	2718
F)	Flue Outlet Diameter	IN	12	12	12	12	14	14	14	16
Γ)		MM	305	305	305	305	356	356	356	407
G)) To Center of Flue Outlet	IN	76.5	86	80.5	86.5	92	95	106	106
(0)	To certier of Flue Outlet	MM	1943	2184	2045	2197	2337	2413	2692	2692
Ή)) Feedwater Inlet	IN	35	35	35	35	35	35	39	39
Π)	reedwater iffiet	MM	889	889	889	889	889	889	991	991
(1)	Handholes - 3" x 4" (Quantity)	IN	21.125 (x4)	21.125 (x4)	21.125 (x4)	21.125 (x4)	21.125 (x5)	21.125 (x5)	25 (x5)	25 (x5
,1)	Hamunoles - 3 X4 (Quantity)	MM	536 (x4)	536 (x4)	536 (x4)	536 (x4)	536 (x5)	536 (x5)	635 (x5)	635 (x5
(ل	Blowdown Outlet	IN	17.5	18	17.5	17.5	17.5	18	22	22
رر	Blowdown Outlet	MM	445	457	445	445	445	457	559	559
K)	Height to Steam Outlet ¹	IN	73	77	76.5	82	88	88.5	100	100.5
(N)	neight to steam outlet	MM	1854	1956	1943	2083	2235	2248	2540	2552
L)	Clearance Required for Burner Removal	IN	110	115	115	125	130	132	145	145
Clearance Required for Buffler Reffloval		MM	2794	2921	2921	3175	3302	3353	3683	3683
Ne	ights									
۸nr	arov Shipping Waight	LB	5775	6550	6575	7370	8000	9500	12350	12350
٦µ٢	orox. Shipping Weight	KG	2620	2972	2980	3340	3630	4310	5600	5600
۸nr	prox. Operating Weight	LB	6720	8850	8209	9227	11760	14525	20135	20135
4h	orox. Operating weight	KG	3050	4015	3720	4190	5330	6590	9130	9130



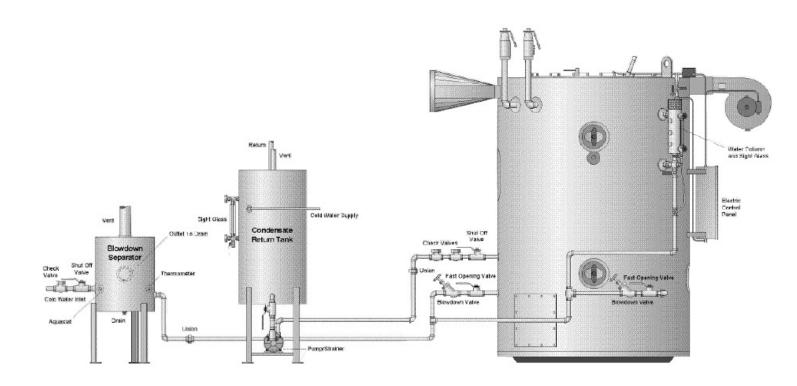


Models VMP	·		40	49.5	50	60	80	100	130	150
Boiler Connections										
		15-25 PSI	4	4	4	4	6	6	*6	*6
Steam Outlet (IN)		30-50 PSI	4	4	4	4	4	6	6	6
N) Steam Outlet (IN) CL 150# Flange		55-70 PSI	3	3	3	3	4	4	6	6
CL 150# Flange		75-95 PSI	3	3	3	3	4	4	4	6
		100-150 PSI	3	3	3	3	3	3	4	4
		IN	1.5	1.5	1.5	1.5	2	2	2	2
O) Safety Outlet 15 PSI		MM	38	38	38	38	51	51	51	51
		IN	1.25	1.25	1.25	1.25	1.5	1.5	2	2
P) Safety Valve Inlet 15 PSI (2)	MM	32	32	32	32	38	38	51	51
		IN	1	1.25	1.25	1.25	1.5	1.5	2	2
O) Safety Outlet 150 PSI		MM	25	32	32	32	38	38	51	51
	IN NPT	.75	1	1	1	1.25	1.25	1.5	1.5	
P) Safety Valve Inlet 150 PSI		MM	19	25.5	25.5	25.5	32	32	38	38
		IN	1	1	1	1	1	1.25	1.25	1.2
2) Feedwater Inlet		MM	25.5	25.5	25.5	25.5	25.5	25.5	32	32
		IN	1.5	1.5	1.5	1.5	1.5	2	2	2
R) Blowdown Outlet (2)	Blowdown Outlet (2)	MM	38	38	38	38	38	51	51	51
i) Watercolumn Blowdown		IN	1	1	1	1	1	1	1	1
Watercolumn Blowdown	MM	25	25	25	25	25	25	25	25	
		IN NPT	.75	.75	.75	.75	.75	.75	.75	.75
Surface Blowdown	MM	19	19	19	19	19	19	19	19	
NG/LPG Connection Size (Std CSD-1)	IN	1.5	1.5	1.5	1.5	2	2	2	2	
	MM	38	38	38	38	51	51	51	51	
	IN	.25	.25	.25	.25	.25	.25	.375	.37	
/) Oil Inlet Size		MM	6	6	6	6	6	6	9.5	9.5
atings** (Sea level to 3000 ft.)									
	,	1000 BTU/HR	1340	1656	1673	2009	2678	3347	4353	502
utput		1000 KCAL/HR	338	417	422	506	675	843	1097	126
		LB/HR	1380	1708	1725	2070	2760	3450	4485	517
team Output		KG/HR	626	775	783	939	1252	1565	2035	234
pproximate Fuel Consumpt	ion at Rated Cap	acity+								
	•	GPH	11	13.9	14	17	22.8	28	37	42
ight Oil		LPH	41.6	52.6	53	64.3	87	106	140	159
				,					,	
		FT³/HR	638	788	797	957	1275	1594	2080	239
ropane Gas		M³/HR	18	22	23	27	36	45	59	14.
		FT³/HR	1595	1972	1992	2392	3188	3985	5200	597
atural Gas		M³/HR	45	56	56	68	90	113	147	169
		Min. Inches WC	9	9	9	9	9	11	40	40
as Pressure Required for Stan	dard Burners	Max. Inches WC	13	13	13	13	13	13	5 psig	5 ps
		HP	1.5	1.5	1.5	1.5	3	3	10	10
urner Motor (Gas)		KW	1.1	1.1	1.1	1.1	2.2	2.2	7.5	7.5
(011/5)		HP	2	2	2	2	3	3	10	10
urner Motor (Oil/Combo)		KW	1.5	1.5	1.5	1.5	2.2	2.2	7.5	7.5
lectrical Power Requiremen	ts** (Burner Only									
08V, 50/60 CY, 3 Phase	(Gas/Oil)	Amps	6.6/7.5	6.6/7.5	6.6/7.5	6.6/7.5	10.6	10.6	30.8	30.
30 V, 50/60 CY, 3 Phase	(Gas/Oil)	Amps	6.0/6.8	6.0/6.8	6.0/6.8	6.0/6.8	9.6	9.6	28	28
60 V, 50/60 CY, 3 Phase	(Gas/Oil)	Amps	3.0/3.4	3.0/3.4	3.0/3.4	3.0/3.4	4.8	4.8	14	14
75 V, 60 CY, 3 Phase	(Gas/Oil)	Amps	3.7/4.0	3.7/4.0	3.7/4.0	3.7/4.0	5.2	5.2	12.3	12.
Vater Content	(,)									
		US Gallons	172	274	242	270	383	518	810	810
		Liters	651	1038	916	1022	1450	1960	3066	306
		Liters	031	1030	210	1022	1430	1 700	2000	1 200

NOTE: 9" - 13" WC gas pressure is required during run for 40-60 HP boilers with standard burners; 9" - 13" WC is required during run for 80 HP boilers with standard burners; 11" - 13" WC is required during run for 100 HP boilers with standard burners; 40" WC is required for 130-150 HP boilers.

Specifications and dimensions are approximate. Fulton reserves the right to change specifications and/or dimensions.

* Steam separator or dual steam nozzle design required. ** Steam output ratings at 212°F (100°C) feedwater temperature; 0 PSIG. +Consumption based on light oil 140,000 BTU/G; Natural Gas 1000 BTU/ft³; Propane 2500 BTU/ft³. ** Power requirements shown are for standard unit packages and may vary slightly when additional control options are added.



■ NOTE: When calculating ventilation requirements, heat losses from the Fulton equipment (and other equipment) should be considered.

Clearances & Serviceability

Adhere to the following for equipment clearances and serviceability:

- Ensure appropriate front, back, sides and top clearances are met. This will allow access around the equipment to facilitate maintenance and a safe work environment, and ensure technicians will commission the unit.
 Technicians will not commence commissioning if hazardous conditions exist.
- 2. Place boiler with clearances to unprotected combustible materials, including plaster or combustible supports, per the following:

ВНР	IN	MM
40	110	2794
49.5	115	2921

BHP	IN	MM
50	115	2921
60	125	3175
80	130	3302
100	132	3352
130	145	3683
150	145	3683

- 4. Pipes must not be run within 10" (254 mm) of any control cabinets or combustible material.
- 5. Verify that all clearances are acceptable with the local ordinances.
- 6. It is recommended to have three feet of vertical rise out of the steam header outlet. This is considered a good piping practice and will allow for proper operation.
- 7. Steam outlet sizes should not be reduced until after the three feet of vertical rise.

MARNING

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

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.

The installation of an exhaust fan in the boiler room is not recommended. An exhaust fan or similar equipment can create a downdraft in the stack or restrict the burner's air supply and result in poor combustion. It is essential only fresh air be allowed to enter the combustion air system. Foreign substances such as combustible volatiles and lint may create hazardous conditions.

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.

It is essential that only fresh air be allowed to enter the combustion air system. Foreign substances can create hazardous conditions. If foreign substances can enter the air stream, the combustion air inlet must be piped to an outside location. Failure to do so will void the warranty.

Environment, Ventilation and Combustion Air Requirements

Ventilation must be sufficient to maintain a boiler room temperature of 120F (48C) or less, and the panel box temperature must not exceed 125F (51C). A temperature exceeding 120F (48C) in the room may cause pre-mature failure of electrical components. Pumps, PLCs, or ModSync panels may require lower ambient temperatures or additional cooling. Consistent proper ventilation of the equipment room is essential for good combustion. Ensure the equipment room air supply openings are kept clear at all times.

NOTE: When calculating ventilation requirements, the combined heat losses from Fulton boilers/heaters and all other equipment in the room should be considered.

Adhere to the following to meet ventilation and combustion air requirements:

- 1. Install two fresh air openings, one at a low level, 24" (610 mm) from the floor, and one at a higher level on the equipment room wall. This will provide a flow of air to exhaust the hot air from the equipment room.
- 2. Ensure the burner has an adequate supply of air. Per NBIC recommendations, unobstructed air openings must be sized on the basis of 1.0 in 2 of free area per 2,000 BTU/hr of the maximum fuel input of the combined burners in the equipment room (650 mm2 per 586 W). These measurements are subject to state and local regulations.
- 3. Avoid ventilation which creates a negative pressure in the boiler room as it will seriously affect combustion and proper operation of the stack. The equipment room must maintain a steady neutral or slightly positive air pressure. The installation of an exhaust fan in a boiler room is not recommended. 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 or nuisance failures.
- 4. It is essential that only fresh air be allowed to enter the combustion air system. Foreign substances in the combustion system can create hazardous conditions. Particulate matter like lint, combustible volatiles, dust, smog or chemicals (example, perchlorethlylene, halogenated compounds) in the combustion air supply to the equipment will cause damage or failure of the burner and is not covered under warranty. Eliminate potential for high risk situations for particulate matter to be in the air supply (e.g., as the result of construction or maintenance activities). If foreign substances can enter the air stream, the combustion air inlet must be piped to an outside location. Failure to do so will void the warranty.

INSTALLATION

Utilities

■ The Fuel Oil Supply

Adhere to the following for installation:

- Fuel pipes must be of approved materials and of a diameter suitable for the quantity of oil being delivered to the burner. Vacuum must not exceed 10 in. (254 mm) of mercury at the pump inlet. Maximum inlet pressure to oil pump is 3 PSIG.
- 2. Oil burners are of a two-pipe design system, requiring a return line and a supply line. The oil pump is factory set per Test Fire Sheet. Do not alter the setting without consulting the factory.
- 3. A stop valve, a check valve, and an oil filter must be installed on the oil supply line.
- 4. When one line is feeding two burners, a check valve must be installed in each unit.
- 5. Ensure there are no loose fittings. Loose fittings in the fuel oil line will permit air to enter the fuel line and cause improper firing.

Electrical Supply

Adhere to the following for electrical supply installation:

- 1. Install wiring and ground in equipment in accordance with authority having jurisdiction or in absence of such requirements the National Electrical Code, ANSI/NFPA.
- 2. Provide a wall-mounted, fused disconnect sized for the unit. This must be fitted by the client/contractor if disconnect is not supplied on the panel.
- 3. Size fuses according to motor name plates and local electrical codes.
- 4. Connect power to the terminal strip as supplied on the inside of the panel box.
- 5. Determine multiple skid systems wiring requirements (between the skids). Fulton will run conduit and wire the devices on each skid. For the devices that have to come down for shipping, the wire will be left at the end of the conduit where possible, and wired in the field (by others). When the system has multiple skids that are adjoining, the conduit will be installed to break at the skid joints. The wire for the conduit running between the skids will be shipped loose to prevent damage when the skids are put back together. These wires will need to be run by the installing contractor in the field, and wired to proper locations. If there is wiring between skids that are not adjoining, this will need to be done by qualified personnel.

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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.

A qualified installer must perform installation and service on the fuel delivery system.

Ensure all electrical connections are powered down prior to attempting work on electrical components or connections.

\triangle

CAUTION

Loose fittings in the fuel oil line will permit air to enter the fuel line and cause improper firing.

\triangle

WARNING

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

\triangle CAUTION

A large amount of improperly treated makeup 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.

- ► NOTE: If the unit is not skid-mounted at the factory, it is the responsibility of the client/contractor to wire the circulating/feed water pump starter.
 - 6. Locate electrical schematic diagram, a copy of which is inside of the panel box.
- 7. Ensure the information on the electrical drawing corresponds to your voltage and frequency. Adhere to the following:
- Typical 120 VAC controls allow for a +10% and a -15% voltage fluctuation.
- 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.
- For three-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 these limits will degrade motor performance. 575V rated motors cannot be operated a voltages above 600V. Depending on the motor manufacturer, a 208V rated motor may not be able to run below the design voltage.
- 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.
- Normal supply will be 460 volts, 3 phase, 60 Hz, AC unless otherwise specified.

Water Chemistry

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:

- 1. Isolation valves and unions 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)

INSTALLATION

from the boiler. Clearance from hot water pipes to combustibles must be at least 6 inches (152 mm).

- 4. Pipe the water supply line to the lower opening on the back of the boiler. Water stop valve should be in line between the boiler and the first piece of equipment. Hot water outlet should be piped to process/equipment requiring hot water. Water makeup supply should be installed. Hot water inlet should be piped to the make-up water supply.
- 5. Pipe the water safety valve carry piping from the outlet of the valve to a safe blow-off point.
- NOTE: Do not alter water temperature/pressure gauge assembly in any way.
- 6. Drain valve is connected to the lowest opening at bottom rear of boiler. Carry piping from the outlet of the valve to safe drain point. Provision should be made for easy access to drain valve of boiler.
- NOTE: The water connection on the top of the boiler is the outlet connection. The water connection on the rear of the boiler is the inlet connection.
- 7. Install filtration to remove particulates if appropriate.
- 8. Install bypass chemical feeder for corrosion inhibitor maintenance if appropriate.
- 9. Install corrosion coupon holder to assess corrosion inhibitor performance if appropriate.
- NOTE: The boiler is provided with a drain valve connection and a drain valve.
- 10. 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.
- 11. 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.

∕!\ WARNING

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Water Chemistry Requirements

Recommended Water Conditions

Table below lists recommendations for feed water and boiler water. Contact your local water treatment professional for testing and treatment recommendations. It is very important that a strict water treatment program be followed.

It is critical that the boiler water chemistry follow table below whenever water is in the boiler. Solids that enter the feed water will concentrate in the boiler. A regular schedule of boiler blowdown (see **Maintenance** section of this manual) must be maintained to prevent high solid concentrations from corroding the vessel or forming deposits.

Water Supply

The quality of the water used in the boiler will affect the life of the pressure vessel (PV). It is strongly recommended that a competent water treatment company be consulted prior to the installation of the boiler. Elements/PV damaged due to adverse water conditions will not be replaced under warranty.

Natural feedwater supplies contain solids and dissolved gases. These may promote scale, foaming, corrosion, and/or poor steam quality. To prevent this, feedwater must be studied individually and treated accordingly. The treatment should provide quality feedwater to the boiler such that corrosion and deposition in the boiler will be minimized.

Thermal cycling, dissolved oxygen, high or low pH can all be major causes of corrosion. Untreated hardness is the major

WATER CHEMISTRY REQUIRMENTS FOR FULTON BOILERS

	Carbon Steel			Stainless Steel		
Parameter	Feedwater	Vertical Boiler/	Horizontal Boiler/	Feedwater	Vertical Boiler/	Horizontal Boiler/
		SteamPac Water	SteamPac Water		SteamPac Water	SteamPac Water
рН	7.5-9.2	8.5-10.5	8.5-10.5	6.0-9.2	8.5-10.5	8.5-10.5
Feedwater Temperature	140 F (60 C)*			140 F (60 C)*		
Hardness as CaCO ₃	< 2ppm	< 10 ppm	< 15 ppm	< 2ppm	< 10 ppm	< 15 ppm
Chlorides		***	***		50 ppm	50 ppm
Total Alkalinity		< 300 ppm	< 500 ppm		< 300 ppm	< 500 ppm
OH Alkalinity		200-300 ppm	200-300 ppm		200-300 ppm	200-300 ppm
Total Dissolved Solids		< 2000 ppm	< 3000 ppm		< 2000 ppm	< 3000 ppm
Suspended Solids	No visual turbidity**	No visual				
		turbidity**	turbidity**	turbidity**	turbidity**	turbidity**
Total Organic Carbon	No sheen	No sheen	No sheen	No sheen	No sheen	No sheen
	No foam +	No foam +	No foam +	No foam +	No foam +	No foam +
Iron	0.1 ppm and	0.1 ppm and	0.1 ppm and	0.1 ppm and	0.1 ppm and	0.1 ppm and
	colorless liquid++	colorless liquid++	colorless liquid++	colorless liquid++	colorless liquid++	colorless liquid++
Dissolved Oxygen	<1 ppm*	ND	ND	< 5 ppm	ND	ND
Visual Oil	ND	ND	ND	ND	ND	ND
Conductivity (mS/cm)		< 2985	< 4477		< 2985	< 4477

^{*} This is a minimum temp. Feedwater temperatures below 200 F (93 C) will require an oxygen scavenger.

ND: None Detected ppm: parts per million

^{**}Suspended solids: Take a water sample. After the sample sits for 10 minutes, no solids should be visible.

^{***}For carbon steel electric boilers with stainless steel heating elements, chlorides must be kept below 50 ppm.

⁺Total Organic Carbon: Take a water sample. Shake vigorously for 30 seconds. No sheen or foam should be visible.

⁺⁺ Iron: Take a water sample. The upper limit is 0.1 ppm. Hold the sample against a white background. The water should have no visible yellow, red or orange tinge.

cause of scale deposits. Poor quality feedwater requires increased blowdown and increased chemical treatment costs to prevent boiler corrosion and scaling.

One way to lower the amount of dissolved gases in the boiler feed water is to preheat the feedwater. This option injects live steam into the feedwater to increase the water temperature to 180 F (82 C) or higher which removes oxygen and carbon dioxide from the water.

Reverse Osmosis / Deionized (RO/DI) water is water from which all dissolved solids have been removed. Reverse osmosis is a process that uses a semi-permeable membrane, under pressure, to reject dissolved salts and allow only water to pass through. RO/DI water has no buffering capacity and a pH of <7.0. It is corrosive to carbon steel; however, it is not corrosive to stainless steel. Very high purity steam quality can be obtained with RO/DI water.

If RO/DI water is used as a water source in a carbon steel boiler, it must be neutralized to pH >7.5 prior to entering the boiler. Failure to neutralize the RO/DI will void the PV warranty and cause high general corrosion rates.

GLOSSARY OF WATER SUPPLY TERMS

Dissolved Oxygen: Oxygen that is dissolved in the feedwater will cause the steel in the boiler and the feedwater system to be attacked by the water in a manner described as "pitting". The pits that are produced can vary from tiny depressions to holes large enough to penetrate the boiler metal and are usually covered with tubercles of iron oxide. Once pitting starts, it may be extremely hard to arrest. Pitting can proceed at a surprisingly rapid rate and can occur not only in the boiler proper, but also in pre-boiler equipment such as economizers, feedwater tanks, and feedwater lines.

Suspended Solids: Suspended solids are the undissolved matter in water, including dirt, silt, vegetation, iron oxides, and any other insoluble matter. Normally suspended solids are expressed in terms of turbidity. Suspended solids may also deposit in low velocity areas and create fouling. In line filters, or various types of pretreatment can be used to lower the suspended solids level. Periodic blowdowns will eliminate suspended solids.

Alkalinity: Alkalinity is the capacity of a water to neutralize acids. Common water alkalinities consist of bicarbonate, carbonates, hydroxide, phosphate, and silicate. These alkalinities, especially bicarbonates and carbonates, break down to form carbon dioxide in steam, which is a major factor in the corrosion on condensate lines. High alkalinity also causes foaming and carry over in boilers. Both foaming and carry over cause erratic boiler operation. The reason for the high alkalinity should be determined. It may result from lack of sufficient blow off. The source of alkalinity may be due to an overdose of alkaline internal water treatment chemical.

pH: pH is a measure of the degree of acid or base of solution. A pH range of 8.5-10.5 will have little influence on the corrosion rate of carbon steel. A low pH can result in corrosion of metals, while a high pH can result in scale formation or caustic embrittlement. In order to control boilers and equipment used for the external treatment of make-up water, it is essential that reliable pH measurements be made. RO/DI water will have a pH of 6.0 - 6.5 and will require neutralization if used in a carbon steel vessel. It is critical that the boiler pH be

$\hat{m M}$ WARNING

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Hot pipework and vessels must be adequately insulated with material suited to the temperature and application to prevent both heat loss and personnel injury.

Boilers damaged due to adverse water conditions are not covered by warranty.

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

CAUTION

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

alkaline (8.5-10.5) whenever water is in the boiler.

Chlorides: If chloride levels are high enough to cause severe corrosion, they can be controlled by limiting the cycles of concentration and increasing boiler blowdowns. Corrosion from chlorides can also be controlled by increasing the amount of corrosion inhibitor, or changing to a more effective inhibitor. Reverse osmosis is another method of pretreatment to reduce chlorides. Chloride stress corrosion is a major concern in a stainless steel vessel.

Oil: Oil is not a natural constituent of boiler water; still it can frequently enter a system through leaks in a condenser or other heat exchanger. Oil can also enter a system through the lubrication of steam driven reciprocating equipment. Whatever the source, the presence of oil in boiler water is undesirable. Oil can act as a binder to form scale. In high heat-transfer areas oil can carbonize and further contribute to the formation of scale and low pH. Foaming is one indication of oil in boiler water. Its presence can also be confirmed by first shaking a bottle containing boiler water. If oil is present foam will result. Often oil in boiler water will originate in the condensate. This contaminated condensate should be directed to the sewer until the source of the oil is determined and corrective steps taken.

Iron (oxides): Iron in any of its oxide or complex forms is undesirable in boiler water. Iron in its various forms can originate in the raw water makeup, condensate return water, or form directly in the boiler as a result of corrosion. It can concentrate in the boiler and it tends to collect in stagnant areas.

Water Hardness: Water hardness is the measure of calcium and magnesium content as calcium carbonate equivalents. Water hardness is a primary source of scale in boiler equipment. Hardness is removed by softening.

Periodically, the ion exchange resin bed requires regeneration by flushing through with a brine solution followed by rising with fresh water. The interval between regeneration is dependent upon the raw water hardness and flow rate.

In all cases the water hardness should be tested periodically and prior to starting the generator to ensure efficient operation of the softener. Unsoftened water should not be allowed to enter the steam generator unless sufficient scale inhibitor chemical is used.

Feedwater: Feedwater is the combination of fresh makeup and returning condensate that is pumped to the boiler.

Condensate: Condensate is condensed steam that is normally low in dissolved solids. Hence, it does not contribute to the dissolved solid content of the feedwater. In addition, condensate is very expensive to waste. It's been chemically treated, heated, pumped, converted to steam, and condensed.

Dissolved Solids: Dissolved solids are salts in the water that stay in solution. They are invisible to the naked eye. As the boiler generates steam, dissolved solids will concentrate. If the concentration becomes too high, they will precipitate, form a suspended solid, and concentrate in the vessel. Daily boiler blowdown is recommended to help prevent the formation of deposits. Consult Blowdown procedure in the **Daily Maintenance Schedule** section of this manual.

Chemical Dosing: In addition to softening the feedwater, it is also important

to consider other factors such as dissolved oxygen and acidity. Depending on the results of an analysis, it may be necessary to inject appropriate amounts of corrective chemical into the feedwater system. This is usually achieved by means of a chemical compound solution and variable output metering pump mounted at the storage vessel. It is important that the chemicals and quantities are correct and it is advisable to contact a water treatment company to arrange a feedwater analysis.

Piping Specifications

For piping, the basic considerations are: the design temperature, the pressure retained by the pipe, the fluid in the pipe, the load resulting from thermal expansion or contraction, impact or shock loads imparted such as water hammer, external loads, wind loads and vibration from equipment.

Adhere to the following for piping installation:

- 1. Ensure the arrangement of the piping and its appurtenances takes into consideration the location of other structures and equipment adjacent to the piping, which may result in freezing interference and/or damage as a result of expansion, contraction, vibration, or other movements.
- Consider the appropriate location and orientation of valves necessary
 for safe operation and isolation of the piping. Valves are used in piping
 systems to stop and start the flow of fluids, to regulate flow, to prevent the
 back flow, and to relieve excessive pressure build up in the piping.
- 3. Ensure all piping and piping components are suitable for the design temperatures, pressure and fluid used in the system.
- 4. For boilers to 200 psig, it is recommended that boiler external pipe nipples be per tables at end of this section of the manual.
- 5. During construction of the installation, ensure that no dirt, water, or residue from welding is left in the system.
- 6. Provide expansion joints or properly designed and sited loops to accommodate thermal expansion. Thermal expansion should be calculated using the maximum possible utilization fluid temperature, regardless of whether the pipe considered is in the feed or return circuit. Steel pipe will expand approximately 1 " per 100' over a 100° F temperature rise (1 mm per meter over 100 C rise).
- 7. Provide supports and anchors for all pipes where necessary to prevent undue stresses from being placed on items of equipment, including pumps, valves, and the boiler. Supports and anchors which will not interfere with thermal expansion should be chosen.
- 8. All threaded joints may be used for connections (2.5 in (63.5 mm) and smaller in carbon steel piping. For larger diameters, all pipe joints should be welded or flanged construction. Stainless steel piping should be welded or flanged for connections greater than 1 in (25.4 mm).
- 9. Use gaskets to make all flanged connections. Gasketing material must be

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



CAUTION

The weight of all piping must be properly supported. Failure to support piping may result in equipment damage and/or system leakage.

Piping must take into consideration potential for freezing interference and/ or damage as a result of expansion, contraction, vibration, or other movements.

Dirt, water, and/or other debris in the piping system after welding may result in equipment failure.

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WARNING

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Cements for plastic pipe should be kept away from all sources of ignition. Proper ventilation should be maintained to reduce the hazard and to minimize breathing of cement vapors.

- suitable for use with the pressure, temperatures and fluids in the system. Ensure that all bolts are tightened evenly and to the torque recommended values provided by the gasket manufacturer.
- 10. Install high point bleeds at all high points in the system piping. 1/2" x 12" nipples welded in the top of the piping with ball valves and plugs attached are to be used.
- 11. Install all pipes with a pitch to facilitate draining and venting.

RECOMMENDED GASKET LOADS FOR FLEXITALLIC SPIRAL WOUND CLASS 150# GASKETS

SA 193 GRADE B7 BOLTS OR EOUAL

Nominal Flange Size (inches)	Number of Bolts	Diameter of Bolts (inches)	Minimum Torque Req. Per Bolt (ft-lb)	Maximum Torque Req. Per Bolt (ft-lb)
1/2	4	1/2	30	40
3/4	4	1/2	30	40
1	4	1/2	30	40
1 1/4	4	1/2	30	40
1 1/2	4	1/2	30	60
2	4	5/8	60	90
2 1/2	4	5/8	60	110
3	4	5/8	90	120
3 1/2	8	5/8	60	90
4	8	5/8	70	120
5	8	3/4	100	160
6	8	3/4	130	200
8	8	3/4	180	200
10	12	7/8	170	320

RECOMMENDED LOADS FOR FLEXITALLIC SPIRAL WOUND CLASS 300# GASKETS SA 193 GRADE B7 BOLTS OR EOUAL

Nominal Flange Size (inches)	Number of Bolts	Diameter of Bolts (inches)	Minimum Torque Req. Per Bolt (ft-lb)	Maximum Torque Req. Per Bolt (ft-lb)
1/2	4	1/2	30	40
3/4	4	5/8	60	70
1	4	5/8	60	70
1 1/4	4	5/8	60	70
1 1/2	4	3/4	100	120
2	8	5/8	60	70
2 1/2	8	3/4	100	120
3	8	3/4	100	120
3 1/2	8	3/4	100	120
4	8	3/4	100	140
5	8	3/4	110	160
6	12	3/4	110	160
8	12	7/8	180	260
10	16	1	250	290

INSTALLATION

RECOMMENDED LOADS FOR JM CLIPPER ELASTOGRAPH 150# GASKETS SA 193 GRADE B7 **BOLTS OR EQUAL**

Nominal Flange Size (inches)	Number of Bolts	Diameter of Bolts (inches)	Minimum Torque Req. Per Bolt (ft-lb)	Maximum Torque Req. Per Bolt (ft-lb)
1/2	4	1/2	26	42
3/4	4	1/2	26	42
1	4	1/2	26	47
1 1/4	4	1/2	31	52
1 1/2	4	1/2	31	58
2	4	5/8	84	126
2 1/2	4	5/8	95	126
3	4	5/8	105	137
4	8	5/8	105	126
5	8	3/4	189	227
6	8	3/4	189	227
8	8	3/4	189	245
10	12	7/8	306	367

RECOMMENDED LOADS FOR JM CLIPPER ELASTOGRAPH 300# GASKETS SA 193 GRADE B7 **BOLTS OR EQUAL**

Nominal Flange Size (inches)	Number of Bolts	Diameter of Bolts (inches)	Minimum Torque Req. Per Bolt (ft-lb)	Maximum Torque Req. Per Bolt (ft-lb)
1/2	4	1/2	26	42
3/4	4	5/8	53	84
1	4	5/8	53	84
1 1/4	4	5/8	63	95
1 1/2	4	3/4	132	208
2	8	5/8	74	116
2 1/2	8	3/4	151	208
3	8	3/4	170	208
4	8	3/4	170	227
5	8	3/4	189	227
6	12	3/4	189	227
8	12	7/8	306	367
10	16	1	459	551

Insulation

Return tanks, surge tanks, and deaerators should be insulated. Insulation should be chosen with care, so that the fluid in the tanks does not exceed the maximum

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operating temperature of the pump. Blowoff vessels should **not** be insulated.

System Interfaces

Proper selection and installation of the components in the system will ensure proper and safe operation of the boiler.

■ Condensate Return Feed Set Tank

Where an atmospheric condensate return tank is to be fitted, adhere to the following:

- 1. Vent to a safe location.
- 2. Have a pump capacity sufficient to satisfy boiler consumption as well as maintain proper return tank temperature. Capacity should provide 2 ½ times the evaporation rate of the boiler at a minimum discharge pressure of 3% higher than the safety valve set pressure, plus the pressure drop of the components between the pump discharge and the boiler feedwater inlet. Maximum temperature of the condensate return tank is dependent on the Net Positive Suction Head Required (NPSHR) of the feed water pump selected. Consult factory for details.
- 3. Do not downsize vent pipe (this may cause pressure build up in the condensate tank).
- 4. Shield return pipes to prevent burn hazard.
- See Return System Instructions Manual for detailed instructions.

■ The Feed Water Piping

Where the feed water piping is to be fitted, adhere to the following:

1. Size piping adequately to provide proper water supply. Minimum water supply piping sizes:

Unit Size (BHP)	inch (mm)
40 - 80	1 (25)
100 -150	1.25 (31.7)

2. When feeding the boiler using a Fulton return system with float valve assembly: ensure the water pressure does not exceed 40 psi. A pressure reducing valve should be installed ahead of the return tank when pressures exceed 40 psi. Other configurations may allow for higher pressures.

- 3. Do not use the feed water pump as a support for the feed water piping. This could add undue strain to the pump head. Use proper piping supports as necessary to support feed water piping.
- 4. Do not use stainless steel within the Boiler External Piping (BEP) boundary.
- 5. Ensure all piping is done in compliance with all applicable codes.

Blow Off Separator

Where a blow off separator is to be fitted, adhere to the following:

- 1. Vent to a safe location.
- 2. Have a capacity sufficient to satisfy boiler blow- off, as well as maintain proper drain temperature.
- 3. Ensure compliance with all applicable codes when determining connection piping between the boiler and the blow off separator.
- 4. Do not downsize vent pipe (this may cause pressure build up in the blow off separator tank).
- Include a thermostatically controlled cooling kit in cases where drain temperature exceeds 120 F (49 C) or maximum allowable temperatures allowed by local jurisdiction.
- 6. Do not insulate blow down separator.

■ The Blow Off Valves

Where the boiler blow off valves are to be fitted, adhere to the following:

- 1. Ensure pipes and connections are clean and free of any foreign material.
- 2. Pipe blow off pipes to a blow off separator of approved design.
- 3. Ensure that for each blow off line there is a slowopening and a fast-opening valve.
- 4. Between the boiler and the second blow down valve, ensure all piping is Schedule 80 and fittings are CL

3000 forged steel.

5. Ensure compliance with all applicable codes.

Steam Safety Valve

Where a steam safety valve is to be fitted, adhere to the following:

- 1. Have a capacity sufficient to satisfy maximum boiler output in lbs/hr or Btu/hr.
- 2. Ensure pipes and connections are clean and free of any foreign material.
- 3. Do not install using a pipe wrench. Use the appropriately sized wrench on the bonnet nut.
- 4. Install the valve vertically with no unnecessary intervening piping between the boiler and the valve.
- 5. Do not cap or plug the weep hole on the side of the safety valve.
- 6. Ensure that the valve is vented to a safe location.
- 7. When a discharge pipe is used, ensure it is of a pipe size equal to, or greater than, the outlet of the safety valve.
- 8. Use Schedule 40 piping only for the discharge. Do not use Schedule 80, extra strong or double extra strong piping as the internal diameter is of reduced size and will increase discharge restriction.
- 9. Minimize discharge piping fittings and overall piping run to avoid over pressurization of the piping, limiting safety valve discharge volume.
- 10. Do not support discharge piping with the safety valve. Discharge piping must be supported adequately by appropriate means.
- 11. Terminate the discharge pipe directly to atmosphere. Discharge pipe must



STEAM SAFETY VALVE

riangle warning

Improper installation or maintenance of the gauge glass assembly can cause immediate or delayed breakage resulting in bodily injury and/or property damage.

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

Discharge from safety relief valve must be configured so that there is no danger of scalding personnel or causing equipment damage. Provisions must be made to properly drain safety relief valve discharge piping.

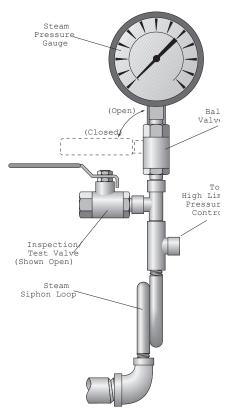
not contain a shut off valve of any sort.

12. Safety valve discharge piping must conform to local codes and jurisdictions. Safety valve piping must be piped in such a way as to allow for proper expansion, so that there is no stress put on the safety valve. Safety valve piping must also be piped so that it does not allow for condensate to collect in the piping. A means to properly drain condensate must be present. A common practice is to use a drip pan elbow where allowable.

Steam Pressure Gauge Assembly

Where a steam pressure gauge is to be fitted, adhere to the following:

- 1. Ensure pipes and connections are clean and free of any foreign material.
- 2. Do not install using a pipe wrench. Use the appropriately sized wrench on the connection fitting.
- 3. Install using a siphon loop flooded with water to act as a water seal to buffer the gauge element.
- 4. Face the gauge in a direction easily viewable by the



STEAM PRESSURE GAUGE ASSEMBLY

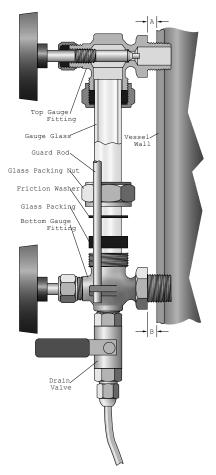
operator.

5. Range the gauge to approximately double the pressure at which the safety relief valve is set but in no case less than 1.5 times the safety relief valve set pressure.

■ The Water Column and Water Gauge Glass

When installing the water column and gauge connections, adhere to the following:

- 1. Inspect the water gauge glass to ensure that the glass is free of cracks or chips. Do not subject the gauge glass to bending or torsional stresses.
- 2. Install the piping from the water column and gauge glass to a safe blow off vessel of approved design.
- 3. Install the top fitting (the fitting without the drain port) into the upper fitting on the water bottle using Teflon tape or pipe sealant. Wrench tighten the fitting until it is snug and the glass outlet is pointing at about 5 o'clock (about 1/8 turn from its final downward vertical position).



WATER COLUMN ASSEMBLY

INSTALLATION

- 4. Install the bottom fitting (the fitting with the drain port) into the lower fitting on the water bottle using Teflon tape or pipe sealant. Wrench tighten the fitting until it is snug and the glass outlet is pointing directly upward.
- 5. Verify that the top and bottom fittings are threaded into the water bottle tappings the same amount.
- 6. Remove the glass packing nut, friction washer and glass packing from the fittings and place them in the same order on either end of the water gauge glass. Push both packings about 1in (25.4 mm) from the end of the water gauge glass.
- 7. Gently insert one end of the water gauge glass into the top gauge fitting. Keeping the glass inside the fitting, gently rotate the top fitting clockwise until it is vertically aligned with the bottom fitting.
- 8. Insert the gauge glass into the bottom fitting until it bottoms out, and then gently raise glass about 1/16 in (1.6 mm). Do not allow glass to remain in contact with any metal surface.
- 9. Carefully slide the bottom glass packing down until the glass packing is touching the lower gauge fitting. Carefully slide the top glass packing up until the glass packing is touching the upper gauge fitting.
- 10. Hand tighten both glass packing nuts, then tighten ½ turn more by wrench. Do not over- tighten. If any leakage occurs, tighten the packing nut slightly, no more than a ¼ turn at a time, until the leak stops.
- 11. Install the protective guard over the gauge glass assembly.
- 12. The gauge glass valves are fitted with ball checks. Make sure that the valves are fully open to ensure that the ball check will function properly in the event that the gauge glass breaks.
- 13. Install drain piping from water bottle and lower water gauge class fitting to the boiler blow off piping.

Assembly of 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

\bigwedge

WARNING

Improper installation or maintenance of the gauge glass assembly can cause immediate or delayed breakage resulting in bodily injury and/or property damage.

\bigwedge

WARNING

For reasons of safety, the hot exhaust gas duct and chimney must be insulated or shielded within the locality of the heater in compliance with local codes and regulations.

△ CAUTION

The stack arrangement and draft conditions should be in accordance with the information in this manual for proper performance of the equipment.

To maintain a reasonable temperature in the equipment area and ensure safety to personnel, the section of the chimney duct within the building should be insulated. 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 maximum) prior to filling the systems.
- 12. Check bolts and connections for tightness after the first heat up cycle. Retorquing may be required.

Stack and Flue

Adhere to the following for stack and flue connections:

- 1. An appropriately-sized stack should be connected to the flue gas outlet at the boiler. The proper flue size and draft control is most important for proper burner operation. The flue must be as large or larger than the outlet on the vessel. Avoid flue piping and elbows by placing the equipment as close as possible to the chimney.
- 2. The stack should rise continuously to the connection at the chimney and

INSTALLATION

should contain no more than two bends at 45 degree angles or less. If required, as a result of space limitations, one 90 degree elbow (or tee) can be fitted at the back of the vessel.

- 3. There should be two feet (0.6 m) of straight, horizontal flue before any change in direction, fitting or draft regulator. This is to prevent potential pilot or main flame failures due to back pressure build up during ignition. Any alternative stack arrangement must supply negative 0.02 to 0.04" in. W.C. draft when standing hot.
- 4. The run in the total distance of stack ducting, as measured in a straight line from the outlet of the heater to the outlet of the stack, should not exceed 70% of the rise. With the exception of the duct run previously described, horizontal sections of ducting must be avoided and should not exceed four feet total.
- 5. The stack, chimney, and any components associated with the stack, such as heat reclaimers or assist fans must be constructed from material that is rated for a 1000F (538 C) operating temperature.
- 6. The stack and chimney material shall comply with all applicable codes.
- 7. Adequate provision must be made for the support of the weight of the chimney and stack to avoid having a load imparted to the outlet connection of the equipment.
- 8. The draft when firing should be negative and constant. A reading of -0.02 to -0.04" W.C. when the unit and stack are cold usually indicates sufficient draft. When the unit is running and the stack is hot, the draft should read -0.04 to 0.08 "W.C.
- 9. The installation of a draft regulator by the client/contractor is recommended at all installations. This will help to maintain the required draft.
- 10. Insulate the section of the chimney duct within the building. For boilers equipped with Flue Gas Recirculation (FGR), ducting must be insulated to prevent personnel injury.
- 11. Concentration levels of only a few ppm of chlorine containing compounds in combustion air can produce serious corrosion of the flue over long periods of time. High chlorine containing compounds such as carbon tetrachloride or perchloroethylene would be prime suspects.

Burner Considerations

Initial Settings

The burner settings will be factory set for normal initial settings. These should be adjusted at start-up to match the application. Only trained personnel should perform any combustion adjustments, limit controls, and burner startup.

Before proceeding with startup and adjustment, perform the following checks:

∕!\ 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.

- All wiring is properly installed and connected
- All fuel lines are connected and tight
- Burner is properly mounted and secured
- The linkage is correct and tight
- The stack is properly connected and draft controls are operational
- Gas vent lines are properly connected
- All cleanout doors are in place and properly secured
- Operating controls are ready
- A combustion analyzer is available to tune combustion.
 Other testing equipment (manometers, gauges, volt meter) are available

Testing

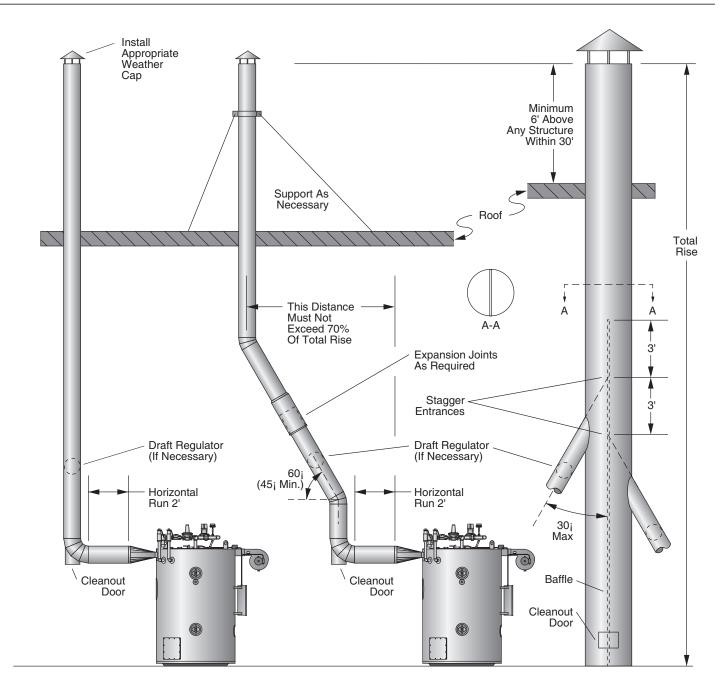
Upon completion of the installation, perform the following testing:

- 1. A pneumatic test not exceeding 15 psig.
- 2. Leak tests at all welds and joints to ensure that the system is free from leaks.

Before Leaving the Installation

Before leaving the installation, adhere to the following:

- 1. Recheck all piping connections.
- 2. Recheck all electrical connections to ensure they are secure.
- 3. Check all controls to ensure they are working properly.
- 4. Cycle the boiler several times by raising and lowering the operating pressure controller. Check safeties to ensure they are functioning correctly.
- 5. Make sure the installation complies with applicable codes.



TYPICAL STACK ARRANGEMENT

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WARNING

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

Do not 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.

Defective or improperly installed equipment is hazardous. Do not operate equipment which is defective or improperly installed.

Defective equipment can injure you or others. Do not operate equipment which is defective or has missing parts. Make sure all repairs or maintenance procedures are completed before using the equipment. Do not attempt repairs or any other maintenance work you do not understand.

\triangle CAUTION

Installation in accordance with the guidelines within the manual should be fully completed before performing the initial start-up; and start-up must be complete prior to putting the unit into service. Starting a unit without the proper piping, venting or electrical systems can be dangerous and may void the product warranty.

"Factory Trained Personnel" refers to someone who has attended a Fulton Service School specifically for the equipment covered in this manual.

Start-Up Preparation & Installation Review

Review the installation section of this manual carefully. Confirm accordance with the Installation guidelines, including:

- 1. You have read and followed all safety information.
- 2. The equipment area is in conformance with established equipment room requirements. Review national and local codes.
- 3. There are no obstructions left in the fluid circuit from pressure leak testing such as blanking plates in flanged joints.
- 4. Equipment is properly installed as shown in **Installation** section of this manual.
- 5. Relief valves have been properly installed as shown in **Installation** section of this manual.
- 6. Flue gas from the equipment is properly vented.
- 7. Combustion air openings are not obstructed in any way and have adequate capacity.
- 8. There are no flammable liquids, materials or hazardous fumes present in the environment.
- 9. Nothing was damaged or knocked loose during shipment and installation.
- 10. Local authorities where approval for start-up is required have been notified. In some localities, final inspection of services may be required.
- 11. Installation checklist is complete.

Start-Up Service

If start-up service has been included in the order, the factory should be contacted after the installation has been successfully completed and approved by the client's representative or engineers. Where possible, contact the factory at least three weeks before a Fulton service engineer is required on site.

Careful preparation can expedite the commissioning of your boiler. Most delays can be avoided by following the instructions in this manual. Failure to complete required procedures properly can result in the need for further service time, at extra cost to the customer.

Service people will not commence start-up if there are obvious system deficiencies. However, start-up service in no way constitutes a system design check or approval of the installation.

In addition to commissioning the boiler, the service person will also familiarize boiler room personnel with the operation of all Fulton equipment. Personnel must be qualified to understand the basic operation and function of controls.

SECTION 3 OILVMP-IOM-2015-0808 OPERATION

Accepted combustion settings for standard vertical steam and hot water boilers are as follows:

02	4%-6%
CO2	8.5%-9.5% NG
	10.5%-13.5% OIL
	9.5%-11.5% LPG
СО	LESS THAN 100 PPM

Prepare For Initial Start-Up

These instructions are for use when the unit is being started for the first time, or after prolonged shutdown. They are to be used in conjunction with the information in **Daily-Start-Up** section of this manual.

Perform Boil Out

Fulton recommends boil out be accomplished prior to boiler system operation. This procedure ensures that all oils, sealants and other organic compounds that may cause erratic water level control are removed from the boiler and piping. Consequently, if boil out is not accomplished prior to system operation, erratic water level control and surging may occur. Fulton strongly recommends that a boiler chemical specialist be consulted for the purchase of chemicals for boiler cleaning.

■ Boil Out Procedure

Fulton recommends pressure vessel cleaning prior to system operation or after major maintenance. This boil-out procedure removes oils, greases and other organic compounds that may cause erratic water level control and surging. There are many chemicals on the market that may be used and our recommendations are as follows:

- For many years Fulton has recommended the use of washing soda (sodium carbonate) to wash out boilers. Sodium carbonate (also known as washing soda or soda ash), Na2CO3 is a sodium salt of carbonic acid. Called washing soda, soda crystals, or sal soda in the detergent section of stores, it effectively removes oil and grease.
- Trisodium phosphate (TSP, E339) is an excellent degreaser and alternative to washing soda. It is a white, granular or crystalline solid, highly soluble in water producing an alkaline solution. The item of commerce is often partially hydrated and may range from anhydrous trisodium phosphate, Na3PO4, to the dodecahydrate, Na3PO4·12H2O. Most often found in white powder form, it can also be called trisodium orthophosphate or just plain sodium phosphate.

Adhere to the following when performing boil-out:

1. The boil-out shall include "over-the-top" wasting of water. A temporary 2" pipe shall be run from the relief valve tapping to a suitable point of

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WARNING

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\triangle 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.

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

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WARNING

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When opening any drains on the equipment or piping system, steps should be taken to avoid scalding/burning of personnel due to hot fluids. Whenever possible, the system should be cooled prior to opening any drains.

Use only your hand to turn valve handles. Never use tools. If the handle will not turn by hand, don't try to repair. Forced or attempted repair may result in fire or explosion.

WHAT TO DO IF YOU SMELL GAS:
Do not use matches, candles, flame
or other sources of ignition to check
for gas leaks. Do not try to light the
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.

Wear eye and hand protection for your safety.

Do not attempt to start the equipment prior to filling and purging the vessel. A dry fire will seriously damage the equipment and may result in personnel injury or proerty damage. In the case of a fire event, shut off the fuel supply.

discharge as required by local jurisdiction(s) to assure that grease and oils are floated to the top and out of the unit. Minimum time for the procedure shall be four (4) hours of constant water discharge alternating between bottom and top blowdown. At least two (2) complete bottom blowdown and complete refills shall be done. A suitable manner of chemical waste handling shall be employed to meet local jurisdictional requirements.

- 2. Do not introduce steam to the system until the boiler has been properly boiled out.
- 3. On new systems, send condensate returns to the drain to ensure the new system piping has been flushed free of debris and is fully clean. If debris-filled condensate is not wasted, additional boil-out(s) may be required.

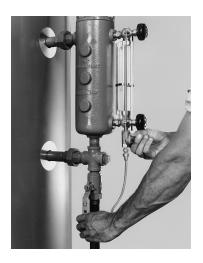
Starting the Boiler

Carry out the following procedure for initial boiler start-up, and on every subsequent restart of the boiler after a shutdown.

- NOTE: When commissioning the boiler, firing rate must remain at low fire during first four hours of operation. The output may then be increased 7% to 10% per hour, until a firing rate of 75% is reached. The 75% firing rate should be maintained for 3-4 hours.
- 1. Close blowdown valves.



2. Close water gauge drain valve.



SECTION 3 OILVMP-IOM-2015-0808 OPERATION

3. Open main steam stop valve at top of boiler.



4. Open the water feed valve on boiler.



5. Open valve on makeup water line to return, if return system is used.



- 6. Place feedwater pump fused switch to ON position. This pump will operate until the water reaches the correct level in the boiler. This level is approximately the center of the water gauge glass.
- 7. Activate the boiler ON switch, located on side of the panel box.
- 8. With unit full of water, the low water safety switch relay(s) will be in a lock

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 attempt to start the equipment for any testing prior to filling and purging the vessel. A dry fire will seriously damage the equipment and may result in property damage or personnel injury and is not covered by warranty. In case of a dry firing event, shut off the fuel supply and allow the vessel to cool to room temperature before fluid is reintroduced to the pressure vessel.

\triangle caution

A qualified installer, service agency or the gas supplier must perform installation and service on the fuel delivery system.

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

After checking controls by manual adjustment, make sure they are always reset to their proper settings. Contact your Fulton dealer before modifying the equipment.

Unburned oil, unlike gas, does not leave the combustion chamber during purge.

The oil burner shall only burn the grade of oil indicated on the rating plate. Failure to use the grade of oil indicated will cause equipment failure.

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WARNING

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

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.

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

Do not tamper with safety features provided by the operating controls.

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CAUTION

Operation of the circulating pump for any amount of time without first bleeding will result in equipment damage.

For all systems containing boilers or unfired steam generators, the water chemistry in the boiler (generator) must be kept within required limits. Failure to do so may cause premature pressure vessel failure and poor steam quality and will void the warranty.

If any "Manual Reset" limit device trips DO NOT reset without determining and correcting the cause. (Manual Reset Limits may include: flame safeguard, high or low gas pressure, high temperature limit, low water).

Never tamper with low water (liquid level) cutoff sensors or circuitry.

out position. Press the low water safety relay manual reset button, which is located on the side of the control panel box.

Boiler Controls

■ Flame Programmer

Refer to cut sheets for provided flame programmer.

Operating Controls

The following specifications, data, equipment and operating descriptions apply to typical Vertical Boiler units. These sections are provided for general information purposes only, and do not necessarily reflect the specific details of individual systems.

At commissioning, the operation of all safeties and interlocks should be verified. Setpoints of all pressure and temperature switches as well as the programs for all programmable controls (pressure controls, pressure limits, operating controls, servo motors etc.) should be recorded for future reference. Contact the Fulton Service Department with any questions regarding the proper operation, set points and verification procedures for these controls.

▶ AIR SAFETY SWITCH

To test, perform the following:

- 1. Disconnect power to boiler.
- 2. Remove air supply from the air switch, and turn on the boiler.
- 3. Once the boiler is in the purge process, the safety interlock should appear and shut down the burner.
- 4. Turn the burner off and reattach the air switch air supply.
- 5. Reset the flame programmer.
- 6. Set the Air Switch:
- While the boiler is running on the lowest modulation rate (usually 0% low fire), adjust air switch clockwise to raise the setpoint pressure and counter-clockwise to lower the setpoint pressure.
- Adjust until switch trips and locks boiler out on air pressure.
- The air switch should be turned the opposite way from the desired set point 1-2 full turns.
- Cycle the boiler multiple times to be sure that no nuisance fault occurs.

▶ BLOWER MOTOR STARTER

For units equipped with manual trip test button or motor starter:

SECTION 3 OILVMP-IOM-2015-0808 OPERATION

- While firing, actuate the manual trip button on blower motor starter. Unit should lock out. Attempt re-start by resetting the flame programmer. Purge cycle will not begin.
- 2. Reset motor starter; blower should start and purge cycle will begin.

▶ PUMP MOTOR STARTER

If a pump starter is supplied, the pump motor starter will be located in the boiler/heater panel or pump skid. When the pump start button is pushed, the pump motor starter will engage the pump.

- While firing, actuate the manual trip button on the pump motor starter. Pump and burner will shut down. The blower should continue to run for approximately 30 seconds.
- 2. Attempt to restart pump by depressing the pump start push button. The pump should not start.
- 3. Reset starter and start pump.

▶ LOW WATER CUT-OFF

Each cutoff device shall be installed to prevent startup, and to cut off the boiler fuel or energy supply automatically, prior to the fall of the water level below the lowest visible level of the gauge glass. Standard low water cutoff devices are Fulton level probes. Alternate cutoff devices are MM-63, MM-150, MM-157, MM-193-7b. Test as follows:

▶ PRIMARY LOW WATER CUT-OFF

This is the first low water safety cut-off, typically an automatic reset safety. Some local jurisdictions require this safety control to be a manual reset.

To test this safety:

- Slowly drain the boiler, open the blowdown valves while boiler is operating, and make sure the that when the safety switch trips, the boiler is shut down. Close the blowdown valves.
- 2. Once water level is above the cut-off point, the burner will automatically turn back on.

▶ SECONDARY LOW WATER CUT-OFF

This is always a manual reset safety.

To test this safety:

- Slowly drain to the secondary cut-off level. This must be above the bottom of the lowest visible point in the sight glass. Once the secondary level cut-off is tripped, a light on the panel will become illuminated.
- 2. Do not push the manual reset button for the low water safety cut-off at this time. Refill the boiler first.
- 3. Once boiler is refilled, turn the boiler ON switch. With the low water cut-off light still illuminated, the burner should not turn on.
- 4. Push the low water reset button. Once this button is reset, the burner should begin the ignition process as long as all other safety interlock devices are satisfied.

▶ HIGH LIMIT PRESSURE SWITCH

Perform the following to test:

- 1. With burner on and the boiler under pressure, lower the set pressure on the switch until it trips and shuts down the burner. Be sure that the pressure is the same as the boiler operating pressure.
- To test the manual reset button, wait until the boiler has fully completed the post purge phase. Once the boiler is in standby position, reset the switch to the original set point.
- Press the manual reset switch on the pressuretrol. This will ensure that the manual reset switch is functioning correctly. The burner should not start until the reset button is pressed.

OPERATING PRESSURE LIMIT SWITCH

Perform the following to test:

- With the boiler under pressure, lower the set pressure on the switch until it trips and shuts down the burner.
 Be sure that the pressure is the same as the boiler operating pressure.
- 2. This switch is an auto reset. Reset the switch to the original set point. The burner should turn back on automatically.

► FLAME SCANNER - OIL

Perform the following to test:

- 1. Verify that the flame scanner is observing flame with the burner running.
- 2. Shut down burner.

- 3. Verify that the combustion settings are correct.
- 4. Remove the flame scanner and cover it up.
- 5. Turn the burner on. This will cause flame failure and verify that the scanner is operating correctly.
- 6. Reinstall scanner.
- Once boiler is completely off and has completed the post purge cycle, normal boiler operation can be resumed.

MODULATING CONTROLS

All boilers are standard-equipped with modulating controls.

The modulating pressure controller continuously regulates the burner between the minimum firing rate and high fire. When the unit is on low fire and the pressure continues to climb past the setpoint, the boiler will shut down. It will typically re-start when the process pressure drops below the setpoint.

Minimum load depends on the degree of modulation provided. Typically 2:1 or 3:1 modulation is provided. In this case minimum load is one third of full firing rate.

▶ PRESSURE RELIEF VALVE

Located on the boiler, this valve limits the maximum operating pressure of the equipment.

▶ SIGHT GLASS ISOLATION VALVES

The brass sight glass isolation valves are equipped with an internal ball check. In the event that a sight glass should break, the ball will set, preventing discharge of steam and water. The brass valve stem must be opened fully to enable this feature. If the valve is in any other position, the ball will not seat.

PROOF OF CLOSURE

- 1. Disconnect power to the boiler.
- 2. While the boiler is off, remove the common wire to the proof of closure (POC) switch on the oil/gas valve.
- Restore power to the boiler. The boiler should immediately lock out on alarm due to the POC being disconnected.
- 4. Disconnect power and reconnect the POC wire.

- 5. Restore power to the boiler and reset any flame programmer faults.
- 6. Cycle the burner and observe for proper operation.

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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.

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.

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.

Procedure for Cleaning Water Probes

Clean probe on top of boiler shell and probes in water column. Make sure there is no pressure on the boiler during the removal of the probes. Remove one probe, clean with very fine emory cloth, and replace it before removing another to assure no probe mix ups that would change the control functions.



For replacement purposes, installed probe lengths are as follows. For a universally adaptable plug and probe that can be cut to length in the field, order Part No. 2-20-017.

A = 7.25 inch (184 mm)

B = 9.25 inch (235 mm)

C = 11.25 inch (286 mm)

D = 4 inch (102 mm)

D is located in the boiler pressure vessel.



B C

Burner Maintenance

Burner reliability can be greatly improved through proper inspection and maintenance. Observing burner operation may lead to early detection of issues. Valve and linkage problems can often be detected by watching the movement for rough, uneven changes. The jackshaft, linkage and valve movement should occur smoothly with no rough jerks.

Leakage may be observing through the detection of a small build-up of oil.

The flame condition can be a good indicator of the status of the firing head. The firing head is exposed to high temperatures of combustion and can have reduced life due to thermal stress. The diffuser, oil nozzle, orifices, manifold, refractory, and burner mounting plate must all be subjected to regular visual inspection.

Linkage-based controls should also be visually inspected for wear. If there is any noticeable change in the linkage rod ends or shaft bearing, they must be replaced. Any control valves that exhibit poor or hard-to-turn movement must be replaced.

Fuel cams must have adjusting screws that are held firmly in place and cannot move due to normal vibration. All moving parts must be maintained in good condition with no noticeable wear. Worn connections will result in reduced combustion efficiency.

■ Flame Scanner Adjustments

- 1. Flame scanner adjustments are made with the detectors installed and the burner running. It is essential to obtain optimum flame signal detection for safe and continual operation of the control relay.
- 2. If a scanner is inoperable, it may prove the detector is working and only an adjustment to the pilot flame is needed to improve the signal.
- 3. If the scanner is found to be defective, replace.

■ Furnace Refractory Replacement Procedure

- 1. Remove the burner plate and top plate assembly, up and out of the air-to-air heat exchanger.
- 2. Remove the stainless steel combustion ring from the furnace.
- 3. Remove the clean-out plugs from the bottom sides of the boiler. The boiler has two clean out plugs, one is located at the bottom of the boiler to the right hand side of the panel box. The second is 180 degrees on the opposite side of the boiler.
- 4. Break off the top holding clips that were used to keep the refractory in position during shipping. The boiler has welded flat bars beneath the top refractory. These bars will have to be cut to change the lower refractory. Rewelding of the bars will be required prior to installation of the top refractory. For the lower refractory, you will also need to break off the top

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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.

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

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CAUTION

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

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

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

If the 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 the life of the gasket.

\triangle CAUTION

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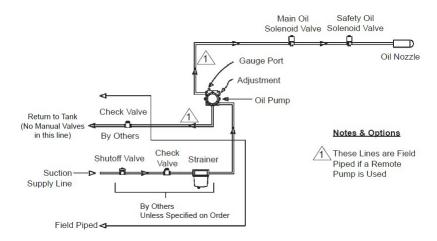
All maintenance procedures should be completed by trained personnel. Appropriate training and instructions are available from the Fulton Service Department at (315) 298-5121 or your local Fulton Thermal Representative.

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

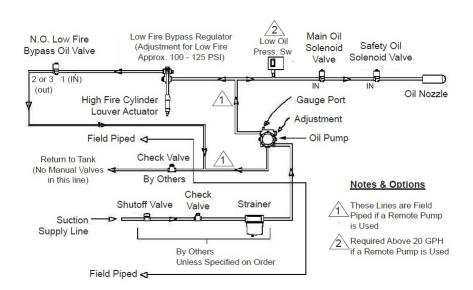
- holding clips that were used to keep the refractory in position during shipping.
- 5. Break up the top and/or bottom refractories and remove the pieces from the boiler through the clean out plugs.
- 6. Round and bevel the outer edges of the new refractories. The bottom refractory has the larger hole, while the top refractory has the smaller.
- 7. Lower the bottom refractory down into the furnace with wire fastened in three locations. When the refractory is close to position, it can be tipped by maneuvering the wire to drop it flat onto the holding clips. If the refractory will not tip, it may have to be removed and again rounded and beveled.
- 8. Install the top refractory in the same manner as the bottom refractory. When installed, the outer edges must be sealed with insulcrete a castable refractory mix available from the Fulton factory. It is not necessary to reinstall the shipping clips.
- 9. Install the stainless steel combustion ring, burner assembly, and clean out plug.
- 10. Normal operation can be resumed immediately.

Care of Burner

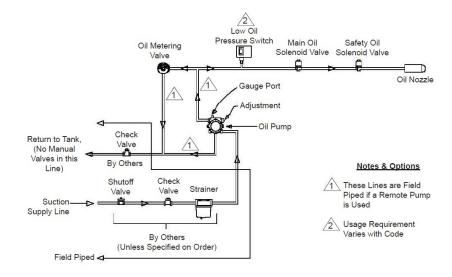
The burner can be equipped with a wide range of fuel and operating systems to control fuel, air, modulation, and pilots. This section describes how these systems operate. Burner start-up must be performed by qualified, trained personnel. The following illustrations identify the devices that have adjustment features. All adjustments must be performed by qualified personnel.



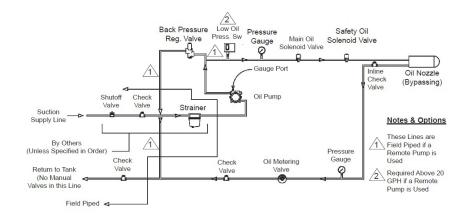
PRESSURE ATOMIZED OIL SYSTEMS "A" - ON - OFF



PRESSURE ATOMIZED OIL SYSTEMS "L" - LOW FIRE START OR "H" LOW-HI-LOW



PRESSURE ATOMIZED OIL SYSTEMS "MP" MODULATING SIMPLEX NOZZLES



PRESSURE ATOMIZED OIL SYSTEMS "MP" MODULATING RETURN FLOW NOZZLES

\triangle CAUTION

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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.

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WARNING

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Follow proper lockout / tag out procedures for the electrical, gas and water connections. Use caution when lifting heavy parts.

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CAUTION

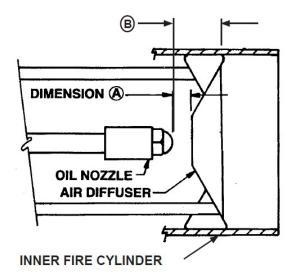
All maintenance procedures should be completed by trained personnel. Appropriate training and instructions are available from the Fulton Service Department at (315) 298-5121 or your local Fulton Representative.

Initial Burner Settings

The burner will be factory-set for normal initial settings. These are adjusted at start-up.

OIL NOZZLE POSITION

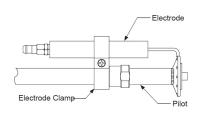
The oil nozzle position is indicated in figure below and should be set per chart below.

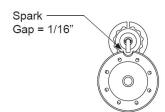


VMP Oil Nozzle Chart					
HP	Model	Diffuser I.D.	Qty of Nozzles Spray Angle		Dimensions (in)
40	JB1	1 1/2"	1	30	7/8
50	JB1	1 1/2"	1	45	3/4
60	JB1	1 1/2"	2	30	3/8
80	JB2	1 3/4"	2	60	1/2
100	JB2	1 3/4"	2	60	1/2
130	JB2	1 3/4"	2	60	1/2
150	JB2	1 3/4"	2	60	1/2

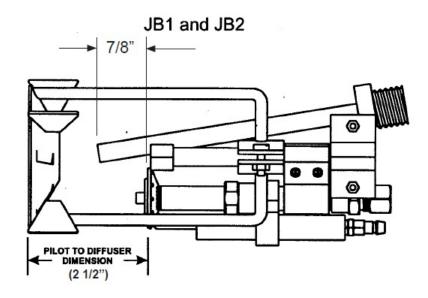
GAS PILOT ASSEMBLY

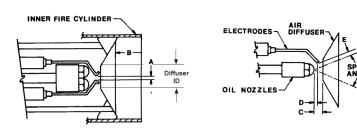
It is critical that the pilot be properly adjusted and kept clean. The following figures show typical configurations. Pilot gas pressure should be measured at the 1/8" port, located on the downstream side of the last pilot solenoid valve. Additional figures show initial settings for direct spark oil. For pressure atomizing, the low fire position should be adjusted to get the correct low fire pressure, as indicated on the rating label. Typically this would be 100 psi for simplex systems and 65 psi for return flow nozzles. The high fire position should be about 45 degrees to 60 degrees travel from low fire.





Note: Required 2 1/2" - 3" wc pressure for natural gas ans 1/2" - 2" for LP, as measured at the last solenoid in the pilot train.





	Dimension Table for Direct Spark Oil Ignition (pressure atomizing)							
Burner Data		Nozzle Data		Adjustment Settings (inches)				
Model	Diffuser I.D.	Qty	Spray Angle	А	В	С	D	E
JB1	1″	1	30		1/2	1/2		
		1	45		3/8	3/8		
	1 1/2"	1	30			7/8		
		1	45			3/4		
		2	30	1/8		1/4	5/16	1/4
		2	45		1 1/2	1/4		
			30			3/4		
JB2	1 3/4"	2	45			5/8		
			60			1/2		

♠ 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

Ensure that the blower/gas train assembly is fully supported during removal/cleaning or burner.

BURNER DRAWER ADJUSTMENTS

The burner drawer has adjustment capabilities, allowing the combustion to be tuned. Be sure to retain the position of other components, and follow the sequence provided. Before making adjustments, mark the position of each component with a felt tip pen or tape, as follows:

- Mark the distance of the oil nozzle tube from the backplate.
- Mark the distance of the gas pilot line from the backplate.

Once marked, proceed as follows to **adjust the diffuser to inner fire cylinder dimension:**

- Measure the dimension from the backplate to the end of the oil nozzle tube. This dimension, along with the initial position, will determine the limit of the adjustment.
- 2. Loosen the two set screws locking the pilot gas line and oil nozzle tube to the backplate.
- Adjust the diffuser by moving the oil nozzle tube in and out per step 1's measurement. When the best position is located, lock into place with the two set screws.

To adjust the oil nozzle to diffuser position:

- 1. Remove the drawer assembly, per instructions below.
- Adjust the oil nozzle, watching for spray back on the diffuser when the oil nozzle is pulled too far back. The flame may appear to be good, but carbon will quickly develop on the diffuser.

To remove the burner drawer assembly:

- 1. Disconnect the pilot gas line. Move the pilot line so the drawer can be pulled out without interference.
- 2. Disconnect oil line(s) and move out of way to avoid interference.
- 3. Remove screws on the burner drawer.
- 4. Disconnect ignition cable from drawer assembly.
- 5. Pull drawer out, holding it centered to prevent it from hanging up when removing.
- Disconnect the scanner by unscrewing it from the scanner tube.
- 7. Set drawer down horizontally to prevent damage to the

diffuser and/or changing settings.

8. To reinstall, reverse steps.

PRESSURE ATOMIZED OIL SETUP

The pressure atomized oil system has a limited range of adjustments for low/high fire, as dictated by the operation of the oil nozzle.

For burners equipped with FGR with linkage, the type of FGR control must be determined prior to starting. For oil only combustion, the NOx level will be provided on the burner detail sheet, and should be used in setting the control valve.

- 1. Place the burner switch in OFF position.
- Place AUTO-MANUAL switch in manual position, or low fire hold switch in the hold position for LO-HI-LO operation.
- 3. Place manual flame control potentiometer in the min (low fire) position on modulation units.
- 4. Turn on electrical power to the burner/boiler/related components.
- 5. Verify the oil metering valve is nearly opened (it will be closed at high fire).
- 6. Turn burner switch ON. This will start the blower motor and initiate the purge cycle.
- 7. When the pre-purge sequence is complete and the low fire switch (if applicable) is made, the pilot valve will open and the pilot flame should be visible through the burner sight port. As pilot flame is established, the flame safeguard will energize the main oil valves and the burner should ignite at low fire. This operation of the main fuel valves must be visually checked by observing the valve stem moving up with a motorized valve, or hearing the clicking noise from the solenoid valve. The main flame may not light on the first attempt, because it must fill the oil lines before providing oil to the nozzle. Press the restart button on the flame safeguard to restart the burner.
- 8. After a few seconds, the combustion analyzer should provide an accurate reading of the O2 in the stack. The O2 level should be between 5% and 7% and the nozzle oil should be 100 PSIG for the JB1/JB2 burner, low fire oil pressure.
- 9. If the unit is equipped with FGR, the FGR control valve should be set for the approximate NOx level required.

- 10. Operate the burner until the boiler is warmed up, and operating pressure/temperature has been achieved.
- 11. Increase the firing rate, using the manual potentiometer, or put the low fire hold switch in AUTO position, while monitoring and adjusting the O2 level. Adjust the cam as needed to reach the high fire input. If burner is equipped with FGR, adjust the FGR control as needed to maintain the NOx level.
- 12. At high fire, adjust the high fire input (open or close the fuel valve) to match the maximum input and/or pressure listed on the rating label. The fuel metering valve should be closed or nearly closed, at this point, and the nozzle pressure should be about 150 PSIG return line for the JB3 burner, 250-300 PSIG for the JB1/ JB2 burner.
- 13. If equipped with FGR, adjust the NOx level to be about 10% below any guaranteed NOx performance.
- 14. Modulate the burner to low fire, adjusting the O2 level as the burner modulates.
- 15. Adjust the low fire input, using the fuel cam or low fire regulator on LO-HI-LO systems and air damper adjustments.
- 16. Readjust the midfire points for the correct O2 levels. The linkage may require adjustment to retain correct relationship between fuel valve and air damper.
- 17. The burner should be operating at low fire to adjust the air proving switch. Turn the adjusting screw clockwise until the burner trips. Then turn the adjustment screw counterclockwise 1.5 turns from the point of shutdown. Check operation at higher rates.
- 18. Adjust the oil pressure switch to trip and shutdown the burner at a pressure that is 10% lower than the supply oil pressure.

▶ OPERATING CONTROL ADJUSTMENTS

The operating controls must be adjusted to properly cycle the burner ON and OFF, and provide modulation. The controls should not force the burner into rapid ON-OFF cycles, as this may cause unit damage.

The operating control must be adjusted to provide the ON pressure or temperature desired. The OFF pressure or temperature must be sufficiently above the ON point to allow reasonable run time.

The modulating control must be adjusted to start modulation

at some reasonable point below the ON temperature or pressure, or provide modulation to high fire at the lowest temperature or pressure.

Burner Shutdown

Normal operation of the burner will allow the operating controls to shut the burner down when demand is satisfied. If burner must be shut down for any reason, use the ON-OFF switch. This will cause fuel valves to close and start a post-purge cycle to remove any unburned fuel from the unit.

It is recommended that the burner be manually driven to low fire before turning the burner off, as this reduces dynamic and thermal stress. If the burner will remain off for some time, the manual fuel valves, fuel pumps, and power supply should be turned off.

▶ EMERGENCY BURNER SHUTDOWN

All fuel and electrical power should be de-energized or turned off to secure the burner. This includes the main power disconnect, manual gas shutoff valve at the drop-down line, and the manual oil valve (if equipped).

► CARE OF BURNER DURING EXTENDED SHUTDOWN

The following should be conducted when the burner will be placed out of service for an extended shutdown.

- 1. Turn main fuel valve off.
- 2. Turn main electrical disconnect to the burner off.
- 3. Follow proper tagout/lockout procedures.
- 4. If burner will be in an area subject to sweating/condensation, cover the control cabinet and electrical devices with plastic and secure tightly.
- 5. If burner is to be out of service for more than 30 days, a complete operation safety check must be made at the time of restart.

▶ RESTARTING THE BURNER AFTER EXTENDED SHUTDOWN

Follow same procedure as normal shutdown, however the air atomized oil nozzle should also be removed and cleaned. If pressure atomized, it should be replaced. In addition, oil filter and strainer must be removed and cleaned prior to starting. Conduct a complete operational safety check.

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WARNING

Burner adjustments must be performed by qualified personnel only. Attempting to perform any burner maintenance or start-up by anyone other than qualified personnel may result in death, personal injury, or equipment damage.

Do not attempt to start the burner when excess oil has accumulated, when unit is full of vapor, or when combustion chamber is hot.

Recommended Daily Maintenance

The following procedures should be carried out daily. They are designed to prevent the buildup of scale, silt, or sludge in the bottom of the boiler and in the pipes leading to the water gauge. In addition to these procedures, the advice of a water treatment supplier should be sought and followed. An ASME Section VIII blow down receptacle must be provided for the appropriate pressure.

Recommended daily maintenance:

1. Blow down the boiler each morning by starting the boiler and generating not more than 10 PSI (.703 kg/cm2) of steam. Turn on cooling water to blowoff separator, then open the boiler blow off valve for approximately 10 seconds, then close valve. Be sure that the slow opening valve (Y-Valve) is adjusted properly. During each blowdown, there should be 1-2" of level drop in the sight glass. Shut off tap water to blow-off separator. If there are two bottom blowdown connections on the boiler, both should be blown down daily.



2. Blow down water column each morning when boiler is at 10 PSI (.703 kg/cm2) by opening the water column and the water gauge blowoff valves





for approximately five seconds, then close the valves. On boilers with float type level devices, refer to the water column cut sheet for proper blowdown technique. Any water column on the system should be blown down daily following the above processes.

- 3. If the feed water is being treated by compounds, make sure that this treatment is carried out carefully and according to the manufacturer's instructions.
- ► NOTE: Fulton recommends that the feedwater treatment should be added between the pump and the boiler.
- 4. Check water level in sight glass.
- 5. Check to be sure feed water pump is working.
- 6. For float type water level control, blow down the float chamber.
- 7. Check water chemistry.
- 8. Visually inspect burner cam and jackshaft to ensure free movement, no loose parts, and correct component positions.

Recommended Weekly Maintenance

Weekly maintenance and inspection must include checking that the low water cut-off relay is operating correctly in the following manner:

- 1. Make sure that the boiler is cool with little or no pressure showing on the steam pressure gauge.
- 2. With burner operating, open the boiler blow-down valves. When the water drops below the required level (note the level in the water gauge glass), the burner should shut off; this is when the water level falls below the low water electrode in the water column assembly and/or the boiler shell. Manual reset of the low water relay is required.

Recommended Monthly Maintenance

The following steps should be carried out monthly:

■ Cleaning the Water Gauge Glass

- Clean the water gauge glass using a commercial non-abrasive glass cleaner. Use diluted acids such as hydrochloric (muriatic) acid when regular cleaners do not seem to work. Do not use wire brushes or any abrasive materials that could scratch the glass. If leakage is evident, replace the gaskets.
- 2. Always reinstall the gauge glass protectors.
- Clean water pump strainers.

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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.

Follow proper lockout / tag out procedures for the electrical, gas and water connections. Use caution when lifting heavy parts.

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CAUTION

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

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

Follow proper lockout / tag out procedures for the electrical, gas and water connections. Use caution when lifting heavy parts.



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 Representative.

- 4. Check scanner or flame rod and ignition electrodes.
- 5. Check starter contacts. Burned or pitted contacts must be replaced. Do not use sand paper to file or clean.
- 6. Clean water traps and strainers in fuel lines.
- Check operation of all steam traps on condensate return system, and all other system traps.
- 8. Remove brass pipe plug at the cross connection below the water column and clean nipple into boiler. Boiler must be cold and water level below pipe.

Burner Components

Check the linkage and cams for wear and loose parts. Replace and worn parts immediately.

Recommended Semi-Annual Maintenance Schedule

The following steps should be carried out semi-annually:

- 1. Check combustion settings for all fuels.
- 2. Check and adjust combustion to the correct settings.
- 3. Check for proper operation of steam traps in your system.
- 4. Check water pumps for correct operation.
- 5. Check and clean burner head.
- 6. Check settings of flame rod (if applicable) and ignition electrode.
- 7. Inspect ignition electrode for cracks.
- Clean water safety and level probes.
- 9. Check refractory for cracks.
- 10. Inspect stainless steel ring.
- 11. Check operation of steam safety valve at no more than 15 PSIG.
- 12. Drain and clean condensate return tank.
- 13. Check electrical controls and motors for correct operation.
- 14. Shut off boiler completely and drain.
- 15. Remove hand holes and inspect water side for scale, pitting, or sludge.

Recommended Annual Maintenance

The following steps should be carried out annually:

- 1. Have combustion (CO2, O2, CO) and input checked by qualified personnel.
- 2. Clean dirty flues to prevent air flow restrictions resulting in poor combustion and loss of efficiency, as follows:
- Remove outer flue cover.
- Remove inner plate and turbulators.
- Remove clean-out plugs at lowest part of unit, and clean the bottom of the combustion chamber.
- Remove all soot from the top, and from the clean-out

- plugs at the bottom, with a vacuum cleaner.
- Replace clean-out plugs carefully so as not to damage insulation, and replace burner and flue cover plates.
- Flush boiler if necessary. See **Boil Out Procedure** section of this manual. More extensive cleaning may be required; consult a local water chemistry expert for recommendations.
- 4. Provide annual inspection by a qualified ASME boiler inspector, as required by local codes.

Troubleshooting

Refer to table on following pages for troubleshooting.

Issue	Cause	Correction		
No ignition (no spark)	Electrode is grounded	Replace		
	Cracked porcelain	Replace		
	Electrode is improperly positioned	Recheck dimensions and adjust		
	Loose ignition wire connection	Reconnect or tighten		
	Defective ignition transformer	Check and replace as needed		
No ignition (with spark,	Lack of fuel, no gas pressure, closed fuel valve	Check fuel supply and valves		
but no flame)	No voltage to pilot solenoid	Check electrical connections		
	Defective pilot solenoid valve	Replace		
	Incorrect location of pilot	Check location of pilot		
	Improper raw gas tube position	Check location of raw gas tube		
	Improperly positioned electrodes	Recheck dimensions		
	Too much combustion air flow	Check air damper position		
Pilot not detected, but	Scanner tube not properly positioned	Check location/position of scanner tube		
flame is present	Scanner tube dirty or wet (oil film)	Clean scanner tube/scanner		
	Faulty scanner or amplifier	Replace		
	Pilot improperly positioned	Check pilot position		
	Incorrect gas pressure to pilot	Readjust pressure		
	Combustion air flow rate too high	Readjust damper		
No main gas flame (pilot	Weak scanner signal	Clean scanner lens and tube		
OK)	Damper or fuel control valve setting incorrect	Readjust		
	Fuel valve(s) not opening	Check wiring to valves		
No main oil flame (pilot	Weak scanner signal	Clean scanner lens and tube		
OK)	Damper or fuel control valve setting incorrect	Readjust		
	Fuel valve(s) not opening	Check wiring to valves		
	Oil nozzle or line obstructed	Check and clean		
	No atomizing air pressure	Check compressor wiring		
	Compressor pressure too high or too low	Adjust		
	Burner not level, oil is draining into vessel	Check level, adjust as required		
Burner stays at low fire	Manual pot in low fire position (low fire hold)	Readjust to high fire position		
•	Manual-auto switch or low fire hold switch in wrong position	Change switch position		
	Modulating control or lo-hi-lo control wiring is faulty	Check wiring or replace		
	Loose linkage	Readjust and tighten		
	Binding linkage or valve	Readjust or replace		
Burner shuts down	Loose electrical connection	Check and tighten connections		
during operation	Loss of fuel supply	Replenish fuel supply		
	Limit switch breaks (opens)	Readjust limit switch		

Issue	Cause	Correction		
Burner doesn't start	Main disconnect switch is open	Close switch		
	Loose electrical connection	Check electrical connections		
	Operating controls are tripped	Check and reset operating limits		
	High or low fuel pressure	Check fuel supply, reset switches		
High CO at low fire	Improper excess air level	Readjust excess air		
(firing gas)	Input too low for burner components	Check input and compare to rating label		
	High stack draft (especially at low fire)	Stabilize draft		
	Poor air flow distribution (off center flame)	Adjust air straightener blade		
	Diffuser not in optimum position	Adjust diffuser position (in or out)		
	Fluctuating gas pressure (regulator not holding pressure)	Check regulator pressure, sensing line and supply pressure for proper sizing		
Gas combustion noise	Input too low for burner components	Check input and compare to rating label		
(rumbling)	Improper excess air	Readjust excess air		
	Fluctuating gas pressure (regulator not holding pressure)	Check regulator pressure and supply		
	High stack draft (especially at low pressure)	Stabilize draft		
	Diffuser not in optimum position	Adjust diffuser position (in or out)		
	Poor air flow distribution (off center flame)	Adjust air straightener blade		
Oil combustion smoking	Oil nozzle dirty or plugged	Clean oil nozzle		
	Improper excess air	Readjust excess air		
	nput too low for burner components Check input, compare to rating l			
	High stack draft (especially at low fire)	Stabilize draft		
	Incorrect nozzle position	Adjust the nozzle to diffuser position		
	Fluctuating oil pressures(regulator not holding)	Check regulator pressure and oil supply		
	Poor air flow distribution (off center flame)	Adjust air straightener blade		
	Too much FGR (if equipped)	Reduce FGR rate		
Fuel-Air Ratios are not	Linkage flexing	Realign linkage, straighten rods		
consistent	Linkage slip	Check linkage and tighten all joints		
	Fuel cam screws have moved	Replace fuel cam		
	Fuel line plugged	Check and clean lines, strainers and filters		
	Fuel supply pressure changing	Check and/or replace pressure regulator		
	Combustion air temperature changed	Retune burner		
	Draft condition changed	Check draft and outlet damper		
	Plugged or leaky FGR line	Clean/repair		
	Gas control valve - low fire stop not set (if used)	Adjust low fire stop		

Issue	Cause	Correction		
Fuel-Air ratios have	Linkage wear	Check linkage and tighten all joints		
changed over time	Fuel cam screws have moved	Replace fuel cam		
	Air damper seal worn	Replae air damper seals		
	Fuel lines plugged	Check and clean lines, strainers and filters		
	Fuel control valve worn	Replace fuel control valve		
	Gas orifices or gas manifold plugged	Clean and/or replace		
	Combustion air temperature changed	Retune burner		
	Draft condition changed	Check draft and outlet damper		
	Vessel plugged	Clean vessel		
	Plugged or leaky FGR valve	Clean/repair		
Cannot obtain capacity	Wrong spring range in regulator	Install higher spring range		
on gas	Too many elbows before control valve	Rework piping to reduce elbows		
	Gas line too small, high pressure drop	Use larger pipe size		
	Supply pressure lower than stated	Increase supply pressure		
	Supply pressure drops too low at high fire	Use larger gas line sizes/ orifice in service regulator		
	Regulator to small for flow and pressure	Change regulator		
Cannot obtain rated	Oil nozzles plugged	Clean/replace nozzles		
input on oil firing	By-pass seal on nozzle leaking	Replace nozzles		
(pressure atomized)	Oil pressure is too low	Increase oil pressure		
	Flow valve set too low (should be closed at high fire)	Adjust oil control valve		
Cannot obtain rated	Oil nozzles plugged	Clean/replace nozzles		
input on oil firing (air	Air pressure too low	Replace nozzle		
atomized)	Oil pressure is too low	Increase oil pressure		
	Flow valve set too low	Adjust oil control valve		
Cannot obtain NOx	FGR valve not full open	Adjust FGR valve to full open		
levels on gas	FGR valve full of condensate	Clean duct and add drains		
	FGR duct not direct to flue stream	Add angle cut in center of the stack		
	FGR line too small	Check sizing; use fittings with less drop		
	Operating on propane, not natural gas	Resize FGR for propane operation		
	Shutoff valve is not full open	Check FGR shutoff valve position		

INTRODUCTION

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Standard Warranty for Fulton Boilers

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

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. 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.



Effective 08.04.2011



WARNING

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

Parts

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

No part of this Installation, Operation, and Maintenance manual may be reproduced in any form or by any means without permission in writing from the Fulton Companies.

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