Installation Operation And Maintenance Manual

VMP-STEAM-GAS_IOM_2016-1007-REV1

Fulton VMP (Vertical Multi-Port) Gas Fired Steam Boilers 40-150 HP

Serial # : _____

Model # : _____

Fulton Order # : _____

Sold To : _____

Job Name : _____

Date : _____

Product Bulletin

Date: January 22, 2010

Subject: Water Chemistry Requirements for Fulton Steam Products

Products: ICS/ICX, FB-A, FB-F, FB-S, VMP, PVLP, PHP, Electric Steam Boilers and Unfired Steam Generators

Please note that the water chemistry is different for carbon steel vs. stainless steel pressure vessels and vertical vs. horizontal orientation.

Effective immediately, please use the limits below. Should you have any questions, please do not hesitate to contact Fulton at 315-298-5121.

Water Chemistry Requirements for Fulton Steam Products (to 300 psig MAWP)

	Carbon Steel			Stainless Steel		
Parameter	Feedwater	Vertical Boiler/Steam Pac Water	Horizontal Boiler/Steam Pac Water	Feedwater	Vertical Boiler/Steam Pac Water	Horizontal Boiler/Steam Pac Water
pH	7.5-9.5	8.5-10.5	8.5-10.5	6.0-9.5	8.5-10.5	8.5-10.5
Feedwater Temperature	140F*	---	---	140F*	---	---
Hardness as $CaCO_3$	<2ppm	<10 ppm	<15 ppm	<2 ppm	<10 ppm	<15 ppm
Chlorides	---	---	---	---	50 ppm	50 ppm
Total Alkalinity	---	<300 ppm	<500 ppm	---	<300 ppm	<500 ppm
Total Dissolved Solids	---	<2000 ppm	<3000 ppm	---	<2000 ppm	<3000 ppm
Suspended Solids	No visual turbidity**	No visual turbidity**	No visual turbidity**	No visual turbidity**	No visual turbidity**	No visual turbidity**
Total Organic Carbon	No sheen No foam+	No sheen No foam+	No sheen No foam+	No sheen No foam+	No sheen No foam+	No sheen No foam+
Iron	Colorless liquid++	Colorless liquid++	Colorless liquid++	Colorless liquid++	Colorless liquid++	Colorless liquid++
Dissolved Oxygen	<1ppm*	ND	ND	<5ppm	ND	ND
Visual Oil	ND	ND	ND	ND	ND	ND
Conducivity (uS/cm)	---	<2985	<4477	---	<2985	<4477

NOTES:

*This is a minimum temperature. Feedwater temperatures below 200F will require an oxygen scavenger.

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

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

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

ND: None Detected.

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The Fulton Companies
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Pulaski, N.Y. 13142

Contents

Section 1 Safety Warnings and Precautions

12345

This manual is provided as a guide to the correct operation and maintenance of your Fulton Gas Fired Steam Boiler, and should be permanently available to the staff responsible for the operation of the gas fired boiler.

These instructions must not be considered as a complete code of practice, nor should they replace existing codes or standards which may be applicable.

The requirements and instructions contained in this section generally relate to the standard Fulton Gas Fired Steam Boiler. When installing a packaged unit, this entire section should be read to ensure that the installation work is carried out correctly.

Prior to shipment the following tests are made to assure the customer the highest standards of manufacturing:

a) Material inspections.
b) Manufacturing process inspections.
c) ASME welding inspections.
d) ASME hydrostatic test inspection.
e) Electrical components inspection.
f) Operating test.
g) Final Engineering Inspection
h) Crating inspection.

All units are crated for fork lift transport. Once uncrated, all units can be transported with a forklift. Under no circumstances should weight be allowed to bear on the jacket, control panel, or fan housing of any Fulton Boiler.

Rigging your boiler into position should be handled by a competent rigger experienced in handling heavy equipment.

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

NOTE

The installation of the Fulton Gas Fired Steam Boiler should be carried out by competent personnel in accordance with the standards of the National Fire Protection Association, National or Canadian Electrical Code. All state and jurisdictional codes beyond the scope of the applicable ASME Boiler and Pressure Vessel Codes, for its corresponding classification, should be followed in all cases. Jurisdictional authorities must be consulted prior to installation.

WARNING

Operating the boiler beyond its design limits can damage the boiler and can also be dangerous. Do not operate the boiler outside its limits. Do not try to upgrade the boiler performance by unapproved modifications. Unapproved modifications can cause injury and damage. Contact your Fulton dealer before modifying the boiler.

WARNING

A defective boiler can injure you or others. Do not operate a boiler which is defective or has missing parts. Make sure that all maintenance procedures are completed before using the boiler. Do not attempt repairs or any other maintenance work you do not understand. Obtain a Service Manual from Fulton or call a Fulton Service Engineer.

WARNING: If the information in this manual is not followed exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

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

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

- Installation and service must be performed by a qualified installer, service agency or the gas supplier.

For Your Safety

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

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

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

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

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

WARNING

Care should be taken to ensure that the blow off receptacle used meets the regulations covering such vessels. A means to cool boiler blowdown water to <140^{O} F prior to discharging to floor drains is required for personnel and equipment protection.

WARNING

Only properly trained personnel should install and maintain water gauge glass and connections. Wear safety glasses during installation. Before installing, make sure all parts are free of chips and debris. Gauge glass valves must be fully open to prevent boiler water damage if a gauge glass breaks.

WARNING

Prior to the commencement of any work requiring the removal of cover plates and the opening of the control panel box, the electrical supply to the boiler must be disconnected.

WARNING

DO NOT TAMPER WITH THE SAFETY FEATURES OF THE LOW WATER SAFETY CUT OFF.

WARNING

When shutting down the boiler for any extensive repairs, shut off main disconnect switches on both the boiler and the feed water pump.

WARNING

Do not clean the gauge glass while pressurized. Ensure gauge glass valves are fully shut prior to glass removal.

WARNING

Do not allow anyone to operate, service or repair this equipment unless they fully understand all applicable sections of this manual.

CAUTION

To prevent corrosion fatigue at the feedwater nozzle or cold end corrosion, boiler feed water must be at least 140^{O} F prior to entry into the boiler.

CAUTION

A temperature exceeding 100^{O}F in the boiler room may cause premature failure of electrical components in the boiler control panel.

CAUTION

The water chemistry in the boiler must be kept within limits outlined in this manual. Failure to do so will likely cause premature boiler pressure vessel failure and poor steam quality.

NOTE

After installation is complete and prior to operation the pressure vessel should be cleaned or boiled out per instructions included in this manual.

NOTE

a) The fused disconnect switch that controls the feed water pump should be kept in the "on" position at all times during the boiler operation as well as during the non-operating period of the boiler.

b) This switch should be turned "off" only when repairs or adjustments should be made.

NOTE

The feedwater pump will continue to operate until the water reaches the correct level in the boiler. This level is approximately the center of the water gauge glass.

NOTE

To ensure that your Fulton Steam Boiler is kept operating safely and efficiently, follow the maintenance procedures set forth in Section 4 of this manual.

NOTE

If only the top refractory is to be changed, the bottom refractory need not be removed.

NOTE

The boiler blow off operation should be done once during the day when the boiler is at 10 PSIG or less.

NOTE

After a new Fulton Boiler has been in operation for several months, pieces of burned metal will be found in the space at the bottom of the boiler. These pieces of metal are the remains of a light gauge metal form which was used during manufacture for forming the boiler insulation. This is a normal condition and does not affect the efficiency or the life of the boiler in any way.

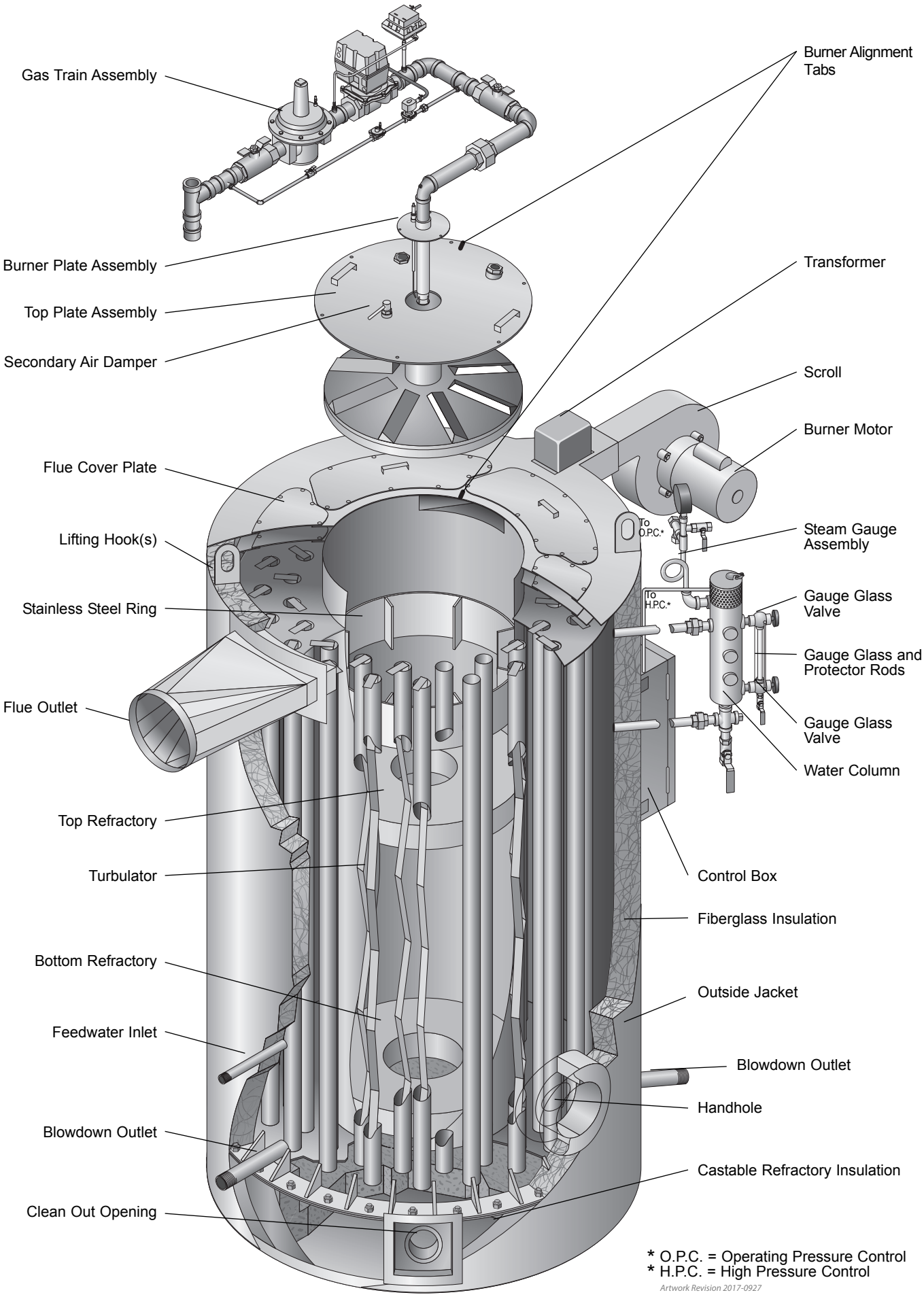
1

Section 2 Installation

3

4

5



* O.P.C. = Operating Pressure Control
* H.P.C. = High Pressure Control

Artwork Revision 2017-0927

Product Data Submittal

Fulton Models: VMP40, VMP49.5, VMP50, VMP60, VMP80, VMP100, VMP130 and VMP150

Fulton Vertical MultiPort Steam Boilers

(Standard Burners)

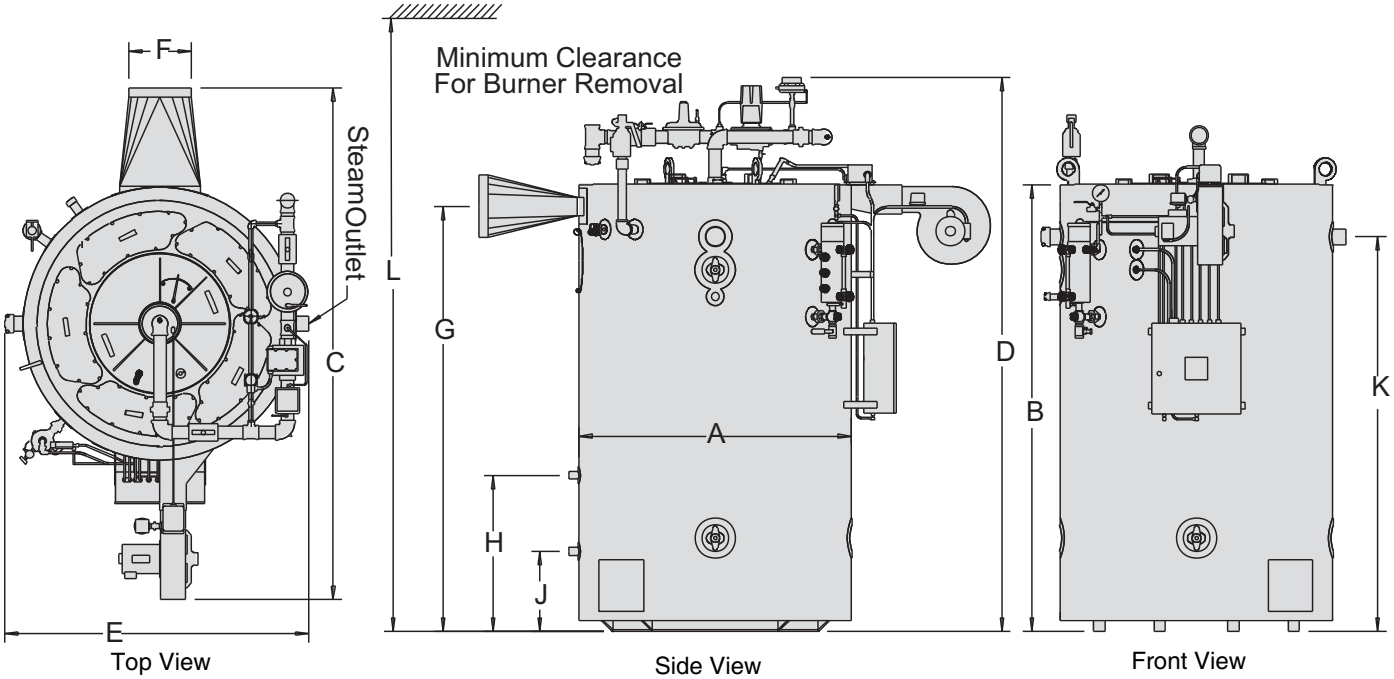
Dimensions

Models VMP		**40**	**49.5**	**50**	**60**	**80**	**100**	**130**	**150**
Unit Size:	BHP	40	49.5	50	60	80	100	130	150
A. Boiler Diameter	IN	50.5	55	55	55	63	69	76.5	76.5
	MM	1283	1397	1397	1397	1600	1753	1943	1943
B. Boiler Height	IN	84	91	91	97	100	100	115	115
	MM	2133	2312	2312	2464	2540	2540	2921	2921
C. Boiler Depth	IN	90	100	100	100	114	119	128	130
	MM	2286	2540	2540	2540	2896	3022	3251	3302
D. Boiler Height w/trim	IN	107	112	112	118	124	126	135	141
	MM	2718	2832	2832	2984	3150	3200	3429	3582
E. Overall Boiler Width	IN	56	62	62	62	68	74	84.5	84.5
	MM	1422	1575	1575	1575	1727	1880	2146	2146
F. Flue Outlet Diameter	IN	12	12	12	12	14	14	14	16
	MM	305	305	305	305	356	356	356	407
G. To Center of Flue Outlet	IN	79	86	86	92	95	95	107	107
	MM	2006	2184	2184	2237	2413	2413	2718	2718
H. Feedwater Inlet	IN	35	35	35	35	35	35	39	39
	MM	889	889	889	889	889	889	991	991
J. Blowdown Outlet	IN	17	18	18	18	18	18	22	22
	MM	432	457	457	457	457	457	559	559
K. Height to Steam Outlet[1]	IN	73	77	77	84	89	89	102	102
	MM	1854	4956	4956	2134	2260	2260	2591	2591
L. Min. Clearance to Ceiling	IN	110	115	115	125	130	132	145	145
	MM	2794	2921	2921	3175	3302	3353	3683	3683

Specifications and Dimensions are approximate. We reserve the right to change specifications and/or dimensions.

NOTE: Minimum clearance is 24" to the side and back and 36" in front of unit.

1. The boiler may be fitted with a 90° elbow spool piece making the steam outlet connection higher.



Specifications

Models VMP		**40**	**49.5**	**50**	**60**	**80**	**100**	**130**	**150**
Unit Horsepower		40	49.5	50	60	80	100	130	150
Boiler Connections									
Steam Outlet 15 PSI - 150# Flanged	IN	4	4	4	4	6	6	* 6	* 6
	MM	101	101	101	101	152	152	203	203
Steam Outlet 150 PSI	IN NPT	3	3	3	3	3	3	4	4
	MM	76	76	76	76	76	76	101	
Feedwater Inlet	IN NPT	1	1	1	1	1	1.25	1.25	1.25
	MM	25	25	25	25	25	31	32	32
Blowdown Outlet (2)	IN NPT	1.5	1.5	1.5	1.5	1.5	2	2	2
	MM	38	38	38	38	38	51	51	51
Water Column Blowdown	IN NPT	1	1	1	1	1	1	1	1
	MM	25	25	25	25	25	25	25	25
Surface Blowdown	IN NPT	.75	.75	.75	.75	.75	.75	.75	.75
	MM	19	19	19	19	19	19	19	19
Safety Valve 150 PSI Inlet	IN NPT	.75	1	1	1	1.25	1.25	1.5	1.5
	MM	19	25	25	25	31	31	38	38
Safety Valve 150 PSIOutlet	IN NPT	1	1.25	1.25	1.25	1.5	1.5	2	2
	MM	25	31	31	31	38	38	51	51
Safety Valve 15 PSI Inlet (2)	IN NPT	1.25	1.25	1.25	1.25	1.5	1.5	2	2
	MM	31	31	31	31	38	38	51	51
Safety Valve 15 PSI Outlet	IN NPT	1.5	1.5	1.5	1.5	2	2	2	2
	MM	38	38	38	38	51	51	51	51
Natural Gas Connection	IN	1.5	1.5	1.5	2	2	2	2	2
	MM	38	38	38	51	51	51	51	51
Light Oil Connection	IN	.25	.25	.25	.25	.25	.25	.375	.375
	MM	6	6	6	6	6	6	9.5	9.5
Burner Motor (Gas)	HP	1.5	1.5	1.5	1.5	3	3	10	10
	KW	1.1	1.1	1.1	1.1	2.2	2.2	7.5	7.5
Burner Motor (Oil/Combo)	HP	2	2	2	2	3	3	10	10
	KW	1.5	1.5	1.5	1.5	2.2	2.2	7.5	7.5
Approximate Weights									
Shipping Weights (approx.)	LB	5775	6550	6575	7370	8000	9500	12350	12350
	KG	2620	2972	2980	3340	3630	4310	5600	5600
Operating Weight (approx.)	LB	6720	8850	8209	9227	11760	14525	20135	20135
	KG	3050	4015	3720	4190	5330	6590	9130	9130
****Ratings Sea Level to 3000 FT. (914 M)**									
Output	1000 BTU/HR	1340	1656	1673	2009	2678	3347	4353	5022
	1000 KCAL/HR	338	417	422	506	675	843	1097	1266
Steam Output	LBS/HR	1380	1708	1725	2070	2760	3450	4485	5175
	KG/HR	626	775	783	939	1252	1565	2035	2348
Water Content	GAL	172	274	242	270	383	518	810	810
	LITERS	651	1038	916	1022	1450	1960	3066	3066
Approximate Fuel Consumption at Rated Capacity+									
Natural Gas	FT^3/HR	1595	1972	1992	2392	3188	3985	5200	5978
	M^3/HR	45	56	56	68	90	113	147	169
LP Gas	FT^3/HR	638	788	797	957	1275	1594	2080	2391
	M^3/HR	18	22	23	27	36	45	59	68
Light Oil	GPH	11.0	13.9	14.0	17.0	22.8	28.0	37.0	42.0
	LPH	41.6	52.6	53	64.3	87	106	140	159
Gas Pressure Required Standard Burners Min.	IN W.C.	7	7	7	7	9	9	40	40
Gas Pressure Required Standard Gas Train Max.	IN W.C.	13	13	13	13	27	27	5 psig	5 psig
Electrical Requirements/Amps for Burner Motors									
208V, 50/60 CY, 3 Phase (Gas/Oil)		6.6/7.5	6.6/7.5	6.6/7.5	6.6/7.5	10.6	10.6	30.8	30.8
230V, 50/60 CY, 3 Phase (Gas/Oil)		6.0/6.8	6.0/6.8	6.0/6.8	6.0/6.8	9.6	9.6	28	28
460V, 50/60 CY, 3 Phase (Gas/Oil)		3.0/3.4	3.0/3.4	3.0/3.4	3.0/3.4	4.8	4.8	14	14

* Steam separator or dual steam nozzle design required.

**Ratings - From 0 PSIG and at 212 Degrees F and KG/HR - From 0 KG/CM^2 and at 100 Degrees C +Consumption based on natural gas 1000 BTU/FT3; Propane 2500, and Light Oil 140,000 BTU/GAL.

NOTE: 7" - 11" wc gas pressure is required during run for 40-60 HP boilers with standard burners. 9"-11" wc gas pressure is required during run for 80-100 HP boilers with standard CSD-1 burners, 40" W.C. is required for 130-150 HP

Specifications & dimensions are approximate. We reserve the right to change without notice.

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vmpstd-pds-2010-1008

Fulton Vertical MultiPort Steam Boilers

(Low Emissions Burners)

(<20 PPM NOx)

Product Data Submittal

Fulton Models: VMP40, VMP49.5, VMP50, VMP60, VMP80, and VMP100

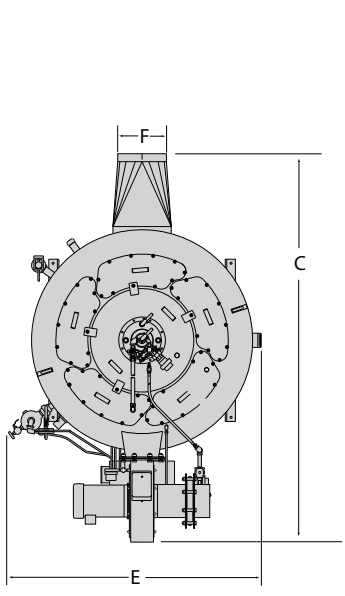
Dimensions

Models VMP		**40**	**49.5**	**50**	**60**	**80**	**100**
Unit Size:	BHP	40	49.5	50	60	80	100
A. Boiler Diameter	IN	49	55	55	55	63	69
	MM	1245	1397	1397	1397	1600	1753
B. Boiler Height	IN	84	91	91	97	100	100
	MM	2133	2312	2312	2464	2540	2540
C. Boiler Depth	IN	90	100	100	100	114	119
	MM	2286	2540	2540	2540	2896	3022
D. Boiler Height w/trim	IN	107	112	112	118	124	126
	MM	2718	2832	2832	2984	3150	3200
E. Overall Boiler Width	IN	56	62	62	62	68	74
	MM	1422	1575	1575	1575	1727	1880
F. Flue Outlet Diameter	IN	12	12	12	12	14	14
	MM	305	305	305	305	356	356
G. To Center of Flue Outlet	IN	79	86	86	92	95	95
	MM	2006	2184	2184	2237	2413	2413
H. Feedwater Inlet	IN	35	35	35	35	35	35
	MM	889	89	889	889	889	889
J. Blowdown Outlet	IN	17	18	18	18	18	182
	MM	432	457	457	457	457	457
K. Height to Steam Outlet[1]	IN	73	77	77	84	89	89
	MM	1854	4956	4956	2134	2260	2260
L. Min. Clearance to Ceiling for Burner Removal	IN	123	135	135	144	147	147
	MM	3124	3429	3429	3658	3734	3734

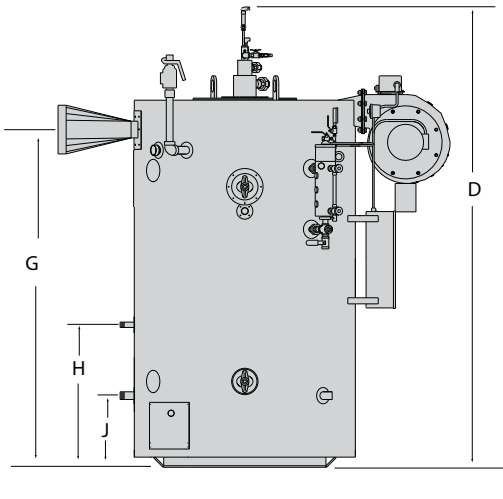
Specifications and Dimensions are approximate. We reserve the right to change specifications and/or dimensions.

NOTE: Minimum clearance is 24" to the side and back and 36" in front of the unit.

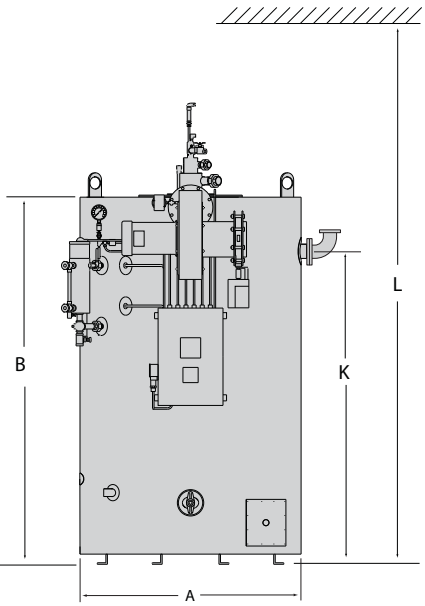
1. The boiler may be fitted with a 90º elbow spool piece making the steam outlet connection higher.



Top View



Side View



Front View

Specifications

Models VMP		**40**	**49.5**	**50**	**60**	**80**	**100**
Unit Horsepower		40	49.5	50	60	80	100
Boiler Connections							
Steam Outlet 15 PSI	IN	4	4	4	4	6	6
150# Flanged	MM	101	101	101	101	152	152
Steam Outlet 150 PSI	IN NPT	3	3	3	3	3	3
150# Flanged	MM	76	76	76	76	76	76
Feedwater Inlet	IN NPT	1	1	1	1	1	1.25
	MM	25	25	25	25	25	31
Blowdown Outlet	IN NPT	1.5	1.5	1.5	1.5	1.5	2
	MM	38	38	38	38	38	51
Water Column Blowdown	IN NPT	1	1	1	1	1	1
	MM	25	25	25	25	25	25
Surface Blowdown	IN NPT	.75	.75	.75	.75	.75	.75
	MM	19	19	19	19	19	19
Safety Valve 150 PSI Inlet	IN NPT	.75	1	1	1	1.25	1.25
	MM	19	25	25	25	31	31
Safety Valve 150 PSIOutlet	IN NPT	1	1.25	1.25	1.25	1.5	1.5
	MM	25	31	31	31	38	38
Safety Valve 15 PSI Inlet (2)@	IN NPT	1.25	1.25	1.25	1.25	1.5	1.5
	MM	31	31	31	31	38	38
Safety Valve 15 PSI Outlet (2)	IN NPT	1.5	1.5	1.5	1.5	2	2
	MM	38	38	38	38	51	51
Natural Gas Connection	IN	1.5	1.5	1.5	2	2	2
	MM	38	38	38	51	51	51
Burner Motor	HP	5	5	5	5	5	7.5
	KW	3.7	3.7	3.7	3.7	3.7	5.6
Approximate Weights							
Shipping Weights (approx.)	LB	6575	7375	7375	8170	8800	10300
	KG	2982	3345	3345	3706	3992	4672
Operating Weight (approx.)	LB	8659	9684	9684	10671	12051	14700
	KG	3928	4393	4393	4840	5466	6668
Ratings Sea Level to 3000 FT. (914 M)							
Output	1000 BTU/HR	1340	1656	1673	2009	2678	3347
	1000 KCAL/HR	338	417	422	506	675	843
Steam Output**	LBS/HR	1380	1708	1725	2070	2760	3450
	KG/HR	626	775	783	939	1252	1565
Water Content	GAL	172	274	242	270	383	518
	LITERS	651	1038	916	1022	1450	1960
Approximate Fuel Consumption at Rated Capacity+							
Natural Gas	FT^3/HR	1595	1972	1992	2392	3188	3985
	M^3/HR	45	56	56	68	90	112
Gas Pressure Required Min.	IN W.C.	30	30	30	40	40	40
Gas Pressure Required Max.	PSIG.	5	5	5	5	5	5
Electrical Requirements/Amps for Burner Motors							
208V, 60 CY, 3 Phase		16.7	16.7	16.7	16.7	16.7	24.2
230V, 60 CY, 3 Phase		15.2	15.2	15.2	15.2	15.2	22.0
460V, 60 CY, 3 Phase		7.6	7.6	7.6	7.6	7.6	11.0

* Steam separator or dual steam nozzle design required. Consult factory for availability.

**Steam Output LB/HR - From 0 PSIG and at 212 Degrees F and KG/HR - From 0 KG/CM^2 and at 100 Degrees C

+Consumption based on natural gas 1000 BTU/FT^3 and 20 ppm NO_x @ 3% CO_2 burner.

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vmp40-100le-pds-2010-1008

Fulton Vertical MultiPort Steam Boilers

(Low Emissions Burners)

(<30 PPM NOx)

Product Data Submittal

Fulton Models: VMP130 and VMP150

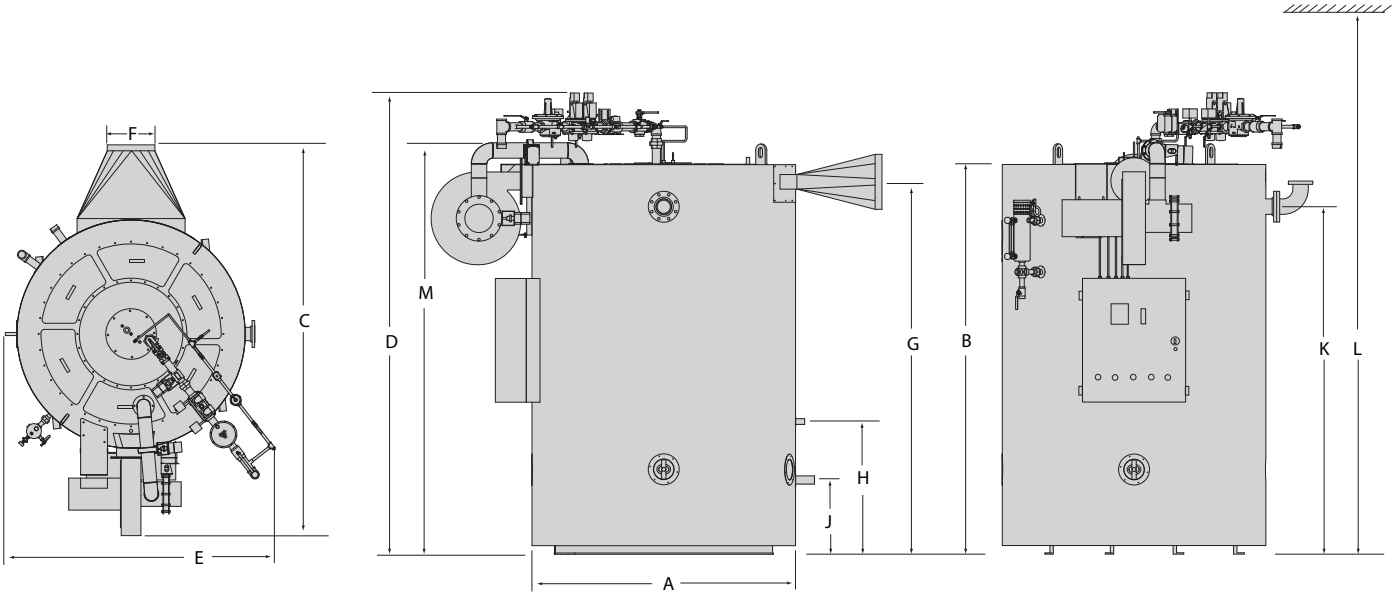
Dimensions

Models VMP		**130**	**150**
Unit Size:	BHP	130	150
A. Boiler Diameter	IN	76.5	76.5
	MM	1943	1943
B. Boiler Height	IN	115	115
	MM	2921	2921
C. Boiler Depth	IN	128	130
	MM	3251	3302
D. Boiler Height w/trim	IN	135	149
	MM	3429	3785
E. Overall Boiler Width	IN	84.5	84.5
	MM	2146	2146
F. Flue Outlet Diameter	IN	14	16
	MM	356	407
G. To Center of Flue Outlet	IN	107	107
	MM	2718	2718
H. Feedwater Inlet	IN	39	39
	MM	991	991
J. Blowdown Outlet	IN	22	22
	MM	559	559
K. Height to Steam Outlet[1]	IN	102	102
	MM	2591	2591
L. Min. Clearance to Ceiling for Burner Removal	IN	155	155
	MM	3937	3937
M. Height to top of FGR Loop	IN	121	121
	MM	3073	3073

Specifications and Dimensions are approximate. We reserve the right to change specifications and/or dimensions.

NOTE: Minimum clearance is 24" to the side and back and 36" in front of unit.

1. The boiler may be fitted with a 90º elbow spool piece making the steam outlet connection higher.



Specifications

Models VMP		**130**	**150**
Unit Horsepower		130	150
Boiler Connections			
Steam Outlet 15 PSI - 150# Flanged	IN	* 6	* 6
	MM	152	152
Steam Outlet 150 PSI	IN NPT	6	6
150# Flanged	MM	152	152
Feedwater Inlet	IN NPT	1.25	1.25
	MM	32	32
Blowdown Outlet	IN NPT	2	2
	MM	51	51
Water Column Blowdown	IN NPT	1	1
	MM	25	25
Surface Blowdown	IN NPT	.75	.75
	MM	19	19
Safety Valve 150 PSI Inlet	IN NPT	1.5	1.5
	MM	38	38
Safety Valve 150 PSIOutlet	IN NPT	2	2
	MM	51	51
Safety Valve 15 PSI Inlet (2)@	IN NPT	2	2
	MM	51	51
Safety Valve 15 PSI Outlet (2)	IN NPT	2	2
	MM	51	51
Natural Gas Connection	IN	2.5	2.5
	MM	63	63
Burner Motor	HP	10	10
	KW	7.4	7.4
Approximate Weights			
Shipping Weights (approx.)	LB	12800	12800
	KG	5806	5806
Operating Weight (approx.)	LB	20585	20585
	KG	9337	9337
Ratings Sea Level to 3000 FT. (914 M)			
Output	1000 BTU/HR	4353	5022
	1000 KCAL/HR	1097	1266
Steam Output**	LBS/HR	4485	5175
	KG/HR	2035	2348
Water Content	GAL	810	810
	LITERS	3066	3066
Approximate Fuel Consumption at Rated Capacity+			
Natural Gas	FT^3/HR	5182	5978
	M^3/HR	146	169
Gas Pressure Required Min.	IN W.C.	21	21
Gas Pressure Required Max.	PSIG	5	5
Electrical Requirements/Amps for Burner Motors			
208V, 60 CY, 3 Phase		30.8	30.8
230V, 60 CY, 3 Phase		28	28
460V, 60 CY, 3 Phase		14	14

* Steam separator or dual steam nozzle design required. Consult factory for availability.
**Steam Output LB/HR - From 0 PSIG and at 212 Degrees F and KG/HR - From 0 KG/CM^2 and at 100 Degrees C
+Consumption based on natural gas 1000 BTU/FT^3 and 20 ppm NO_x @ 3% O_2 burner.

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www.fulton.com

vmp130-150le-pds-2010-1008

Locating the Boiler

a. The boiler should be located in dry surroundings on a level base, making sure that there is sufficient room around the boiler to enable the operator and/or the maintenance engineer to gain access to all parts of the boiler. Check location for ease of water supply and electrical connections.

b. Place the boiler on a non combustible floor with clearances to unprotected combustible materials, including plaster or combustible supports.

c. It is necessary to have the following vertical clearance from the floor to the ceiling for removal of the burner for servicing:

Minimum Vertical Clearances

BHP	IN	MM
40	110	2794
50	115	2921
60	125	3175
80	130	3302
100	130	3302
130	145	3683
150	145	3683

The Gas Supply

a. Gas Piping should be installed in accordance with National Fuel Gas Code, ANSI-Z223-1-1984 or latest addenda and any other local codes which may apply. In Canada gas installations must be in accordance with the current CAN/CGA B149.1 and .2 and/or local codes.

b. Install a dirt trap ahead of all of the gas valves.

c. The pipe and the fittings used must be new and free of dirt or other deposits.

d. The piping must be of the proper size to ensure adequate gas supply to the gas head assembly. Consult your gas company for specific recommendations.

e. 7" - 11" wc gas pressure is required during run for 40-60 HP boilers with standard burners. 9"-11" wc gas pressure is required during run for 80 100 HP boilers with standard CSD-1 burners, 11"-13" wc gas pressure is required for 80-100 HP IRI boilers. 40" W.C. is required for 130-150 HP

f. For propane or butane gas: see "e" above. Propane not available for LoNOx boilers.

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

h. The main and the pilot gas pressure regulators must be vented to the atmosphere.

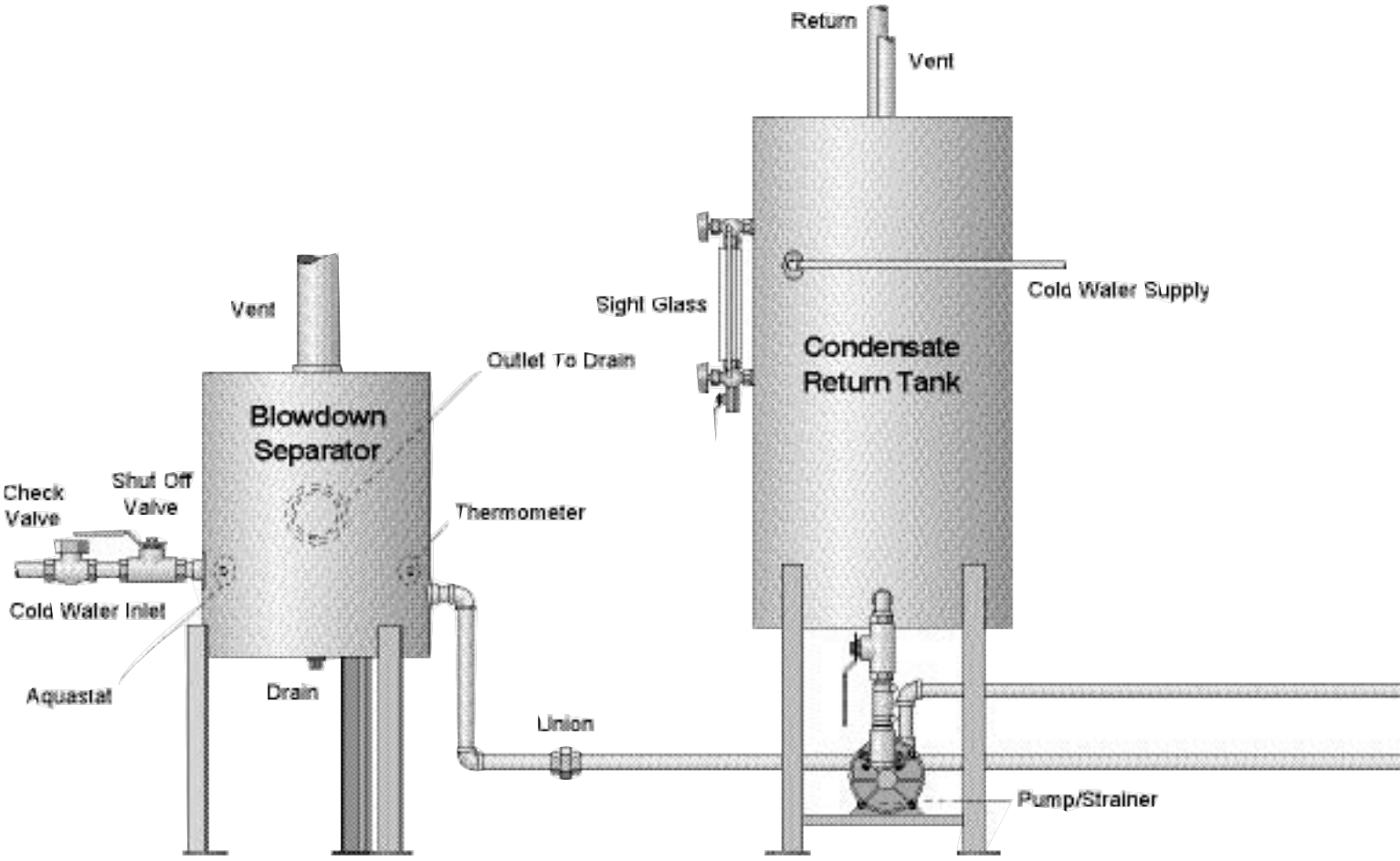
i. After gas piping is completed carefully check all piping connections, (factory and field), for gas leaks. Use a soap and water solution.

CAUTION

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

j. The boiler must be disconnected at the boiler shut off valve from the gas supply piping system during any pressure testing of the system at pressure in excess of 1/2 PSIG-14" W.C.

k. The boiler must be isolated from the gas supply piping system by closing the shut-off cock during any pressure testing of the gas supply piping system at pressures equal to or less than 1/2 PSIG--14" W.C.



The Gas Supply For LE Models

A minimum of 40" w.c. gas pressure is required at the inlet of the gas train while operating for the 40-100HP; 60" w.c. for the 130-150HP boiler.

WARNING

For units equipped with Flue Gas Recirculation (FGR), the ducting must be insulated.

CAUTION

Do not exceed the rated pressure of the fuel train.

Basic Boiler, Condensate Tank, and Blow-Down Separator

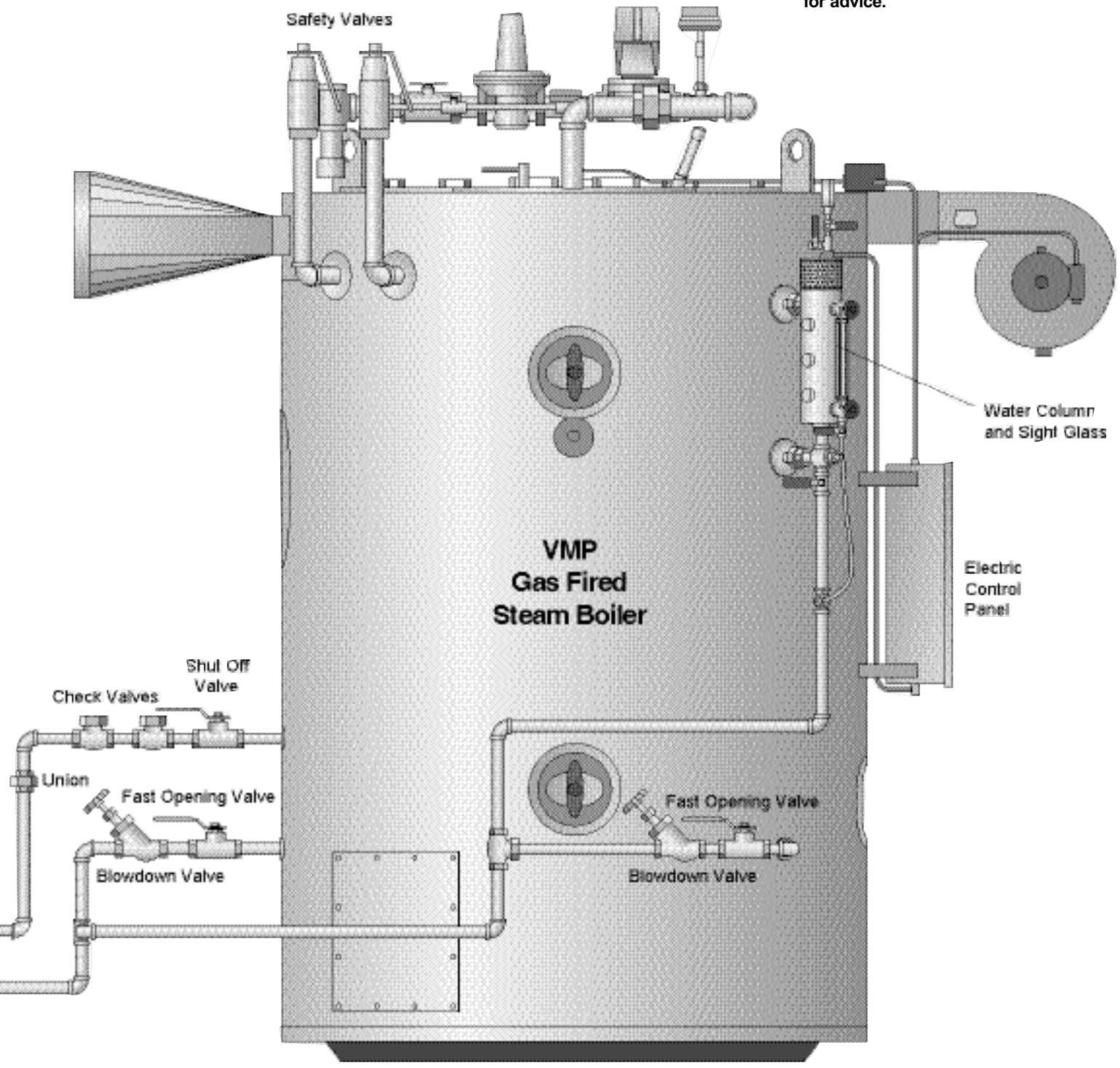
NOTE

Where a condensate return tank is to be fitted:

1. **This should be vented to a safe location.**
2. **This should have a capacity sufficient to satisfy boiler consumption as well as maintain proper return tank temperature.**
3. **Vent pipe should not be down-sized (this may cause pressure build up in the condensate tank).**
4. **Return pipes must not be insulated. This can cause overheating the return system, causing a vapor lock in the pump.**
5. **See Return System Instruction Manual for detailed instructions.**

NOTE

Care should be taken to ensure that the blow-down receptacle used meets the regulations covering such vessels. If in doubt consult a Fulton Representative for advice.



a. Make sure two check valves are installed between the boiler and pump (one check valve is supplied with the unit).

b. In a closed system an end of the line trap should be installed.

c. There are four blow-down valves on the boiler: Two main bottom blow-down valves, the gauge glass blow-down valve, and the water column blow-down valve. All blow-down connections must be piped to blow-down seperator.

All these procedures should be done in accordance with state and/or local codes. The water column blow-down valve and the gauge glass blow-down valve should be connected to the main blow-down line.

Steam Supply

Pipe the steam supply line from the top right side of the boiler.

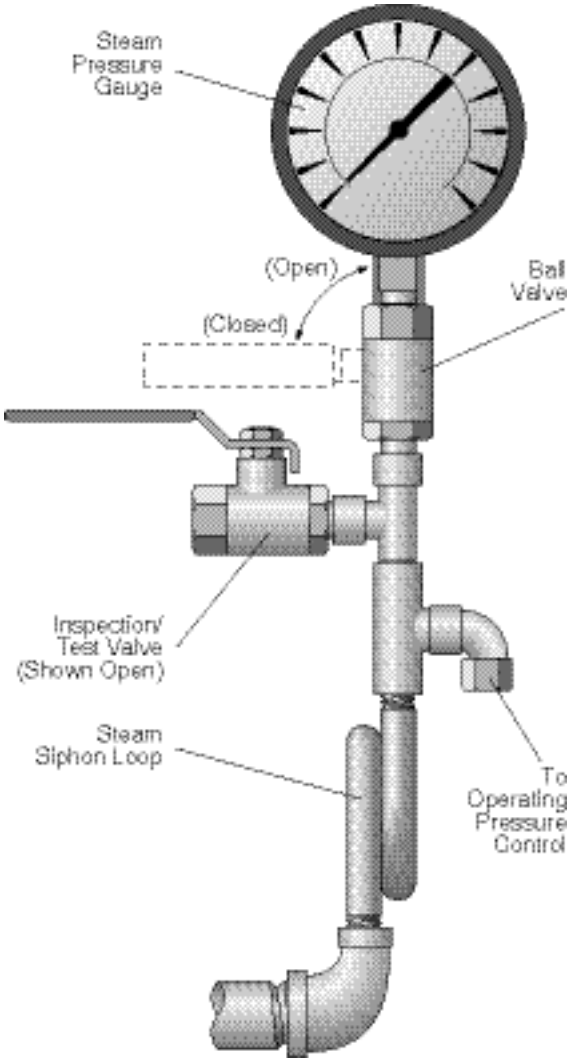
Steam Safety Valve

1. Before installing, be sure that all pipes and connections have been blown clean. Pipe compound or dope is used on external threads only. Be sure inlet of valve is free of any foreign material.

2. Do not use a pipe wrench! When making installation, use proper type and size wrench.

3. The valve should be installed in a vertical upright position in the connection provided on the top left side of the boiler with no unnecessary intervening pipe. Under no circumstances should there be a shut off valve or restriction of any kind between the safety valve and the connection provided.

4. Do not cap or plug drain hole in the side of valve body.



5. Since the purpose of this safety valve is to protect against an overpressure situation, it will loudly discharge hot steam in doing so. Therefore, it is recommended that a discharge pipe be securely installed and run to a safe point of disposal.

6. When a discharge pipe is used, it must be of a pipe size equal to or greater than that of the valve outlet. Use schedule 40 discharge pipe only. Do not use schedule 80, extra strong or double extra strong discharge pipe or connections. It must be as short and straight as possible and so arranged as to avoid undue stress on the valve. It must have an ample provision for draining condensate at or near the valve outlet. It must terminate freely to atmosphere with no intervening valve of any description and it must be securely anchored and supported.

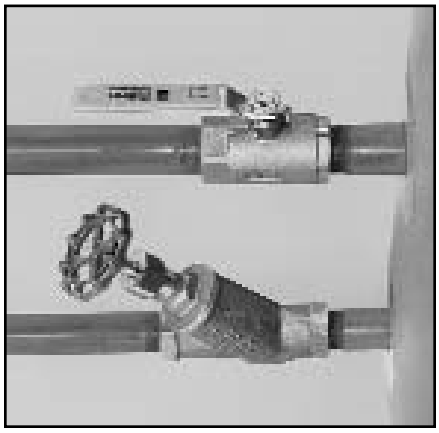
Steam Pressure Gauge Assembly

The gauge should be facing front towards the panel box and/or operator of the boiler.

Except as noted, each assembly or any of its component parts may be oriented, other than as shown to provide improved operating clearances and/or view of gauge. Before installing steam gauge on the siphon, add a small amount of water to the siphon to create a water seal to buffer the gauge element. This must be done to prevent inaccurate pressure readings and /or premature failure of the gauge. Install the steam gauge into the siphon on the water column.

Blow-Down Valve

There are four blow-down valves on the boiler: Two main bottom blow-down valves, the gauge glass blow-down valve, and the water column blow-down valve. All blow-down connections must be piped to blow-down seperator.



Feed Water Piping

1. Provisions must be made for adequate water supply and properly sized piping. Piping must be done in compliance with all local codes. The following chart may be used as a guideline for sizing.

BHP	Minimum Water Supply Piping Size	
	IN	MM
40	1	25
50	1	25
60	1	25
80	1	25
100	1.25	31.7
130	1.25	31.7
150	1.25	31.7

2. When feeding the boiler using a return system, the city water pressure should not exceed 40 PSI. A pressure reducing valve should be installed a head of the return tank when above this pressure.

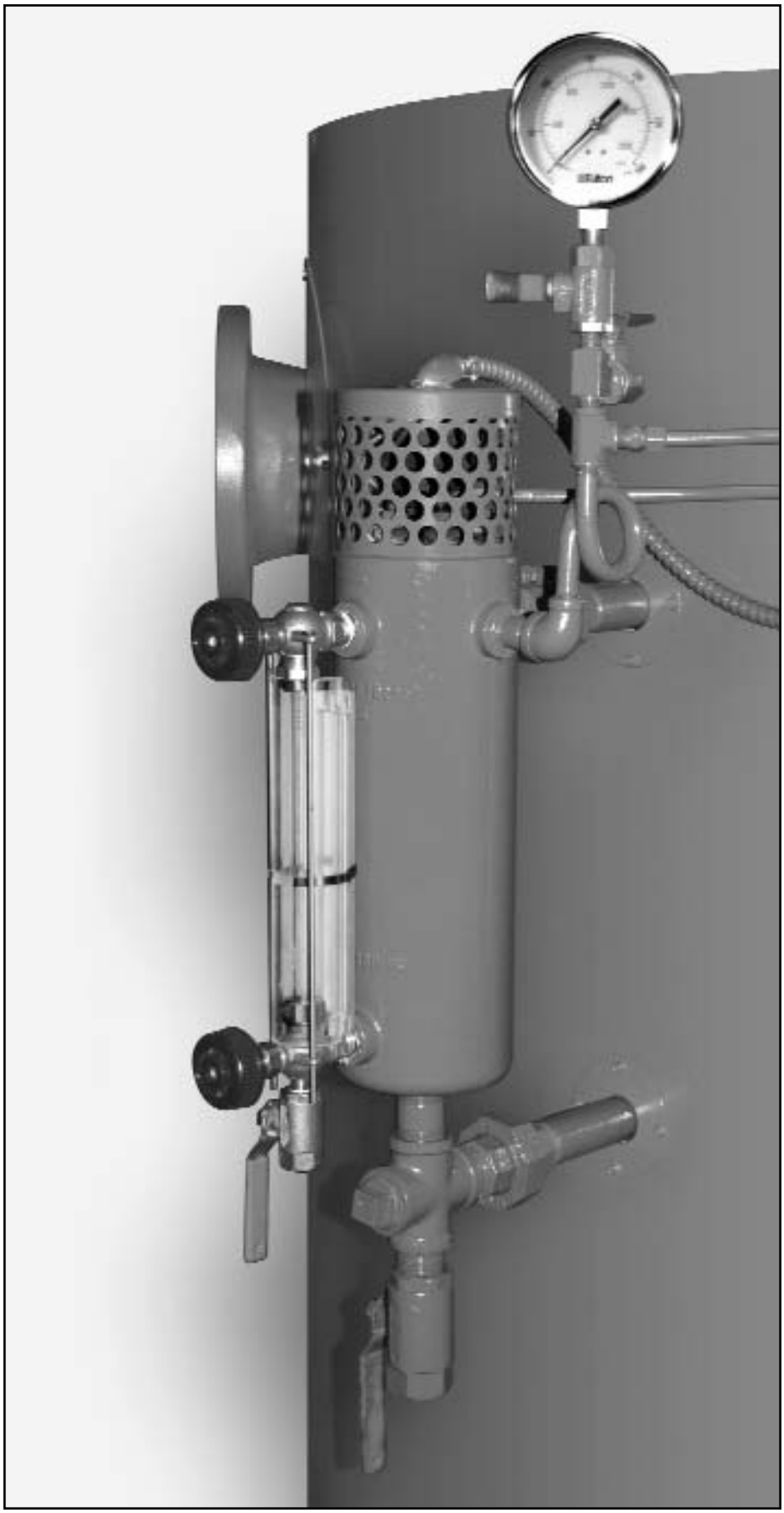
3. It is important that all piping be lined up and not forced into place. It is recommended that you begin piping at the pump. If the lines are ended at the pump, particularly if the last piece is cut too short or long, the pump will be forced to meet the pipe and strain or distortion will result.

4. Do not use the pump as a piping support. It is critical that the pipe be independently supported near the pump so no strain will be transmitted to the unit.

5. Connect the feed water stop valve to the feed water pipe at the rear of the boiler and pipe it to the return system.

Water Column

Install the piping from the water column and water gauge glass to a safe blow-down point.



Water Gauge and Gauge Glass Installation Instructions

NOTE

Only properly trained personnel should install and maintain water gauge glass and connections. Wear safety glasses during installation. Before installing, make sure all parts are free of chips and debris.

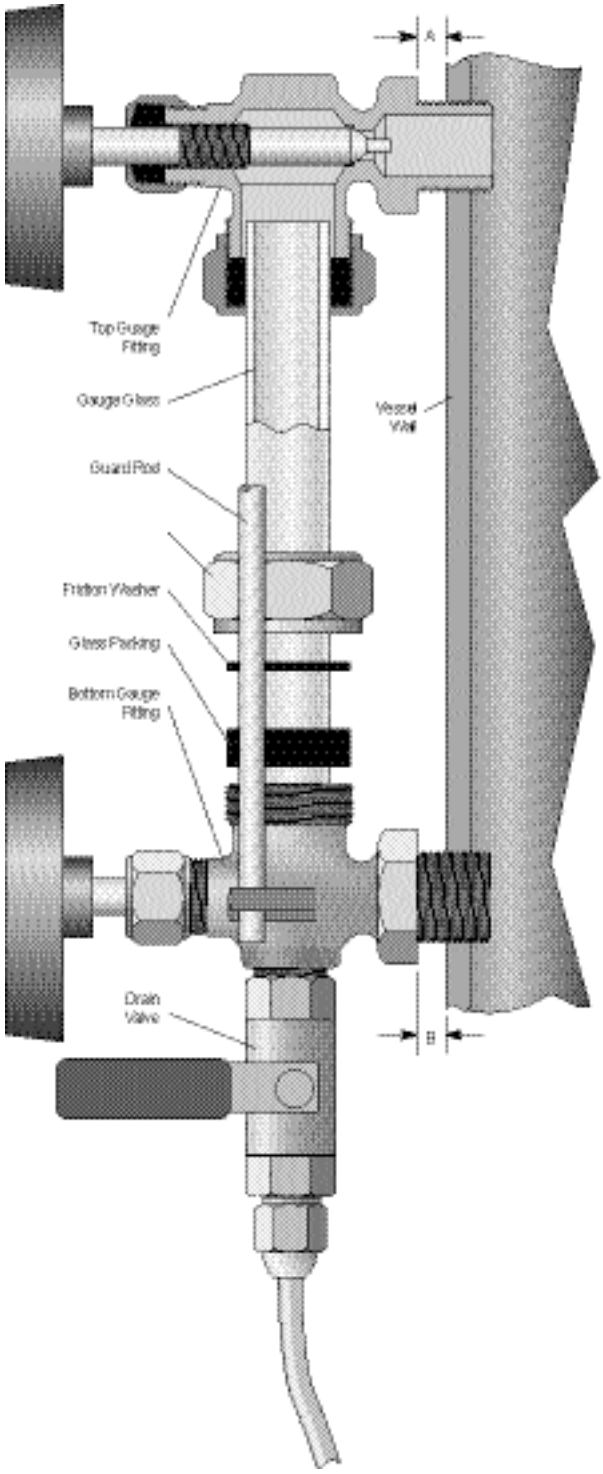
NOTE

Keep gauge glass in original packaging until ready to install.

1. Verify the proper gauge has been supplied.
2. Examine the gauge glass and packings carefully for damage before installation. Do not use the glass if it contains any scratches, chips, or any other visible signs of damage.
3. Do not subject the gauge glass to bending or torsional stresses.
4. Apply teflon tape or pipe dope to pipe threads. Install top gauge fitting (fitting without a drain valve) into the uppermost tapping. Wrench tighten the fitting until it is snug and the glass outlet is pointing at five o'clock (about 1/8 turn from its final downward vertical position).
5. Install the bottom gauge fitting (the fitting with a drain valve) until it is snug and the glass outlet is pointing directly upward. Verify top and bottom fittings are threaded into the tappings the same number of turns (distance A=distance B).
6. Remove glass packing nut, friction washer and glass packing from the fittings, and place them, in the same order, on to both ends of the gauge glass. Push both packings about an inch up the gauge glass.
7. Gently insert one end of the glass into the top gauge fitting. Keeping the glass inside the top fitting, gently rotate the top gauge fitting clockwise until vertically aligned with the bottom gauge fitting, then inset glass into bottom fitting until glass bottoms out on the shoulder inside the bottom fitting.
8. Carefully raise glass about 1/16" and slide lower glass packing down until the glass packing contacts the lower gauge fitting. **DO NOT** allow the glass to remain in contact with any metal!
9. Carefully slide upper glass packing up as far as possible.
10. Hand tighten both glass packing nuts, then tighten 1/2 turn more by wrench. Tighten only enough to prevent leakage. **DO NOT OVER TIGHTEN!** If any leakage should occur, tighten slightly, a quarter turn at a time, checking for leakage after each turn.
11. Install the protective guard, and utilize automatic ball checks where necessary to help prevent injury in case of glass breakage.

WARNING

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



Water Supply

Feed water contains solids and dissolved gases. These may promote formation of scale; foaming, priming, surging, and solids in steam; corrosion and pitting; or caustic embrittlement. To prevent this, feedwater must be studied individually and treated accordingly by reputable professionals specializing in this field. It is strongly recommended that a competent water treatment company be consulted prior to the installation of the boiler.

The purpose of this treatment should be to provide quality feedwater to the boiler such that corrosion and deposition in the boiler will be minimized. Dissolved oxygen, high TDS levels and low pH can all be major causes of corrosion. Untreated hardness is the major cause of scale deposits. Poor quality feedwater will require increased blow-down and increased chemical treatment costs to prevent boiler corrosion and scaling.

One way to lower the amount of dissolved oxygen in the boiler feed water is the feedwater preheating option. This option injects live steam into the feedwater to increase the water temperature to at least 180 degrees F (82 degrees C) which removes oxygen from the water.

TDS can be controlled by increasing the number and/or duration of blow downs per day from one to four.

The Fulton Warranty does not cover damage or failure that can be attributed to corrosion, scale or sludge accumulations. Oxygen is corrosive. See the Warranty Section of this manual for full details.

Recommended Water Treatment

a. Following are 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.

Feedwater:

Dissolved Oxygen.....less than 0.05 ppm
pH Value.....9-11 (tested at room temperature)
*Hardness .....less than 25 ppm in the form of $CACO^3$
Oil.....none
Suspended Solids.....none
Organic Matter .....less than 5.0 ppm
Total Dissolved Solids .....less than 300ppm

Boiler Water:

Alkalinity .....less than 300 ppm in the form of $CACO^3$
Chloride.....less than 500 ppm
pH Value .....9 to 11 (tested at room temperature)
Total Dissolved Solids..... 2,000 ppm maximum
Hardness.....less than 50.0 ppm
Dissolved Oxygen .....none
Suspended Solids.....40 ppm

ppm = parts per million; $CACO^3$=Calcium Carbonate; PO^4=Phosphate; SiO^2=silicon dioxide; * 1 Grain Hardness = 17.118 ppm
Therefore: 70 ppm = 4.10 grains hardness

b. It is critical that the boiler pH be alkaline (9-11) whenever water is in the boiler. Solids that enter in with the feed water concentrate in the boiler. Daily boiler blow down is recommended to prevent corrosion and/or deposits from forming.

Glossary of Water Supply Corrosives and Inhibitors

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 heaters, and feedwater lines.

SUSPENDED SOLIDS

Suspended solids are the undissolved matter in water, including dirt, silt, rust and any other insoluble matter. Normally suspended solids are expressed in terms of turbidity.The presence of suspended solids in cooling water can increase impingement type corrosion. Suspended solids may also deposit in low velocity areas and create differential aeration cells. Pitting can result. The most common cause of high suspended solids is high hardness feedwater piping corrosion and inadequate blow-down rate.

In line filters, or various types of pretreatment can be used to lower the suspended solids level. Various polymers assist in holding solids in suspension. Boiler blow-down is the best way to control 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. When foaming occurs an anti-foam should be added or increased. The reason for the high alkalinity should be determined. It may result from lack of sufficient blow-down. Pretreated makeup water and condensate should also be checked. quite often the source of alkalinity is an overdose of alkaline internal water treatment chemical.

pH

pH is a measure of the degree of acid or base of solution. Neutral pH ranges of 6.5-7.5 will have negative 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. Optimal boiler pH is 9-11, slightly alkaline

In order to control boilers and equipment used for the external treatment of make up water, it is essential that frequent reliable pH measurements be made.

CHLORIDES/CHLORINE
Chlorides are generally considered detrimental in stainless steel systems only. Stress corrosion cracking can occur from high chlorides.

High chlorine levels can cause severe corrosion. Corrosion from chlorine can be controlled by removal via carbon filtration. City water can contain high levels of chlorine.

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.

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. To ensure the foaming is being caused by oil, add a small amount of powdered activated carbon to the bottle containing the boiler water and shake. Little or no foam will appear if the foaming is caused by oil.

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. Boiler and boiler system piping boil out procedure are designed to rid a system of oil contamination.

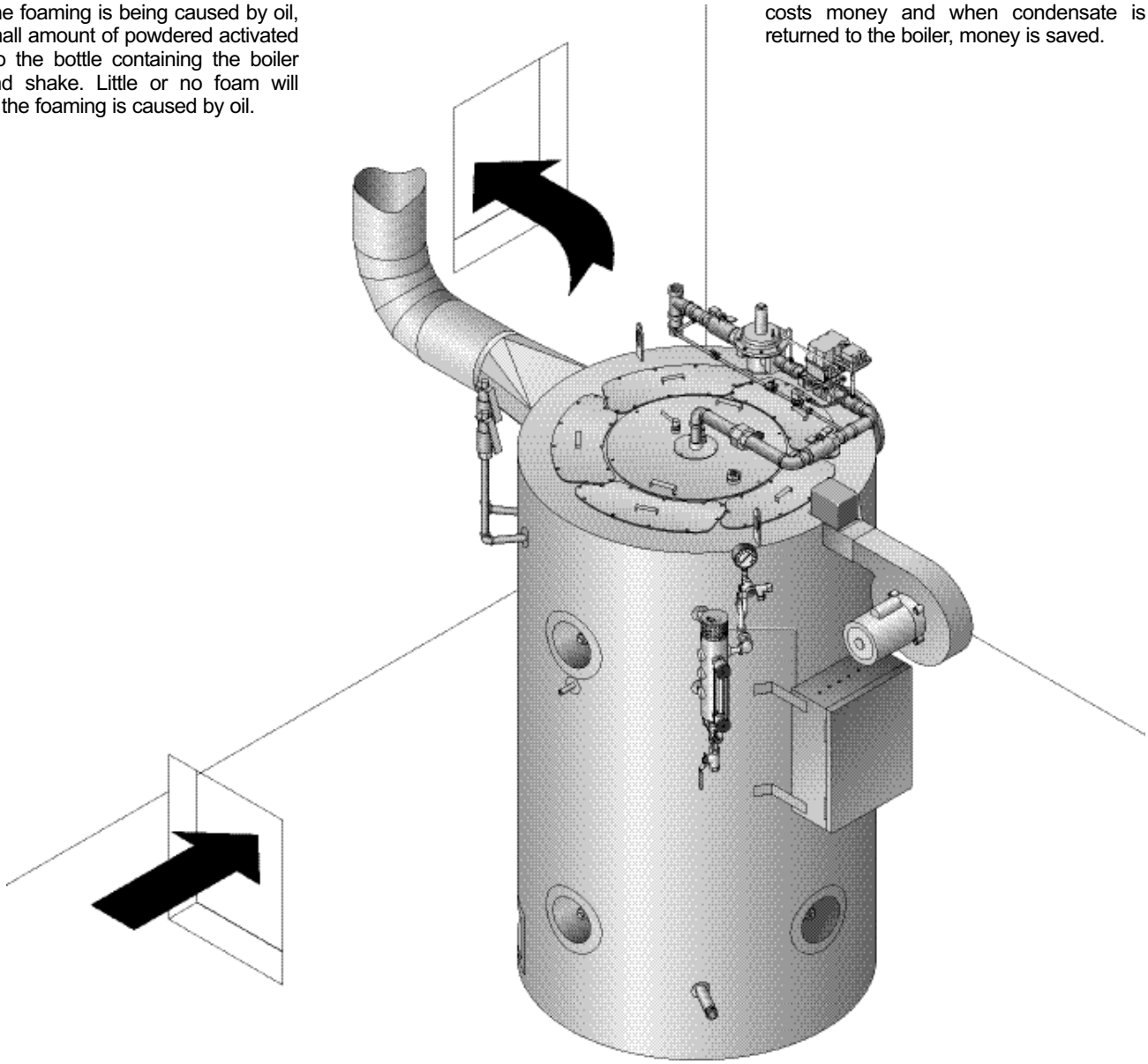
IRON (OXIDES)
Iron in any of its oxide or complex forms is undesirable in boiler water. It is very difficult to disperse so that it can be removed the bottom blow-down lines.

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. Most iron oxide originates outside the boiler. It concentrates in the boiler and it tends to collect in stagnant areas. If a boiler is using raw water makeup, iron is almost certain to be a major component of developing scale or sludge deposits.

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 water softeners or RO/DI systems. It can also be treated with various chemical treatments (i.e. Phosphates).

FEEDWATER
Feedwater is the combination of fresh makeup and returning condensate that is pumped to the boiler. Hot (>180°F) feedwater, free of hardness, solids and oxygen will yield the most protection to a 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. This costs money and when condensate is returned to the boiler, money is saved.



Electrical Requirements

1. Connect wiring as shown in the wiring diagram which is furnished inside the electrical control panel box.

2. Be sure to install a separate disconnect for each piece of equipment. The disconnects should be installed in compliance with the NEC (National Electric Code) and all local codes.

3. Connections for an optional audible alarm are provided in the control panel and are clearly indicated on the diagram.

Fresh Air Supply for Boiler

It is most important to provide free access of air to the boiler. To burn fuel properly, it requires one square inch opening of fresh air for every 3,000 BTU input of fuel. (6.4cm^2 for every 756 Kcal).

Proper ventilation of the boiler room is essential for good combustion. **Install two fresh air openings**, one at a low level 24" (610 mm) from floor and one at a higher level in the boiler room wall.This will provide a flow of air to exhaust the hot air from the boiler room. **Boiler room temp not to exceed 100°F.**

The following openings are recommended for each size boiler:

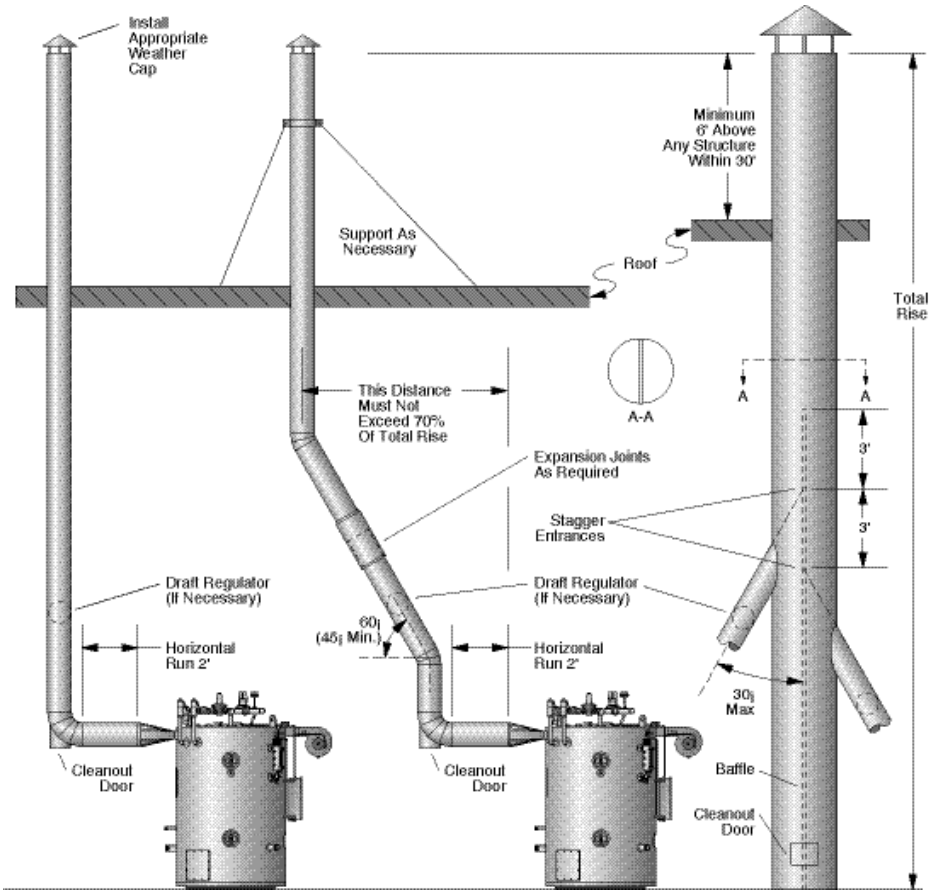
Make Up Air Openings

BHP	FT^2	M^2
40	5	.46
50	5	.46
60	7.5	.69
80	12.5	1.11
100	16	1.49
130	21	1.95
150	24	2.23

Be sure total BHP = proper make up air opening size.

These measurements are subject to state and local regulations. The installation of exhaust fans 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. It is essential that only fresh air is allowed to enter the combustion air system. Foreign substances, such as combustible volatiles and lint, in the combustion system can create hazardous conditions.



Conventional Venting

The stack should rise continuously to the connection with the chimney, and should contain no more than two bends at 45° angles or less. If required as the result of space limitations, one 90° elbow can be fitted at the back of the boiler. There should be two feet of straight, horizontal flue before any bends or turns. Any alternative stack arrangement must supply a negative .02 - .04" W.C. pressure (0.508 to 1.016 mm) with the burner off.

The run in the total distance of stack ducting, as measured in a straight line from the outlet of the boiler to the outlet of the stack, should not exceed 70% of the rise. With the exception of a duct run described in Item a, horizontal sections of ducting must be avoided, and should not exceed four feet of total run.

The stack and chimney must be constructed from material that is rated for 1000°F operating temperature. Check all local codes for exact requirements.

Adequate provision must be made for the support of the weight of the chimney and stack to avoid having too great a load imparted to the flue outlet connection of 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 boiler. Avoid flue piping and elbows by placing the boiler as close as possible to the chimney.

A mechanical draft regulator should be installed in the flue outlet. Do not install the draft regu-lator prior to the first turn of the flue.

BHP	Boiler Flue Size	
	IN	MM
40, 50, 60	12	305
80, 100, 130	14	356
150	16	406

The installer should check the draft with a meter at negative .02 -.04" W.C. pressure (0.508 to 1.016 mm) with the burner off.

Corrosion of flue pipe

In the case of a combustion flue pipe, acid may develop over a long period of time per the following process. Chlorine containing gases, such as halocarbon refrigerants, carbon tetrachloride, trichloroethylene, or perchloroethylene, when drawn into combustion air are broken down into elemental chlorine gas which exits up the flue pipe. If the flue pipe is cold, as it would be if the combustion process had been off for some time, the water vapor condenses in the flue pipe during the first few minutes of ignition and the chlorine in the combustion gas dissolves in the water forming hydrochloric acid. As the combustion system flue line increases in temperature, the water vapor no longer condenses because the flue temperature is above the dew point of the combustion gas.

The combustion gas then dries out (dehydrates) the hydrochloric acid solution leaving behind dry chloride salt.

When the next cold start-up occurs, the process repeats except that more and more chloride collects and concentrates along the flue. As the quantity of chloride increases it does not dehydrate completely as the flue heats up and a corrosive poultice develops which attacks the steel and will also attack the boiler.

Concentration levels of only a few ppm of chlorine containing compounds in combustion air can produce serious corrosion over long periods of time. High chlorine containing compounds such as carbon tetrachloride or perchloroethylene would be prime suspects.

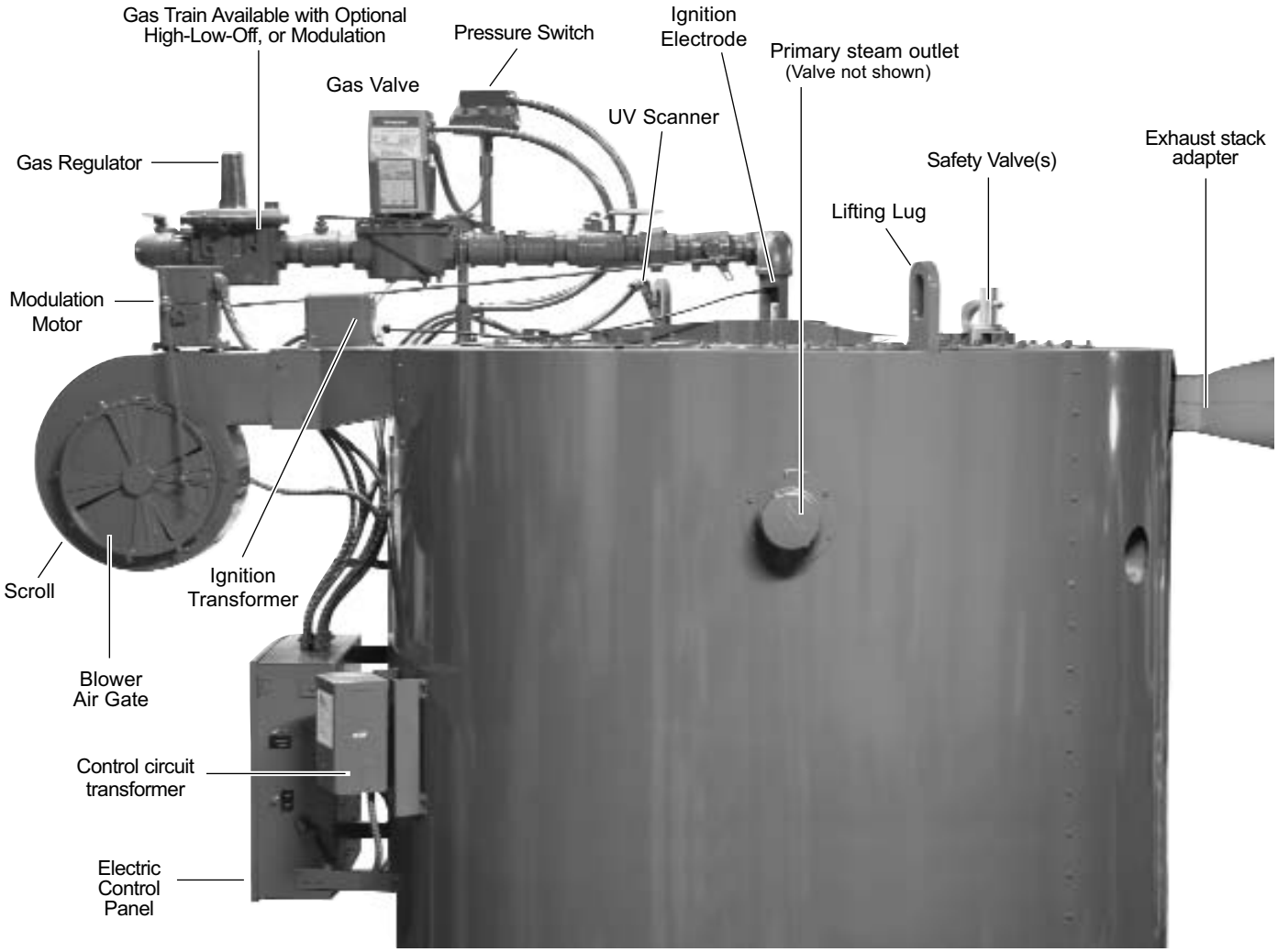
In addition, normal combustion creates carbon dioxide which may condense in a cold flue to form carbonic acid.

Installation Check Points

1. Make sure all piping connections are complete and tight.
2. Make sure the pressure controls are adjusted properly.
3. Make sure all electrical connections in the control panel box, the water column, and elsewhere are secure.
4. Make sure the door in the boiler room is closed. Combustion air contaminates can cause damage to the boiler jacket and stack.

NOTE

After installation is complete and prior to operation the pressure vessel should be cleaned.



Cleaning (Boil out) the Pressure Vessel

After the boiler has been installed and before it is placed in service it is advisable to purge the pressure vessel of any oil film,dirt, or other impurities. Clean the pressure vessel as follows:

1. Isolate the boiler from the system by shutting off the main steam valve.

2. Remove the steam safety valve.

3. Mix washing soda with water in a one-gallon container and pour it into the boiler through the steam safety valve opening.

4. The mixture of washing soda to water is as follows:

Boiler Size	Soda
40, 50, 60	4 lb (1,814g)
80	5 lb (2270g)
100	7 lb (3178g)
130	9 lb (4080g)
150	10.5 lb (4760g)

5. Replace the steam safety valve.

6. Fill the boiler with water. Water level is about center in the water gauge glass.

7. Generate 15 PSI (1.054 kg/cm^2) of steam and shut off the boiler. Allow this hot solution to remain in the boiler for 10 minutes.

8. Drain and flush the boiler twice with fresh water.

9. To remove all the oil and dirt from the main steam and the condensate return lines, allow the returns to go into a floor drain or a safe discharge point for the first week of operation.

CAUTION

Do not store halogenated hydrocarbons in or near the boiler room. In general, ensure that the boiler area is in conformance with established boiler room requirements. Review national and local codes.

We cannot emphasize enough the importance of proper water treatment: Water analysis should be made by a competent water treatment concern and their recommendations should be followed.

Section 3 Operation

Starting the Gas Fired Boiler

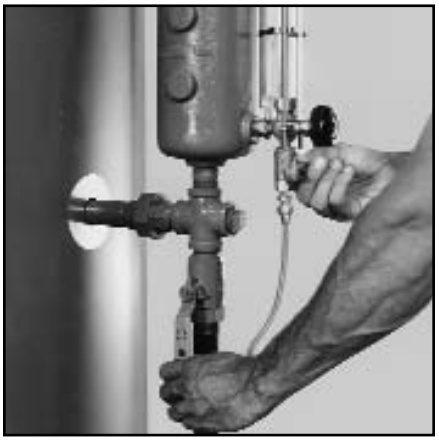
STOP! Make sure you have read and followed all previous safety information.

Check with local authorities where approval for start-up is required. In some localities, final inspection of services may be required.

In general, ensure that the boiler area is in conformance with established boiler room requirements. Review national and local codes.

Carry out the following procedure on the initial start up of the boiler and on every subsequent occasion when restarting the boiler after a shut down.

1. Close the blow-down valves.



2. Close the water gauge drain valve.

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

IMPORTANT

When commissioning this boiler, firing rate must remain at low fire during first 4 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 to 4 hours.

4. Open the water feed valve on the boiler.

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

6. Place feedwater pump fused switch in the "on" position.

NOTE

The pump will continue to 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 power on switch, located on the side of the panel box.

8. With the unit full of water the low water safety relay(s) will be in a lock-out mode. Press the low water safety relay manual reset button located on the side of the control panel box.

Gas Burner Set Up

1. Open the manual gas cocks on the pilot and main lines of the gas head.

2. Switch on the main power to the burner. The water level relay is equipped with a manual reset. Depress the button on the box.

3 The flame programmer is the main control in the panel box. The programmer in conjunction with a sensing device, either a flame rod or a UV scanner, "supervises" the ignition sequence - proves the flame is satisfactory, and finally"monitors" the established flame. Should any fault occur, either during the ignition sequence or during normal running, the programmer will immediately go to "lock-out" and the burner will shut down.

NOTE

To reset the boiler burner after a "Lock out" signal, push the reset button on the control.

4. When the pilot flame is established, the flame rod (or ultra-violet scanner) senses the voltage which is created in the flame between the flame rod and the gas nozzle (ground). This signal is transmitted back to the flame programmer which opens the main gas valve giving a main flame.

5. All Fulton propane or butane boilers and Fulton natural gas boilers 50 HP and above are standardly furnished with UV Scanners.

   a. If the installation is new or the burner has been disassembled, the burner may not fire at the first attempt due to air which must be purged from the gas lines. This will result in the burner flame programmer going to lockout. Repeat the procedure for starting the burner.

   b. The main gas valve will remain open as long as there is a demand for heat and the flame is carrying a sufficient signal to the flame programmer.

   c. If the flame is not established at the start, the safety switch in the flame programmer control will open the contacts and shut off the burner.

   d. Push the reset button on the control to reset. If trouble persists, it may be necessary to check the flame rod setting or the UV scanner. See Maintenance Section 4 for procedure to check flame rod setting or UV Scanner.

Gas Burner Set Up For LE Models

WARNING

For units equipped with Flue Gas Recirculation (FGR), the ducting must be insulated.

a. Open the manual gas cocks on the pilot and main lines of the gas head.

b. Switch on the main power to the burner. The water level relay is equipped with a manual reset. Depress the button on the box.

c. The flame programmer is the main control in the panel box. The programmer in conjunction with a UV scanner "supervises" the ignition sequence - proves the flame is satisfactory, and finally "monitors" the established flame. Should any fault occur, either during the ignition sequence or during normal running, the programmer will immediately go to "lock-out" and the burner will shut down.

d. When the pilot flame is established, ultra-violet scanner senses the flame. This signal is transmitted back to the flame programmer which opens the main gas valve giving a main flame.

e. If the installation is new or the burner has been disassembled, the burner may not fire at the first attempt due to air which must be purged from the gas lines. This will result in the burner flame programmer going to lockout. Repeat the procedure for starting the burner.

f. The main gas valve will remain open as long as there is a demand for heat and the flame is carrying a sufficient signal to the flame programmer.

g. If the flame is not established at the start, the safety switch in the flame programmer control will open the contacts and shut off the burner.

h. Push the reset button on the control to reset. If trouble persists, it may be necessary to check the UV scanner. See Maintenance Section for procedure to check UV Scanner.

WARNING

Prior to the commencement of any work requiring the removal of cover plates and the opening of the control panel box, the electrical supply to the boiler must be disconnected.

Gas Burner Set Up For Boilers Equipped with Modulation

1. Modulation is available as an option on Fulton gas fired steam boilers for 40 - 150 HP units.

2. Boilers equipped with modulation will have the linkage rod disconnected between the modulation motor and the gas butterfly valve for shipment.

NOTE

If Seiman linkageless modulation is ordered, no mechanical linkage rod is required, thus none provided.

3. Mount the gas train on the pipe nipple of the burner plate with the gas train inlet directly facing over the panel box. Reconnect the linkage from the butterfly valve to the modulation motor.

4. The end of the linkage arm that attaches to the butterfly valve will have a notch on both sides of it, where the swivel collar should be centered. This setting was based on factory test fire conditions.

5. Combustion analysis should be done at the installation to make any changes to insure proper combustion characteristics.

6. The modulating burner will have a modulation lock switch to enable you to lock the firing sequence anywhere along the firing rate from low to high.

7. Depending on the combustion characteristics, it may be necessary to adjust both linkage arms. To adjust the linkages, unscrew the swivel collar and move the linkage rod in the appropriate direction.

8. Standard modulating burners will have a proportioning pressure control in addition to the standard operating pressure control that will send a 0-135 ohm signal to the modulation motor to adjust the firing rate. Both operating pressure controls should have the same setting.

9. NEMA 4 units will use a digital pressure controller with transducer as the operating pressure control which sends a 0ma signal to the modulation motor to control firing rate.

Gas Burner Set Up For Boilers Equipped with High-Low-Off

1. A gas fired burner equipped for high-low-off firing is available as an option on Fulton gas fired steam boilers for 40 - 150 HP units.

2. Boilers that have a high-low-off firing rate will have a linkage between the high-low gas valve and the primary air gate. This valve is equipped with a spring return.

3. The linkage will be disconnected from the gas valve for shipment.

4. Mount the gas train on the pipe nipple of the burner plate with the gas train inlet directly facing over the panel box. Reconnect the linkage from the primary air gate to the high-low gas valve.

5. The end of the linkage arm that goes to the gas valve will have a notch on both sides of where the swivel collar should be centered. This setting was based on factory test fire conditions.

6. Combustion analysis should be done at the installation to make any changes to insure proper combustion characteristics.

7. To adjust the linkage, unscrew the swivel collar and move the linkage rod in the appropriate direction. The high-low-off configuration comes with two operating pressure controls.

8. Set the low operating pressure control to approximately 60% of your desired set point and the main operating pressure control to your desired set point.

WARNING

Prior to the commencement of any work requiring the removal of cover plates and the opening of the control panel box, the electrical supply to the boiler must be disconnected.

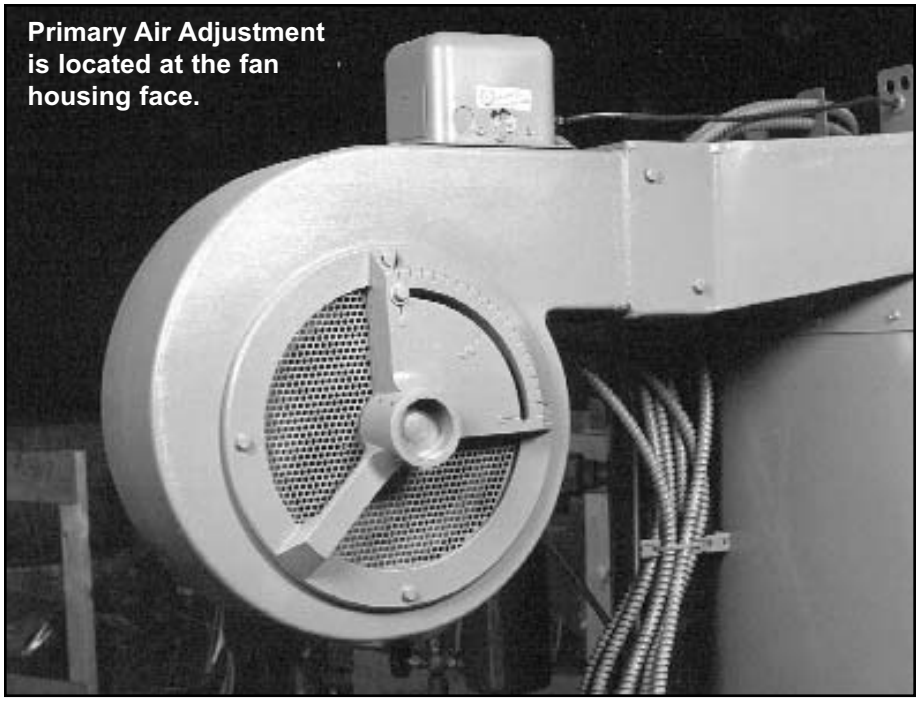
Primary Air Adjustment for Fulton Gas Fired Steam Boilers

1. The primary air adjustment or main air control is located at the fan housing face. This control is used to supply the burner with excess air needed to facilitate good combustion. Too much or too little air will result in poor combustion. It is important to make sure the lowest level of excess oxygen is present while still maintaining a high level of carbon dioxide and negligible carbon monoxide. Using a CO_2 or O_2 tester it is possible to determine the percent of excess air in the combustion mixture.

2. It is a good policy on a gas fired unit to have between 3.5% and 4% oxygen present in the combustion. This will give you 10.5% to 9.5% carbon dioxide. The carbon monoxide level should always be less than 400 PPM.

Secondary Air Adjustment Procedure for Fulton Gas Fired Steam Boilers

1. The secondary air control adjustment is located on the top, right-hand side of the burner assembly. This damper type air controller is used to introduce air to and through the blast tube of the burner. The purpose of the secondary air adjustment is to proportionately divide the air to the center or outer fire chamber. By moving the damper closed, the air is forced to the outside of the fire chamber with less air going down the blast tube area. By pulling the damper open more air is forced down the blast tube and less on the outside wall of the deflector face and fire chamber.



2. It is important in the combustion process to maintain proper air mixtures between the outer surface and center of the blast tube area. On most boilers the damper is locked in a wide open position. However, if it is necessary to close the damper, care should be taken to close the damper slowly and no more than 1/4 of the distance of the swing of the damper assembly.

3. A visual examination down the blast tube should reveal that no heat, flames or fumes are backing up through the burner plate area. If they are, the secondary damper must be opened up once again. Failure to remove the flame or gases from the blast tube area can cause a backfire as well as cause premature failure of electrodes, flame rods, and other burner components.

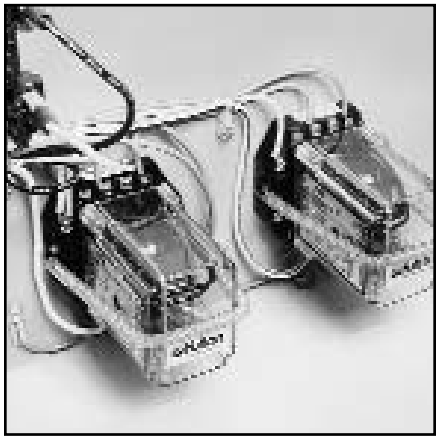
4. A visual inspection down the burner view port should also show the fire completely covering the furnace walls. If the fire is tunneling down or is not to the outside wall of the furnace, the efficiency will drop off. Close the secondary air damper until tunneling stops.

IMPORTANT

When commissioning this boiler, firing rate must remain at low fire during first 4 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 to 4 hours.

Boiler Controls

a. **Flame safeguard burner control**
This is the main control in the panel box. The programmer in conjunction with a sensing device, either a flame rod or an ultra violet scanner, "supervises" the ignition sequence - proves the flame is satisfactory - and finally "monitors" the established flame. Should any fault occur, either during the ignition sequence or during normal running, the programmer will immediately go to "lock-out" and the burner will shut down.



b. **Low Water Cut-Off - Probe Type**
Cuts off the unit when water level is too low after a 3 second time delay to avoid nuisance shut downs. As a standard feature, Fulton boilers are equipped with ASME CSD-1 Code controls which include a manual reset feature on the burner low water cut off relay and ASME CSD-1 Code controls also feature an independent second low water cut off relay. Press the low water reset button and the boiler will start.

CAUTION

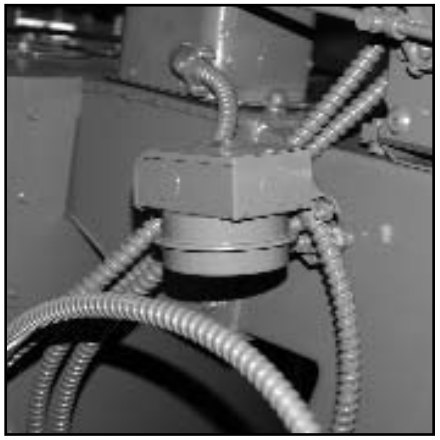
Do not tamper with the safety features of the low water safety cut out.

c. **Pressure Relief Valve**
Limits the maximum operating pressure of the boiler.

d. **Operating Steam Pressure Control**
Located in the control panel box and connected to the steam pressure gauge assembly by means of a copper tube. The pressure control regulates the on/off cycle of the burner, shutting the burner off when maximum pressure is reached and switching on when the steam pressure falls below a predetermined level.

e. **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 seat, preventing the 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 than full open, the ball will not seat. For added safety all Fulton boilers are equipped with gauge glass protectors.

f. **High Limit Pressure Control**
Located in the control panel box and connected to the water column assembly by means of a copper tube. The pressure is usually set 10 to 15 PSI (.703 - 1.054 kg/cm^2) above the operating pressure, but below the maximum pressure of the pressure relief valve. If the pressure exceeds the high limit pressure control setting, the boiler will automatically shut off. The high limit pressure control must be manually reset by depressing the plunger located on top of the control.



g. **Air Pressure Switch**
Mounted on the burner scroll, this switch is operated by the pressure of air entering the burner through the throat of the scroll. Absence of air, or insufficient pressure, will prevent the switch completing the circuit, thus preventing the burner from operating.

WARNING

When stopping the boiler for any extensive repairs, shut off main disconnect switches on both the boiler side as well as the feed water side.

NOTE

To ensure that your Fulton Steam Boiler is kept operating safely and efficiently, follow the maintenance procedures set forth in Section 4 of this manual.

Air and Gas Adjustment for LE Models

The low emission burner can be best described as a fuel staged, multi-radial injection type. Two air/gas ratio electro servo actuators control the fuel supplied to this burner. A radial blade type fan supplies the air. A direct-coupled reversing actuator modulates the air which in turn regulates the fuel input. No mechanical linkage is utilized with this system. As a safety device, a thermocouple is placed in the small partial premix area of the burner to monitor temperature. It is used in conjunction with a temperature limit that should be set between 600° and 700°F.

Commissioning/Start Up for LE Models

WARNING

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

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

SIEMENS LMV LINKAGELESS BURNER MANAGEMENT SYSTEM
(If Equipped)

The Siemens LMV system is a fully packaged burner management system, linkageless control and first out annunciator.

When operating the Siemens LMV systems, all changes are made through the Siemens AZL display. The left and right arrow keys are used for scrolling through the menu and changing controller parameters. Enter accepts the menu and parameter changes.

It is possible to return to the main menu at any time by repeatedly pressing Escape. When running the boiler, the status of the burner is to be monitored with the Siemens AZL display.

If at any time the burner control locks out on a fault condition and the red flame failure light illuminates:

- Read the diagnostic feedback on the AZL display, address the fault if possible.
- Press escape on the AZL once.
- Press enter on the AZL to reset the control. The red light should go out.

If the fault persists contact Fulton.

If the boiler has a dual fuel burner, the burner setup procedures on the following pages must be performed for each fuel.

LMV Control for LE Models

NOTE

The following procedure must be repeated for each fuel the boiler is equipped to operate on.

PRE-IGNITION STEPS

1. Verify the main burner switch is in the **OFF** position. If the boiler has dual fuels, verify the fuel selector switch is turned to the correct fuel.

2. Supply power to the boiler. The AZL will display “system test” and then move to the main menu.

3. Select **PWLogin**, press **Enter**. Select **AccessServ**. Press **Enter**. (This type of step will be shown as **PWLogin > AccessServ** for the remainder of this section. Enter the service passwords using the arrow key. The password is case sensitive. The case of a letter can be changed by pressing the other arrow key. (For example, if you used the right arrow key to get to the letter **A**, press the left arrow key to get a). After you have pressed **Enter** on the last character of the password, press **Enter** once more to accept the password. If you do not have the password, contact your Fulton Authorized Representative to perform the changes.

4. Select **Params&Display**. Press **Enter**. Select RatioControl. Press **Enter**. Select **ProgramStop**. Press **Enter**. Change the Program Stop to **44 Interv1** by using the arrow keys. Confirm the change by pressing **Enter**. This will set the burner management system to a ‘pilot hold’ setting.

Verify that the current value “curr” changes to **44 Interv 1**.

IMPORTANT
When commissioning this boiler, firing rate must remain at low fire during first 4 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 to 4 hours.

The full list of program stops are:
24: Air damper in the prepurge position
32: Traveling to the FGR position (if the unit is equipped with FGR)
36: Ignition position (before pilot ignition)
44: Ignition position (after pilot ignition)
52: Ignition position (after main burner ignition)
72: Air damper in the postpurge position
76: Traveling to the FGR position (if the unit is equipped with FGR)

5. Press **Escape** 4 times to get back to the main menu.

6. Under **ManualOperation > Setload,** change the load to 0% by using the arrow keys. Press enter and verify the 0% has been acknowledged in the “curr” field.

7. Press **Escape** once to get back to the **ManualOperation** menu.

8. Under **Auto/Manual/Off**, change the operation to **Burner On** by using the arrow keys. Press enter and verify that “**Burner On**” is acknowledged in the current field.

9. Press **Escape** twice to get back to the main menu.

10. Increase the setpoint on the temperature controller to create a heat demand.

11. Turn the main burner switch to the **Local** or **On** position.

NOTE

If the burner loses flame while driving to a point then:

- **Turn the main ON/OFF switch to OFF. Reset the loss of flame fault. Press Escape on the AZL once. Press Enter on the AZL to reset the control The red light on the panel box door should go out.**
- **Adjust the air and gas servos for that point while the burner is off. Follow steps 28-29.**
- **Turn the main ON/OFF switch to ON.**

23. Under **Params&Display > RatioControl ProgramStop**, change the program stop to deactivated by using the arrow keys. Confirm that ‘deactivated’ is acknowledged in the current field.

24. This change will allow the burner to modulate. The burner will now drive to low fire. Remember, it is only important at this stage to set low fire to be stable and with clean combustion. Exact setting is to be performed once high fire is confirmed.

25. Press **Escape** 5 times to get back to the main menu.

26. You can observe the status of the burner by going to **OperationalStat > NormalOperation**.

27. Verify the flame signal on the display, measure input if fuel meter is available. If not, match last elbow pressures and combustion from test fire sheet. Adjust the burner as needed. To adjust the servo position, follow steps 28-29.

SETTING LOW FIRE

NOTE

As soon as a servo position is altered, the servo will move to that position. Only change servo settings by a maximum of 0.5° at a time before verifying combustion.

28. Go to Params&Display > RatioControl > GasSettings (or Oil Settings, depending on the current fuel) > CurveParams.

29. Wait for the spinning line on the left to disappear. Press Enter. The number 1 should appear to the right of the cursor, this is the Point Number.

Press **Enter** once. Select **ChangePoint** by pressing the arrow keys to highlight and then press **Enter** to select. This will cause the servo motors to move to this low fire point.

Check combustion and adjust the servo motors as required. To adjust a servo motor, arrow to it and press **Enter**. Then adjust the setting as required and press **Enter**. You can now adjust another servo motor if needed.

When combustion is properly set for that point, press **Escape** once more. If it asks you to store the point, press **Enter**. Note the AZL will only ask to save if either servo value has been altered.

Low fire is now set and stored.

SETTING THE COMPLETE RANGE

a. Remember it is only necessary to approximate the setting through the modulation range until high fire conditions are established.

b. Press **Enter** once more to have access to the point number field. Increase the point number by one and press **Enter**. Select **ChangePoint** and press **Enter**. The servos will now move to that point.

c. Verify combustion is satisfactory.

d. Measure input or monitor last elbow pressure. Verify that these points are in general correspondence with the test fire sheet. Repeat step b. until the point position has a load value of 100%. You are now at high fire. Verify combustion is per test fire sheet.

30. If operating on gas, adjust the incoming gas pressure at the main gas regulator to match the test fire report. Adjust the gas servo motor to change the last elbow pressure to match the test fire report. Adjust the air servo motor to adjust the emissions as needed. If operating on oil, adjust the oil pump and air pressure regulator to match the pressures on the test fire sheet. Adjust the oil servo until the oil flow rate matches the test fire sheet. Adjust the air servo to match the test fire sheet.

31. Repeat step 28 but start at the high fire point number. Continually decrease the point number after combustion has been verified at each point.

32. Once all the points have been verified, press Escape until you are back to the main menu.

33. You can observe the status of the burner by going to **OperationalStat > NormalOperation**.

34. Turn the main **ON/OFF** switch to **OFF**. The control will now postpurge.

35. Follow steps 3-20 again to verify ignition with the new gas pressures.

36. Turn the main burner switch to **OFF**. The control will now post purge.

37. Change the operation to **Automatic** under **ManualOperation > Auto/Manual/Off** and press **Enter** and confirm Automatic is entered in the current field.

38. Press **Escape** twice to get back to the main menu.

39. Under **Updating > ParamBackup**, select **LMV51 - AZL**. This will store all of the adjustments that have been made in the LMV base module to the display. If the base module were to fail, the display can be used to download all of the parameters into a new base module.

40. Press Escape 4 times. Select PW Logout, the password is now logged out.

41. Press **Escape** twice. Select **OperationalStat > NormalOperation**. The control is now on the normal operational display screen.

42. The boiler is now ready to run. Adjust your setpoint on the temperature control to the desired temperature and turn the main **ON/OFF** switch to **ON** for the burner to operate.

BEFORE LEAVING THE INSTALLATION

Check all controls to insure they are operating properly. Cycle the boiler several times. Make sure the installation complies with all applicable codes.

NOTE

Decreasing the primary will typically decrease the NOx levels. If the primary is decreased too much, stability may be compromised.

a. Start the boiler and check for stable combustion at low fire. Refer to the test fire sheet for acceptable parameters.

b. Adjust secondary servo air/gas if needed to bring combustion into an acceptable range. Adjust carefully as this is the main fuel adjustment.

c. After a stable flame is achieved and the combustion is within the test fire sheet parameters, manually and slowly drive the servo's motor to high fire insuring that the combustion readings stay within the given parameters. Adjust secondary servo as needed.

d. If the last elbow pressure is above or below the stated requirement on the test fire sheet, adjust the combustion air damper to bring the last elbow pressure inline. The gas pressure is directly proportional to the air pressure and therefore, increasing the air pressure to the burner will increase the gas input proportionally.

e. Manually drive the unit back to low fire and check combustion.

f. If the combustion is outside of the test fire parameters for the servo, adjust the secondary.

g. After the unit is brought back into range, manually drive the unit back to high fire.

h. Adjust secondary air/gas ratio slightly if needed.

i. Repeat this procedure 2 or 3 times until you obtain consistency in high and low fire combustion.

j. In most cases, the primary gas should only be adjusted if the unit is unstabe at low fire and/or NOx are not acceptable at low fire.

CAUTION

During startup insure that adequate gas pressure is supplied to the main valves. The indicator on the actuator should never reach the bottom of the indicator window. In the event that this happens, adjustability will be lost. See minimum incoming gas pressure requirement on the test fire sheet. The SKP10 actuator functions only as on/off. When activated, the indicator will reach the bottom of the indication window. The main gas pressure regulator is only used to comply with standard regulations and therefore uses a high outlet pressure spring that is set at the max. The SKP70 fuel valves have a built in regulator function.

Glossary of Terms

PRIMARY GAS
The smaller gas line injects fuel at the burner head.

SECONDARY GAS
The main gas line inject fuel prior to the burner head.

REVERSING ACTUATOR
Used for positioning control inlet damper, combustion air.

AIR/GAS RATIO CONTROLLING ACTUATOR
Regulates gas flow according to air pressure.

IMPORTANT

When commissioning this boiler, firing rate must remain at low fire during first 4 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 to 4 hours.

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Section 4 Maintenance
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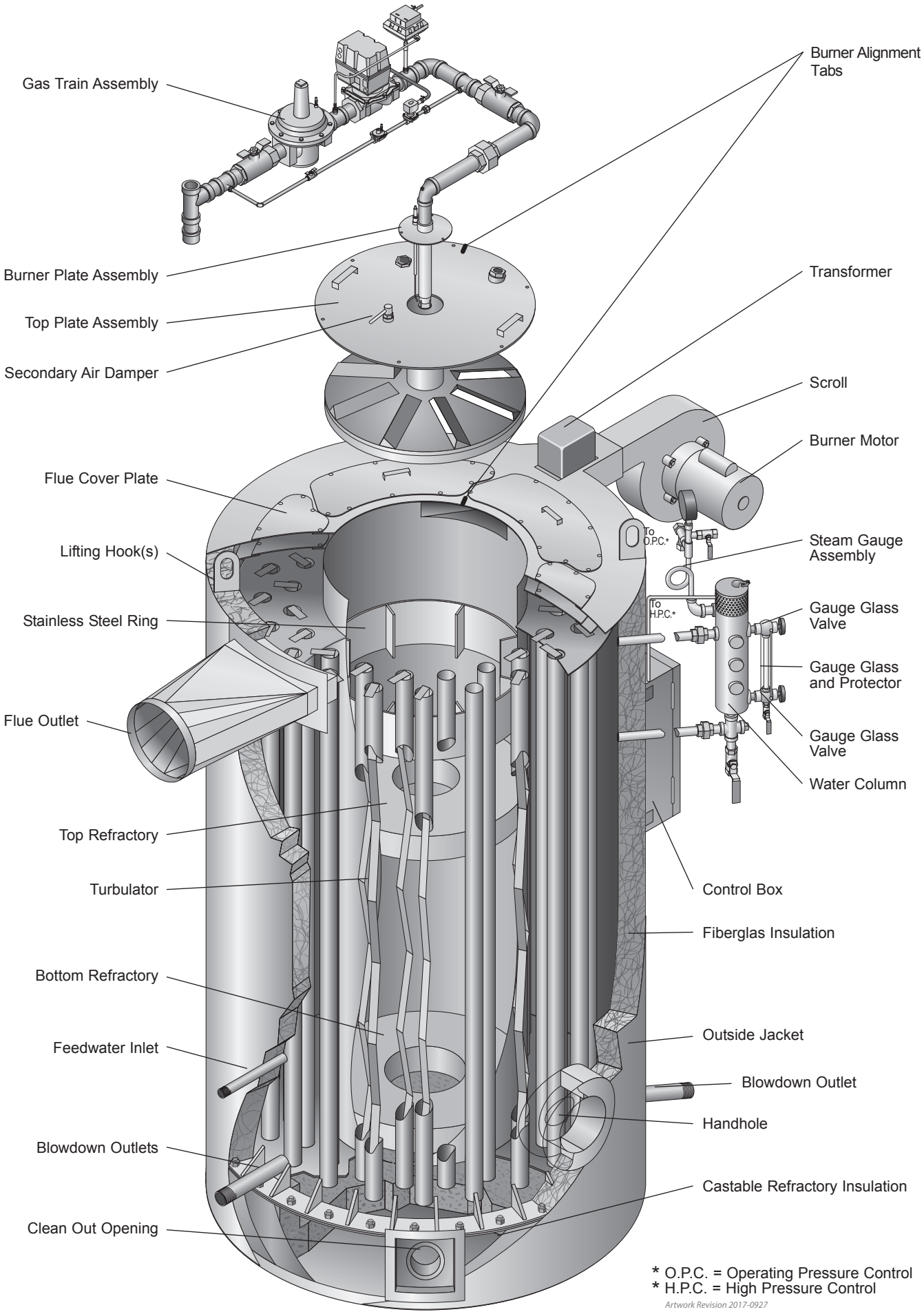


* O.P.C. = Operating Pressure Control
* H.P.C. = High Pressure Control

Artwork Revision 2017-0927

NOTE

To ensure the continued safety and efficiency of the boiler, the schedule of maintenance outlined in this section should be adhered to.

WARNING

Prior to the commencement of any work requiring the removal of cover plates and the opening of the control panel box, the electrical supply to the boiler must be disconnected.

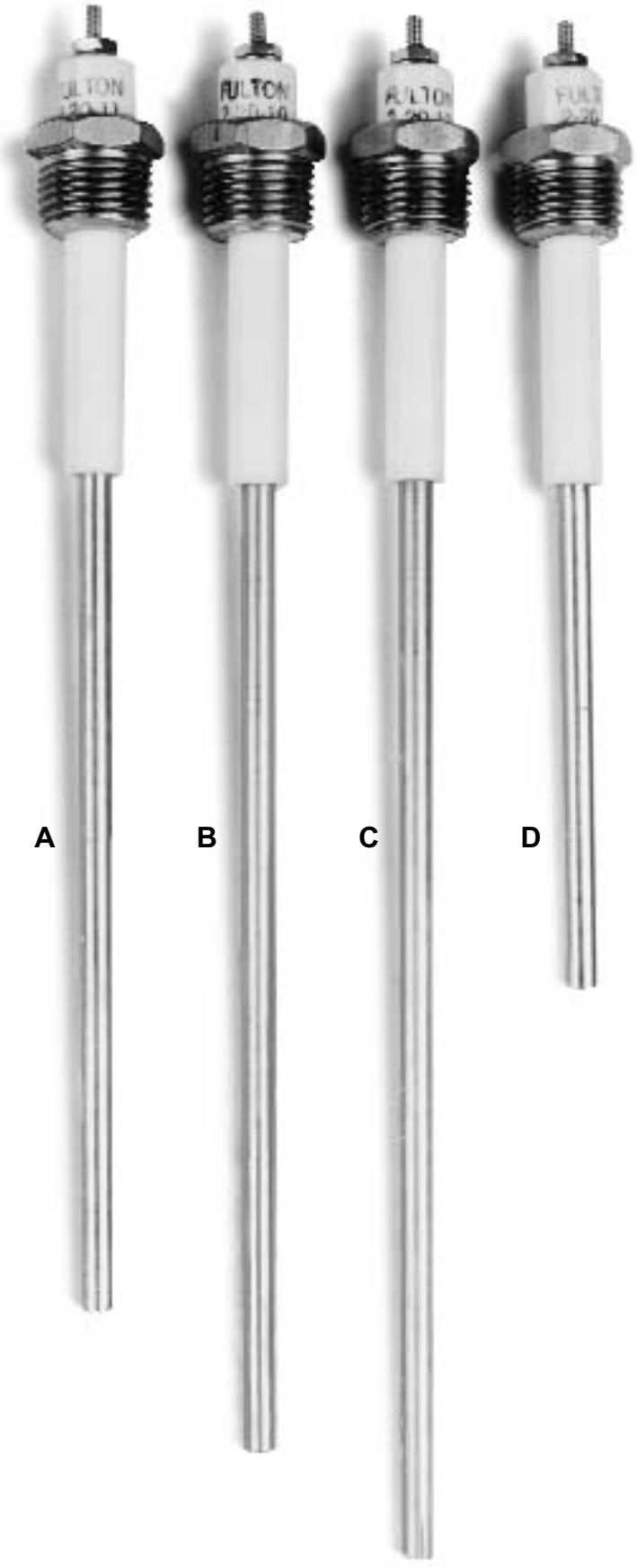
Procedure for Cleaning Water Probes

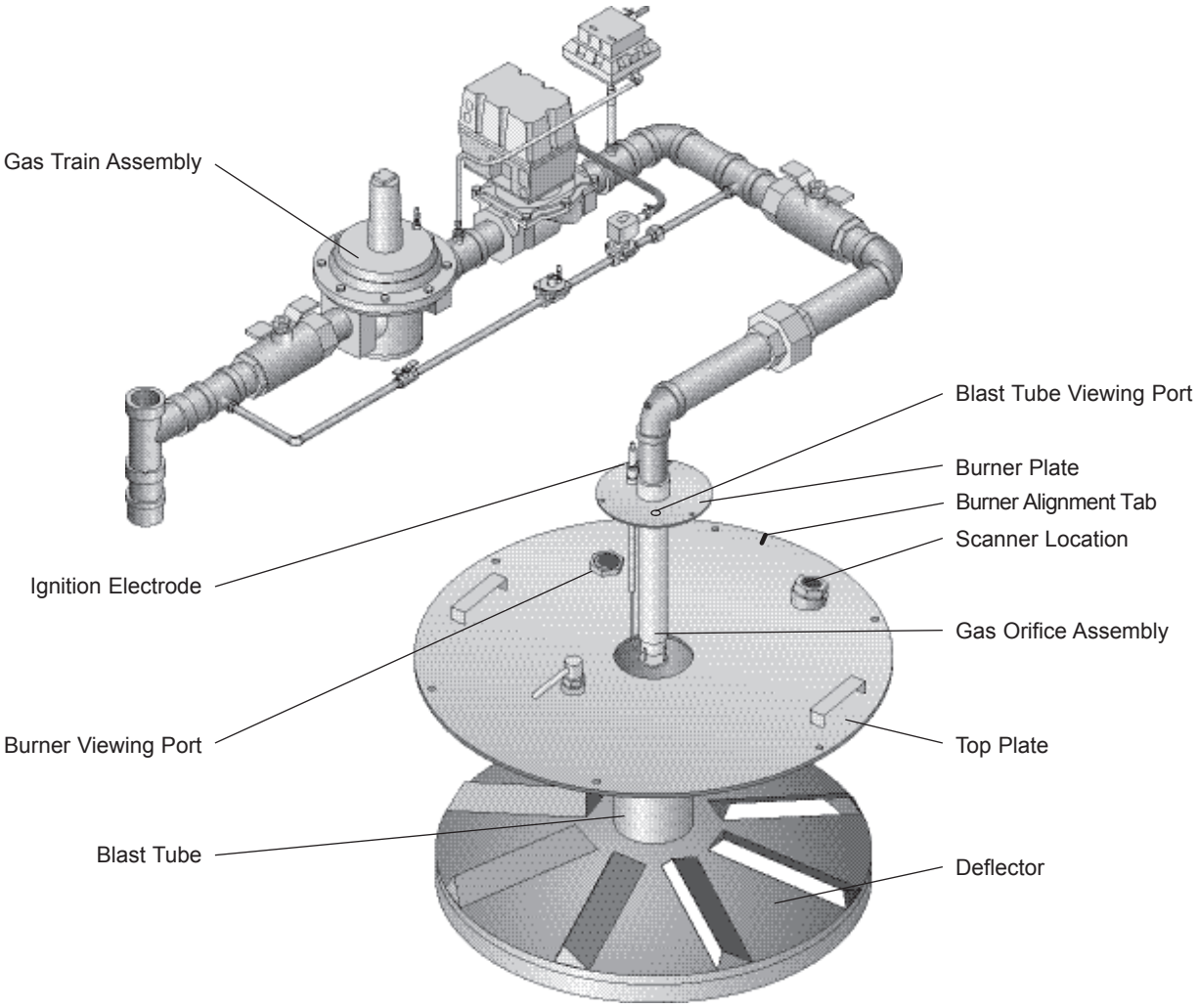
Clean probe on top of boiler shell and probes in water column. Make sure there is no pressure on the boiler during the removal of the probes. Remove one probe, clean with very fine emory cloth and replace it before removing another to assure no probe mix ups that would change the control functions.

For replacement purposes, installed probe lengths are indicated in the chart below. For a universally adaptable plug and probe which can be cut to length in the field to fit all boilers, order Part No. 2-20-017.

A = 7 1/4 IN / 184 mm
B = 9 1/4 IN / 235 mm
C = 11 1/4 IN / 286 mm
D = 4 IN / 102 mm

"D" is located in the boiler pressure vessel.





Flame Scanner Adjustments for Fulton Gas Fired Steam Boilers

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.

NOTE

The scanner is located on the outside edge of the burner top plate for 40, 80, and 100 HP.

4. For the RM7800 Series use a keyboard display module or volt meter. The flame safeguard will require a 1.25 VDC signal to pull in the main flame. Then a maximum signal should be obtained on main flame (5.0 VDC).

5. Adjustments to establish a good signal may include the following items:

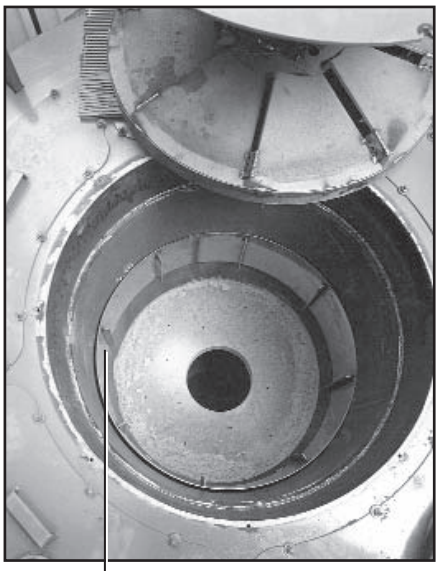
   a. Primary and secondary air adjustments.

   b. Increasing the pilot gas through the pilot gas regulator.

Checking the Stainless Steel Combustion Ring on Fulton Gas Fired Steam Boilers

1. The stainless steel combustion ring in Fulton gas fired boilers are designed to bring quick and effective flame transfer to the fire wall. The ring should fit securely and tight against the furnace wall for best results.

2. The ring should be inspected for distortion in the event of poor combustion which could result in flame failures.



Stainless Steel Combustion Ring (40-100)

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 one 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 holding clips that were used to keep the refractory in position during shipment.

5. Break up the top and/or bottom refractories and remove the pieces from the boiler through the clean-out plugs.

NOTE

If only the top refractory is to be changed, the bottom refractory need not be broken.

6. Round and bevel the outer edges of the new refractories.

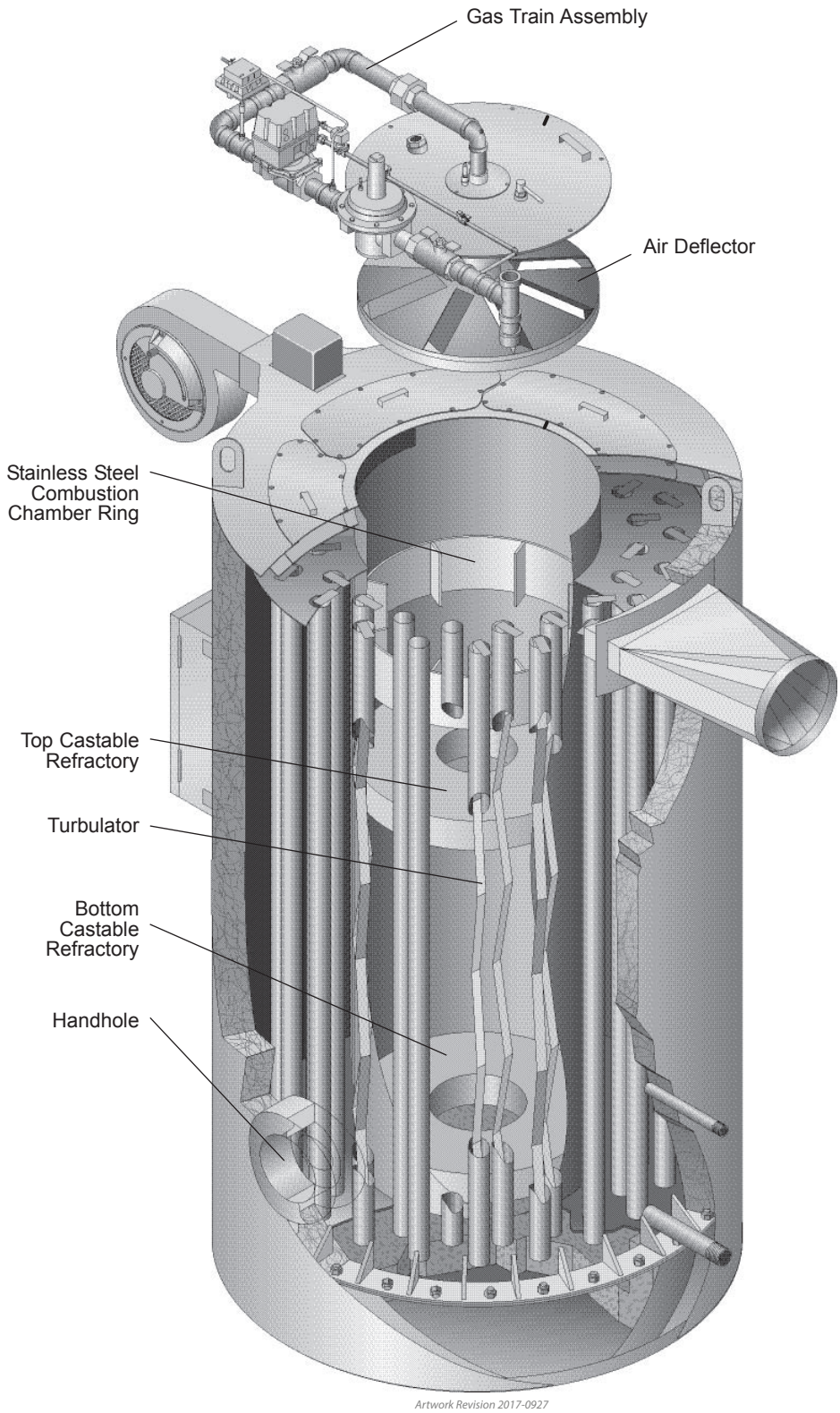
7. The bottom refractory has the largest hole, while the top refractory has the smallest.

8. Lower the bottom refractory down the furnace with wire fastened around the refractory in three positions. When the refractory is close to position, it can be tipped by maneuvering the wire to drop it flat on the holding clips. If the refractory will not tip, it may have to be removed and again rounded and beveled.

9. 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.



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Pilot Adjustment for Fulton LoNOx Burner.

1. Close downstream shut off valve.
2. Start boiler and check flame signal on pilot, lock programmer into pilot hold.
3. Adjust air and gas regulator as needed to obtain a strong pilot signal.
4. Slowly open downstream shut off valves and take the flame programmer off of hold.

Main Flame Adjustment For LE Models

1. Place a combustion analyzer in the exhaust of the boiler.
2. Do not adjust main gas regulator. To increase fuel to the burner, the servos that control modulating gas valves require adjustment.

Burner Tile Replacement For LE Models

1. Remove scroll assembly.
2. Break off top holding clips.
3. Remove ceramic fiber burner tile.
4. Replace burner tile bottom holding clips if needed.
5. Replace with new burner tile.
6. Carefully replace scroll assembly so that the ceramic fiber burner tile is not damaged.

Servo Motor Replacement For LE Models

If it is determined that a servo motor needs to be replaced, the first step in this process is to verify the model number of the new servo motor is the same as the old servo motor.

The model number starts with the letters SQM and is displayed on a label on the side of the motor. Once the new motor has been verified to be correct, turn power to the boiler off.

1. Turn off all electricity to the boiler.
2. Remove the cover on the servo motor to be changed.
3. Remove the green wiring plugs and the conduit termination point from the motor by pulling them towards you. A black grounding wire runs from the motor to the conduit termination point. Pull it off from the conduit termination point.
4. Also note the location of the jumper on the left side of the motor.
5. Loosen the allen screws on the motor end of the motor to valve coupling.
6. Unbolt the motor from the mounting bracket and remove the motor.
7. Turn the valve so it is in the closed position and can rotate clockwise to open.
8. Mark the coupling or valve shaft if needed so the position of the valve can be determined when the servo motor is installed.
9. Bolt the new servo motor on to the mounting bracket with the motor shaft inserted into the coupling.
10. Rotate the valve shaft/coupling assembly closed as stated above.
11. While holding the valve closed, tighten the allen screws on the coupling.
12. Install the wired green wiring plugs and the conduit termination point on the new motor. Connect the black grounding wire from the motor to the conduit termination point.
13. Verify the jumper on the motor is located on the same pins as the motor that was replaced.
14. Turn power to the boiler on.
15. The screen will display 'system test'. The fault "Fault Feedback Air Actuator' will be displayed. **DO NOT RESET THIS FAULT YET**. Press **Escape** twice to clear the fault from the screen.
16. Press **Escape** to get to the main menu. Under **Params&Display > Actuators > Addressing**, select either the gas actuator or air actuator depending upon which was replaced. The control will run an actuator check then display 'Start Address Assignment with ENTER'. Press **Enter**. The display will then have you press the addressing button on the actuator. This is the red button on the actuator. The screen will then display 'Actuator Address Assignment Successful'.
17. Press **Escape** until the main menu is reached. Under **OperationalStat > Status/Reset**, reset the fault.

CAUTION

The boiler emissions may not be correct after changing the servo motor. Verify the emissions throughout the range of modulation. If emissions are off, the servo motor can be adjusted by following the procedure in the Commissioning the Boiler section of this manual.

18. Attach cover to servo motor.

Recommended Daily Maintenance Schedule

The following procedures should be carried out daily. They are designed to prevent the build up 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.

1. Blow down the boiler each morning by starting the boiler and generating not more than 10 PSI (.703 kg/cm^2) of steam. Turn on tap water to blow-down separator, then open the boiler blow-down valves for approximately 10 seconds, then close the valve. Shut off tap water to blow-down separator.

Blow Down Boiler Daily. Shown is the blow down "Y" valve.

NOTE

If the boiler is being operated automatically on a time clock, the blow-down operation may be done once during the working day and once at the end of the day when at 10 PSIG or less.

2. Blow down water column each morning when boiler is at 10 PSI (.703 kg/cm^2) by opening the water column and the water gauge blow-down valves for approximately 5 seconds, then close the valves.

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. When first starting the boiler each day, make sure ignition and burner are working properly.

5. Check water level in sight glass.

6. Check to be sure feed water pump is working.

7. For float type water level control, blow down float chamber.

Recommended Weekly Maintenance Schedule

Check 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 the 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 Schedule

WARNING

Make sure main power switch is off before starting work.

1. Cleaning the water gauge glass:

CAUTION

Do not clean the gauge or gauge glass while pressurized or in operation.

   a. 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 other abrasive materials which could scratch the glass. If any leakage is evident, replace the gaskets.

   b. Always replace the high impact plastic gauge glass protector which is standard on all Fulton Boilers.

2. Clean water pump strainers.

3. Check scanner or flame rod and ignition electrodes.

4. Check starter contacts. Burned or pitted contacts should be replaced. Do not use sand paper or file to clean.

5. Clean water traps and strainers in fuel lines.

6. Check operation of all steam traps on condensate return system.

7. Remove brass pipe plug at the cross connection below water column and clean nipple into boiler. Boiler must be cold and water level below pipe.

Recommended Semi-Annual Maintenance Schedule

1. Cleaning the gas burner assembly:

   a. Disconnect the gas head from the burner by disconnecting the union. Remove the burner plate screws.

   Withdraw the burner assembly and clean the flame rod and ignition electrode.

   b. Check that the settings of the flame rod, if applicable, and ignition electrode correspond to those in the illustration below.

   c. Reassemble the burner assembly and check the flame rod setting or scanner setting.

   d. Check the combustion efficiency of the burner and adjust if necessary.

   e. Clean probe on top of boiler shell and probes in water column. There must be no pressure on the boiler during the removal of the probes.

   f. Check refractories for soot or breakage and inspect the stainless steel ring (50-100 HP only).

   g. With the boiler under no more than 15 PSI pressure, check that the steam safety valve is operating by lifting the lever.

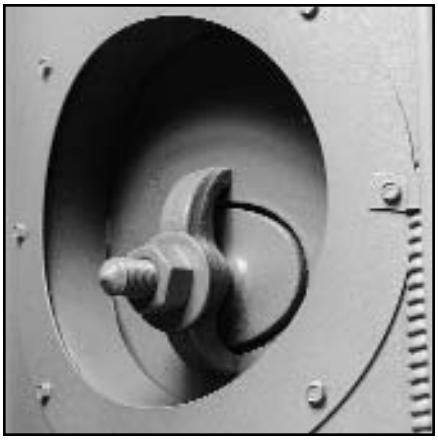
2. Drain condensate tank and clean tank by flushing with hose. Check float valve operation.

3. Check electrical controls and motors for correct operation.

4. Check water pump for correct operation.

5. Shut off the boiler completely and drain.

6. Remove the hand holes and inspect the interior of the vessel for scale or sludge deposits. The amount of deposits will indicate the efficiency of the water treatment being used. The frequency of the inspection will depend on the condition of the water side of the boiler.



7. Replace hand hole gaskets using the following procedure:

   a. Remove the hand hole assembly using a 1 1/4 " tee handle wrench or 1 1/4 " drive socket wrench.

b. Remove the old gasket and thoroughly clean the surface on the boiler and the plate.

c. Fit the hand hole assembly as follows:

i. Place the gasket on the hand hole plate and ensure that it is seating correctly. Do not use any grease, lubricant, or adhesive.

ii. Position the plate in the boiler. Set the yoke and tighten the securing nut sufficiently enough to provide a snug fit. Verify the position of the plate in the boiler, then make it hand tight and then snug with wrench about 1/4 turn. Do not compress excessively.

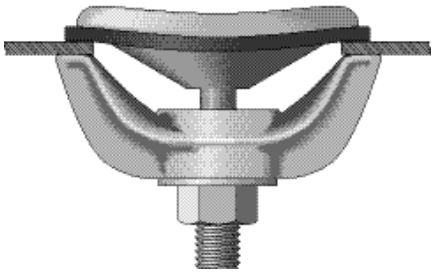


Illustration shows correct pressure on gasket.

iii. 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.

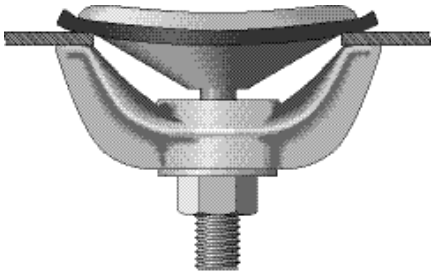


Illustration shows over-compressed gasket.

d. Refill the boiler with fresh water.

NOTE

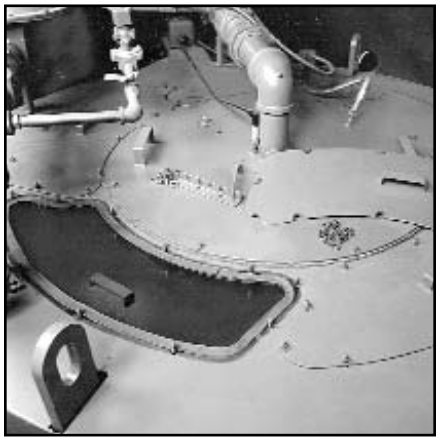
After a new Fulton Boiler has been in operation for several months, pieces of burned metal will be found in the space at the bottom of the boiler. These pieces of metal are the remains of a light gauge metal form which was used during manufacture for forming the boiler insulation. This is a normal condition and does not affect the efficiency or the life of the boiler in any way.

Recommended Annual Maintenance Schedule

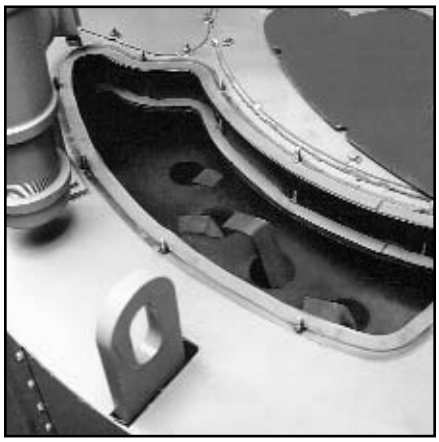
1. Have combustion (CO_2, O_2, CO) and input checked by responsible personnel.

2. Dirty flues can cause air flow restrictions resulting in poor combustion and loss of efficiency. Clean flues as follows:

a. Remove the outer flue cover plate.

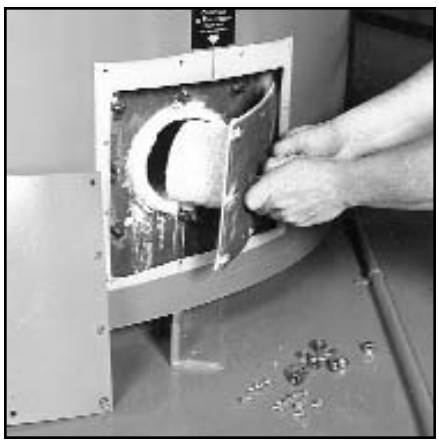


b. Remove inner plate and turbultors.



c. Remove clean out plugs at lowest part of unit and clean the bottom of combustion chamber.

d. Remove all soot from the top, and from the clean out plugs at the bottom with a vacuum cleaner.



e. Replace clean out plugs carefully so as not to damage insulation and replace burner and flue cover plates.

3. Flush boiler out if necessary. See Section 2 for proper procedure for "Cleaning the Pressure Vessel."

4. Provide annual inspection by a qualified ASME Boiler inspector.

Troubleshooting

The following trouble shooting guide will assist in the diagnosis and the correction of minor field problems. It contains instructions and information necessary to locate and isolate possible troubles which occur during normal operation. It should be used in conjunction with the unit wiring diagram and the component literature provided in Section 7 of this manual.

The following lists cover the most common troubles that may occur on the Fulton gas fired boilers. Refer to left hand column of the chart to locate the problem. Determine which cause, listed in the center column, that represents the problem by performing the corrective action as listed in the right hand column titled “REMEDY”.

Boiler Safety Testing – Fulton Vertical Steam Boilers

High Pressure Limit Switch:

- With the burner on and the boiler under pressure, lower the set pressure on the switch until it trips and shuts down the burner. Ensure the pressure that the switch trips at 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 the 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:

- 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 that the switch trips at is the same as the boiler operating pressure.
- This switch is an auto reset.
- Reset the switch to the original set point. The burner should turn back on automatically.

Flame Scanner:

- Verify that the flame scanner is observing flame with the burner running.
- Turn boiler to the off position.
- NOTE
    - Do not shut off gas supply with boiler operation. This can lead to a potentially dangerous situation.
- Close both the main gas supply isolation valve and gas pilot line isolation valve.
- Turn the boiler to the on position. The boiler will proceed through the ignition sequence. Once burner control completes the ignition sequence, the burner control should display fault code for pilot flame failure.
- During the pilot sequence, burner control should not display any flame signal during scanner test with gas valves turned to the off position. If flame signal is present, troubleshooting will be required to identify cause of the spark pickup.
- Turn the boiler to the off position and open the gas pilot line isolation valve while leaving the main gas isolation valve in the closed position. This will allow for the burner to cycle through the pilot sequence and test main flame failure. The burner control should display fault code for main flame failure. Turn the boiler off after this test is complete.
    - Typically on boilers 30 HP and below, the pilot flame will be sufficient to allow the boiler to cycle through the main flame test. If this occurs, slowly shut the pilot line isolation valve. This will cause the boiler to fail on main flame.
- Once the boiler has completed the post purge cycle, turn the boiler to the off position. Open the main gas supply valve, turn the boiler to the on position and resume normal operation.

Low Water Cutoffs:

Definition: 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 part of the gauge glass.

Standard low water cutoff is Fulton level probes. Alternate cutoffs are MM-63, MM-150, MM-157, MM-193-7b, etc. All cutoffs are tested in the same manner as described below.

When testing the low water cutoff devices, it is important that the boiler feed pump is turned off to allow for proper draining. Remember to turn the pumps back on when level cutoff testing is complete.

Testing of Low Water Cutoff Controls:

Your Fulton steam boiler is equipped with two automatic Low-Water Cut-Off (LWCO) controls. Each LWCO will prevent startup and cut off the boiler fuel or energy supply automatically when the surface of the water falls to a level not lower than the lowest visible part of the gage glass. One control is set to function ahead of the other. The standard Fulton LWCO control utilizes a water level probe and incorporates a 3 seconds time delay to prevent short cycling. Optional float type LWCO controls may also be used on the boiler.

The LWCO controls can be tested by lowering the water in the boiler. The test should be done with zero steam pressure in the boiler, or not more than 10 PSI.

Shut off the make-up water supply to the boiler.

Open the blow-down valve at the back of the boiler to allow the water level to slowly drop until ¾" and 1" of water level is visible sight glass and close the blow down valve. The first LWCO control will drop out within 3 seconds and cut off the boiler fuel or energy supply. This LWCO control is typically configured to automatically reset when the adequate water level in the boiler is restored. Some local jurisdictions require this LWCO control to be a manual reset.

Open the blow-down valve at the back of the boiler to allow the water level to slowly drop until 1/8" to 1/4" of water level is visible sight glass and close the blow down valve. The second LWCO control will drop out within 3 seconds and cut off the boiler fuel or energy supply. This LWCO control is configured for manual reset. When the adequate water level in the boiler is restored you have to momentarily press the LWCO manual reset button to enable operation of the boiler.

Air Switch:

- To test the air switch, first turn the boiler to the off position.
- Once the boiler is off, remove the air supply from the air switch and turn on the boiler. Once the boiler is in the purge process, the safety interlock should appear and shut down the burner.
- Turn the burner off and reattach the air switch air supply.
- Reset the flame programmer.
- Cycle the boiler multiple times to be sure that no nuisance faults occur.

Low Gas Pressure Switch:

- Bring boiler to high fire (100% firing rate)
- Increase the dial on the low gas pressure switch until it trips and locks out the boiler
- Make note of the pressure that the burner shuts down at
- Once the gas switch trips, set the pressure switch to 50% lower than the value that the switch tripped at – Example: gas switch trips at 10 in. w.c., set the switch to 5 in. w.c.
- Reset the switch and flame programmer
- Cycle the burner and observe for proper operation

High Gas Pressure Switch:

- Bring boiler to low fire (0% firing rate)
- Decrease the dial on the high gas pressure switch until it trips and locks out the boiler
- Make note of the pressure that the burner shuts down at
- Once the switch trips, set the pressure switch to 50% higher than the value that the switch tripped at – Example: gas switch trips at 10 in. w.c., set the switch to 15 in. w.c.
- Reset the switch and flame programmer
- Cycle the burner and observe for proper operation

Proof of Closure:

- Disconnect power to the boiler
- While the boiler is off, remove the common wire to the proof of closure switch and install a wire nut on the end of switch or wrap in tape to properly protect the wire.
- Turn power to the boiler back on
- The boiler should immediately lock out on alarm due to the POC being disconnected.
- Disconnect power and reconnect the POC wire
- Turn power to the boiler back on and reset any flame programmer faults
- Cycle the burner and observe for proper operation

Flashback Protection:

- Locate the flashback protection device and change the setting to the lowest setting. This is typically 32 deg. F.
    - To change the setting, the "Set/Reset" button must be pressed as the wheel is rotated
- The device will generate an alarm
- Reset the device to the factory temperature setting. This is typically 750 deg. F for standard steam units.
- Try to turn on the burner. It should not work as the reset button on the control has not yet been pressed.
- Press the reset button on the controller. The boiler should now operate correctly.

Troubleshooting Gas-Fired Boilers

PROBLEM	CAUSE	REMEDY
Ignition Failure	1. Power Supply	Check fuse or circuit breaker. Reset or replace, as necessary.
	2. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain. If found,replace.
	3. Transformer	Check voltage between transformer leads at terminal block to be sure transformer is being powered.
	4. Flame Safeguard Control	Check voltage between ignition terminal and neutral. Check must be made before control locks out on safety. If no power, replace control.
	5. Faulty Air Switch	Check for bad air switch by jumpering the two air switch leads at the terminal block. If the boiler starts and runs with these terminals jumpered, the air switch should be replaced.
	6. Gas Valve Sticking (Pilot)	Check for dirt in valve or orifice and clean if necessary. Check for faulty actuator or valve and replace if necessary.
	7. Gas Supply	Check for gas pressure and for intermittent supply problems. Gas pressure for natural gas should be 3-1/2" W.C. plus fan pressure at the elbow to the burner and 7" to 11" W.C. at the head of the train.
	8. Loose wire connection	Check connections to all components.
Flame Failure	1. Power Supply	Check fuse or circuit breaker. Reset or replace, as necessary.
	2. Gas Supply	Check for gas pressure and for intermittent supply problems. Gas pressure for natural gas should be 3-1/2" W.C. plus fan pressure at the elbow to the burner and 7" to 11" W.C. at the head of the train.
	3. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain; if found, replace.
	4. Primary Air Adjustment	Check air adjustment.
	5. UV Scanner Adjustment	Check for dirt on flame scanner and clean. Check for proper location of detector.
	6. Flame Safeguard Control	Check voltage at terminal leading to main gas valve. If no power, replace the control.
	7. Loose wire at fuel valve circuit	Tighten wiring connections.
	8. Contact open on air safety switch	Adjust to proper setting.
	9. Scanner wiring reversed at panel box.	Change to correct terminals.
Burner Cut-Off	1. Power Supply	Check fuse or circuit; reset or replace, as necessary.
	2. Gas Supply	Check to be sure main gas cock is not closed. Check coil in gas valve with OHM meter. Replace if faulty. Check gas regulator setting and readjust as necessary. Check inlet gas pressure and increase or decrease as necessary.
	3. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustment Readjust if necessary. Check for cracks in porcelain; if found replace.
	4. Air Switch	Check for bad air switch by jumpering the two air switch leads at the terminal block. If the boiler starts and runs with these terminals jumpered, the air switch should be replaced.
	5. Gas Valve Sticking (Pilot)	Check for dirt in valve or orifice and clean if necessary. Check for faulty actuator or valve and replace if necessary.
	6. Weak Amplifier	Replace.
	7. Weak Pilot	Adjust to larger pilot by adjusting pilot gas pressure regulator.
	8. Faulty Liquid Level Control	Check to see if there is power to terminal number 10 when the sight glass shows the proper water level. If there is no power at this terminal, the control is bad and must be replaced.
	9. Dirty or defective UV Scanner	Clean or replace.

PROBLEM	CAUSE	REMEDY
Poor Combustion	1. Refractories	Check refractories to see if they are plugged with soot or broken in pieces. Clean or replace as necessary.
	2. S.S. Ring	Check to be sure ring is present and fits tight against the furnace wall.
	3. Primary Air Adjustment	Check air adjustment. Air/fuel mixture may be off. Open primary air so fire is to outside wall of furnace.
	4. Secondary Air Adjustment	Check main air adjustment to see if it is loosened up. Adjust as necessary and tighten plate in position. Check CO_2 and O_2 levels.
	5. Draft	Check draft with a gauge. Draft should be a -.02 " to -.04" W.C. with burner off or -.04" to -.06" when operating. May need to install a barometric damper.
	6. Dirty Flue	Check flue for carbon buildup or blockage. Clean flue passages with brush.
	7. Negative Room Pressure	Make sure no exhaust fans are running in the boiler room.
Burner back fires	1. Refractories	Check refractories to see if they are plugged with soot or broken in pieces. Replace as necessary.
	2. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustment Readjust if necessary. Check for cracks in porcelain; if found replace.
	3. Draft	Check draft with a gauge. Draft should be a -.02 " to -.04" W.C. with burner off or -.04" to -.06" when operating. May need to install a barometric damper.
	4. Negative Room Pressure	Make sure no exhaust fans are running in the boiler room.
Boiler will not maintain pressure	1. Gas Supply	Check gas pressure coming into gas train. If low, contact gas company. Check coil in gas valve with AMP meter. Replace if bad. Check gas regulator setting and readjust as necessary.
	2. Dirty Flue	Check flue for carbon buildup or blockage. Clean flue passages with brush.
	3. Pressuretrol	Disconnect all power to the controller. Disconnect the wires from the controller. Put an OHM meter between the switch terminals. Lower the set point of the controller. Switch should make. Raise the set point and recheck with OHM meter. Switch should break. If the controller operates improperly, replace it.
	4. Scale Built up in boiler	Refer to Section 2 “Pressure Vessel Cleaning”.
	5. Refractories	Check refractories to see if they are cracked or broken in pieces. Replace as necessary.
	6. Steam traps blowing through	Check traps to see if they are clean or replace as necessary.
	7. Boiler size.	Boiler may be undersized.
Boiler is Surging	1. Steam traps blowing through	Check traps to see if they are clean or replace as necessary.
	2. High organic in boiler (i.e. Perc or oil)	Drain and clean boiler with washing soda per instruction manual.
	3. High boiler TDS	Drain boiler and flush system. Refill and increase blow-down rate/frequency.
	4. Too much water akalinity (high PH)	Have water tested by water treatment company, lower boiler alkalinity to recommended level.
	5. High sudden steam load	Check total equipment horsepower required against horsepower of boiler being used. Decrease amount of equipment being used at one time, or reduce the steam flow by partially closing the steam stop valve.
	6. High level of water treatment chemicals	Consult water treatment expert and adjust levels to boiler recommended levels.
Boiler Rumbles and Pulsates	1. Draft problem	Check draft with a gauge. Draft should be a -.02” to -.04” W.C. with burner off or -.04” to -.06” when operating. May need to install a barometric damper.
Boiler pushing water with the steam (carryover)	1. Steam Traps	Check traps. Clean or replace as necessary.
	2. High boiler TDS	Drain boiler and flush system. Refill and increase blow-down rate/frequency.
	3. High level of water treatment chemicals	Consult water treatment expert and adjust to boiler recommended levels.

PROBLEM	CAUSE	REMEDY
Pump will not cut off	1. Dirty Probes	Clean or replace as necessary.
	2. Relay failed	Make sure relay is plugged in tightly. If so, replace water level relay.
	3. Ground Connection	Check for tightness and clean.
	4. Probes not sensitive enough (RO/DI Water)	Replace probes and relays with extra sensitive ones.
Pump runs but does not put water into boiler	1. Vapor locking of pump	Allow system to cool down, check steam traps and check to be sure return lines are not insulated. Check return tank temp. If it is above 180°F (82°C) vapor locking of pump may occur. Inspect check valves. Clean and replace as needed. Replace pump with multistage centrifugal good for 250°F (121°C).
	2. Impeller Adjustment	Check for impeller wear and adjust per component information in instruction manual (Burks only).
	3. Pump suction plugged	Remove/clean inlet strainer.
	4. Plugged feed water nipple	Check and clean or replace as necessary.
	5. Pump undersized/worn	Replace with appropriate pump.
	3. Back pressure on pump	Need to install repair kit on pump.
Water pump will not come on at times	1. Scale on probes.	Check and clean or replace as necessary.
	2. Bad Pump Contactor	Check to see if contactor is being powered. Check to see if contactor coil is pulling in. Replace if necessary.
	3. Bad Pump Motor	Check the incoming power to the pump to be sure it is receiving power. If power is present but motor does not run, replace it.
Low Fuel pressure	1. Gas pressure regulator	Check and replace.
Boiler Flooding	1. Pump does not shut off	Dirty Probes. Clean or replace as necessary.
	2. Relay failed	Make sure relay is plugged in tightly. If so, replace water level relay.
	3. Ground Connection	Check for tightness and clean.
	4. Vacuum created with boiler off	As the boiler cools off, it pulls water from the system piping. To prevent this, add a 1/4" check valve on the steam gauge assembly piping, which closes under pressure and opens under vacuum.

Troubleshooting Gas-Fired Boilers - LE Models

PROBLEM	CAUSE	REMEDY
Ignition Failure	1. Power Supply	Check fuse or circuit breaker. Reset or replace, as necessary.
	2. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustments. Readjust if necessary. Check for cracks in porcelain. If found, replace.
	3. Transformer	Check voltage between transformer leads at terminal block to be sure transformer is being powered.
	4. Flame Safeguard Control	Check voltage between ignition terminal and neutral. Check must be made before control locks out on safety. If no power, replace control.
	5. Faulty Air Switch	Check for bad air switch by jum pering the two air switch leads at the terminal block. If the boiler starts and runs with these terminals jumpered, the air switch should be replaced.
	6. Gas Valve Sticking (Pilot)	Check for dirt in valve or orifice and clean if necessary. Check for faulty actuator or valve and replace if necessary.
	7. Gas Supply	Check for gas pressure and for intermittent supply problems. See test fire sheet for last elbow.
	8. Loose wire connection	Check connections to all components.
Main Flame Fails	1. Gas Servo Motor not set properly	Verify the last elbow gas pressure matches the start up report. Adjust gas servo setting.
	2. Air Servo Motor not set properly	Verify the over burner pressure matches the start up report. Adjust the air servo motor.
Boiler Fails while Modulating	1. Gas Servo Motor not set properly	Verify the last elbow gas pressure matches the start up report. adjust gas servo setting.
	2. Air Servo Motor not set properly	Verify the over burner pressure matches the start up report. Adjust air servo setting.

PROBLEM	CAUSE	REMEDY
Flame Failure	1. Power Supply	Check fuse or circuit breaker. Reset or replace, as necessary.
	2. Gas Supply	Check for gas pressure and for intermittent supply problems.
	3. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain; if found, replace.
	4. Primary Air Adjustment	Check air adjustment. Air may be blowing flame away from burner head.
	5. Scanner	Check for dirt on flame scanner and clean. Check for proper location of detector.
	6. Flame Safeguard Control	Check voltage at terminal leading to main gas valve. If no power, replace the control.
	7. Loose wire at fuel valve circuit	Tighten wiring connections.
	8. Contact open on air safety switch	Adjust to proper setting.
	9. Scanner wiring reversed at panel box	Change to correct terminals.
Burner Cut-Off	1. Power Supply	Check fuse or circuit; reset or replace, as necessary.
	2. Gas Supply	Check to be sure main gas cock is not closed. Check coil in gas valve with OHM meter. Replace if faulty. Check gas regulator setting and readjust as necessary. Check inlet gas pressure and increase or decrease as necessary.
	3. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks in porcelain; if found, replace.
	4. Scanner	Check for dirt on flame scanner and clean. Check for proper location of detector.
	5. Air Switch	Check for bad air switch by jumpering the two air switch leads as the terminal block. If the boiler starts and runs with these terminals jumpered, the air switch should be replaced.
	6. Gas Valve Sticking (Pilot)	Check for dirt in valve or orifice and clean if necessary. Check for faulty actuator or valve and replace if necessary.
	7. Weak Amplifier	Replace.
	8. Weak Pilot	Adjust to larger pilot by adjusting pilot gas pressure regulator.
	9. Faulty Liquid Level Control	Check to see if there is power to terminal number 10 when the sight glass shows the proper water level. If there is no power at this terminal, the control is bad and must be replaced.
	10. Dirty or defective UV Scanner	Clean or replace.
Poor Combustion	1. Refractories	Check refractories to see if they are plugged with soot or broken in pieces. Clean or replace as necessary.
	2. Air Adjustment	Check CO_2 and O_2 levels. Adjust Gas/Air Ratio.
	3. Draft	Check draft with a gauge. Draft should be a -.02” to -.04” W.C. with burner off or -.04” to -.06” when operating. May need to install a barometric damper.
	4. Dirty Flue	Check flue for carbon buildup or blockage. Clean flue passages with brush.
	5. Negative Room Pressure	Make sure no exhaust fans are running in the boiler room.
	6. Gas Servo Malset	Adjust gas servo setting.
	7. Air Servo Malset	Adjust air servo setting.
Burner back fires	1. Refractories	Check refractories to see if they are plugged with soot or broken in pieces. Replace as necessary.
	2. Ignition Electrodes	Check electrodes for carbon buildup and clean if necessary. Check for proper adjustment. Readjust if necessary. Check for cracks i nporcelain; if found, replace.
	3. UV Scanner	Check for dirt on flame scanner and clean. Check for proper location of detector.
	4. Draft	Check draft with a gauge. Draft should be a -.02” to -.04” W.C. with burner off or -.04” to -.06” when operating. May need to install a barometric damper.
	5. Negative Room Pressure	Make sure no exhaust fans are running in the boiler room.

PROBLEM	CAUSE	REMEDY
Boiler will not maintain pressure	1. Gas Supply	Check gas pressure coming into gas train. If low, contact gas company.
	2. Dirty Flue	Check flue for carbon buildup or blockage. Clean flue passages with brush.
	3. Pressuretrol	Disconnect all power to the controller. Disconnect the wires from the controller. Put an OHM meter between the switch terminals. Lower the set point and recheck with OHM meter. Switch should break. If the controller operates improperly, replace it.
	4. Scale Built up in boiler	Refer to Section 2 “Pressure Vessel Cleaning”.
	5. Refractories	Check refractories to see if they are cracked or broken in pieces. Replace as necessary.
	6. Steam traps blowing through	Check traps to see if they are clean or replace as necessary.
	7. Boiler size	Boiler may be undersized.
Boiler is Surging	1. Steam traps blowing through	Check traps to see if they are clean or replace as necessary.
	2. High organic in boiler (i.e. Perc or oil)	Drain and clean boiler with washing soda per instruction manual.
	3. High boiler TDS	Drain boiler and flush system. Refill and increase blow-down rate/frequency.
	4. Too much water akalinity (high PH)	Have water tested by water treatment company, lower boiler alkalinity to recommended level.
	5. High sudden steam load	Check total equipment horsepower required against horsepower of boiler being used. Decrease amount of equipment being used at one time, or reduce the steam flow by partially closing the steam stop valve.
	6. High level of water treatment chemicals	Consult water treatment expert and adjust levels to boiler recommended levels.
Boiler Rumbles and Pulsates	1. Draft problem	Check draft with a gauge. Draft should be a -.02” to -.04” W.C. with burner off or -.04” to -.06” when operating. May need to install a barometric damper.
Boiler pushing water with the steam (carryover)	1. Steam Traps	Check traps. Clean or replace as necessary.
	2. High boiler TDS	Drain boiler and flush system. Refill and increase blow-down rate/frequency.
	3. High level of water treatment chemicals	Consult water treatment expert and adjust to boiler recommended levels.
Pump will not cut off	1. Dirty Probes	Clean or replace as necessary.
	2. Relay failed	Make sure relay is plugged in tightly. If so, replace water level relay.
	3. Ground Connection	Check for tightness and clean.
	4. Probes not sensitive enough (RO/DI Water)	Replace probes and relays with extra sensitive ones.
Pump runs but does not put water into boiler	1. Vapor locking of pump	Allow system to cool down, check steam traps and check temp. If it is to be sure return lines are not insulated. Check return tank above 180°F (82°C) vapor locking of pump may occur. Inspect check valves. Clean and replace as needed. Replace pump with multistage centrifugal good for 250°F (121°C).
	2. Impeller Adjustment	Check for impeller wear and adjust per component information in instruction manual (Burks only).
	3. Pump suction plugged	Remove/clean inlet strainer.
	4. Plugged feed water nipple	Check and clean or replace as necessary.
	5. Pump undersized/worn	Replace with appropriate pump.
Water pump will not come on at times	1. Scale on probes	Check and clean or replace as necessary.
	2. Bad Pump Contactor	Check to see if contactor is being powered. Check to see if contactor coil is pulling in. Replace if necessary.
	3. Bad Pump Motor	Check the incoming power to the pump to be sure it is receiving power. If power is present but motor does not run, replace it.
Low Fuel pressure	1. Gas pressure regulator	Check and replace.
Boiler Flooding	1. Pump does not shut off	Dirty probes. Clean or replace as necessary.
	2. Relay failed	Make sure relay is plugged in tightly. If so, replace water level relay.
	3. Ground Connection	Check for tightness and clean.
	4. Vacuum created with boiler off	As the boiler cools off, it pulls water from the system piping. To prevent this, add a 1/4” check valve on the steam gauge assembly piping, which closes under pressure and opens under vacuum.

1 2 3 4

Section 5 Parts and Warranty

Parts and Warranty

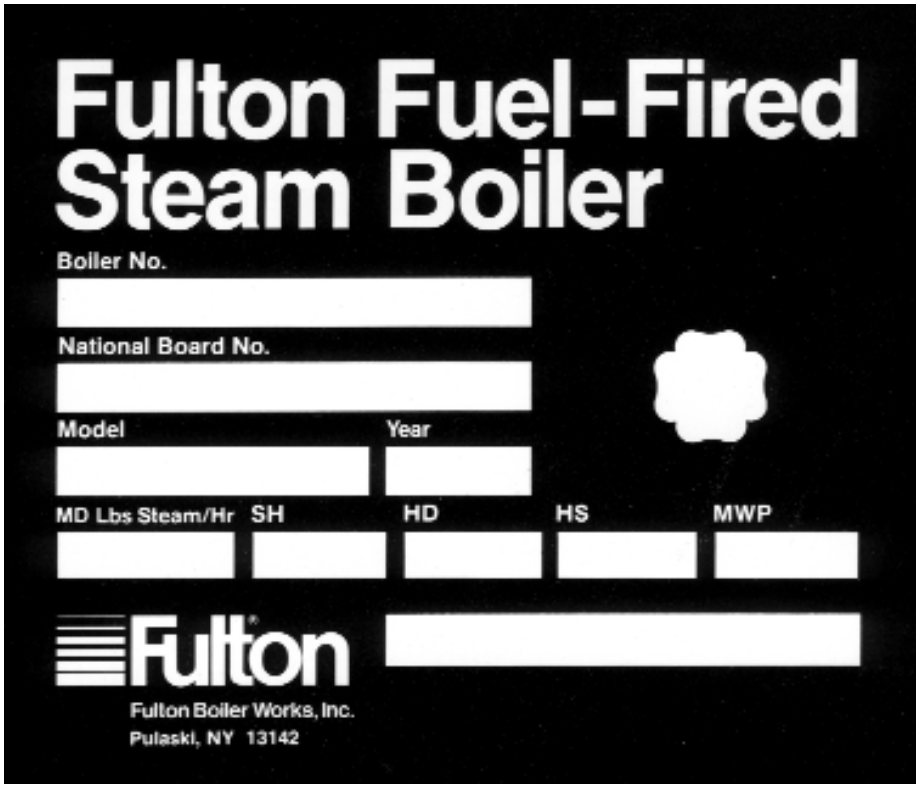
It is important that the correct replacement part is fitted to your Fulton Gas Fired Steam Boiler.

When ordering replacement or spare parts, make sure that the full information given in the Parts List is supplied, together with the following details as shown on your boiler identification plate:

1. Boiler Number
2. Boiler Type
3. Electrical Specifications

NOTE

The policy of Fulton Boiler Works, Inc. is one of continuous improvement, and therefore, we reserve the right to change prices, specifications, and equipment without notice.



Part No.	Description	Approx. Net Weight (lbs)	(kgs)
5-60-100	Instruction Manual, Fuel-Fired	2	0.91
5-60-165	Certification Papers		
Boiler Shell Parts			
5-12-017	Furnace Refractory 30" OD x 91/2" ID (80 HP Top)	225	102.27
5-12-018	Furnace Refractory 30" OD x 10" ID (100 HP Top)	225	102.27
5-12-019	Furnace Refractory 30" OD x 13"D (80 & 100 HP Bottom)	225	102.27
5-12-015	Furnace Refractory 24" OD x 8" ID (40 - 60 HP Top)	125	56.82
5-12-016	Furnace Refractory 24" OD X 10" ID (40- 60 HP Bottom)	125	56.82
2-12-000	Furnace Cement- 2 lb. can	2	0.91
2-12-001	Furnace Cement - 8 lb. can	8	3.64
2-12-002	Furnace Cement - 15 lb. can	15	6.82
Misc	Flue Cover 40-60 HP (10)		
5-10-11034	Flue Cover Plate - 80 HP (10)	64	29.09
5-10-11024	Flue Cover Ring -100 HP (10)	75	34.09
5-12-003	Square Cleanout Plug	15	6.82
2-12-064	Flexitalic (HHG) Extra Heavy High Pressure	0.5	0.23
2-12-088	Blue Max HHG	0.05	0.02
5-10-804	Handhole Welding Patch 60-100 HP	1.1	0.5
2-12-004	Handhole Gasket 60-100 HP	0.05	0.02
2-11-TIL105	HandholeYoke	1.5	0.68
2-11-TIL104	3 x 4 Handhole Cover 40-100 HP (Blue)	2	0.91
4-11-028	40 -100 HP Handhole Assembly (Blue)	7	3.18
2-12-504	Blanket Insulation (Sq. ft.)	0.5	0.23
5-21-306	Steel Jacket 40-60 HP - No Holes Cut	125	56.82
5-21-308	Steel Jacket 80 HP - No Holes Cut	180	81.82
5-21-309	Steel Jacket 100 HP - No Holes Cut	205	93.18
5-21-375	Exhaust Transition (40-60 HP)		
5-21-374	Exhaust Transition (80 HP)	8.5	3.86
5-21-373	Exhaust Transition (100 HP)		
2-12-502	Kast Set - per lb. (10 lbs. minimum) - Use for making refractories		
2-21-015	Buckeye Stamping for Bottom Handhole 60-100 HP	1	0.45
2-21-093	Buckeye Stamping for Upper Handhole 60-100 HP	1	0.45
2-23-171	Touch Up Paint - MICA Spray (10 oz.)	1	0.45
4-23-014	Mica Paint - Quart	2	0.91
4-23-044	Mica Paint - Gallon	7.8	3.55
2-12-504	TIW Filler Insulation per sq ft		

Part No.	Description	Approx. Net Weight (lbs)	(kgs)
Burner Assembly - Parts (Common)			
2-40-613	1.5 HP 115/230/60/1 Burner Motor 3450 RPM	40	18.18
2-40-615	1.5 HP 230/460/60/3 Burner Motor 2850/3450 RPM	31	14.09
2-40-621	3.0 HP 230/460/50/60/3 Burner Motor 2850/3450 RPM	43	19.55
2-12-014	Pyrex Plate Glass 1 " - 4 -100 HP	0.1	0.05
2-45-025	Bakelite Terminal 90° for Electrode	0.05	0.02
2-45-026	Bakelite Terminal Straight for Electrode	0.05	0.02
2-45-017	Ignition Wire - per foot	0.01	0
2-11-080	Burner Scroll Casting - 80 & 100 HP	65	29.55
5-20-061	Burner Scroll Casting - 40, 50 & 60 HP	50	22.73

Burner Fans:	Size	HP	Applicable Fuel	Hz.		
2-30-421	8-3/8 x 2-1/2 x 1	40-50	Propane or nat. Gas	50/60	3.00	1.36
		60	Propane or nat. Gas	50/60	3.00	1.36
2-30-826	9-15/16 x 3-1/2 x LO75	80				
2-30-559	9-15/16 x 3 x LO75	100				

*When ordering burner fans, check for the correct part number on the back of the fan plate.

Burner Assembly - Gas			
2-40-082	Ignition Transformer - Gas 115/60	9.5	4.32
2-45-026	Straight Bakelite Terminal	0.03	0.01
4-45-010	Ignition Cable with 90° Bakelite Terminal	0.5	0.23
2-20-033	Ignition Electrode	0.4	0.18
2-30-118	Air Switch 80-100 HP	0.72	0.33
5-20-018	Burner Plate Gas - 30-60 HP	1	0.45
5-10-398	Burner Plate Gas - 80 HP	1	0.45
5-10-399	Burner Plate Gas -100 HP	1	0.45
7-20-094	Air Deflector - Gas 80 & 100 HP	65	29.55
7-20-092	Air Deflector - Gas 40 - 60 HP	45	20.45
2-40-533	Gas Pressure Switch High-Low	3.25	1.48
2-30-298	1/2" Pilot Gas Valve (80-100 HP)	1.5	0.68
2-30-312	1-1/2" Gas Valve V5055A (40-60 HP)	10.7	4.86
2-30-313	2" Gas Valve V5055A (80-100 HP)	9.85	4.48
2-30-3003	Modulating Butterfly Valve (40-60 HP)		
2-30-3020	Modulating Butterfly Valve (80-100 HP)		
2-30-303	1-1/2" Main Gas Valve - V48A	4.5	2.05
2-40-253	Gas Valve Body - P.O.C V5055C (40-60 HP)	11.5	5.23
2-40-254	Gas Valve Body - P.O.C V5055C (80-100 HP)	10.5	4.77
2-40-	High-Low-Off Gas Valve Body 80 HP		
2-40-	HIgh-Low-Off Gas Valve Body 100 HP		
2-40-214	Actuator Valve Body	13.70	6.23
2-40-220	Actuator Valve Body w/Proof of Closure Switch	12.8	5.82
2-30-583	High-Low-Off Gas Valve Actuator 80 and 100 HP		
2-30-402	1-1/4" Vent Valve - 120V Normally Open	4.7	2.14
2-30-401	1" Vent Valve - 120V Normally Open	4.3	1.95
2-30-198	1/8" Gas Cock (Pet Cock)	0.25	0.11
2-30-111	1/2" Pilot Gas Cock	0.6	0.27
2-30-115	1-1/2 " Main Gas Cock	4.8	2.18
2-30-110	2" Main Gas Cock	16.8	7.64
2-30-102	1/2" Gas Pressure Regulator RV 48	0.7	0.32
2-30-107	1-1/2"Gas Pressure Regulator - RV 81	4.8	2.18
2-30-108	2" Gas Pressure Regulator - RV 91	8.5	3.86
7-20-298	Natural Gas Orifice - 40 HP	4	1.81
7-20-299	Natural Gas Orifice - 50 HP	4	1.81
7-20-300	Natural Gas Orifice - 60 HP	4	1.81
7-20-093	Natural Gas Orifice - 80 HP	4.5	2.04
7-20-302	Natural Gas Orifice - 100 HP	4.5	2.04
7-20-275	Propane Orifice - 40 HP	4	1.81
Misc.	Propane Orifice - 50 hP	4	1.81

Part No.	Description	Approx. Net Weight (lbs)	(kgs)
7-20-322	Propane Orifice - 60 HP	4	1.81
7-20-094	Propane Orifice - 80 HP	4.5	2.04
7-20-095	Propane Orifice - 100 HP	4.5	2.04
2-30-180	Propane Spring RV81	.05	0.23
2-30-181	Propane Spring RV91	.05	0.23
7-30-006	Top Plate Assembly - 40, 50 & 60 HP - Natural or Propane Gas	65	29.55
7-30-000079	Top Plate - 80 HP - NG/LP	100	45.4
7-30-000081	Top Plate - 80 HP - Combo	100	45.4
7-30-000110	Top Plate - 100 HP - NG/LP	100	45.4
7-30-000112	Top Plate - 100 HP - Combo	100	45.4
7-30-000031	Burner Plate Assembly - 40, 50 HP - Natural Gas	12	5.45
7-30-000073	Burner Plate Assembly - 80 HP - Natural Gas	12	5.45
7-30-000075	Burner Plate Assembly - 80 HP - Combo	12	5.45
7-30-000173	Burner Plate Assembly - 80 HP -Propane	12	5.45
7-30-000174	Burner Plate Assembly - 80 HP - Town Gas	12	5.45
7-30-000175	Burner Plate Assembly - 80 HP - Butane	12	5.45
7-30-000115	Burner Plate - 100 HP - Gas	1	.454
7-30-000117	Burner Plate - 100 HP - Combo	1	.454
7-30-000176	Burner Plate - 100 HP -Propane	1	.454
7-30-000177	Burner Plate - 100 HP - Town Gas	1	.454
7-30-000178	Burner Plate - 100 HP - Butane	1	.454
7-54-1006	Gas Train Assembly - 40 - 50 HP - Natural Gas	70	31.82
7-54-5158	Gas Train Assembly - 80 HP - Natural Gas On/Off	100	45.45
7-54-5159	Gas Train Assembly -100 HP - Natural Gas On/Off	100	45.45
7-54-6158	Gas Train Assembly - 80 HP - Propane Gas On/Off	100	45.45
7-54-6159	Gas Train Assembly -100 HP - Propane Gas On/Off	100	45.45
7-54-8488	Gas Train Assembly 80 HP - Natural Gas High/Low/Off	100	45.45
7-54-8489	Gas Train Assembly 100 HP - Natural Gas High/Low/Off	100	45.45
7-54-7758	Gas Train Assembly 80 HP Natural Gas Modulation	100	45.45
7-54-7759	Gas Train Assembly 100 HP Natural Gas Modulation	100	45.45
7-54-8498	Gas Train Assembly 80 HP - Propane Gas High/Low/Off	100	45.45
7-54-8499	Gas Train Assembly 100 HP -Propane Gas High/Low/Off	100	45.45
7-54-8409	Gas Train Assembly 80 HP Propane Gas Modulation	100	45.45
7-54-8410	Gas Train Assembly 100 HP Propane Gas Modulation	100	45.45
Water Column			
5-20-022	Fulton Water Column Bottle Casting -4-100 HP	20	9.09
2-30-151	MM 150 Pump Control	25	11.36
2-30-193	MM 150 - M/R Control	25	11.36
2-30-152	MM 150 HD Assembly	25	11.36
2-30-192	MM 150-M-HD M/R Head	25	11.36
2-12-125	MM 150-14 Gasket	0.05	0.02
2-30-136	MM 157 Pump Control and Low Water Cutoff	39.7	18.05
2-30-137	MM 53-2 Boiler Feeder and Low Water Cutoff	38.5	17.5
2-45-144	MM Mercury Switch - 2 Wire	1	0.45
2-45-143	MM Mercury Switch - 3 Wire	1	0.45
2-30-149	Water Gauge Glass Valves w/Ball Checks	1.5	0.68
2-30-047	Try Cocks	0.4	0.18
2-12-065	8-5/8" Extra Heavy Gauge Glass	0.05	0.02
2-12-008	9-1/4 Water Gauge Glass - standard	0.05	0.02
2-12-007	9-1/4" Extra Heavy Gauge Glass	0.1	0.05
2-12-017	9-1/4" Water Gauge Glass -Corning	0.05	0.02
2-12-018	10" Water Gauge Glass- MM	0.06	0.03
2-12-020	Brass Water Gauge Glass Gasket	0.0018	0
2-12-019	Rubber Water Gauge Glass Gasket	0.004	0
2-12-080	Teflon Water Gauge Gaskets	0.01	0
2-35-514	Brass Packing Nut for Gauge Glass Valve	0.1	0.05
2-30-330	Gauge Glass Protector Rods	0.04	0.02
2-12-022	Lucite Gauge Glass Guard for 9-1/4" Glass	0.4	0.18

Part No.	Description	Approx. Net Weight (lbs)	(kgs)
2-12-024	Lucite Gauge Glass Guard for 10" Glass	0.5	0.23
4-21-010	Water Column Electrode Basket & Cover	0.5	0.23
4-30-052	Set of four (4) Water Level Probes & Plugs - 80-100 HP	1.3	0.59
4-30-042	Set of 3 Water Column Probes	0.8	0.36
2-20-010	Pump Off Probe - 7-1/4 "	0.2	0.09
2-20-011	Pump On Probe - 9-1/4"	0.2	0.09
2-20-012	Low Water Probe in Water Column -11-1/4”	0.3	0.14
2-20-017	Low Water Probe in Boiler- 17-1/2”	0.5	0.23
2-21-012	Probe Cover - 2"	1	0.45
2-21-013	Probe Cover - 4"	1	0.45
2-30-398	1/4"Male-Female Ball Valve for Water Column	0.6	0.27
2-40-021	Probe Basket	0.05	0.02
Panel Box Parts			
2-40-420	Fulton Pump Relay-120V	0.5	0.23
2-40-421	Fulton Burner Relay - 120V	0.5	0.23
2-40-422	Base for Fulton Pump Relay	0.25	0.11
2-40-423	Base for Fulton Burner Relay	0.25	0.11
2-12-090	Spring Retainer for burner/pump relay	0.001	0
2-40-131	General Purpose Relay (Ice Cube) - AB	0.8	0.36
2-40-096	Base for Ice Cube Relay	0.1	0.05
2-45-091	On/Off Switch	0.05	0.02
2-45-092	Manual Reset Switch	0.05	0.02
2-45-090	Night Switch for two (2) Pressuretrols	0.05	0.02
2-40-552	4" Alarm Bell	1	0.45
2-40-551	120V Transformer for Bell	1	0.45
2-45-412	AB Green Panel Light 120 V - NEMA 4	0.02	0.01
2-45-413	AB Amber Panel Light 120 V - NEMA 4	0.02	0.01
2-45-411	AB Red Panel Light 120 V - NEMA 4	0.02	0.01
2-45-410	AB White Panel Light 120 V - NEMA 4	0.02	0.01
2-40-567	Motor Contactor - AB - 100 - 3RT1015-1AK6	0.8	0.36
2-40-642	3 Phase Motor Contactor - 3RT1017-1AK6	0.8	0.36
2-40-648	Overload - AB - BSB 16 3RB1015-2PBO	0.45	0.2
	Overload - AB - BSB 15	0.45	0.2
	Overload - AB - BSB 30	0.45	0.2
	Overload - AB - BSC 10	0.45	0.2
	Overload - AB - BSC 15	0.45	0.2
	Overload - AB - BSC 24	0.45	0.2
	Overload - AB - BSB 42	0.45	0.2
2-40-573	Overload - 60 3RB1015-2SBO	0.45	0.2
	Overload - AB - BSB 80	0.45	0.2
2-40-566	Overload - 3RB1015-2NBO	0.45	0.2
2-40-651	Overload - 3RB1025-2OBO		
4-40-050	Night Heating Pressuretrol Set Up	3.5	1.59
2-40-227	Pressuretrol L404A - 2-15 PSI	1.7	0.77
2-40-228	Pressuretrol L404A - 5-50 PSI	2	0.91
2-40-229	Pressuretrol L404A - 10-150 PSI	2	0.91
2-40-230	Pressuretrol L404A - 20-300PSI	2.7	1.23
2-40-231	Pressuretrol L404C - 2-15 PSI	2	0.91
2-40-232	Pressuretrol L404C - 5-50 PSI	2	0.91
2-40-233	Pressuretrol L404C - 10-150 PSI	2	0.91
2-40-234	Pressuretrol L404C - 20-300 PSI	2.7	1.23
2-40-161	Flame Scanner (Mini-Peeper)	0.5	0.23
2-40-262	RM7800M Programmer 40-100 HP - 120 V	2.5	1.14
2-40-265	7 Second Prepurge Timer	0.1	0.05
2-40-266	30 Second Prepurge Timer	0.1	0.05
2-40-267	60 Second Prepurge Timer	0.1	0.05
2-40-269	RM7800 Amplifier - For UV Amp	0.2	0.09
2-40-161	Mini Peeper For All 7800	0.5	0.23

Part No.	Description	Approx. Net Weight (lbs)	(kgs)
2-40-270	Base For All 7800	0.5	0.23
2-40-272	Display Module for 7800 Controls English (Also Available in Spanish)	0.5	0.23
2-40-247	Remote Mounting Bracket for 7800	0.65	0.3
2-40-248	Extension Cable		
Boiler Trim			
2-30-396	1" Spring Loaded Check Valve - 200#	2.55	1.16
2-30-397	1-1/4" Spring Loaded Check Valve - 200#	3.8	1.73
2-30-019	1/4" Ball Valve - 200#	0.6	0.27
2-30-008	1/2" BallValve-200#	0.7	0.32
2-30-027	3/4" BallValve-200#	1.4	0.64
2-30-026	1" Ball Valve - 200#	1.75	0.8
2-30-001	1" MxF Ball Valve 200#	2	0.91
2-30-017	1-1/4" Ball Valve - 200#	3.1	1.41
2-30-018	1-1/2" Ball Valve - 200#	4.7	2.14
2-30-025	2" Ball Valve - 200#	6.35	2.89
2-30-208	3" Ball Valve - 200#	18	8.18
2-30-393	1-1/2" Y Type Blowdown Valve - 200#	8.4	3.82
2-30-394	2" Y Type Blowdown Valve-200#	13.5	6.14
2-30-023	1-1/2" Quick Action Blowdown Valve	23	10.45
2-30-024	2" Quick Action Blowdown Valve	28	12.73
2-40-133	Timer for Automatic Blowdown System	0.8	0.36
2-30-403	1-1/2" Motorized Valve for Automatic Blowoff	12.6	5.73
2-30-389	2" Motorized Valve for Automatic Blowoff	13.7	6.23
2-30-1066	1/2" Steam Solenoid Valve - 120V	2.3	1.05
2-30-122	3/4" Steam Solenoid Valve - 120V	2.5	1.14
2-30-146	1" Steam Solenoid Valve - 120V	4.5	2.05
2-30-147	1-1/4 " Steam Solenoid Valve - 120V	4.9	2.23
2-30-148	1-1/2" Steam Solenoid Valve - 120V	6.3	2.86
2-30-016	1-1/2" 15# Series 19 V-Stamped Safety Valve	2	0.91
2-30-217	2" 15# Series 19 V-Stamped Safety Valve	2.5	1.14
2-30-085	1-1/4"-150# Safety Valve	6.8	3.09
2-30-086	1-1/2"-15# Safety Valve	2	0.91
2-30-087	1-1/2"-100# Safety Valve	12.4	5.64
2-30-088	1-1/2"-125# Safety Valve	10.9	4.95
2-30-089	1-1/2"-150# Safety Valve	12.3	5.59
2-35-518	1/4" Steel Pigtail Syphon for Steam Gauge Assembly- Long	0.6	0.27
2-30-326	0-30 PSI Steam Pressure Gauge	0.5	0.23
2-30-334	0-60 PSI Steam Pressure Gauge	0.5	0.23
2-30-333	0-200 PSI Steam Pressure Gauge	0.5	0.23
2-30-332	0-300 PSI Steam Pressure Gauge	0.5	0.23
2-30-327	0-600 PSI Steam Pressure Gauge	0.5	0.23
2-12-027	Teflon Disc for 1-1/2" Y Valve	0.2	0.09
2-11-017	Brass Seat for 1-1/2" Y Valve	0.1	0.05
2-12-028	Teflon Disc for 2" Y Valve	0.2	0.09
2-11-018	Brass Seat for 2" Y Valve	0.1	0.05
Test Equipment/Tools			
2-40-090	Test Leads	0.6	0.27
2-40-215	Microampmeter - W136	2	0.91
2-60-100	Jr. Amprobe - Y25	1	0.45
2-60-102	Pocket Draft Meter	1	0.45
2-60-103	All Purpose Draft Meter	3	1.36
2-60-104	CO Tester-Gas	15	6.82
2-60-105	CO Tubes	0.25	0.11
2-60-106	StackThermometer	4	1.82
2-60-108	SmokeTester-Oil	2	0.91
2-60-110	Fisher Gauge - 50 PZ	1	0.45
2-60-247	Flue Brush - Pipe Type - 2-1/2" - 100 HP	1	0.45

Part No.	Description	Approx. Net Weight (lbs)	(kgs)
2-60-248	Flue Brush - Pipe Type - 2" - 40 and 80 HP	1	0.45
5-10-397	Tee Handle Wrench	2.7	1.23
2-20-110	Fan Puller - 5/8" Hub	2	0.91
Barometric Controls			
2-30-099	14" M&MG2 80 - 100 HP - Oil, Gas, Comb.	16	7.27
2-30-0415	16" M&MG2	25	11.36
Spare Parts Kits			
2-12-517	Burner Plate Gasket 40, 80 and 100 HP Gas	0.06	0.03
2-12-023	Screws (11)	0.001	0.00
5-12-046	Bottom Cleanout Gasket Only	0.5	0.23
2-12-550	Combination Gasket	0.05	0.02
4-12-114	Flue Cover Plate Gasket - Strip & Stick - Box of 3	3	1.36
	1/4" Braided Rope Gasket 80-100 HP - price per foot	0.25	0.11
2-12-077	Handhole Funnel Gasket 80-100 HP Top	0.05	0.02
2-12-079	Handhole Funnel Gasket 80-100 HP Bottom	0.05	0.02
2-12-531	Scroll Gasket- 40-60 HP	1	0.45
	Scroll Gasket- 80-100 HP	1	0.45
	Stack Extension Gasket 14" 80-100 HP	1	0.45
2-12-521	Top Plate Gasket - 40-60 HP	1	0.45
2-12-522	Top Plate Gasket - 80-100 HP	1	0.45
4-12-516	Gas, Oil, & Comb Gasket Kit	15	6.82
4-12-520	80-100 HP Gas, Oil, & Comb Gasket Kit	10	4.55

See the component assembly drawings to assist with parts identification.

Standard Warranty for Fulton Boilers

(Warranty Valid for Models ICS, ICX, ICW, ICXW, VMP, VMPW, FB-A, FB-F, FB-L, FB-S, FB-W)

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 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.

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Extended Warranty for Fulton Boilers

(Warranty Valid for Models ICS, ICX, VMP, FB-A, FB-F, FB-L, FB-S)

Ten (10) Year Material and Workmanship Warranty

The pressure vessel is covered against defective material or workmanship for a period of ten (10) years from the date of shipment from the factory. Fulton will repair or replace at our option, F.O.B. factory any part of the equipment, as defined above, provided this equipment has been installed, operated and maintained in accordance with the Installation, Operation and Maintenance Manual. The commissioning agency must also successfully complete and return the equipment Installation and Operation Checklist to Fulton's Service 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, Operation and Maintenance Manual.

The extended warranty is valid only for steam boilers that are purchased as part of a skid mounted boiler system. Generally, this system MUST include ALL of the following equipment in order for the warranty to apply.

1. Fulton boiler with model number as listed above.
2. Fulton DA or condensate return system with preheat kit.
3. Fulton blowdown tank/separator
4. Water softener
5. Chemical feed system
6. Automatic surface or bottom blowdown, which must operate to maintain TDS levels as specified in the Installation, Operation and Maintenance Manual.

Any deviation or additional equipment specified by Fulton Engineering must be used and maintained per the Installation, Operation and Maintenance Manual

There is a $1,000 labor allowance for any failed pressure vessel that is covered under the above warranty.

Parts Warranty

Fulton will repair or replace FOB factory any part of the equipment of our manufacture that is found to be defective in workmanship or material within twelve (12) months 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.

General

Fulton shall be notified in writing as soon as any defect becomes apparent. This warranty does not include freight, handling or labor charges of any kind.

No Sales Manager or other representative of Fulton other than the Quality Manager or an officer of the company has warranty authority. Fulton will not pay any charges unless they were pre-approved, in writing, by the Fulton Quality Manager.

This warranty is exclusive and in lieu of all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose. Fulton shall in no event by liable for any consequential or incidental damages arising in any way, including but not limited to any loss of profits or business, even if Fulton has been advised of the possibility of such damages. Fulton's liability shall never exceed the amount paid for the original equipment found to be defective.

Conditions of Warranty

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

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

The boiler must be maintained in accordance with the product manual and annual combustion and maintenance reports must be produced for warranty consideration.

The warranty is valid for the original installation only in the U.S.A and Canada.

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Fulton Heating Solutions, Inc., Fulton Boiler Works, Inc. & Fulton Thermal Corporation are part of the Fulton Group of Companies, manufacturers of high grade industrial/commercial heat transfer products.