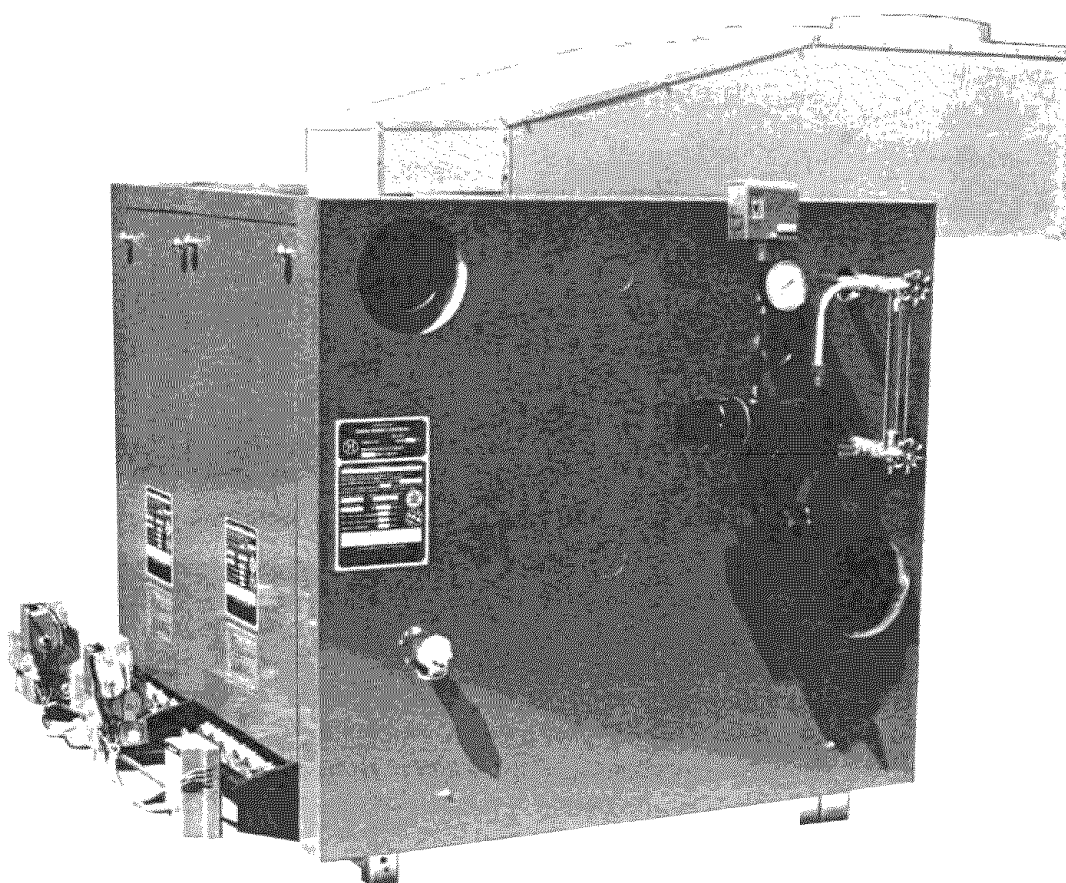


**SERIES
D247**

**Dunkirk®
Gas-Fired
Steam or
Water
BOILER**



INSTALLATION INSTRUCTIONS

These instructions must be affixed on or adjacent to the boiler.

DUNKIRK BOILERS

Dunkirk, New York 14048

*

Area Code 716 366-5500

Member: The Hydronics Institute

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introduction

Please read our instructions before you install and use your new boiler. This will help assure you of proper installation and help you avoid needless service.

You may plan to install the boiler yourself. You must then realize that the wrong use of any tool can be dangerous, unless you know how to use the tool and equipment and understand the electrical wiring, piping, and potential hazards involved. The boiler must be installed in accordance with the requirements of the local utility and those of other authorities.

RULES FOR SAFE INSTALLATION AND OPERATION

1. Read the Owner's Manual and the Rules for Safe operation carefully. Failure to follow the rules for safe operation and the instructions could cause a malfunction of the boiler and result in death, serious bodily injury, and/or property damage.
2. Check your local codes and utility requirements before installation. The installation must be in accordance with their directives.
3. Before servicing, allow boiler to cool and always shut off any electricity and gas to boiler when working on it. This will prevent any electrical shocks or burns.
4. Never test for leaks with an open flame. Use soap suds to check all connections. This will avoid any possibility of fire or explosion.
5. Be certain boiler is equipped for type of gas (natural) to be used. Overfiring will result in premature failure of the boiler sections and cause dangerous operation.
6. Never vent this boiler into an enclosed space. Always connect the boiler to a chimney and vent to the outside. Never vent to another room or inside a building.
7. Be sure there is adequate air supply for complete combustion.
8. Follow a regular service and maintenance schedule for efficient and safe operation.
9. Never install the boiler on carpeting.
10. Keep boiler area clear and free from combustible material such as gasoline and other flammable vapors and liquids.

WHEN YOUR BOILER ARRIVES

When your boiler arrives be sure to save and refer to the instructions.

First, inspect each item received for visible damage. If any parts are damaged, report this to the freight company immediately and request them to call and make an inspection before you make any installation. Have the inspector prepare a signed report. Send a copy of this report to the manufacturer and we will send replacements for the damaged parts. But we must have the signed inspection report of the freight company to prove their liability.

Read these instructions carefully before beginning the installation to be sure all packages have been received. It is recommended that you follow the step-by-step instructions for best assembly results. Before discarding any packing material carefully examine for loose parts. Also store all parts received where they will not be lost or damaged.

CODES GOVERNING INSTALLATION

Boiler should be installed in accordance to the latest edition of American National Standard National Fuel Gas Code Z223.1 (Available from the American Gas Association, 8501 East Pleasant Valley Road, Cleveland, Ohio 44131). Reference should also be made to local gas utility regulations and other codes in effect in the area in which the installation is to be made. The jurisdiction normally covers electrical wiring, gas piping, flue specification, and insulation of adjacent combustible material where required clearance cannot be maintained.

Where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. CSD-1.

INSTALLATION

This boiler is designed to provide wide capacity range with multiple burner modules, each equipped with its own set of controls. For purposes of orientation, the manifold side of the boiler is considered the front. The end sections are so designed that the controls may be placed on either the left or right end. These instructions are written for the assembling of the boiler starting with the left side and working to the right side. If the boiler is to be used as a steam boiler and connected to another steam boiler, the factory designed water lines of the two boilers must be of equal height above the floor.

A hot water boiler installed above radiation level must be provided with a low water cutoff device either as a part of the boiler or at the time of boiler installation.

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

The boiler must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig (3.5 kPa)



RATINGS AND CAPACITIES

CHART 1

BOILER MODEL NO.	A.G.A.* INPUT	A.G.A.* OUTPUT	NET I=B=R RATINGS†			FLUE OUTLET NO. & SIZE			CHIMNEY SIZE‡	FLUE COLLECTOR SIZE TO CHIMNEY	HORSE- POWER GROSS OUTPUT**	PRESSURE DROP THRU WATER BOILER††	
	Bitu Mbh	Btu Mbh	Steam	Steam	Water	8"	10"	12"	I.D. x Ht.			GPM	In. Water
			Sq. Ft.‡	Btu Mbh	Btu Mbh								
JC 300	300	240	750	180	209	1			8" x 20'	8	7.16	18.9 37.8	0.10 0.50
JC 400	400	320	1000	240	278		1		10" x 20'	10	9.55	25.2 50.4	0.27 0.86
JC 500	500	400	1250	300	348			1	12" x 20'	12	11.94	31.5 63.0	0.40 1.20
JC 600	600	480	1500	360	417	2			12" x 20'	12	14.33	37.8 75.6	0.50 1.70
JC 700	700	560	1750	420	487	1	1		12" x 20'	12	16.72	44.1 88.2	0.70 2.50
JC 800	800	640	2000	480	557		2		14" x 20'	14	19.10	50.4 100.8	0.88 2.90
JC 900	900	720	2250	540	626		1	1	14" x 20'	14	21.49	56.7 113.4	1.10 3.80
JC1000	1000	800	2500	600	696			2	14" x 20'	14	23.88	63.0 126.0	1.30 4.00
JC1100	1100	880	2750	660	765	1	2		16" x 20'	16	26.27	69.3 138.6	1.50 5.00
JC1200	1200	960	3000	720	835		3		16" x 20'	16	28.66	75.6 151.2	1.80 6.00
JC1300	1300	1040	3250	780	904	1		2	16" x 20'	16	31.04	81.9 163.8	2.00 5.60
JC1400	1400	1120	3500	840	974		1	2	18" x 20'	18	33.43	88.2 176.4	2.40 7.00
JC1500	1500	1200	3750	900	1043			3	18" x 20'	18	35.82	94.5 189.0	2.60 8.30
JC1600	1600	1280	4008	962	1113		4		18"x 20'	18	38.21	100.8 201.0	2.80 9.60
JC1700	1700	1360	4283	1028	1183	1	1	2	18" x 20'	18	40.60	107.1 214.2	3.15 10.30
JC1800	1800	1440	4563	1095	1252		2	2	20" x 20'	20	42.99	113.4 226.8	3.50 11.00
JC1900	1900	1520	4838	1161	1322		1	3	20" x 20'	20	45.37	119.7 239.4	4.00 12.50
JC2000	2000	1600	5117	1228	1391			4	20" x 20'	20	47.76	126.0 252.0	4.50 14.00
JC2100	2100	1680	5392	1294	1461	2		3	20" x 20'	20	50.15	132.3 264.6	4.95 16.00
JC2200	2200	1760	5671	1361	1530		3	2	22" x 20'	22	52.54	138.6 277.2	5.40 18.00
JC2300	2300	1840	5942	1426	1600		2	3	22" x 20'	22	54.93	144.9 289.8	5.70 17.00
JC2400	2400	1920	6213	1491	1670		1	4	22" x 20'	22	57.31	151.2 302.4	6.00 19.00
JC2500	2500	2000	6471	1553	1739			5	22" x 20'	22	59.70	157.5 315.0	8.00 20.50
JC2600	2600	2080	6729	1615	1809	2		4	22" x 20'	22	62.09	163.8 327.6	7.00 22.00
JC2700	2700	2160	6988	1677	1878	1	1	4	24" x 20'	24	64.48	170.1 340.2	7.50 24.00
JC2800	2800	2240	7246	1739	1948		2	4	24" x 20'	24	66.87	176.4 352.8	8.00 26.00
JC2900	2900	2320	7504	1801	2017		1	5	24" x 20'	24	69.25	182.75 365.5	8.50 27.50
JC3000	3000	2400	7763	1863	2087			6	24" x 20'	24	71.64	189.1 378.2	9.00 9.00

* Ratings are at sea level to 2,000 feet. For altitudes above 2,000 feet, reduce all ratings 4% for each 1,000 feet above sea level

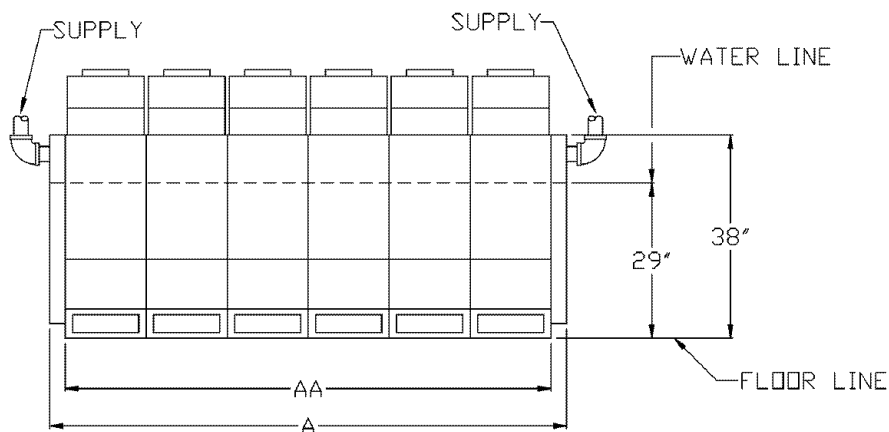
† Ratings based on selection factors recommended by Hydronics institute for piping and pickup. Net water boiler ratings are based on an allowance of 1.15, and net steam boiler ratings are based on an allowance of 1.33. For water applications with high piping and pickup requirements, use steam rating.

‡ Ratings in square feet are computed at 240 Btuh/square foot for steam boilers.

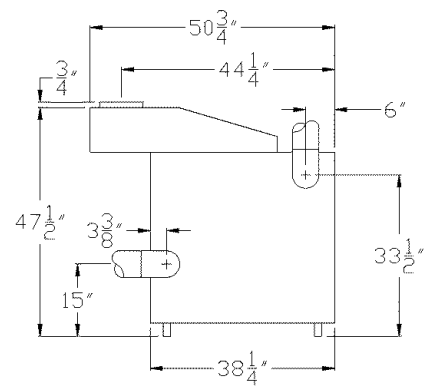
** Ratings based on 33,500 Btuh per horsepower.

†† Pressure drop based on given flow from a single outlet and returning to a single inlet at the opposite end of the boiler.

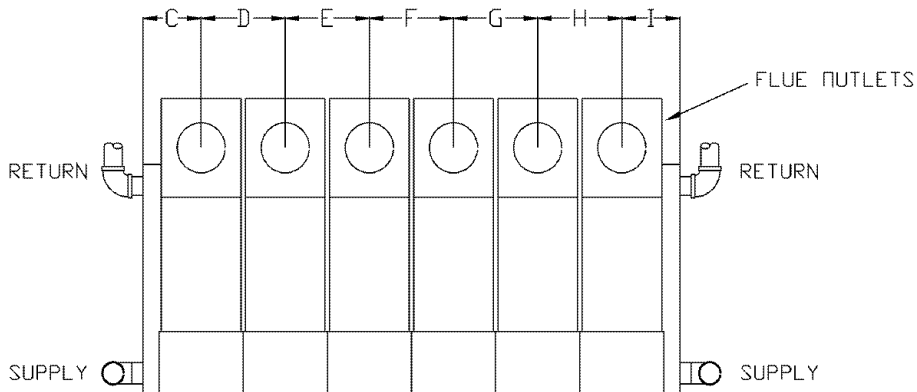
‡‡ Chimney sizes shown are one option based on a typical venting system as shown in Figure 21, and sized according to the National Fuel Gas Code, assuming Type B double wall vent and vent connectors. Other venting system designs are acceptable as shown on page 16. For further chimney design and sizing information, consult the National Fuel Gas Code, ANSI Z223.1/NFPA 54-latest revision, or ASHRAE-1996 HVAC Systems and Equipment Handbook, Chapter 30, Chimney, Gas Vent, and Fireplace Systems, or the Standard for Chimneys, Fireplaces, Vents, and Solid Fuel Burning Appliances. NFPA 211 -latest revision. Follow standard engineering practice.



FRONT VIEW



LEFT SIDE VIEW



TOP VIEW

ALL SUPPLY AND RETURN CONNECTIONS, 4IN.

Boiler Model No.	Water Content In Gallons		Shipping Weight Lbs.	A Jacket Width L to R	AA Base & Battery Length	C	D	E	F	G	H	I
	Steam	Water										
JC 300	20	26	922	18 3/4	16 3/4	9 3/8	omit	omit	omit	omit	omit	9 3/8
JC 400	25	33	1133	23	21	11 1/2	↓	↓	↓	↓	↓	11 1/2
JC 500	30	40	1344	27 1/4	25 1/4	13 5/8	↓	↓	↓	↓	↓	13 5/8
JC 600	35	46	1555	31 1/2	29 1/2	9 3/8	12 3/4	↓	↓	↓	↓	9 3/8
JC 700	40	52	1766	35 3/4	34 3/4	9 3/8	14 7/8	↓	↓	↓	↓	11 1/2
JC 800	45	58	1977	40	38	11 1/2	17	↓	↓	↓	↓	11 1/2
JC 900	50	65	2188	44 1/4	42 1/4	11 1/2	19 1/8	↓	↓	↓	↓	13 5/8
JC1000	55	71	2399	48 1/2	46 1/2	13 5/8	21 1/4	↓	↓	↓	↓	13 5/8
JC1100	60	78	2610	52 3/4	50 3/4	9 3/8	14 7/8	17	↓	↓	↓	11 1/2
JC1200	65	84	2821	57	55	11 1/2	17	17	↓	↓	↓	11 1/2
JC1300	70	91	3032	61 1/4	59 1/4	9 3/8	17	21 1/4	↓	↓	↓	13 5/8
JC1400	75	97	3243	65 1/2	63 1/2	11 1/2	19 1/8	21 1/4	↓	↓	↓	13 5/8
JC1500	80	104	3454	69 3/4	67 3/4	13 5/8	21 1/4	21 1/4	↓	↓	↓	13 5/8
JC1600	85	110	3665	74	72	11 1/2	17	17	17	↓	↓	11 1/2
JC1700	90	117	3876	78 1/4	76 1/4	9 3/8	14 7/8	19 1/8	21 1/4	↓	↓	13 5/8
JC1800	95	123	4087	82 1/2	80 1/2	11 1/2	17	19 1/8	21 1/4	↓	↓	13 5/8
JC1900	100	130	4298	86 3/4	84 3/4	11 1/2	19 1/8	21 1/4	21 1/4	↓	↓	13 5/8
JC2000	105	136	4509	91	89	13 5/8	21 1/4	21 1/4	21 1/4	↓	↓	13 5/8
JC2100	110	143	4720	95 1/4	93 1/4	9 3/8	12 3/4	17	21 1/4	21 1/4	↓	13 5/8
JC2200	115	149	4931	99 1/2	97 1/2	11 1/2	17	17	19 1/8	21 1/4	↓	13 5/8
JC2300	120	156	5142	103 3/4	101 3/4	11 1/2	17	19 1/8	21 1/4	21 1/4	↓	13 5/8
JC2400	125	162	5353	108	106	11 1/2	19 1/8	21 1/4	21 1/4	21 1/4	↓	13 5/8
JC2500	130	169	5564	112 1/4	110 1/4	13 5/8	21 1/4	21 1/4	21 1/4	21 1/4	↓	13 5/8
JC2600	135	175	5775	116 1/2	114 1/2	9 3/8	12 3/4	17	21 1/4	21 1/4	21 1/4	13 5/8
JC2700	140	182	5986	120 3/4	118 3/4	9 3/8	14 7/8	19 1/8	21 1/4	21 1/4	21 1/4	13 5/8
JC2800	145	188	6197	125	123	11 1/2	17	19 1/8	21 1/4	21 1/4	21 1/4	13 5/8
JC2900	150	195	6408	129 1/4	127 1/4	11 1/2	19 1/8	21 1/4	21 1/4	21 1/4	21 1/4	13 5/8
JC3000	155	201	6619	133 1/2	131 1/2	13 5/8	21 1/4	21 1/4	21 1/4	21 1/4	21 1/4	13 5/8

COMBUSTION AIR

Provision for combustion and ventilation air must be in accordance with Section 5.3, "Air for Combustion and Ventilation", of the National Fuel Gas Code, ANSI Z223.1 latest revision, and applicable provisions of the local building codes. Consult the code books or boiler manufacturer for specific requirements.

WARNING

**ENOUGH AIR ENSURES PROPER
COMBUSTION AND ASSURES THAT
NO HAZARD WILL DEVELOP DUE TO
THE LACK OF OXYGEN**

CHIMNEY AND VENT PIPE CONNECTION

This is a very important part of the heating system. It must be clean, the right size, properly constructed and in **GOOD CONDITION**. No boiler can function properly with a bad chimney. See Page 16 for specific venting instructions.

The flue pipe should be the same size as draft hood outlet from boiler to flue collector. See Page 4 for typical chimney size. Maintain a minimum upward slope of 1/4 inch per linear foot from boiler to the chimney. Fasten joints together with sheet metal screws to prevent sagging.

MINIMUM VENT PIPE CLEARANCE

If the vent pipe must go through a crawl space, double wall vent pipe should be used. Where vent passes through a combustible wall or partition, use a ventilated metal thimble. The thimble should be 4 inches larger in diameter than vent pipe. If boiler is installed with single wall galvanized type vent pipe, it must have 6 inches clearance between its surface and any combustible material. If UL listed type B (Insulated) vent pipe is used, clearance between it and combustible material to be as listed by pipe manufacturer.

**FOR INSTALLATION ON NON-COMBUSTIBLE
FLOORS ONLY, MINIMUM CLEARANCES TO
COMBUSTIBLE CONSTRUCTION ARE.**

Top.....	54 inches
Front	Alcove
Flue Connector	6 inches
Rear	18 inches
Sides	18 inches

Greater clearances for access should supersede fire protection clearances.

LOCATING THE BOILER

Locate the boiler on a level, non-combustible foundation as near chimney or flue as possible. Allow 24 inches at front and sides of boiler for servicing and cleaning. When installed in a utility room, the door should be wide enough to allow the largest boiler parts to enter, or permit replacement of any other appliance in the same room.

When the boiler is installed over a room below, or over electrical wiring or cables of any kind, or if the concrete floor is "green," or water is channeled under the concrete, the installing contractor must provide a ventilated foundation for the boiler.

The boiler shall be installed such that the automatic gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (condensate trap, control replacement, etc.)

INSTALLATION

This boiler is designed to provide a wide capacity range with multiple burner modules, each equipped with its own set of controls. For purposes of orientation, the manifold side of the boiler is considered the front. The end sections are so designed that the controls may be mounted on either the left or right end. These instructions are written for the assembling of the boiler starting with the left side and working to the right side.

If the boiler is to be used as a steam boiler and connected to another steam boiler, the factory designed water lines of the two boilers must be of equal height above the floor level.

Boilers with Inputs above 500,000 BTU Per Hour are made up of a combination of the 300,000, 400,000 and 500,000 BTU Per Hour Input Module Bases. Each base is equipped with its own gas valve and gas ignition system.

When connecting the cold water supply to the boiler, make sure that a clean water supply is available. When the water supply is from a well, a sand strainer should be installed at the pump.

ASSEMBLY OF BASES

The 300, 400 and 500 boilers are the basic models. The 300 model has (6) burners, the 400 model has (8) burners and the 500 model has (10) burners. Combinations of the basic models are used to assemble the 600 through 3000 models. **See Chart No. 2** for the proper order of assembly. When two or more bases are used to assemble the boiler, be sure the top angles of the bases are even. **(See Figure No. 6).** The bases are fastened together with 5/16 cap screws and nuts. Insert two screws in the front posts and two in the rear posts as shown in **Figure No. 1**. After bases are fastened together, install the base end panels. These end panels must be installed before assembling sections. **Important:** After bases are assembled check to be sure they are level.

STARTING SECTION ASSEMBLY

The sections may be started from either the left or right end of the base. Place the end section on the base with the parting line of the section directly over the joint of the base and base end closure. With boilers having two or more bases, as you progress be sure the parting line (center-line of section) of the intermediate sections fall on the junction of the two bases. Install a top cover support bracket on the draw bolts of the intermediate sections at each base junction.

PULLING SECTIONS TOGETHER WITH TIE RODS

Before beginning, clean nipples and nipple ports. Coat nipples and nipple ports with pipe joint compound furnished or other good sealant and keep them clean. Place nipples in ports taking care to seat them squarely to prevent cocking. **(See Figure 2).** When pulling sections together with tie rods, **always insert tie rods in holes nearest to nipple ports.** Move tie rods to proper location, if necessary, only after sections are fully pulled together. Oil or lubricate threads, insert tie rods in lugs with washers under nuts and tighten uniformly and evenly so that sections are pulled

parallel as they go together. When all sections are pulled up locate the tie rods in alternating pairs of upper and lower holes between adjacent sections, and back off nuts so that they are only finger tight. **(See Figure 7).** Be sure both ends of completed section assembly are resting evenly on both ends of base.

Apply boiler putty at the joints of the sections front, top and back. Putty should also be applied where the sections join the base.

Place the necessary plugs and control wells in the correct locations. Plug all other tappings, leaving an air vent in the top of one of the end sections, and connect water. Fill the boiler with water until it runs out the air vent. Then hydrostatically test the boiler in accordance with applicable codes. Check for leaks before continuing with the assembly. Drain and remove unnecessary plugs.

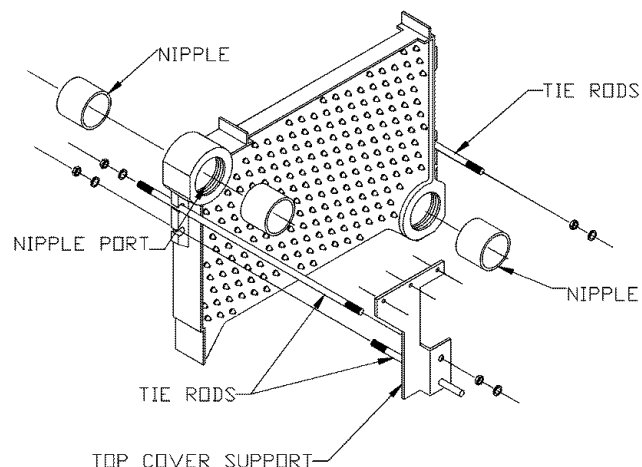


FIGURE 2

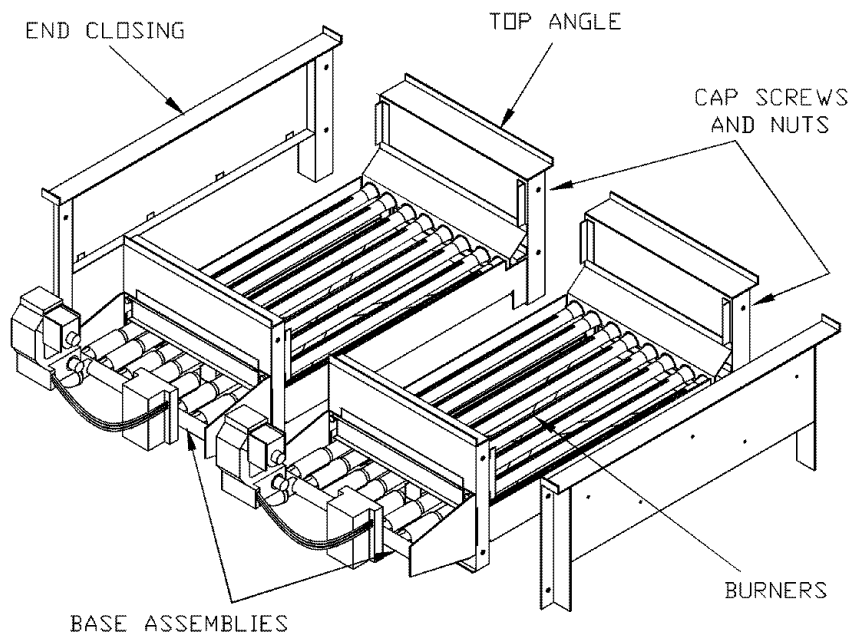


FIGURE 1

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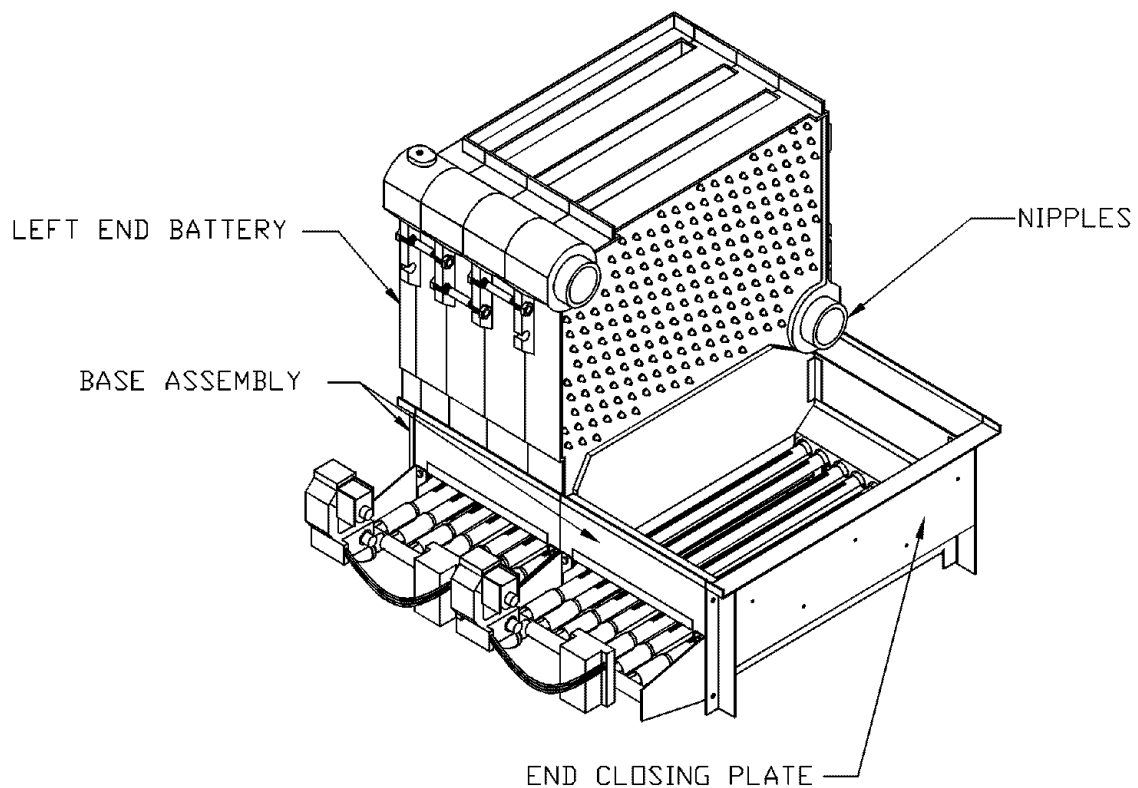


FIGURE 6

ATTACH DRAFT HOODS

Attach the draft hood(s) to the boiler sections after applying boiler putty to the top of the boiler sections where the hoods and sections meet. Use (J) bolts to attach front of draft hood to slots in sections flange.

WARNING:
DO NOT ALTER OR MODIFY DRAFT HOOD
FURNISHED WITH BOILER.

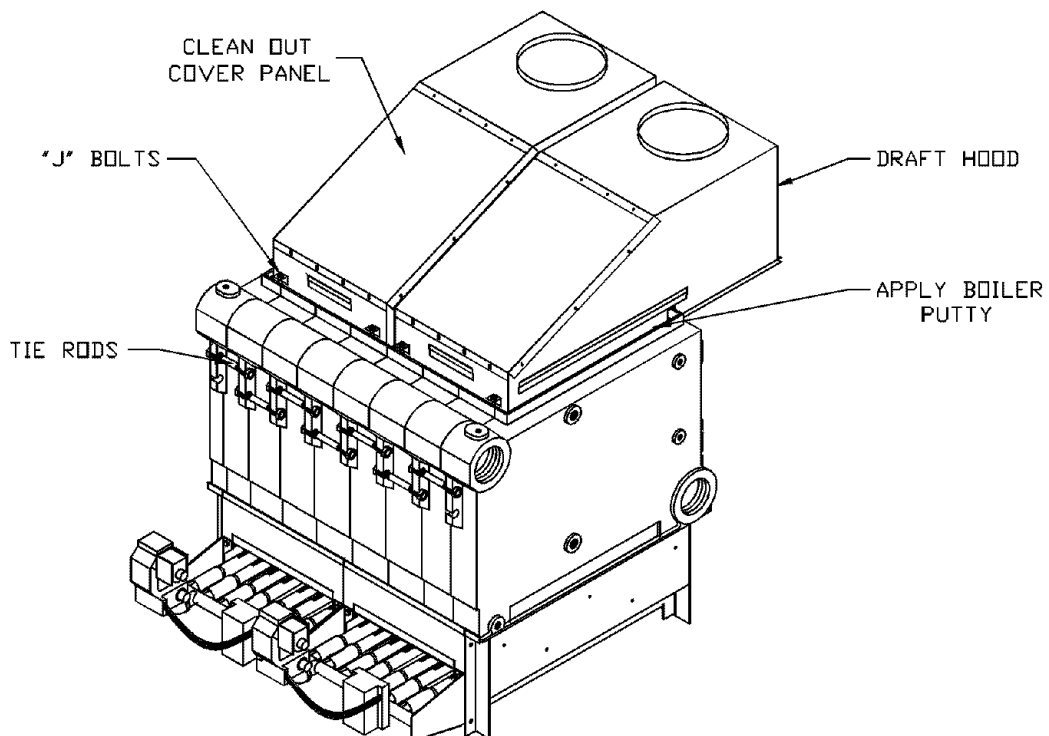


FIGURE 7

CONNECTING GAS SERVICE

Connect gas service from meter to control assembly(s) in accordance with ANSI Z223.1 1984 and local codes or utility. On multiple base boilers, connect gas service with branch lines from common main. Individual branch lines must be the same size as the inlet to the gas valve. A ground joint union should be installed in each branch line for easy servicing of gas controls. A drip leg or trap should be installed at the bottom of a vertical section of piping at the inlet to the control chain, **Figure 8**. A pipe compound resistant to the action of liquefied petroleum gases must be used on all threaded pipe connections.

The main gas supply line should be adequate to prevent undue pressure drop. **See Chart No. 3** for pipe sizes for gas mains.

To check for leaks in gas piping, use a soap and water solution or other approved method, **DO NOT USE AN OPEN FLAME**.

The boiler must be disconnected from the gas supply piping system during any pressure testing of that system. Test the gas connection to the boiler before placing the boiler in operation.

Minimum Gas Supply Pressure

Models 300, 500, 600, 1000, 1300, 1500, 2000, 2100, 2500, 2600, 3000 5.0 inches w.c.

Models 400, 700, 800, 900, 1100, 1200, 1400, 1600, 1700, 1800, 1900, 2200, 2300, 2400, 2700, 2800, 2900 5.3 inches w.c.

Maximum Gas Supply Pressure

All Models 14.0 inches w.c.

Manifold Pressure

All Models 3.5 inches w.c.

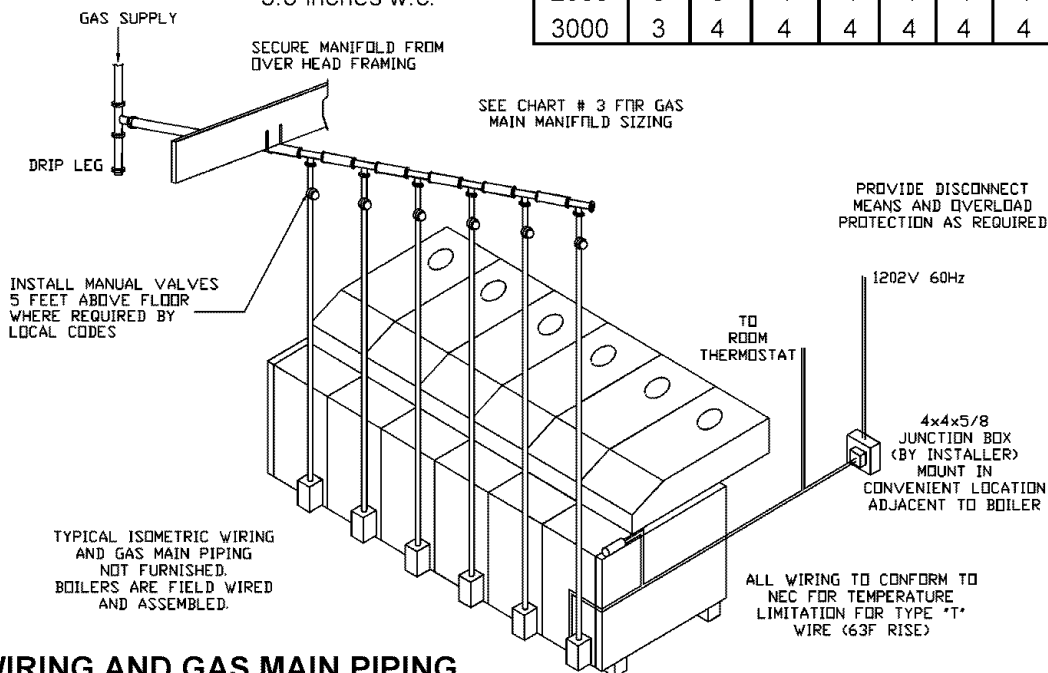


FIGURE 8

SUGGESTED WIRING AND GAS MAIN PIPING

CHART 3

Boiler No.	20'	30'	40'	50'	60'	80'	100'	125'	150'
300	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½
400	1¼	1¼	1¼	1¼	1½	1½	1½	1½	2
500	1¼	1¼	1¼	1½	1½	1½	2	2	2
600	1¼	1½	1½	1½	2	2	2	2	2
700	1¼	1½	1½	2	2	2	2	2	2½
800	1½	1½	2	2	2	2	2	2½	2½
900	1½	2	2	2	2	2	2½	2½	2½
1000	1½	2	2	2	2	2½	2½	2½	2½
1100	2	2	2	2	2	2½	2½	2½	2½
1200	2	2	2	2	2½	2½	2½	2½	3
1300	2	2	2	2½	2½	2½	2½	3	3
1400	2	2	2	2½	2½	2½	3	3	3
1500	2	2	2½	2½	2½	2½	3	3	3
1600	2	2	2½	2½	2½	2½	3	3	3
1700	2	2½	2½	2½	2½	3	3	3	3
1800	2	2½	2½	2½	2½	3	3	3	3
1900	2	2½	2½	2½	3	3	3	3	3
2000	2	2½	2½	2½	3	3	3	3	3
2100	2½	2½	2½	3	3	3	3	3	4
2200	2½	2½	2½	3	3	3	3	4	4
2300	2½	2½	3	3	3	3	3	4	4
2400	2½	2½	3	3	3	3	3	4	4
2500	2½	3	3	3	3	3	4	4	4
2600	3	3	3	3	3	4	4	4	4
2700	3	3	3	3	4	4	4	4	4
2800	3	3	3	4	4	4	4	4	4
2900	3	3	4	4	4	4	4	4	4
3000	3	4	4	4	4	4	4	4	4

ALL WIRING MUST COMPLY WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES

INSTALLING BOILER JACKET

1. Attach the Jacket End Panels to the two Z-bars on the Base End Closures through the two slotted holes on the bottom of Jacket End Panels. Use (2) #10 x 1/2" self-tapping screws each Panel.
2. Use (2) #8 x 3/4" Hex Head Screws to attach Jacket End Panels to rear side of Draft Hood, (1) each end.
3. Position top of Rear Jacket Panel(s) to Draft Hood Baffle Flange and secure with (2) #10 x 1/2" self-tapping screws. Secure bottom of Rear Jacket Panel to bracket on boiler base using (2) #10 x 1/2" self-tapping screws.
4. Position Top Jacket Panel(s) on adjustable clips on front of Draft Hood(s). Then using a #10 x 1/2" selftapping screw secure Top Jacket Panel to Jacket End Panel at front.
5. On multiple base boilers the intermediate Top Panels are bolted at the front through the jacket Top Support Bracket(s) previously installed with the sections. Use the #10-32 x 1/2" slot-head screws and 10-32 Hex Nuts.
6. Attach jacket door knobs with #8-32 x 1/4" hex head screws. Slide Jacket Front Panel(s) into groove in front of Jacket Top Panel(s), then insert Bottom of Front Panel(s) in slots on top of manifold brackets.
7. Lighting Instruction Plates are provided with each boiler base. Each boiler base also includes a data plate indicating the required gas type, firing rate, and gas pressure for that base. These plates are located on the Jacket Front Panels. Boilers also have a rating plate showing the total Input and Output Ratings. This rating plate is shipped in the AC Carton and is to be mounted on the right side Jacket End Panel by the installing contractor.
8. Attach Local Code Label (not provided by manufacturer.)

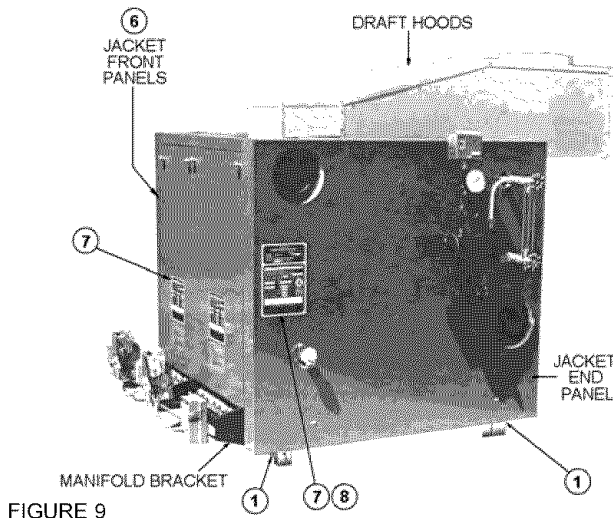


FIGURE 9

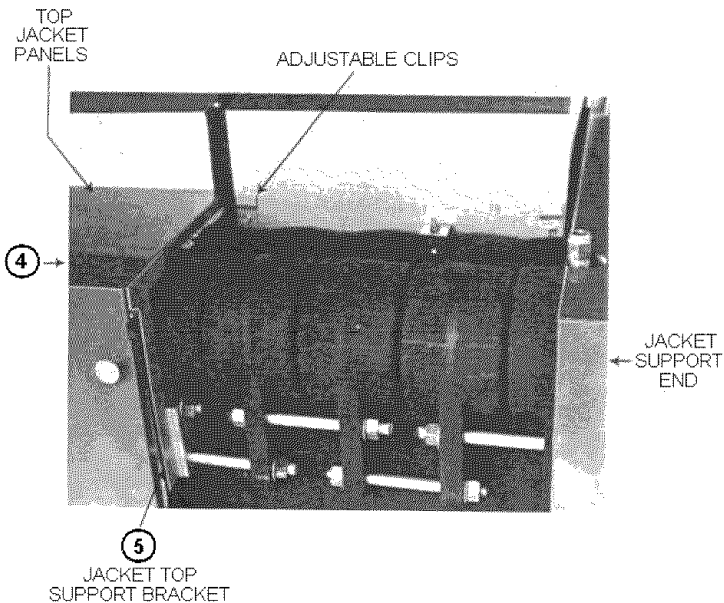


FIGURE 10

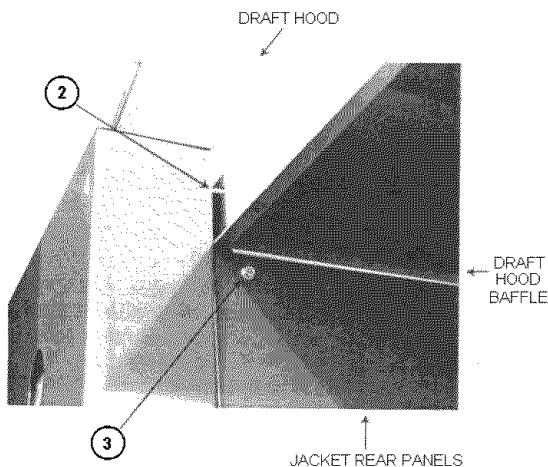


FIGURE 11

Figure No. 12 below shows the End Section and the various tappings provided. Tappings are the same in both Right and Left End Sections, except for the drain valve tapping which is 1 ½" Left End, and ¾" Right End.

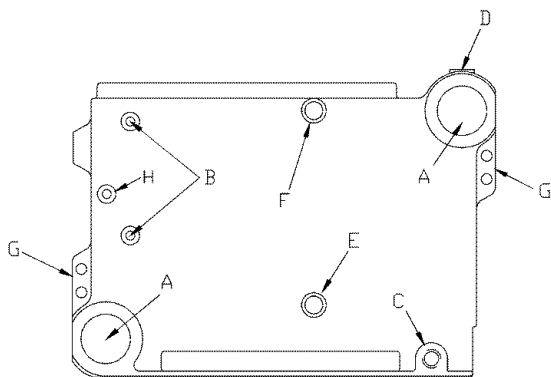


FIGURE 12

OPENING	SIZE	STEAM	WATER
A	4"	Supply and Return	Supply and Return
B	½"	Primary LWCO and Gauge Glass Set	Plugged
C	1 ½"	Drain, Left End	Drain, Left End
C	¾"	Drain, Right End	Drain, Right End
D	½"	Plugged	Limit Control
E	1"	Accessories	Accessories
*F	1"	Pop Safety Valve	Pressure Relief Valve
G		Tie Rod Holes	Tie Rod Holes
H	¾"	Plugged or Electronic (Probe Type) LWCO	Plugged

BOILER TRIM

The following controls are supplied as standard equipment. Details of their function and operation will be found in the section on Controls and Adjustments.

STEAM TRIM

1. Low Water Cut-Off (mounted externally) with blow-off valve.
2. High Pressure Limit Control.
3. Pressure Gauge.
4. Water Gauge Glass Set.
5. Siphon Loop.
6. Pop Safety Valve (15 lbs.).

WATER TRIM

1. Water Temperature High Limit Control.
2. Combination Temperature-Pressure Gauge.
3. Safety Relief Valve (30 lbs.).

STEAM TRIM ASSEMBLY

Assemble Steam Trim, Low Water Cut-Off, High Pressure Limit Control, Pressure Gauge, Water Gauge Glass Set and Siphon Loop, as shown in **FIGURE 13**. See **FIGURE 12** for location of controls.

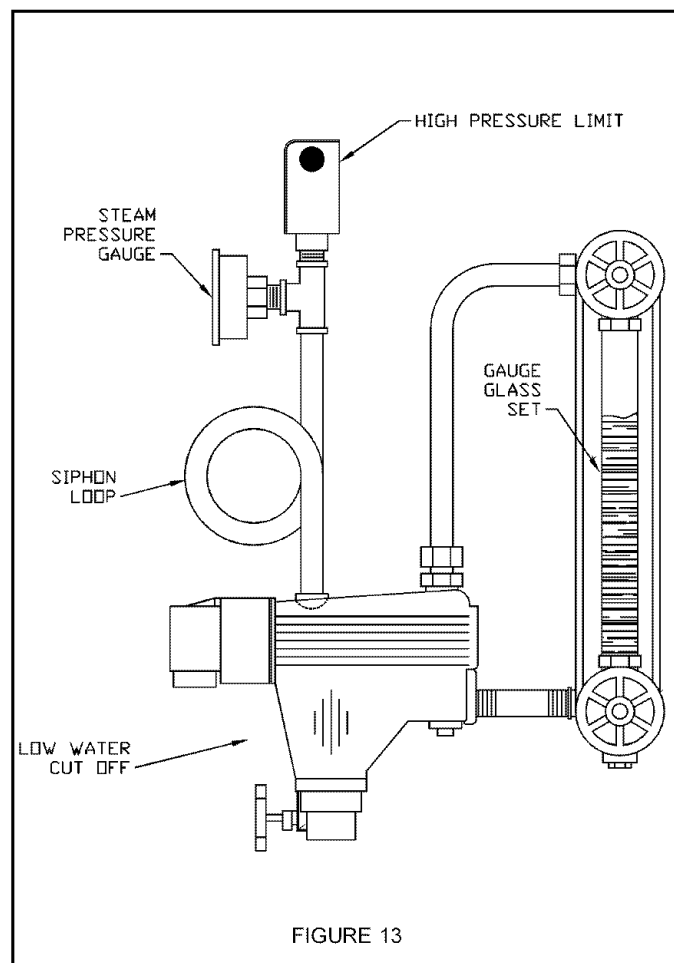


FIGURE 13

WATER TRIM ASSEMBLY

Locate Water Trim Controls per Chart in **FIGURE 12**.

POP SAFETY VALVE AND PRESSURE RELIEF VALVE.

*If opening F shown in **FIGURE 12** is to be used for something other than the Pop Safety Valve or Pressure Relief Valve, or the Safety/Relief valve is larger than 1", the Safety/Relief Valve must be installed in the Header Piping as near the boiler as possible.

NOTE

No shutoff of any description shall be placed between the pop safety valve or safety relief valve and the boiler, or on discharge pipes between such safety valves and the atmosphere. Installation of the pop safety or safety relief valve shall conform to the requirements of the ANSI/ASME Boiler and Pressure Vessel Code, Section IV.

BOILERS USED WITH REFRIGERATION SYSTEM

When the boiler is installed in connection with a refrigeration system, it must be piped so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating system. An example of such piping is shown in Figure 14. Valve A and B open for heating, closed for cooling. Valves C and D closed for heating, open for cooling.

When hot water boilers are connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation on the boiler piping, the boiler piping system shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

WATER BOILER PIPING (Figure 15)

Supply and Return connections to the hot water boiler should be located so that the water will thoroughly circulate throughout the entire boiler. Each installation has a preferred piping arrangement according to the requirements of the particular system and choice of arrangements and sizes of headers should be decided upon by the installer's heating engineer or with standard engineering practice. When using only one supply and one return connection, return must be connected at opposite end of boiler from flow connection, on all boilers 600,000 Btu/ hr input and larger.

HIGH LIMIT

The immersion well for the High Limit Control must be mounted at flow outlet of boiler. This may be either right or left hand.

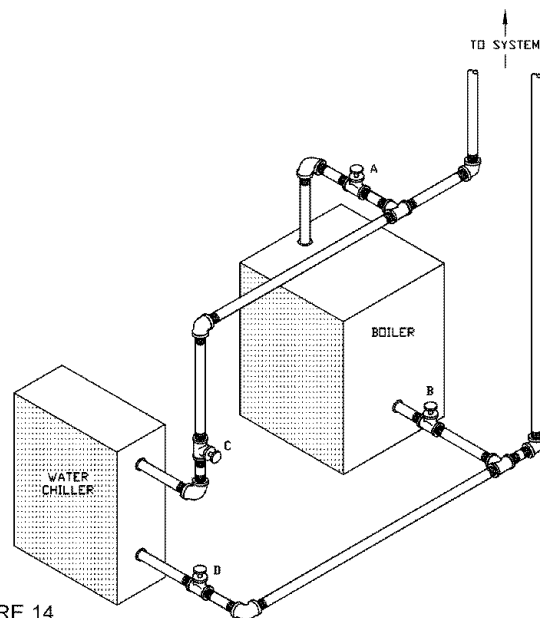
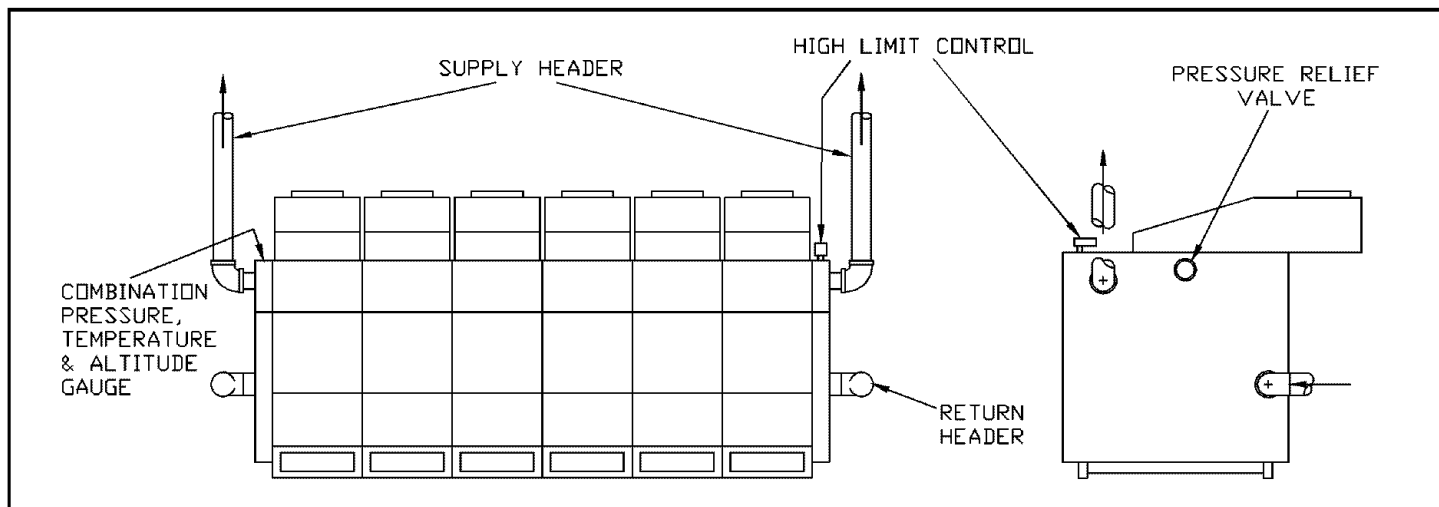


FIGURE 14

PIPE SIZING

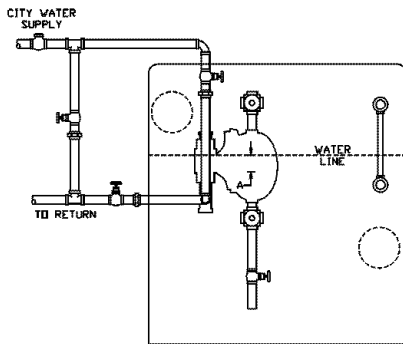
Piping connection sizes are important to control proper water velocity at the inlet and outlet connections to the water boiler. It is recommended that the following pipe sizes be used for flow rates shown and that the boiler be headered to tappings at both ends of boiler where one pipe connection will not be adequate to hold water velocities below 3.33 feet per second.

FLOW RATE GPM	PIPE SIZE
35 - 50	2½"
51 - 76	3"
77 - 131	4"
132 - 205	5"
206 - 300	6"

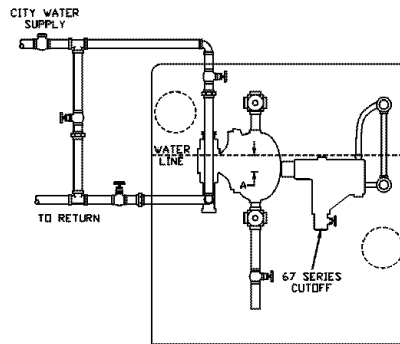


STEAM BOILERS - SERIES S

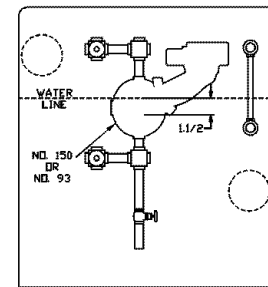
BOILER TAPPINGS ARE AVAILABLE FOR ALL CONNECTIONS SHOWN



McDONNELL FEEDER CUTOFF COMBINATION



SEPERATE McDONNELL FEEDER AND SEPERATE McDONNELL LOW-WATER CUTOFF



McDONNELL PUMP CONTROL AND LOW-WATER CUTOFF USED WITH CONDESATE RECEIVER AND ELECTRIC BOILER FEED PUMP

BOILER SIZE	USE
300 THRU 1500	NO. 47-2* Control Mounts in Gauge Glass Tappings
1600 THRU 3000	No. 51.2* Control Mounts in 1-inch Tappings

FOR CLOSED HEATING SYSTEMS
DIMENSION A = 2 • 2 ½

NOTE: For multiple boiler installation with gravity return, use feeder Cutoff Combination or sepearate feeder and sepearate cutoff on each boiler.

*These items available through your Distributor.

BOILER SIZE	USE
300 THRU 1500	NO. 247 mechanical feeder or No. 101-24V electric feeder with transformer - for use on closed heating systems only.
1600 THRU 3000	No. 51.2*

FOR CLOSED HEATING SYSTEMS
DIMENSION A - 2 • 2 ½ inches

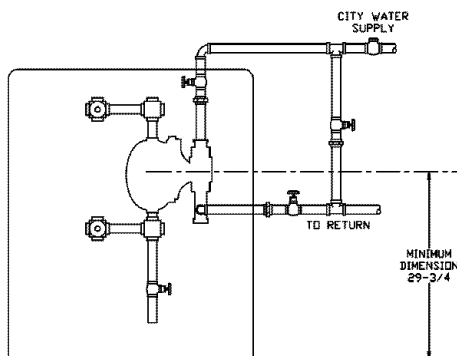
FOR PROCESS OR PARTIAL PROCESS SYSTEMS
DIMENSION A - 1 = 1 ½ inches

NOTE: For multiple installation with condensate tank and single boiler feed pump, use No. 93 on each boiler to operate motorized valve in each boiler feed line.

FIGURE 16

WATER BOILERS - SERIES W

BOILER TAPPINGS ARE AVAILABLE FOR ALL CONNECTIONS SHOWN WITH EXCEPTION OF NO. 764 WHICH MOUNTS IN PIPING



McDONNELL FEEDER CUTOFF COMBINATION

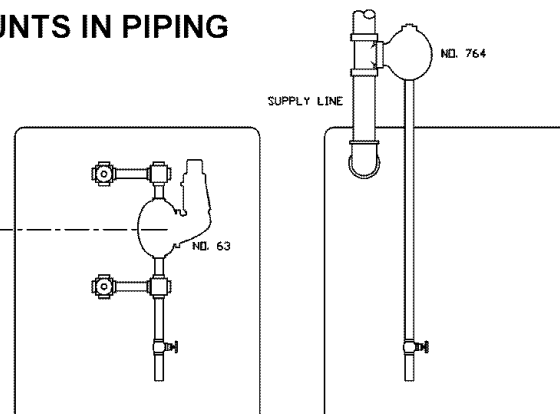
For boilers with
30-psi relief valve setting

BOILER SIZE	USE
300 THRU 1500	No. 247-2
1600 THRU 3000	No. 51-2*

For boilers with up to
75-psi relief valve setting**

BOILER SIZE	USE
ALL SIZES	No. 53-2

** Water supply pressure must exceed relief valve setting by at least 20 psi.



McDONNELL OW-WATER CUTOFF

For boilers with
75-to 100-psi relief valve setting

BOILER SIZE	USE
ALL SIZES	No. 150

For all boilers upto
50-psi relief valve setting

BOILER SIZE	USE
ALL SIZES	No. 63*
ALL SIZES	NO. 764*

*These items available through your Distributor.

FIGURE 17

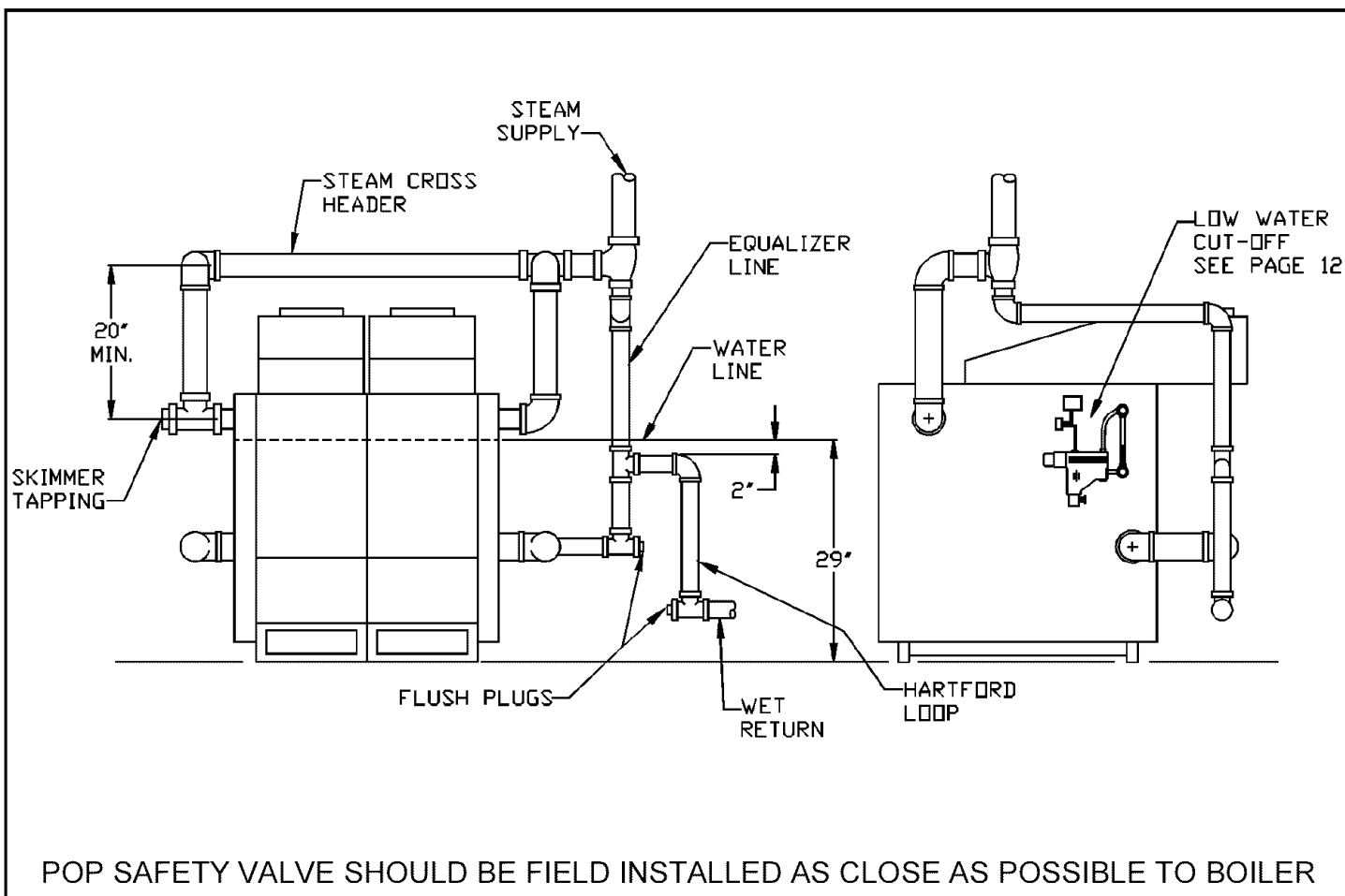


FIGURE 18

STEAM BOILER PIPING (Figure 18)

A full Steam Header is recommended on all steam systems as shown above. On Boiler Models 300, 400 and 500 the full header may be eliminated and a single steam header taken off either side of the boiler provided the system is clean and properly designed.

Risers should be a full 4" and at least 20" in height. Use skimmer tee as shown.

The area of the Main Steam Cross Header Pipe should be equal to or larger than the total area of the Steam Supply Mains leading from the Header and should never be smaller than Supply tapplings on Boiler. The Return Header should be piped to both ends of the Boiler. The area of the Return Header should be equal to the total area of the Return Mains or larger.

Steam cross headers must be piped with swing joints, or be equipped with a slip joint connector, in order to prevent expansion and contraction of steam header from damaging boiler.

Each installation has a preferred piping arrangement according to the requirements of the particular system and choice of arrangements and sizes of Headers should be decided upon by the installer's heating engineer or with standard engineering practice.

WARNING
NEVER INSTALL A SHUT-OFF OR
STEAM VALVE BETWEEN THE POP
SAFETY VALVE AND THE BOILER.

EQUALIZING LINE SIZE

MODEL NUMBERS	SIZE
300 to 900	2"
1000 to 1900	2½"
2000 to 2500	3"
2600 to 3000	4"

FLUE CONNECTION AND VENTING

Consult local codes and gas company requirements. Adhere to the following standard practice recommendations for installing the flue pipe:

1. Consult dimensional drawing for number and size of flue pipes required for each size boiler.
2. Maintain minimum upward slope of 1/4 inch per linear foot from the boiler to chimney.
3. Run flue pipe directly as possible. Keep turns to a minimum. Insert flue pipe into, but not beyond, inside wall of chimney. Do not connect into a chimney serving an open fireplace.
4. Insulate flue pipe where it passes near combustible material.
5. Rigidly support pipe with hangers and straps.
6. Extend chimneys at least 2 feet above any object within radius of 15 feet, including roof.
7. Install a hood on all flue pipes which extend through roof.

In most locations, the venting of a boiler relies on natural draft. Inasmuch as the energy available from natural draft is quite low, serious thought should be given to vent system design, i.e., adequate size, use of gradual transitions, tees, elbows, etc., close proximity of boiler and chimney. On all boilers, the vertical risers must be at least as large as the vent openings on the draft hood.

The boiler manufacturer makes no specific recommendations regarding the application of draft inducers that may be used with this boiler. If a draft inducer is used, it is up to the installing contractor and the draft inducer manufacturer to determine the proper application.

A simple vent system consists of a 6-foot minimum vertical rise immediately off the draft hood, as shown in Figure 19. Terminate this vertical flue above the building roof with a suitable rain cap at least 2 feet above surrounding obstructions, i.e., parapets, adjacent buildings, penthouses, etc. This type of vent system applies to single-draft hood boilers ONLY, and has limited practical use, because it is restricted to single-story boiler rooms and because of the problems encountered in roof flashing.

The vertical venting system shown in Figure 19 cannot be used on multiple-base boilers because of the physical interference of multiple rain caps.

For multiple-base boilers, the pant leg venting system shown in Figure 20 can be applied, if desired.

The vent system shown in Figure 21 is commonly used. With the vent diameters sized to match the flue outlets, a minimum vertical rise of 4 feet above the draft hood must be maintained for proper operation. See Page 4 for typical chimney sizes. Requirements for this type of system are: an adequately sized chimney, adequate combustion air, and the outlet end of the horizontal run must be no more than 6 feet from the chimney with no more than one 90°

elbow in this run as shown.

For installations where the required minimum 4-foot vertical rise cannot be maintained, the diameter of the horizontal run must be increased one inch for each foot of riser reduction. This procedure will reduce the resistance of the system, and if the chimney is adequate the boiler will vent properly.

In certain cases where these short rises of less than 4 feet have been used, spillage of combustion products has occurred at the draft hoods farthest from the chimney. Assuming the chimney is adequately sized, one acceptable method to correct this spillage problem is to permanently baffle the riser(s) closest to the chimney to reduce the excess of room air entering those draft hoods. **DO NOT BAFFLE ENOUGH TO CAUSE SPILLAGE.** The use of fixed baffles in the short risers above the boiler draft hood are acceptable as spelled out in American National Standard NFPA 54/ANSI Z223.1 National Fuel Gas Code, latest revision.

Fabricate these fixed baffles, using 20-gauge steel. See Figure 22. Permanently attach the baffle to the inside of the riser(s). Trial and error will dictate the degree to which each should be positioned to avoid draft hood spillage at the far end of the boiler. Be careful to avoid bending the fixed baffle so it will obstruct the flue gas flow in the horizontal collector.

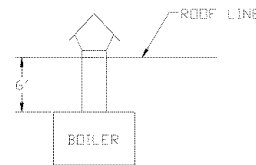


FIGURE 19

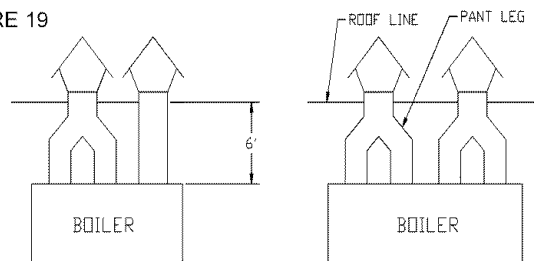


FIGURE 20

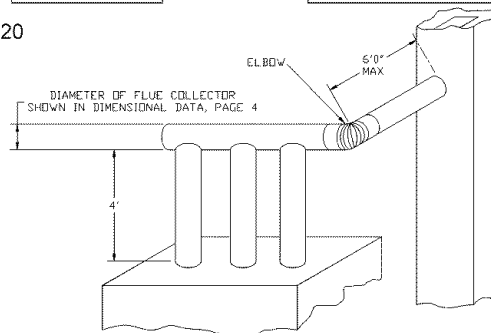


FIGURE 21

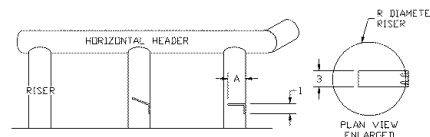


FIGURE 22

Baffle Size (Inches)

R	8	10	12
A	6	8	10

Shown is suggested size of fixed baffle for different size risers.

REMOVING EXISTING BOILER FROM COMMON VENTING SYSTEM

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

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

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
4. Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
5. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
6. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
7. Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1-latest issue. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Part 11 in the National Fuel Gas Code, ANSI Z223.1-latest issue.

ELECTRICAL WIRING

Wiring connections are to be made in accordance with the National Electrical Code, ANSI/NFPA 70-1984 and/or local authority having jurisdiction. When an external electrical source is utilized, the boiler must be electrically grounded in accordance with these requirements. Install a fused disconnect switch between boiler and electrical panel in a convenient location. The wiring from high temperature limit control should be secured to the boiler jacket or gas piping to prevent an accidental disconnect from controls.

All wiring to gas valves must be taped securely to the gas supply lines or run in an appropriate conduit.

WARNING
TURN OFF ELECTRIC POWER AT FUSE BOX BEFORE MAKING ANY LINE VOLTAGE CONNECTION. FOLLOW LOCAL ELECTRICAL CODES.

INSTALLING THERMOSTAT

The thermostat location has an important effect on the operation of the boiler system. Be sure to follow the instructions included with the thermostat. Locate the thermostat about 5 feet above the floor on an inside wall. It should be sensing average temperature, so avoid the following:

- Dead Spots: Behind Doors
Corners and Alcoves
- Hot Spots: Concealed Pipes
Fireplaces
TV Sets
Lamps
Direct Sunlight
Kitchens
- Cold Spots: Concealed Pipes or Ducts
Stairwells
Drafts
Unheated Rooms on other side of wall

Keep thermostat(s) at desired room temperature. If windows are to be opened or heat is not needed, set thermostat(s) pointer to a lower setting.

ADJUST THERMOSTAT HEAT ANTICIPATOR

Suggested heat anticipator settings are shown in the wiring diagrams (Figures 26, 27 and 28). Set accordingly Then follow instructions packaged with thermostat for the final adjustment, **checking thermostat operation**. When set above temperature indicated on the thermometer, boiler burners should ignite. Make certain the thermostat(s) turns off the boiler when room temperature reaches the selected setting and starts the boiler operating when room temperature falls a few degrees.

Finally, set the thermostat for the desired temperature. Special conditions in building and the location of the thermostat will govern this setting.

STAGE FIRING MULTIPLE BASE BOILERS

1. STEAM BOILERS

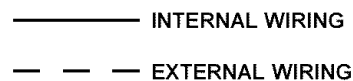
Multiple base steam boilers should not be stage fired due to fluctuations in water line between fired and unfired bases. The boiler should be all bases on or all bases off. When more precise control than a single thermostat offers is required, a weather responsive duty cycle control such as the Honeywell model ZG-54 or the Heat Timer model MPC or model EPU or a similar type of control should be used. These controls determine boiler run time based on outdoor temperature. Consult the various control manufacturers. If stage firing is required, consult the boiler manufacturer.

2. HOT WATER BOILERS

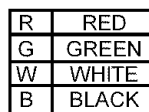
Multiple base hot water boilers are ideal for stage firing. Many controls are available for sequencing or stage firing multiple base hot water boilers. We offer a W7100J Outdoor Reset Stage Fire Control Package that will sequence up to six bases, with lead/ lag, soft start, adjustable reset ratio and setpoint, and microprocessor control. This control will fire bases as required to maintain supply water temperature at a desired set point, which is automatically varied based on outdoor air temperature. Consult the boiler manufacturer for more information.

CAUTION

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



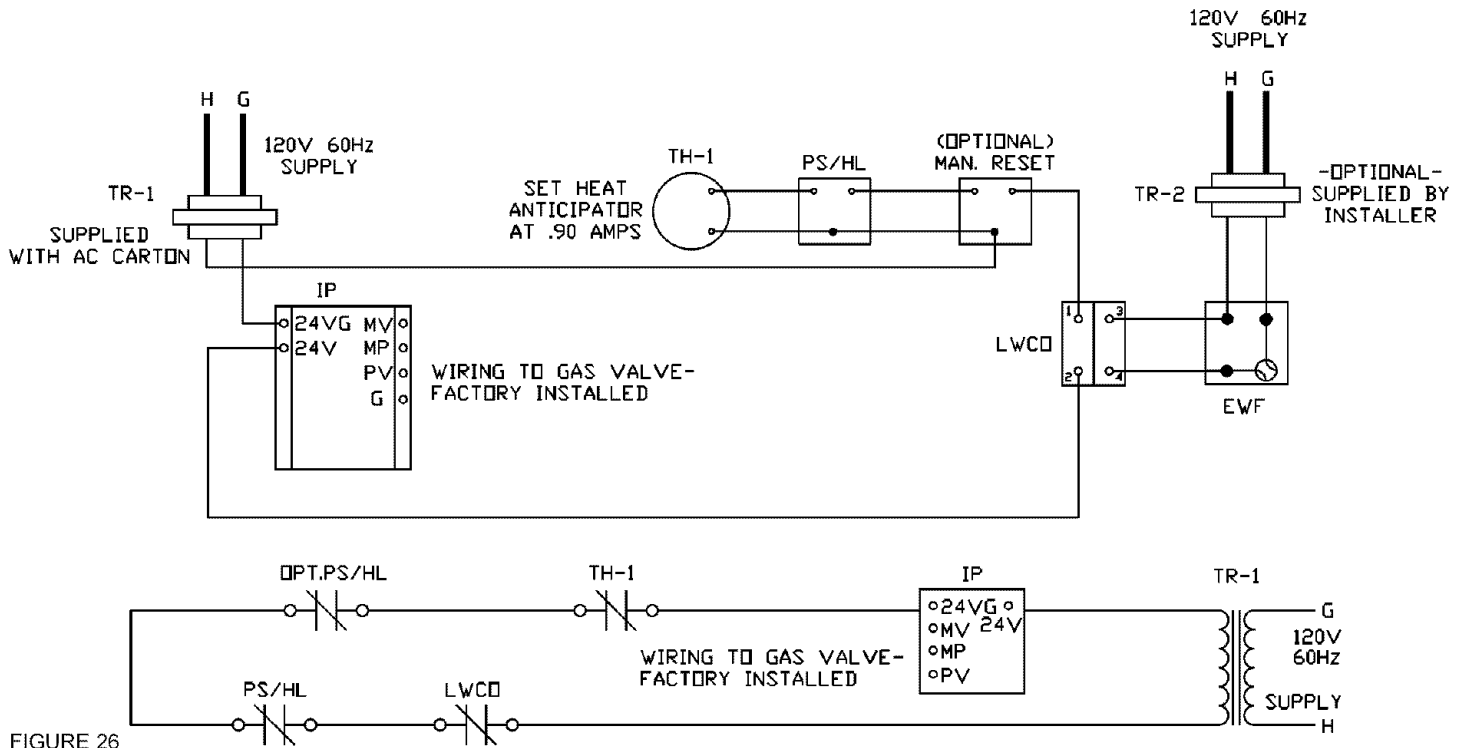
SCHEMATIC WIRING DIAGRAM FOR S8600M



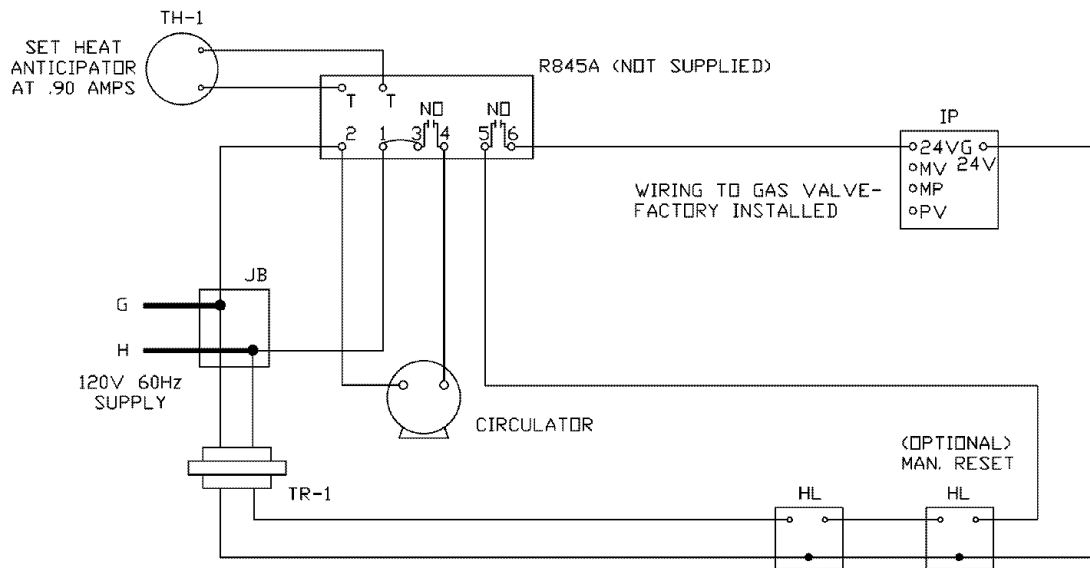
R	RED
G	GREEN
W	WHITE

18

STEAM OR HOT WATER SINGLE BASE BOILERS WITH HONEYWELL INTERMITTENT PILOT WHERE THERMOSTAT DOES NOT CONTROL CIRCULATOR PUMP



SUGGESTED WIRING FOR FORCED HOT WATER SINGLE BASE BOILER WITH HONEYWELL INTERMITTENT PILOT WHERE THERMOSTAT CONTROLS CIRCULATOR PUMP



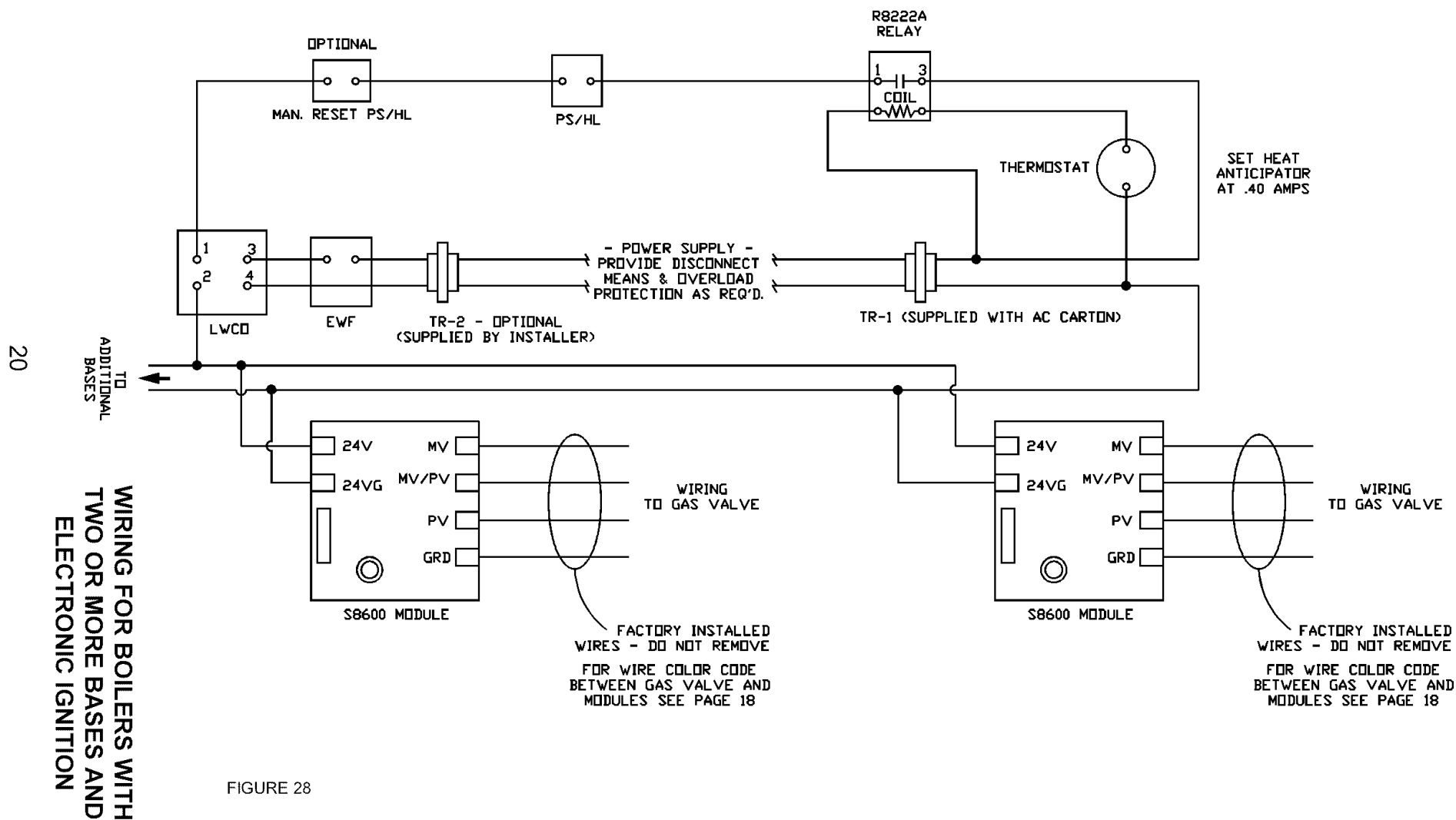
FOR WIRE COLOR CODE BETWEEN GAS VALVE AND MODULE SEE ABOVE

COMPONENT CODING

TH-1	THERMOSTAT (24 VOLT)
TR-1	TRANSFORMER (120V-24V)
TR-2	TRANSFORMER (120V-24V 50VA)
PS/HL	PRESSURE SWITCH (STEAM) HIGH LIMIT (WATER)

○	CONTROL TERMINAL
●	WIRING CONNECTION
	OPTIONAL CONTROLS
LWCO	LOW WATER CUT-OFF
EWF	ELECTRIC WATER FEEDER
IP	INTERMITTENT PILOT MODULE

SUGGESTED WIRING FOR STEAM OR HOT WATER MULTIPLE BASE BOILERS WITH HONEYWELL INTERMITTENT PILOT, WHERE THERMOSTAT DOES NOT CONTROL CIRCULATOR PUMP



OPERATION AND SERVICE

S8600 FUNCTIONS AND OPERATION

The S8600 control module performs the following basic functions:

1. Opens and closes the first (pilot) operator of the gas valve.
2. Provides a spark for igniting pilot burner.
3. Senses the pilot burner flame.
4. Shuts off the spark after pilot flame is lit.
5. Opens and closes the second (Main) operator.

These functions occur in two stages - trial for pilot ignition and main burner operation as described below.

TRIAL FOR PILOT IGNITION

On every call for heat (System start), the S8600 performs an internal safe-start check. If a flame simulating condition is present, the system will not start.

During a normal start, the S8600 opens the first (pilot) valve operator of the gas control, which allows gas to flow to the pilot burner. At the same time, the electronic spark generator in the S8600 produces a 15,000 volt spark pulse output (open circuit). This voltage produces a spark at the igniter sensor rod which ignites the pilot burner. If the pilot flame does not light or the presence of the pilot flame is not detected back through the flamerod, the S8600 will not open the second (Main) valve operator of the gas control. The S8600F will continue to try to ignite the pilot burner until either a flame is detected or the thermostat (controller) is set down below a call for heat.

MAIN BURNER OPERATION

When the pilot flame is established, a flame rectification circuit is completed to the burner ground. The S8600 flame sensing circuit detects the flame current, shuts off the spark generator and opens the second (Main) valve operator to allow gas to flow to the main burners. The pilot flame ignites the main burner conventionally.

IMPORTANT

The electronic S8600 control module cannot be repaired. If the troubleshooting procedure indicates a malfunction in the S8600, the S8600 must be replaced. Intermittent Pilot systems should be serviced only by trained, experienced service technicians.

PRELIMINARY CHECK

The following visual checks should be made before troubleshooting and after maintenance.

1. Check power switch.
2. Manual shutoff cocks in the gas line to the boiler must be open.
3. Make sure all wiring connections are clean and tight.
4. Review the S8600 normal sequence of operation.

SYSTEM TROUBLESHOOTING

Start the system by setting the thermostat or controller above room temperature and observe the system response.

Establish the type of system malfunction or deviation from normal operation by using the S8600 Intermittent Pilot System Troubleshooting Table, page 23.

Use the table by following the questions in the boxes. If the condition is true (answer is yes), go down to next box. If the condition is not true (answer is no), go to the box alongside.

Continue checking and answering conditions in each box until a problem and/or the repair is explained. Use the Component Checks section, see below, as necessary, to perform system checks.

After any maintenance or repair, the troubleshooting sequence should be repeated until the procedure ends with normal system operation.

COMPONENT CHECKS

CHECK SPARK IGNITION CIRCUIT

The Electronic module and step-up transformer in the S8600 provides spark ignition at 15,000 V (open circuit). This circuit can be checked at the S8600 module as follows:

1. Turn off manual gas cock to prevent the flow of gas.
2. Disconnect the ignition cable at the S8600 stud terminal to isolate the circuit from the pilot burner/igniter-sensor, and prepare a short jumper lead using heavily insulated wire, such as ignition wire.
3. Energize the S8600 and touch one end of the jumper firmly to the S8600 ground terminal (GND). (Do not disconnect the existing ground lead.) Move the free end slowly toward the stud terminal to establish a spark and then pull the lead wire slowly away from the stud. Note the length of the gap at which arcing discontinues.
4. An arc length of 1/8 inch (3.2 mm) or more indicates satisfactory voltage output. If no arc can be established or the maximum gap is less than 1/8 inch (3.2 mm) fuse was okay, and power to the S8600 input terminal was proved, replace the S8600.

CAUTION

DO NOT TOUCH EITHER END OF JUMPER OR STUD TERMINAL. THIS IS A VERY HIGH VOLTAGE CIRCUIT AND ELECTRICAL SHOCK CAN RESULT.

IGNITION CABLE CHECK

Cable must not run in continuous contact with a metal surface or spark voltage will be greatly reduced. Connections to the stud terminal on the S8600 and on the igniter-sensor must be clean and tight. Loose connections may not conduct a flame current even though the ignition spark is satisfactory. Check the electrical continuity of the cable.

CHECK GROUNDING

A common ground is required for the pilot burner/igniter-sensor mounting bracket, and the GND terminal of the S8600. If the ground is poor or erratic, safety shutdown may occur occasionally even though operation is normal at the time of the checkout. Therefore, if nuisance shutdowns occur, be sure to check the grounding.

STARTUP AND CHECKOUT

NOTE: If any component in the system fails, the system will not operate. If the system does not perform as outlined in Start System, below, refer to the S8600 Intermittent Pilot System Trouble-shooting Table.

START SYSTEM

1. Turn on power to the S8600(s) and turn off gas supply.
2. Check S8600(s) operation as follows:
 - a. Set the Thermostat or controller above room temperature to call for heat.
 - b. Watch for spark at the pilot burner(s).
3. Turn on gas supply.
4. Set thermostat or controller above room temperature to call for heat.
5. System should start as follows:
 - a. Spark will turn on and pilot gas valve will open at once. Pilot burner(s) should ignite after gas reaches the pilot burner(s).
 - b. Spark ignition should cut off when pilot flame is established.
 - c. Main gas valve should open and main burners should ignite after gas reaches the burner ports.

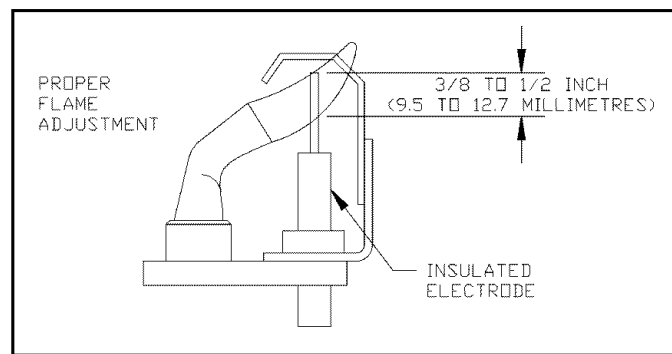
NOTE: Lightoff may not be satisfactory until the gas input and combustion air have been adjusted.

WARNING DO NOT OMIT THIS TEST

With main burners in operation, paint pipe joints, pilot tubing, connections, screws, and valve(s) gaskets with a rich soap and water solution. Bubbles indicate gas leakage. To stop leak, tighten joints and screws or replace gaskets. Never use a flame to check for gas leaks.

PILOT FLAME ADJUSTMENT

The pilot flame should envelop 3/8 to 1/2 inch of the tip of the insulated rod on the igniter-sensor. If adjustment is required, remove the pilot adjustment cover screw and turn the inner adjustment screw clockwise to decrease or counterclockwise to increase the pilot flame. Be sure to replace cover screw after adjustment to prevent possible gas leakage.



PROPER FLAME ADJUSTMENT

CHECK BURNER INPUT

Check boiler for proper BTU input rate.

CAUTION

Do not exceed the Input rate stamped on the nameplate of the boiler located on the End Jacket Panel.

Make certain primary air supply to the Main burners is properly adjusted for complete combustion.

WARNING

If boiler is shut down for service, the gas and electric must be off for 5 minutes before relighting.

To check boiler for proper BTU Input proceed as follows.

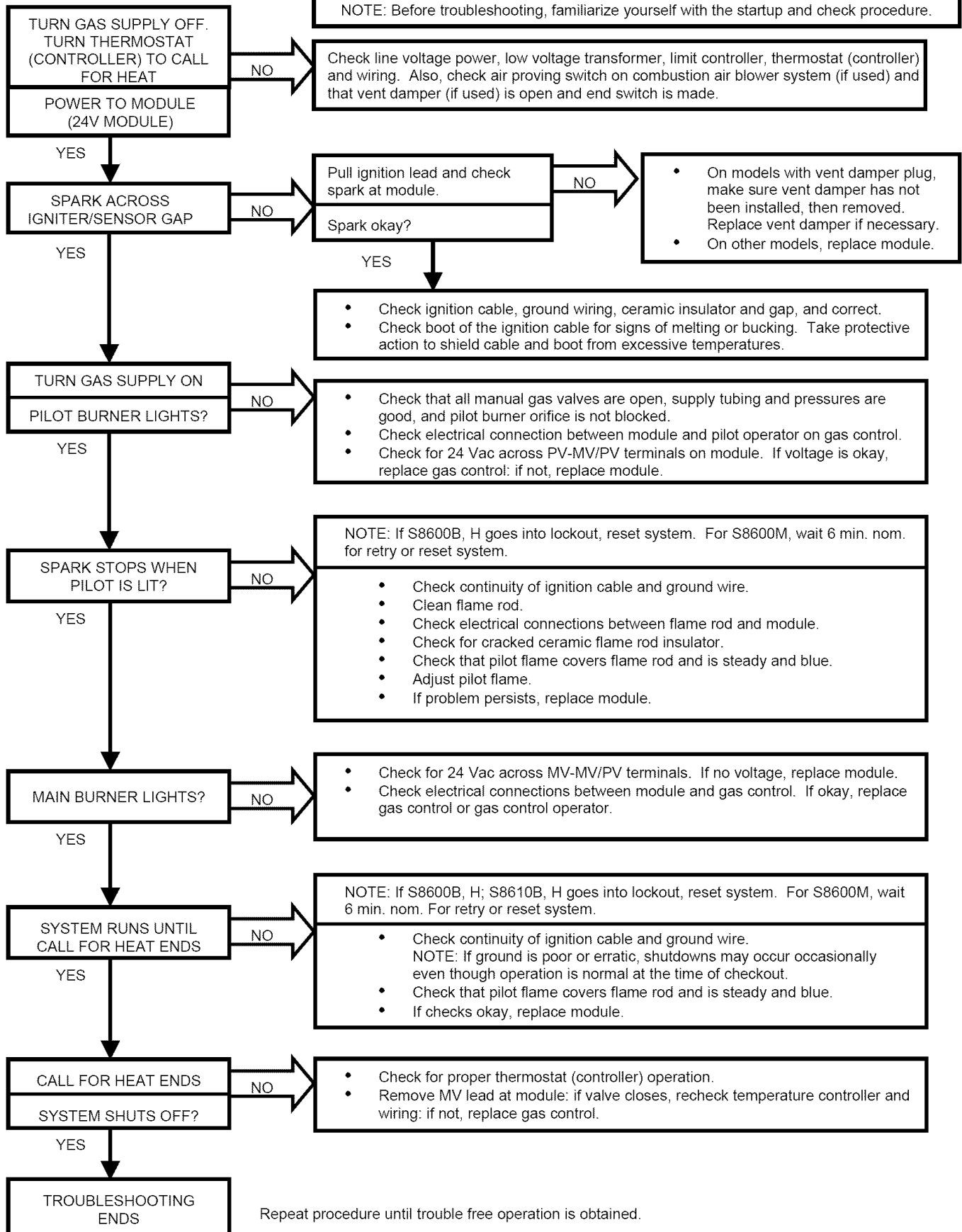
With main burners operating, measure the gas Input to the boiler by reading the meter. Be sure all other appliances connected to the same meter are shut off. Rate of gas flow (cu. ft. per hour) multiplied by the BTU value of the gas should check with the BTU Input shown on the nameplate of the boiler. If it is within 5%, adjust Pressure Regulator to obtain the desired flow (stem for adjustment is under the cap in the top of the regulator). TURN CLOCKWISE TO INCREASE INPUT AND COUNTERCLOCKWISE TO DECREASE THE INPUT RATE.

NOTE: The adjustment screw is plastic and may require slightly greater turning force than metal threads.

Be sure to replace Regulator Cap.

S8600 INTERMITTENT PILOT SYSTEM TROUBLESHOOTING TABLE

START



CHECKING AND ADJUSTING

HIGH LIMIT CONTROL

While the boiler is operating, set the high limit control below boiler water temperature and the main burners should shut off. Return the control to the normal setting and the main burners should start again.

PRESSURE LIMIT CONTROL

While the boiler is operating, set the pressure limit control below the pressure in boiler and the main burners should shut off. Return the control to the normal setting and the main burner should start again.

LOW WATER CUT-OFF

The Low Water Cut-Off will interrupt the electrical current to the burners when the water line in the boiler drops to a low level. It is very important to keep the float chamber free from sediment, a condition essential to dependability. To keep any accumulation from interfering with float action is to "BLOW DOWN" or flush out the control regularly. Do it while the boiler is in operation. First note water level in gauge glass. Open blow-off valve at bottom of control-, water will pour out, flushing away sediment. Drain until water is clear, about a pail, then close valve. If water level in gauge glass has dropped, add water to boiler to restore level.

NOTE: Opening blow-off valve checks cut-off operation too. As float drops with falling water level, burners will shut off. After valve is closed and normal operating conditions are restored, burners will resume firing.

SPECIAL FLUSHING INSTRUCTIONS

For new boilers installed in old systems. The installation of a new boiler in an old system may break loose a heavy accumulation of sediment and scale from old piping and radiators. It is extremely important to blow down the low water cut-off more frequently the first week.

FIRST WEEK - 2 or 3 times

THEREAFTER - At least once a week

PRESSURE RELIEF VALVE

You must have a pressure relief valve on the boiler. Steam and water expand as they are heated. If there is no place for the steam or water to expand into, pressure will build up inside the boiler and system. Should this happen, the pressure relief valve will relieve the strain on the boiler and system by automatically opening at a predetermined pressure. (The Pop Safety Valve on steam boilers is set at 15 psig and the Relief Valve on water boilers is set at 30 psig, 50 psig optional.) Run a pipe from the pressure relief valve outlet to an open drain. This pipe must be of same size as outlet on valve and open end must not be threaded. This drain must be run in an area not subject to freezing. Failure to do so may cause water damage or injury should valve release.

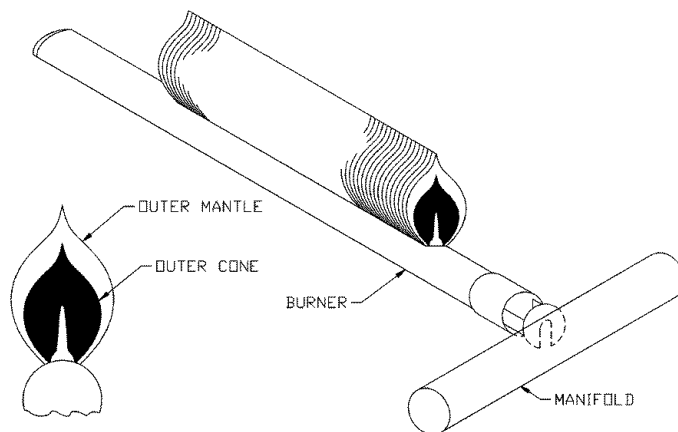
If valve discharge occurs, or if valve fails to open as described above, contact an authorized contractor or

qualified service technician to replace the relief valve and inspect the heating system to determine the cause, as this may indicate an equipment malfunction.

This valve should be tested every month during periods of boiler operation, and at the beginning and end of any extended non-service period. Prior to testing, make certain discharge pipe is properly connected to valve outlet and arranged so as to contain and safely dispose of boiler discharge. Test at normal system operating pressure. Hold the trip lever fully open for at least five seconds in order to flush free any sediment that may lodge on the valve seat. Then permit the valve to snap shut.

BURNER AND PILOT FLAME

We recommend that you make a periodic visual check of the burners and pilot flame (see page 22). During this visual check look for any deterioration from corrosion or other sources of the burners, pilot burners and boiler base frame. Also be sure the boiler base interior and exterior are clean. This visual check should be made once every month during the heating season by the owner and once a year by a competent Service Technician to assure safe and trouble-free operation.



BOILER FLUE PASSAGES

Under normal operating conditions, with the burners adjusted properly, it should not be necessary to clean the boiler flue gas passages. However, to assure trouble-free operation, we recommend that you have the flue passages, burner adjustments and operation of the boiler controls checked once each year by a competent Service Technician. If it becomes necessary to clean flue passages, first remove the burners and pilot(s) from the boiler. Next refer to page 9 of these instructions and remove the cleanout cover panel on the Draft Hood. This will expose the flue passages. Clean flue passageways between the sections with flexible handle wire brush. Remove all dirt from bottom of boiler and reassemble all parts. Be sure to check tightness of pilot connection(s) and adjustment of pilot(s) and burner flames after reassembly.

VENTING SYSTEM

The vent system is a very important part of the heating system. No boiler, however efficient its design, can perform satisfactorily if the chimney that serves it is inadequate. Check your chimney to make sure that it is the right size, properly constructed, clean and in good condition to ensure proper combustion and THAT NO HAZARD WILL DEVELOP. You must also provide enough FRESH AIR FOR COMBUSTION. LACK OF ENOUGH OXYGEN WILL CREATE A HAZARD. If your building is of tight construction, it may be necessary to add a FRESH AIR DUCT to provide the OXYGEN required (see page 6).

AT LEAST ONCE A MONTH DURING HEATING SEASON check to see that the sections of vent pipe are secure at all

CLEANING THE NEW STEAM BOILER

New steam boilers must be cleaned previous to or during the first few days of use in order to ensure efficient operation. The grease or oil used to lubricate the cutting tools or push nipples during the erection of new piping systems picks up sand and dirt causing a scum of fine particles and grease to accumulate on the surface of the water in all new boilers. The heavier particles carried in the grease may settle to the bottom of the boiler and form sludge. This condition, if permitted to remain in the boiler, tends to prevent the generation of steam, produces foaming and causes an unsteady water line. This unavoidable accumulation of oil and grease should be removed by blowing off the boiler as follows:

1. Install a surface blow-off connection of at least 1 1/4' nominal pipe size in boiler using the Skimming Tee shown on page 15. The blow-off line should extend to within 18" of the floor or to the sewer.
 - a. Insert a valve in the line close to the boiler.
2. Bring the water line to the center of the outlet.
 - a. Raise the temperature to a point just below steaming.

joints and fittings. There should be at least two (2) sheet metal screws per joint.

Check to see that the vent pipe slopes at least 1/4" per foot up from the boiler to the chimney. The vent pipe should be securely fastened to prevent sagging.

The Vent Pipe should also be checked for any deterioration from corrosion or any other sources. See venting instructions on page 16.

- b. While the burners are on, open the valve in the skim line and then slowly feed clean water into the boiler adjusting the inlet water so that the boiler water remains hot.
 - c. Continue skimming until the water is clean.
3. Close valves in boiler feed line and skim line.
4. Bring the pressure in the boiler to about 10 lbs.
 - a. Turn off the burners.
 - b. Open the bottom drain valve permitting all the water to drain from boiler.
5. After the boiler has cooled-, fill and flush out several times.
6. Fill to proper water level and ready for normal service.

NOTE: Use of soda or any alkali, vinegar or any acid is not recommended for cleaning heating boilers because it is difficult to completely remove them and injury may occur after the cleaning process has been completed.

BOILER WATER TREATMENT

In closed hot water heating systems, negligible amounts of make up water are used, and water treatment is not required.

In steam systems where the system is tight, free from leaks, and all the steam is returned to the boiler as condensate, the amount of make up water is small. Again, water treatment is not required.

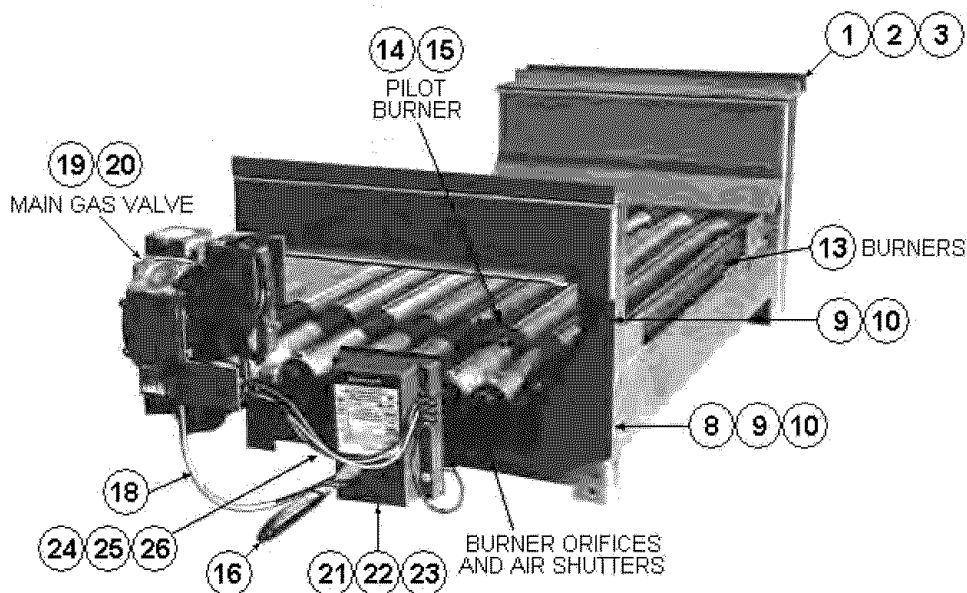
On steam systems with less than 90% of the steam being returned as condensate, or with very hard or corrosive make up water, treatment may be desirable. Follow the recommendations of the ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VI, latest version.

BETWEEN HEATING SEASONS

Boilers should not be drained between heating seasons. Boilers in closed hot water heating systems may be left as is. Steam boilers should be entirely filled with water during the summer months to exclude air.

COMPLETE BOILER MATERIAL LIST

MODEL	SECTIONS			COMPONENT CART.			WATER TRIM CARTON	STEAM TRIM CARTON	AC CARTON	JACKET END PANEL CARTON	BASE END PANEL CARTON
	L	INNER	R	QTY. 300	QTY. 400	QTY. 500					
300	1	2	1	1			WA-1	SA-1	300	1	1
400	1	3	1		1		WA-1	SA-1	400	1	1
500	1	4	1			1	WA-1	SA-1	500	1	1
600	1	5	1	2			WA-1	SA-2	600	1	1
700	1	6	1	1	1		WA-2	SA-2	700	1	1
800	1	7	1		2		WA-2	SA-3	800	1	1
900	1	8	1		1	1	WA-2	SA-3	900	1	1
1000	1	9	1			2	WA-2	SA-3	1000	1	1
1100	1	10	1	1	2		WA-2	SA-3	1100	1	1
1200	1	11	1		3		WA-3	SA-3	1200	1	1
1300	1	12	1	1		2	WA-3	SA-3	1300	1	1
1400	1	13	1		1	2	WA-3	SA-3	1400	1	1
1500	1	14	1			3	WA-3	SA-4	1500	1	1
1600	1	15	1		4		WA-3	SA-4	1600	1	1
1700	1	16	1	1	1	2	WA-4	SA-4	1700	1	1
1800	1	17	1		2	2	WA-4	SA-4	1800	1	1
1900	1	18	1		1	3	WA-4	SA-4	1900	1	1
2000	1	19	1			4	WA-4	SA-4	2000	1	1
2100	1	20	1	2		3	WA-4	SA-4	2100	1	1
2200	1	21	1		3	2	WA-4	SA-4	2200	1	1
2300	1	22	1		2	3	WA-4	SA-4	2300	1	1
2400	1	23	1		1	4	WA-4	SA-5	2400	1	1
2500	1	24	1			5	WA-4	SA-5	2500	1	1
2600	1	25	1	2		4	WA-4	SA-5	2600	1	1
2700	1	26	1	1	1	4	WA-5	SA-5	2700	1	1
2800	1	27	1		2	4	WA-5	SA-5	2800	1	1
2900	1	28	1		1	5	WA-5	SA-5	2900	1	1
3000	1	29	1			6	WA-5	SA-5	3000	1	1



ELECTRONIC IGNITION BASE MATERIAL LIST

	PARTS DESCRIPTION	STOCK NO.	UNIT	QUANTITY		
				300	400	500
1	300 Base	425-57-123	Ea.	1		
2	400 Base	425-57-124	Ea.		1	
3	500 Base	425-57-125	Ea.			1
4†	300 Fire Door	425-57-133	Ea.	1		
5†	400 Fire Door	425-57-134	Ea.		1	
6†	500 Fire Door	425-57-135	Ea.			1
7†	Orifice 30	146-15-310	Ea.	6	8	10
8	300 Manifold	146-16-303	Ea.	1		
9	400 Manifold	146-16-304	Ea.		1	
10	500 Manifold	146-16-305	Ea.			1
11	5/16" - 18 x 3/4" Hex Head Machine Crew - ZP	146-95-302	Ea.	4	4	4
12	5/16" - 18 Nuts - ZP	146-95-013	Ea.	4	4	4
13	Main Burner	146-15-302	Ea.	5	7	9
14	Main Burner with Pilot Bracket	146-15-301	Ea.	1	1	1
15	Q348A1275 Electronic Pilot Burner	146-62-301	Ea.	1	1	1
†	Pilot Mounting Bracket	425-57-029	Ea.	1	1	1
16	#394800-25 Ignition Cable x 25" x Long	146-62-074	Ea.	1	1	1
17A†	#10-32 x 3/16" Hex Head Screw	146-95-301	Ea.	2	2	2
17B†	#6-32 x 5/16" Hex Head Screw	146-95-311	Ea.	2	2	2
18	1/8" OD Aluminum Tubing x 24" Long	146-15-005	Ea.	1	1	1
19	3/4" 90° Street Elbow Black	146-93-040	Ea.	1	1	1
20A	7000 DERHC 3/4" H.C. Electronic Gas Valve	146-63-001	Ea.			1
20B	VR8304M 3/4" x 3/4" Electronic Gas Valve	146-62-315	Ea.		1	
20C	VR8304M 1/2" x 3/4" Electronic Gas Valve	146-62-058	Ea.	1		
21A	S8600M-1000 Intermittent Pilot Module	146-62-071	Ea.	1	1	1
21B	S8600H-1014 Intermittent Pilot Module	146-62-304	Ea.	Optional		
22	#10-32 x 1/2" Machine Screw	146-95-307	Ea.	2	2	2
23	#10-32 Hex Nut	146-95-308	Ea.	2	2	2
24A	Wiring Harness 14" Long	433-00-942	Ea.	1	1	
24B	Wiring Harness 14" Long	433-00-949	Ea.			1
25	Ground Wire 4" Long	433-00-938	Ea.			1
26	Cable Tie 3.7/8" Long	146-91-002	Ea.	1	1	1

† Not Shown

AC-CARTON

	PARTS DESCRIPTION	STOCK No.	UNIT	BOILER MODEL NUMBERS AND QUANTITIES																											
				300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900	3000
1	AC Carton	--	Ea.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
2	4" Push Nipples	433-00-977	Ea.	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
3	5/8" -11NC x 7 Stud	146-95-304	Ea.	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50	52	54	56	58	60
4	5/8" -11NC Hex Nut	146-95-305	Ea.	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120
5	5/8" Flatwasher	146-95-306	Ea.	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120
6	Furnace Cement - Pint	146-91-025	Ea.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4	4	4	4	4
7	FB-1 Fitting Bag	412-00-051	Ea.	1	1	1																									
8	FB-2 Fitting Bag	412-00-052	Ea.				1	1	1	1	1																				
9	FB-3 Fitting Bag	412-00-053	Ea.									1	1	1	1	1															
10	FB-4 Fitting Bag	412-00-054	Ea.														1	1	1	1	1										
11	FB-5 Fitting Bag	412-00-055	Ea.																		1	1	1	1	1						
12	FB-6 Fitting Bag	412-00-056	Ea.																								1	1	1	1	1
13	Main Rating Plate	146-80-901	Ea.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	12" x 9" Plastic Bag	146-84-012	Ea.	1	1	1	1	2	2	2	2	3	3	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5	5	5	5
15	Warning Label	146-80-108	Ea.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	User's Information Manual	19817	Ea.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	Installation Instructions	146-83-004	Ea.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	Top Support Bkt.	425-57-037	Ea.				1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5
19	3/4" Drain Valve	146-22-001	Ea.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	AT87A-1007 Transformer	146-62-305	Ea.	1	1	1	1	1	1	1	1																				
21	AT88A-1005 Transformer	146-62-306	Ea.									1	1	1	1	1															
22	AT92A-1007 Transformer	146-62-307	Ea.														1	1	1	1	1										
23	AT92C-1005 Transformer	146-62-308	Ea.																			1	1	1	1	1	1	1	1	1	1
24	R8222A-1002 Relay	146-62-309	Ea.				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25	129384A Case & Cover	146-62-310	Ea.				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
26	Nipple Paste (4 oz.)	146-91-302	Ea.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27	High Gas Pressure Switch	146-62-314	Ea.																								1	1	1	1	1
28	1" Sq. Head Plugs	146-93-055	Ea.	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

STEAM TRIM CARTON MATERIAL LIST

	PARTS DESCRIPTION	STOCK NO.	UNIT	CARTON NO.				
				SA-1	SA-2	SA-3	SA-4	SA-5
1	67D-1 McDonnell & Miller LWCO	146-26-042	Ea.	1	1	1	1	1
2	PA404-A-1009 Pressuretrol	146-62-015	Ea.	1	1	1	1	1
3	#20-104 Water Gauge Set	146-22-010	Ea.	1	1	1	1	1
4	5/8" x 7.3/4" Glass Only for Item #3	---	Ea.	1	1	1	1	1
5	3/16" x 10" Lg. Rods for Item #3	---	Ea.	2	2	2	2	2
6	2.1/2" Round Steam Gauge	146-23-005	Ea.	1	1	1	1	1
7	3/4" x 3/4" Pop Safety Valve	146-22-002	Ea.	1				
8	1" x 1" Pop Safety Valve	146-22-302	Ea.	1				
9	1.1/4" x 1.1/2" Pop Safety Valve	146-22-303	Ea.			1		
10	1.1/2" x 2" Pop Safety Valve	146-22-304	Ea.				1	
11	2" x 2" Pop Safety Valve	146-22-305	Ea.					1
12	1/4" Brass Syphon Loop	146-43-005	Ea.	1	1	1	1	1
13	1/4" Brass Tee	146-93-057	Ea.	1	1	1	1	1
14	1/4" x 2" Brass TBE Nipple	146-07-054	Ea.	1	1	1	1	1
15	Steam Trim Carton for Items 1 to 14	---	Ea.	1	1	1	1	1

Refer to page 26 for steam carton size required for your boiler

WATER TRIM CARTON MATERIAL LIST

ITEM	PARTS DESCRIPTION	STOCK No.	UNIT	CARTON NO.				
				SA-1	SA-2	SA-3	SA-4	SA-5
1	L4006A1017 Aquastat w/Well	146-62-136	Ea.	1	1	1	1	1
2	Water Temperature/Pressure Gauge	146-23-003	Ea.	1	1	1	1	1
3	1/2" x 1/4" Bushing	146-93-002	Ea.	1	1	1	1	1
4	3/4" x 3/4" Relief Valve	146-22-011	Ea.	1				
5	3/4" x 1" Relief Valve	146-22-311	Ea.		1			
6	1" x 1.1/4" Relief Valve	146-22-312	Ea.			1		
7	1.1/4" x 1.1/2" Relief Valve	146-22-313	Ea.				1	
8	1.1/2" x 2" Relief Valve	146-22-314	Ea.					1
9	Water Trim Carton for Items 1 to 8	---	Ea.	1	1	1	1	1

Refer to page 26 for water carton size required for your boiler

COMPONENT CARTON MATERIAL LIST

ITEM	PARTS DESCRIPTION	STOCK No.	UNIT	MODEL		
				300	400	500
1	Component Carton	---	Ea.	1	1	1
2	300 Base Assembly	412-00-103	Ea.	1		
3	400 Base Assembly	412-00-104	Ea.		1	
4	500 Base Assembly	412-00-105	Ea.			1
5	300 Inter. Jacket Car.	425-57-103	Ea.	1		
6	400 Inter. Jacket Car.	425-57-104	Ea.		1	
7	500 Inter. Jacket Car.	425-57-105	Ea.			1
8	300 Draft Hood	425-57-113	Ea.	1		
9	400 Draft Hood	425-57-114	Ea.		1	
10	500 Draft Hood	425-57-115	Ea.			1

BOILER SECTIONS MATERIALS LIST

ITEM	PARTS DESCRIPTION	STOCK No.	UNIT
1	Left End Section	411-54-051	Ea.
2	Right End Section	411-54-050	Ea.
3	Intermediate Section	411-54-052	Ea.

JACKET END PANEL

Carton - Stock No. 425-57-118

ITEM	PARTS DESCRIPTION	STOCK	UNIT
		No.	
1	Left End Jacket Panel	425-57-073	Ea.
2	Right End Jacket Panel	425-57-074	Ea.

BASE END PANEL

Carton - Stock No. 425-57-119

ITEM	PARTS DESCRIPTION	STOCK No.	UNIT
1	Left Base End Panel	425-57-100	Ea.
2	Right Base End Panel	425-57-101	Ea.

FITTING BAGS (MATERIAL REQUIRED)

MATERIAL DESCRIPTION	STOCK	FB-1	FB-2	FB-3	FB-4	FB-5	FB-6
# 10 x 1/2" Self Tap Screws	146-95-074	10	14	18	22	26	30
#8 x 3/4" Self Tap Screws	146-95-003	2	2	2	2	2	2
# 10-32 x 1/2" Slot Head Screws	146-95-307	none	2	4	6	8	10
# 10-32 Hex Nuts	146-95-308	none	2	4	6	8	10
5/16" - 18NC 3/4" Hex Head Bolts	146-95-302	8	12	16	20	24	28
5/16" - 18NC Hex Nuts	146-95-013	8	12	16	20	24	28
1/4" - 20NC x 1.1/2" J Bolts	146-95-303	1	2	3	4	5	6
1/4" - 20NC Hex Nuts	146-95-041	1	2	3	4	5	6
5" x 8" Plastic Bag	146-91-301	1	1	1	1	1	1
Jacket Door Knobs	137-02-153	2	4	6	8	10	12
Knob Screws	137-04-005	2	4	6	8	10	12

BOILER MODEL	FITTING BAG REQ'D.
300 400 500	FB-1 Assembly

BOILER MODEL	FITTING BAG REQ'D.
600 700 800 900 1000	FB-2 Assembly

BOILER MODEL	FITTING BAG REQ'D.
1100 1200 1300 1400 1500	FB-3 Assembly

BOILER MODEL	FITTING BAG REQ'D.
1600 1700 1800 1900 2000	FB-4 Assembly

BOILER MODEL	FITTING BAG REQ'D.
2100 2200 2300 2400 2500	FB-5 Assembly

BOILER MODEL	FITTING BAG REQ'D.
2600 2700 2800 2900 3000	FB-6 Assembly

WATER & STEAM TRIM KITS

<u>MATERIAL DESCRIPTION</u>	<u>STOCK NUMBER</u>
WATER TRIM WA-1	41200071
WATER TRIM WA-2	41200072
WATER TRIM WA-3	41200073
WATER TRIM WA-4	41200074
WATER TRIM WA-5	41200075

