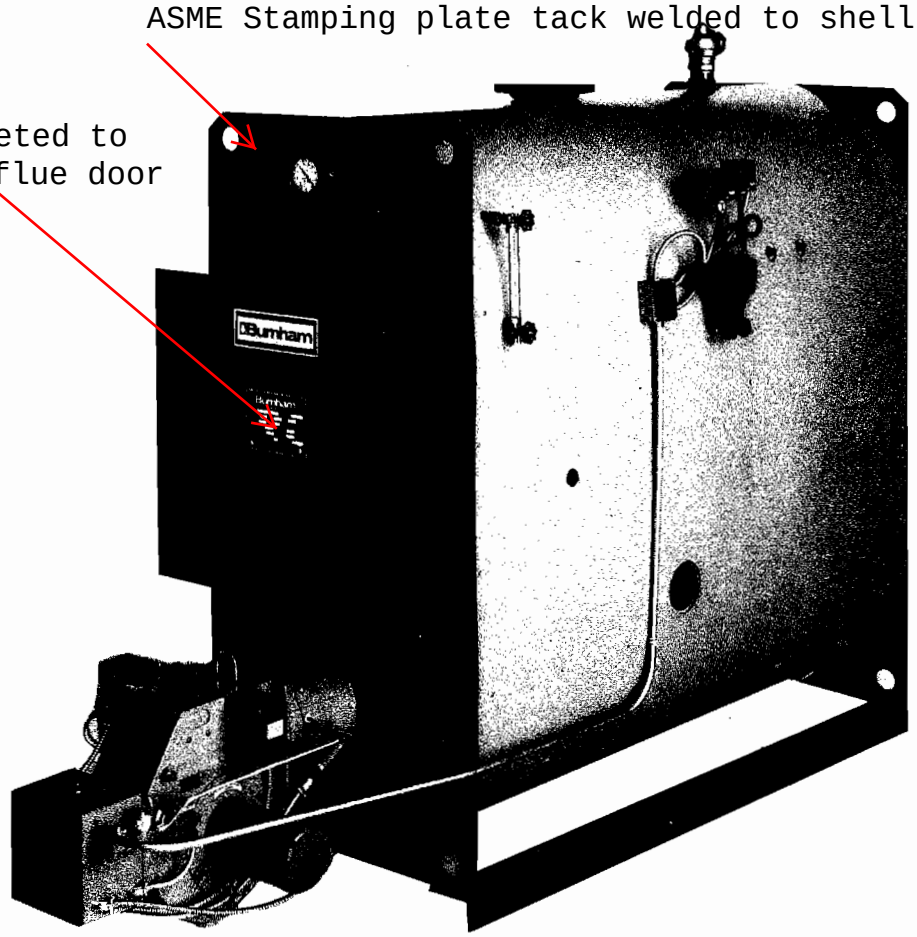
INSTALLATION AND OPERATING INSTRUCTIONS FOR SERIES "E" THREE PASS FIRETUBE GENERATOR

FORCED DRAFT FOR LIGHT OIL, GAS/LIGHT OIL, OR GAS

HOT WATER OR STEAM

7 SIZES:
GROSS OUTPUT —
684,000 to 2,821,000 BTU/HR



For service and repairs to the heating plant, call your Heating Contractor. When seeking information on the boiler, provide series and size designation shown on rating plate.

Boiler Number _____ Type Firing _____ Type System _____

Heating Contractor _____

Address _____ Phone No. _____

Burnham®
COMMERCIAL STEEL BOILERS
Burnham Corporation
Phone: (717) 293-5846
FAX: (717) 293-5877
P.O. Box 3079
Lancaster, PA 17604

Part No. 8145105R2-7/97

IMPORTANT INFORMATION

BURNER/BOILER SYSTEM, AS USED THROUGHOUT THIS MANUAL, SHALL MEAN ALL MECHANICAL AND/OR ELECTRICAL EQUIPMENT INCLUDING THE BOILER, BURNER, PUMPS, COMPRESSORS, FEED WATER SYSTEMS, DEAERATOR SYSTEMS AND ALL ASSOCIATED PIPING, ELECTRICAL AND CONTROL SYSTEMS USED AND MAINTAINED IN THE BOILER ROOM.

THE FOLLOWING DEFINED TERMS ARE USED THROUGHOUT THIS MANUAL TO BRING ATTENTION TO THE PRESENCE OF HAZARDS OF VARIOUS RISK LEVELS OR TO NOTE IMPORTANT INFORMATION CONCERNING THE OPERATING LIFE OF THE PRODUCT.

DANGER

INDICATES PRESENCE OF A HAZARD WHICH WILL CAUSE SEVERE PERSONAL INJURY, DEATH OR SUBSTANTIAL PROPERTY DAMAGE IF IGNORED.

WARNING

INDICATES PRESENCE OF A HAZARD WHICH CAN CAUSE SEVERE PERSONAL INJURY, DEATH OR SUBSTANTIAL PROPERTY DAMAGE IF IGNORED.

CAUTION

INDICATES PRESENCE OF A HAZARD WHICH WILL OR CAN CAUSE MINOR PERSONAL INJURY OR PROPERTY DAMAGE IF IGNORED.

NOTICE

INDICATES SPECIAL INSTRUCTIONS ON INSTALLATION, OPERATION OR MAINTENANCE WHICH ARE IMPORTANT BUT NOT NECESSARILY RELATED TO PERSONAL INJURY HAZARDS.

DANGER

1. IF YOU SMELL GAS OR FUEL OIL VAPORS, DO NOT TRY TO OPERATE THE BURNER/BOILER SYSTEM. DO NOT TOUCH ANY ELECTRICAL SWITCH OR USE ANY PHONE IN THE BUILDING. IMMEDIATELY CALL THE GAS OR OIL SUPPLIER FROM A REMOTELY LOCATED PHONE. FOLLOW THE GAS OR OIL SUPPLIER'S INSTRUCTIONS OR IF THE SUPPLIER IS UNAVAILABLE, CONTACT THE FIRE DEPARTMENT.

2. BURNER/BOILER SYSTEMS PRODUCE STEAM OR HOT WATER IN A PRESSURIZED VESSEL BY MIXING EXTREMELY FLAMMABLE GASEOUS, LIQUID OR SOLID FUELS WITH AIR TO PRODUCE COMBUSTION AND VERY HOT PRODUCTS OF COMBUSTION. EXPLOSIONS, FIRES, SEVERE PERSONAL INJURY, DEATH AND/OR PROPERTY DAMAGE WILL RESULT FROM IMPROPER, CARELESS OR INADEQUATE INSTALLATION, OPERATION OR MAINTENANCE OF FUEL BURNING AND BOILER EQUIPMENT.

3. INSULATE ALL STEAM AND HOT WATER PIPING, FITTINGS AND CONNECTIONS AND ALL OTHER HOT COMPONENTS AND EQUIPMENT FROM PERSONNEL CONTACT.

4. ASSURE ALL PIPES, FITTINGS, ELECTRICAL CONTROLS AND ALL OTHER ASSOCIATED BURNER/BOILER EQUIPMENT IS OF PROPER DESIGN AND CONSTRUCTION FOR THE INTENDED USE AND PROVIDES ADEQUATE PROTECTION FROM ELECTRICAL SHOCK AND HARMFUL PHYSICAL CONTACT TO PERSONNEL.

5. A LEAK TIGHT FUEL DELIVERY CONDUIT AND CONTROL SYSTEM MUST BE MAINTAINED AT ALL TIMES.

6. PRODUCTS OF COMBUSTION MUST BE TRANSPORTED FROM THE BOILER/BURNER SYSTEM TO THE OUTDOORS IN AN APPROVED, LEAK TIGHT, INSULATED VENTING SYSTEM. THE BOILER ROOM MUST BE POSITIVELY VENTILATED TO PREVENT A CONCENTRATION OF PRODUCTS OF COMBUSTION AND A REDUCTION IN THE AMOUNT OF OXYGEN IN THE AIR.

7. BURNER/BOILER MATERIALS OF CONSTRUCTION, PRODUCTS OF COMBUSTION AND FUELS CONTAIN ALUMINA, SILICA, HEAVY METALS, CARBON MONOXIDE, NITROGEN OXIDES, ALDEHYDES, CARBON DIOXIDE, PARTICULATES AND/OR OTHER TOXIC OR HARMFUL SUBSTANCES WHICH CAN CAUSE DEATH OR SERIOUS ILLNESS AND WHICH ARE KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER, BIRTH DEFECTS AND OTHER REPRODUCTIVE HARM. ALWAYS USE PROPER SAFETY CLOTHING, RESPIRATORS AND EQUIPMENT WHEN SERVICING OR WORKING NEARBY THE EQUIPMENT.

WARNING

1. THE EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH REGULATIONS IN FORCE IN THE AREA WHERE THE INSTALLATION IS TO BE MADE. THESE REGULATIONS SHALL BE CAREFULLY FOLLOWED IN ALL CASES. AUTHORITIES HAVING JURISDICTION SHALL BE CONSULTED BEFORE INSTALLATIONS ARE MADE. ALL BOILER INSTALLATIONS IN THE USA SHOULD COMPLY WITH THE CURRENT EDITION OF THE FOLLOWING STANDARDS:

A. AMERICAN NATIONAL STANDARD ANSI/NFPA 31, "INSTALLATION OF OIL BURNING EQUIPMENT".

B. AMERICAN NATIONAL STANDARD ANSI/NFPA 211, "CHIMNEYS, FIREPLACES, VENTS, AND SOLID FUEL BURNING APPLIANCES".

C. AMERICAN SOCIETY OF MECHANICAL ENGINEERS ASME CSD-1, "CONTROLS AND SAFETY DEVICES FOR AUTOMATICALLY FIRED BOILERS".

2. ALL WIRING ON BOILERS INSTALLED IN THE USA SHALL BE MADE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE AND/OR LOCAL REGULATIONS.

3. INSTALLATION, START-UP, OPERATION AND/OR MAINTENANCE (SERVICE) OF THIS BURNER/BOILER SYSTEM MUST BE UNDERTAKEN ONLY BY TRAINED AND SKILLED PERSONNEL.

4. FAILURE TO FOLLOW ALL INSTRUCTIONS IN THE PROPER ORDER CAN CAUSE PERSONAL INJURY OR DEATH. READ ALL INSTRUCTIONS, INCLUDING ALL THOSE IN OTHER BOILER/BURNER SYSTEM MANUALS WHICH WERE PROVIDED WITH THE EQUIPMENT BEFORE INSTALLING, OPERATING OR SERVICING.

5. KEEP BOILER AREA CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS.

6. PROVIDE POSITIVE ASSURANCE THAT ADEQUATE COMBUSTION AND VENTILATION AIR IS PROVIDED FROM THE OUTDOORS TO THE BURNER/BOILER SYSTEM AND THE BOILER ROOM.

7. DO NOT PLACE ANY OBSTRUCTIONS IN THE BOILER ROOM THAT WILL HINDER THE FLOW OF COMBUSTION AND VENTILATING AIR.

8. CAREFULLY READ THIS AND ALL OTHER MANUALS AND INSTRUCTIONS PROVIDED BEFORE PROCEEDING WITH THE INSTALLATION OR SERVICE OF THE BURNER/BOILER SYSTEM. POST ALL INSTRUCTIONS AND MANUALS NEAR THE BOILER FOR REFERENCE BY SERVICE PERSONNEL.

9. REFER TO BURNER MANUFACTURER'S INSTALLATION MANUAL PROVIDED FOR PROPER VENTING OF THE GAS TRAIN COMPONENTS THAT REQUIRE ATMOSPHERIC AIR PRESSURE TO BALANCE A DIAPHRAGM.

10. HIGH WATER TEMPERATURES INCREASE THE RISK OF BURNS OR SCALDING INJURY. INSTALL AN AUTOMATIC MIXING VALVE AT THE TANKLESS HEATER OUTLET TO AVOID EXCESSIVELY HOT WATER AT THE FIXTURES.

11. ALL COVER PLATES, ENCLOSURES AND GUARDS MUST BE IN PLACE AT ALL TIMES, EXCEPT DURING MAINTENANCE AND SERVICING.

NOTICE

1. THIS BOILER HAS A LIMITED WARRANTY, A COPY OF WHICH IS PRINTED ON THE BACK PAGE OF THIS MANUAL.

2. IT IS THE RESPONSIBILITY OF THE INSTALLING CONTRACTOR TO SEE THAT ALL CONTROLS ARE CORRECTLY INSTALLED AND ARE OPERATING PROPERLY WHEN THE INSTALLATION IS COMPLETED.

3. FOR OPTIMUM PERFORMANCE AND SERVICEABILITY FROM THIS UNIT ADHERE TO THE FOLLOWING RECOMMENDATIONS:

A. CLEAN FIRETUBES AT LEAST ONCE A YEAR, PREFERABLY AT THE END OF THE HEATING SEASON TO REMOVE SOOT AND SCALE. INSIDE SURFACES OF THE FURNACE, FRONT AND REAR SMOKEBOXES, AND REVERSING CHAMBER SHOULD ALSO BE CLEANED AT THE SAME TIME.

B. HAVE THE BURNER AND CONTROLS CHECKED AT LEAST ONCE A YEAR OR AS NECESSARY.

C. RETAIN YOUR CONTRACTOR OR A COMPETENT SERVICEMAN TO ASSURE THAT THE UNIT IS PROPERLY ADJUSTED AND MAINTAINED.

TABLE OF CONTENTS

SECTION I — GENERAL INFORMATION

① GENERAL INFORMATION

The E Series is designed specifically for forced draft firing, is available with light oil, gas, or combination gas/light oil burners, and operates with a combustion efficiency of over 80%.

In addition to the advantages of forced draft firing — the elimination of the need for external draft devices such as a high chimney or mechanical draft equipment — the E series offers such features as: Compact, 3 pass firetube design, packaged unit that will fit through a standard doorway; Lightweight vacuum formed reversing chamber; Provision for instantaneous hot water tankless heater; 7 models ranging from 684 MBH to 2821 MBH gross output.

This manual gives the necessary information for the proper installation, operation, maintenance, and service of the units. For special installation problems, contact Burnham Corporation, Commercial Steel Boilers, P.O. Box 3079, Lancaster, Pennsylvania 17604. Dimensional information is given in Figures 3A and 3B. Ratings and data are given in Table I.

② INSPECT SHIPMENT carefully for any signs of damage.

A. ALL EQUIPMENT is carefully manufactured, inspected and packed. Our responsibility ceases upon delivery of boiler to the carrier in good condition.

B. ANY CLAIMS for damage or shortage in shipment must be filed immediately against the carrier by the consignee. No claims for variances from, or shortage in orders, will be allowed by the manufacturer unless presented within sixty (60) days after receipt of goods.

③ SETTING THE UNIT

Front and rear heads are equipped with two lifting eyes each to be used in maneuvering the boiler into position. The boiler can also be rolled into position on a series of pipes.

The unit should be located in the boiler room so as to provide ease of venting and adequate clearance for maintenance, serviceability and installation of piping. The tube pull space listed in Figures 3A and 3B must be provided at either the front or rear of the boiler. Firetubes may be cleaned from the front of the boiler without disturbing the reversing chamber. Care must be taken so as not to damage the reversing chamber with the end of the flue brush. The reversing chamber pull space must always be provided at the rear of the unit, see Figures 3A and 3B. The coil pull space listed in Table II must be maintained at the front of units equipped with tankless coils.

Floor construction should have adequate load bearing characteristics to bear the weight of the boiler filled with water (see Table I). A boiler foundation similar to the one shown in Figure 1 is recommended if the boiler room floor is weak or uneven or if a water condition exists.

These boilers are not approved for installation on combustible flooring.

④ CHIMNEY OR VENT

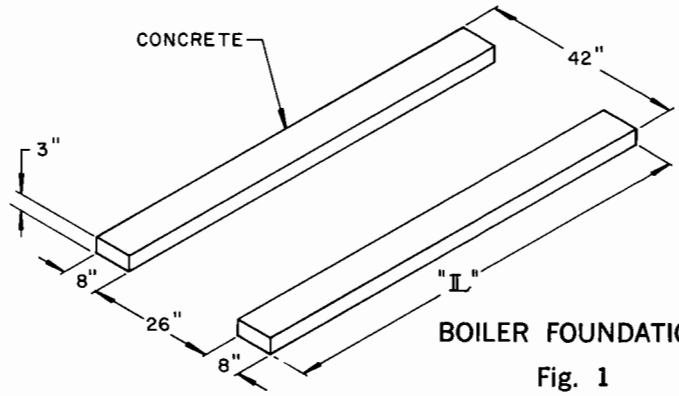
The E Series boiler is designed for forced draft firing and may be used with a conventional natural draft stack or stub vent (see Figure 2). For proper Vent Size, see Figures 3A and 3B. Draft controls are not normally required, although they may be used on installations where a natural draft stack is used or on multiple boiler installations with a common stack. If high breeching drafts make burner adjustment difficult, a locking blade type adjustable damper should be installed at the boiler breeching.

⑤ AIR SUPPLY

A sufficient air supply must be maintained at all times to the boiler room for proper performance of the unit. A permanent opening or duct should be provided so that the boiler input will not exceed 4,000 Btuh/in² of free area.

Example: Model E-20 Firing Rate (Gas) = 877 MBH

$$\frac{877{,}000\ \text{BTUH}}{4{,}000\ \text{BTUH/In}^2} = 220\ \text{In}^2\ \text{Free Area}$$



BOILER FOUNDATION

Fig. 1

NOTE: IF THE BOILER ROOM FLOOR IS WEAK OR UNEVEN OR IF A WATER CONDITION EXISTS, A BOILER FOUNDATION SIMILAR TO THE ONE SHOWN ABOVE IS RECOMMENDED.

Boiler Model	Dimension - Inches "L"
E-20	60
E-30	72
E-40	83
E-50	88
E-60	97
E-70	106
E-80	115

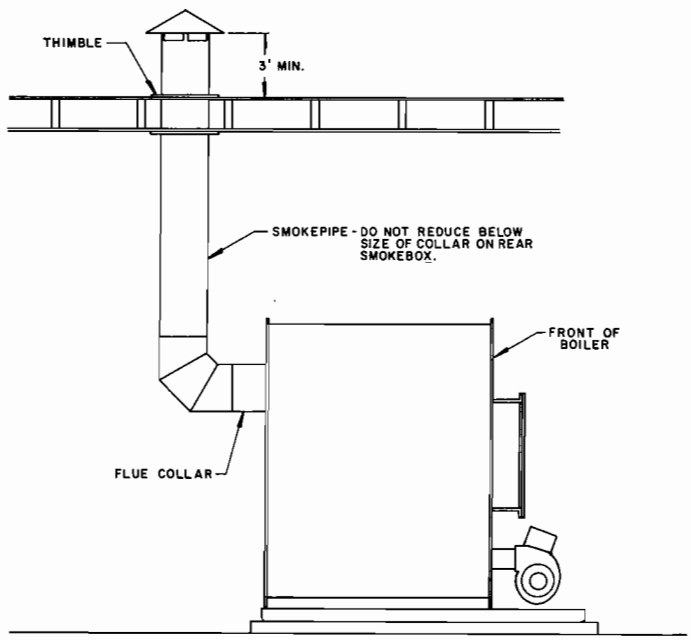


Fig. 2 TYPICAL ARRANGEMENT FOR STUB VENT

TABLE I

RATINGS - - - - - DATA

Boiler Number (1)	Boiler H.P.	I=B=R Gross Output MBH	Net I=B=R Ratings (2) Sq.Ft. Steam	MBH Steam	MBH Water	I=B=R Burner (3) Capacity Light Oil (gph)	Gas (mbh)	Heating Surface Sq. Ft. Fireside	Waterside	Furnace Volume cu. ft.	Water Content Gals. Steam	Water	Approx. Dry Weight Lbs.	Approx. Weight Full - Lbs. Steam	Water
E-20	20.4	684	2138	513	595	6.1	877	80	88	6.88	86	109	1724	2442	2633
E-30	31.2	1043	3258	782	907	9.1	1308	120	132	8.44	132	168	2137	3238	3538
E-40	41.9	1402	4429	1063	1219	12.0	1738	160	176	10.01	178	227	2570	4055	4463
E-50	52.1	1743	5613	1347	1516	15.2	2207	200	219	12.70	190	250	2982	4567	5067
E-60	62.8	2102	6800	1632	1828	18.2	2630	240	261	14.23	228	300	3361	5263	5863
E-70	73.5	2461	7963	1911	2140	21.0	3053	280	304	15.77	267	351	3732	5959	6660
E-80	84.3	2821	9125	2190	2453	24.0	3475	320	346	17.30	305	401	4106	6650	7451

(1) Prefix "EL" indicates 15 PSI Steam, "EW" Indicates 30 PSI water. Suffix "G" indicates gas-fired, "O" indicates oil-fired, "GO" indicates combination gas-oil fired.

(2) I = B = R net ratings shown are based on piping and pickup allowances which vary from 1.333 to 1.288 for steam and 1.15 for water.

Consult manufacturer for installations having unusual piping and pickup requirements, such as intermittent system operation, extensive piping system, etc.

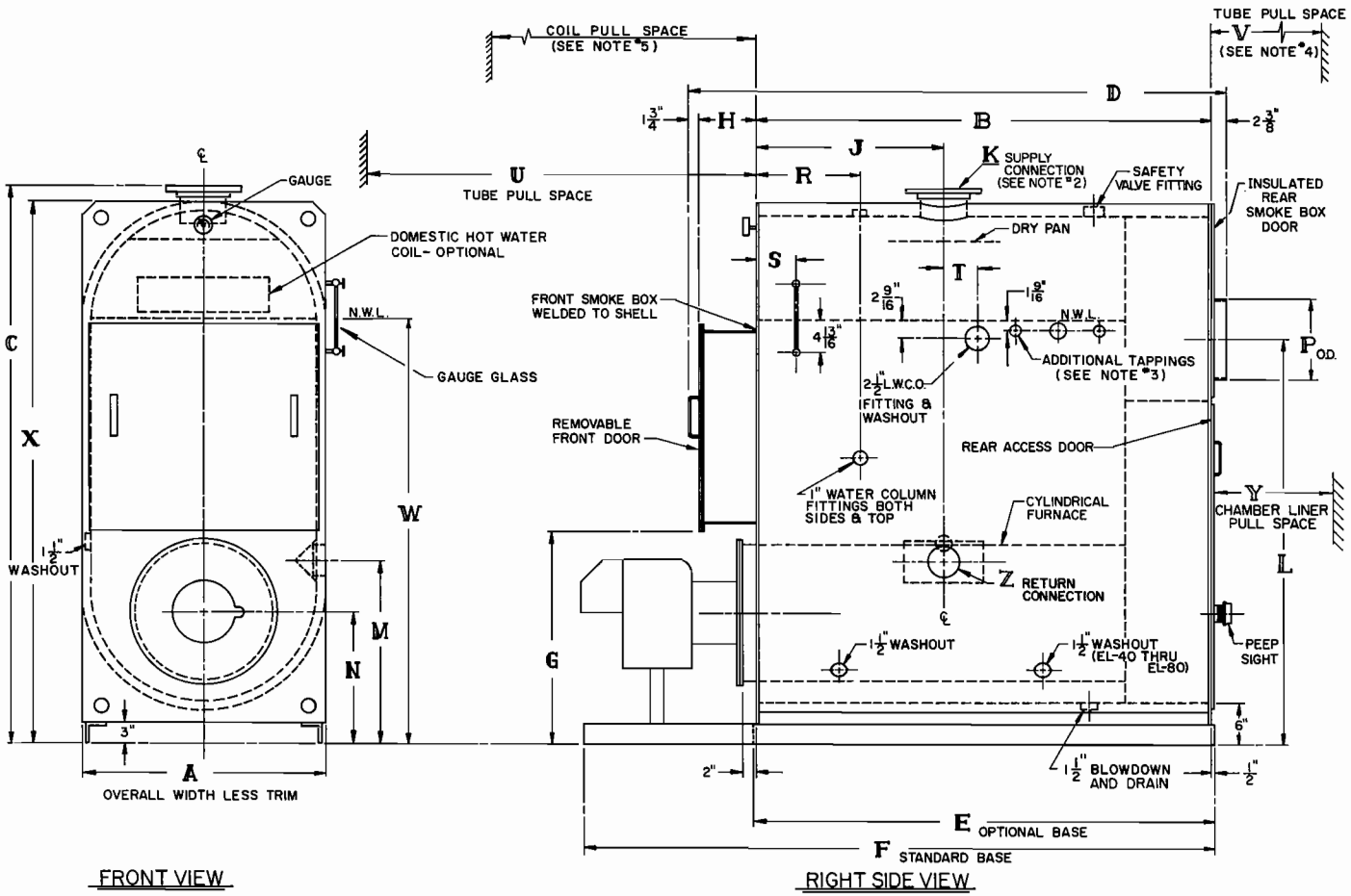
Net ratings for water, square feet, are based on 170°F average water temperature in system.

For higher water temperatures, select boiler on basis of I=B=R Net Ratings, MBH.

(3) The I=B=R burner capacity in GPH is based on light oil having a heat value of 140,000 BTU per gallon.

Boiler ratings are based on 12½% CO^2, + .10" water column pressure at boiler flue outlet.

Ratings shown above apply at altitudes up to 1000 feet on oil and 2000 feet on gas. For altitudes above those indicated, the ratings shoud be reduced at the rate of 4% for each 1000 feet above sea level.



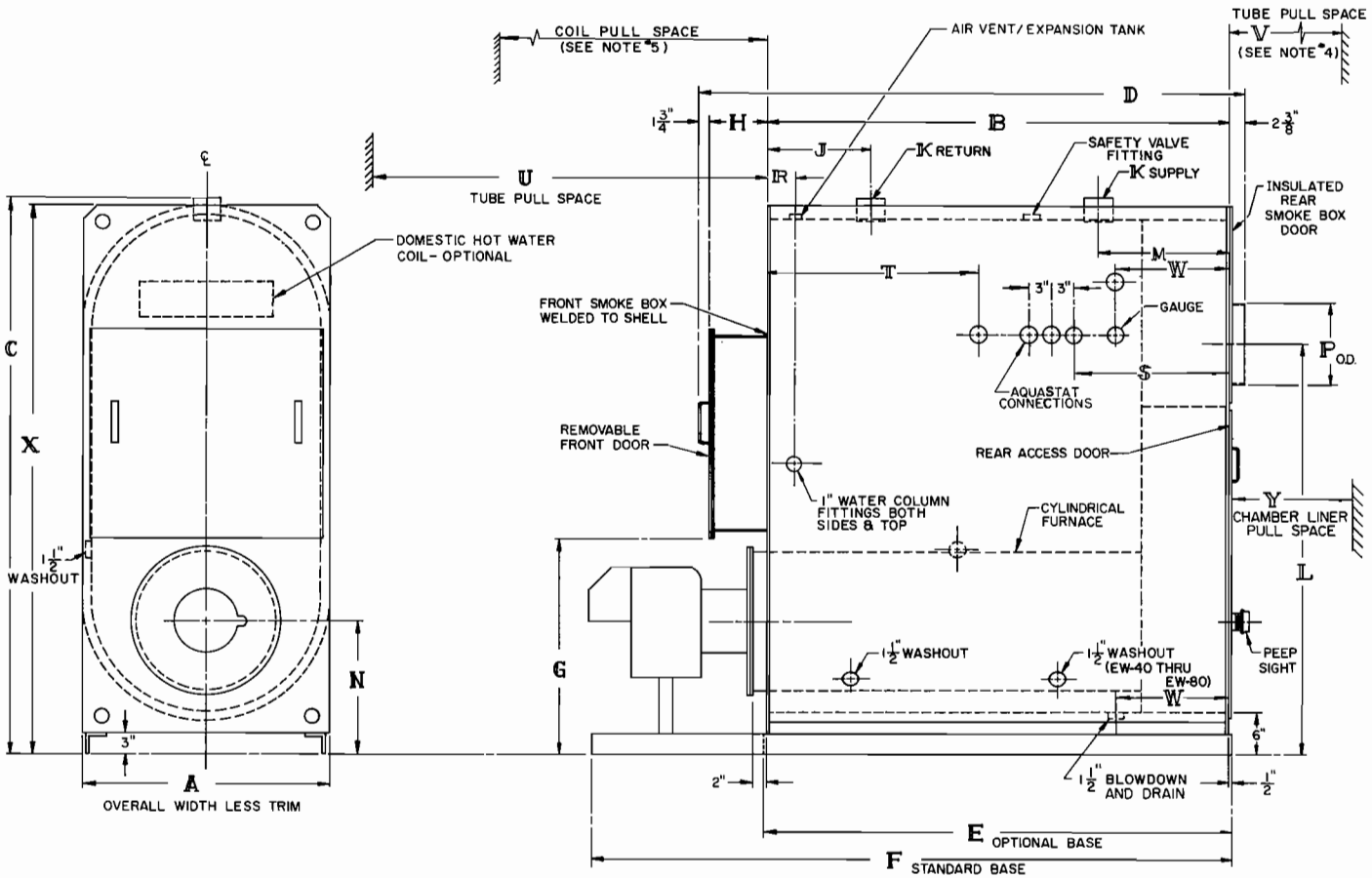
BOILER MODELS	EL-20	EL-30	EL-40	EL-50	EL-60	EL-70	EL-80
A - BOILER WIDTH	31	31	31	34 3/8	34 3/8	34 3/8	34 3/8
B - BOILER SHELL LENGTH	32 3/4	44	55 1/4	56 3/4	65 5/8	74 1/2	83 5/8
C - BOILER HEIGHT	75 1/4	75 1/4	75 1/4	78 1/2	78 1/2	78 1/2	78 1/2
D - BOILER OVERALL LENGTH	44 1/8	55 1/8	66 1/8	69 1/8	78	86 7/8	95 3/4
E - OPTIONAL BASE LENGTH	33 3/4	45	56 1/4	57 3/4	66 5/8	75 1/2	84 3/8
F - STANDARD BASE LENGTH	54	66	77	82	91	100	109
G - FRONT SMOKE BOX HEIGHT	28 5/16	28 5/16	28 5/16	29 5/16	29 5/16	29 5/16	29 5/16
H - FRONT SMOKE BOX DEPTH	7 1/4	7 1/4	7 1/4	8 1/4	8 1/4	8 1/4	8 1/4
J - SUPPLY/RETURN LOCATION	11	16	22	22	26	31	35
K - SUPPLY CONNECTION SIZE	4	4	4	6	6	6	6
M - RETURN CONNECTION HEIGHT	25	25	25	26 1/2	26 1/2	26 1/2	26 1/2
N - FURNACE HEIGHT	18	18	18	19	19	19	19
P - VENT COLLAR DIAMETER	9 13/16	9 13/16	9 13/16	11 13/16	11 13/16	11 13/16	11 13/16
L - VENT COLLAR HEIGHT	57 1/8	57 1/8	57 1/8	59 1/8	59 1/8	59 1/8	59 1/8
R - WATER COLUMN LOCATION	4 5/16	4 5/16	4 5/16	11	15	13	15
S - GAUGE GLASS LOCATION	4 5/16	4 5/16	4 5/16	5 5/16	5 5/16	5 5/16	5 5/16
T - LOW WATER CUT-OFF LOCATION	4	4	4	5	5	5	5
U - TUBE PULL SPACE-FRONT	24	35	46	47	56	64	73
V - TUBE PULL SPACE-REAR	13	24	35	35	44	52	61
W - NORMAL WATER LINE	60 5/16	60 5/16	60 5/16	61 5/16	61 5/16	61 5/16	61 5/16
X - TUBE SHEET HEIGHT	74	74	74	76 1/2	76 1/2	76 1/2	76 1/2
Y - CHAMBER PULL SPACE	14	14	14	15	15	15	15
Z - RETURN CONNECTION SIZE	2 1/2	2 1/2	2 1/2	4	4	4	4

NOTES

1. ALL DIMENSIONS ARE IN INCHES.
2. 6" CONNECTION IS 150 LB. FLANGE; ALL OTHER FITTINGS ARE THREADED FEMALE NPS.
3. ADDITIONAL TAPPINGS: (LOCATED ON LEFT SIDE ON MODELS EL-20 AND EL-30)

   STANDARD ON STEAM BOILER - (2) ¾" CONNECTIONS
   - (1) 1½" BLOW-OFF CONNECTION
4. EITHER FRONT OR REAR TUBE PULL SPACE MAY BE UTILIZED.
5. THE COIL PULL SPACE MUST BE MAINTAINED AT THE FRONT OF UNITS EQUIPPED WITH TANKLESS HEATERS, SEE TABLE II FOR TANKLESS HEATER RATINGS AND DIMENSIONAL DATA.
6. BURNER MAY PROJECT BEYOND SKID, DEPENDING ON BURNER MODEL APPLIED.
7. SPECIFICATIONS, DIMENSIONS, AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE.

STEAM BOILER
DIMENSIONAL INFORMATION
FIG. 3A



FRONT VIEW

RIGHT SIDE VIEW

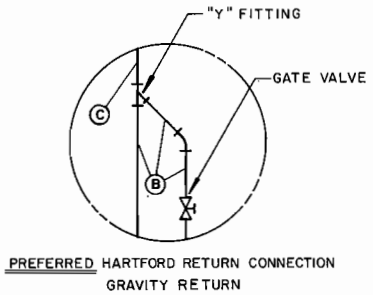
BOILER MODELS	EW-20	EW-30	EW-40	EW-50	EW-60	EW-70	EW-80
A - BOILER WIDTH	31	31	31	34½	34½	34½	34½
B - BOILER SHELL LENGTH	32¾	44	55¼	56¾	65¾	74½	83⅛
C - BOILER HEIGHT	74⅜	75⅝	75	77½	77½	77½	77½
D - BOILER OVERALL LENGTH	44⅛	55⅜	66⅝	69⅛	78	86⅜	95¾
E - OPTIONAL BASE LENGTH	33¾	45	56¼	57¾	66⅝	75½	84⅛
F - STANDARD BASE LENGTH	54	66	77	82	91	100	109
G - FRONT SMOKE BOX HEIGHT	28 5/16	28 5/16	28 5/16	29 5/16	29 5/16	29 5/16	29 5/16
H - FRONT SMOKE BOX DEPTH	7¼	7¼	7¼	8¼	8¼	8¼	8¼
J - RETURN LOCATION	7	10½	13½	14¾	14 5/16	14½	14⅝
K - TOP CONNECTION SIZE	2	2½	3	4	4	4	4
M - SUPPLY LOCATION	13½	16	16	18½	18½	18½	18½
N - FURNACE HEIGHT	18	18	18	19	19	19	19
P - VENT COLLAR DIAMETER	9 3/16	9 3/16	9 3/16	11 3/16	11 3/16	11 3/16	11 3/16
L - VENT COLLAR HEIGHT	57⅛	57⅛	57⅛	59⅛	59⅛	59⅛	59⅛
R - WATER COLUMN LOCATION	2 5/8	3½	4	4	4	4	4
S - AQUASTAT CONNECTIONS	17 5/16	18 5/16	18 5/16	22 5/16	22 5/16	22 5/16	22 5/16
T - LOW WATER CUT-OFF LOCATION	5 5/8	12 11/16	23 13/16	21 7/16	30 5/16	39 5/16	48 1/16
U - TUBE PULL SPACE-FRONT	24	35	46	47	56	64	73
V - TUBE PULL SPACE-REAR	13	24	35	35	44	52	61
W - RECIRCULATION PIPING	14 5/16	14 5/16	14 5/16	18 7/16	18 7/16	18 7/16	18 7/16
X - TUBE SHEET HEIGHT	74	74	74	76½	76½	76½	76½
Y - CHAMBER PULL SPACE	14	14	14	15	15	15	15

NOTES

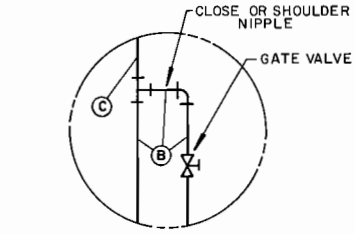
1. ALL DIMENSIONS ARE IN INCHES.
2. ALL FITTINGS ARE THREADED FEMALE NPS.
3. EITHER FRONT OR REAR TUBE PULL SPACE MAY BE UTILIZED.
4. THE COIL PULL SPACE MUST BE MAINTAINED AT THE FRONT OF UNITS EQUIPPED WITH TANKLESS HEATERS, SEE TABLE II FOR TANKLESS HEATER RATINGS AND DIMENSIONAL DATA.
5. BURNER MAY PROJECT BEYOND SKID, DEPENDING ON BURNER MODEL APPLIED.
6. SPECIFICATIONS, DIMENSIONS, AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE.

WATER BOILER
DIMENSIONAL INFORMATION
FIG. 3B

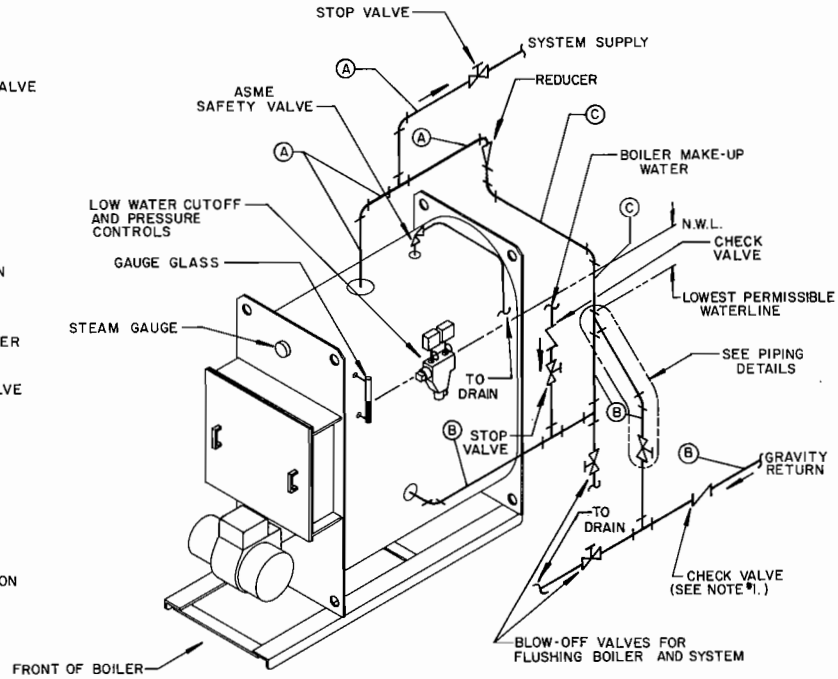
SECTION II - INSTALLATION INSTRUCTIONS



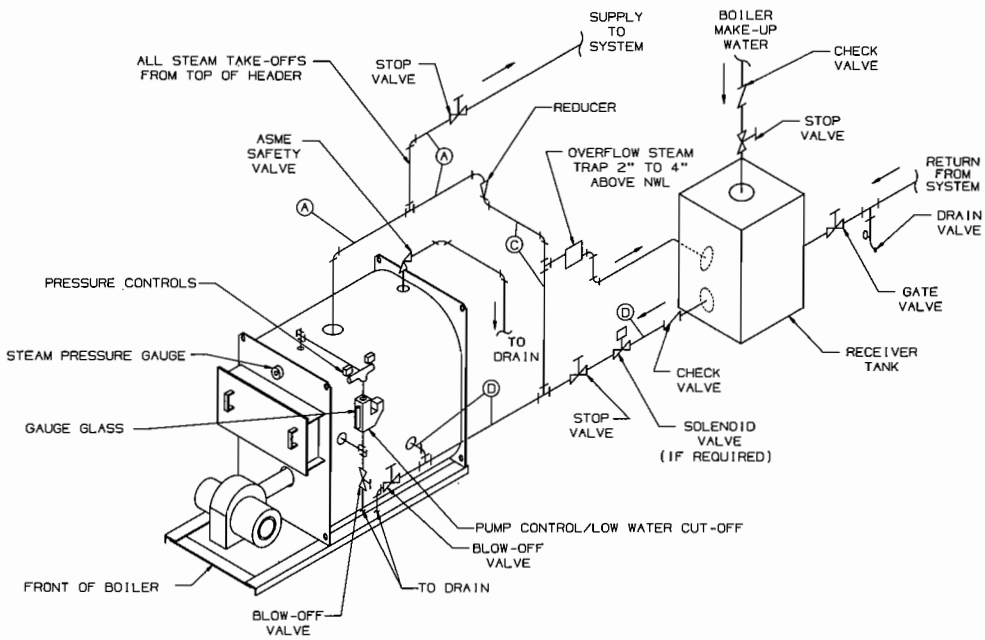
PREFERRED HARTFORD RETURN CONNECTION
GRAVITY RETURN



ALTERNATE HARTFORD RETURN CONNECTION
GRAVITY RETURN



RECOMMENDED BOILER PIPING - STEAM BOILER
GRAVITY RETURN
"E-20" - "E-80"



RECOMMENDED BOILER PIPING - SINGLE STEAM BOILER
"E-20" - "E-80" PUMPED RETURN

Boiler Number	Piping Size (Inches)		
	Supply-A	Return-B	Equalizer-C
E-20	4	2½	2½
E-30	4	2½	2½
E-40	4	2½	2½
E-50	6	4	4
E-60	6	4	4
E-70	6	4	4
E-80	6	4	4

For D, see Note 4

NOTES:

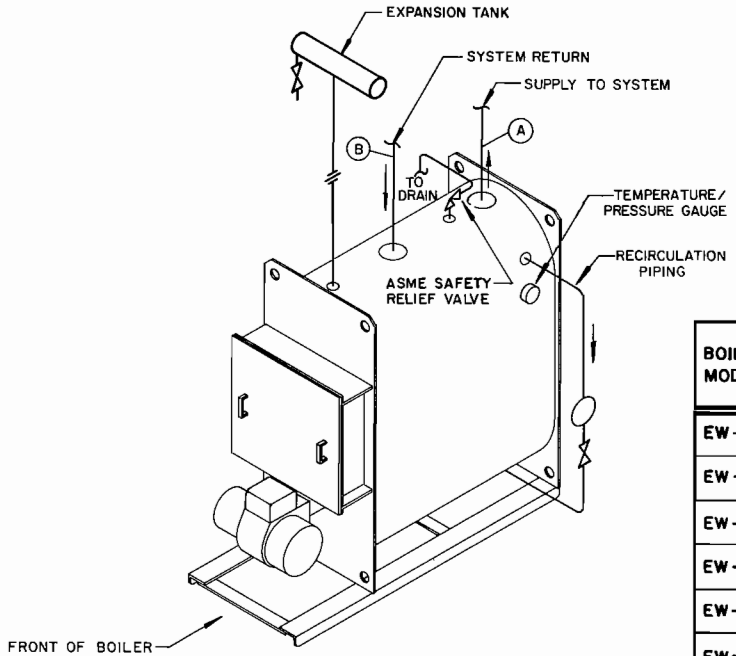
(1) Return loop connection was designed to eliminate necessity of check valves on gravity return systems, but in some localities a check valve is a legal requirement.

(2) When pump discharge piping exceeds 25 ft. install swing check valve at pump discharge.

(3) If pump discharge is looped above normal boiler waterline, install a spring-loaded check valve at return header and at pump discharge.

(4) Pumped return piping size (D) must be calculated using pump size, distance, and standard piping tables.

MINIMUM PIPING REQUIREMENTS — STEAM BOILERS
Fig. 4



BOILER MODEL	PIPE SIZE (INCHES)	
	SUPPLY – A	RETURN – B
EW-20	2	2
EW-30	$2\frac{1}{2}$	$2\frac{1}{2}$
EW-40	3	3
EW-50	4	4
EW-60	4	4
EW-70	4	4
EW-80	4	4

RECOMMENDED BOILER PIPING - WATER BOILER
"EW-20" – "EW-80"

MINIMUM PIPING REQUIREMENTS — WATER BOILERS
Fig. 5

① BOILER PIPING

Attach flow and return piping lines and insert plugs and bushings in connections as required. Flow and return piping headers are detailed in Figure 4 and Figure 5.

CAUTION — IT IS IMPORTANT TO COMPLY WITH THE MINIMUM PIPING REQUIREMENTS IN ORDER TO ENSURE MAXIMUM PERFORMANCE AND RELIABILITY. PARTICULAR ATTENTION SHOULD BE GIVEN TO THE CONSTRUCTION OF THE STEAM HEADER AND HARTFORD LOOP ON STEAM BOILERS.

WARNING:

The nominal temperature differential between supply and return water recommended for Burnham Series E water boilers is 20°F. As a precaution against thermal shock, this differential should never exceed 40°F.

The boiler should not be operated for any length of time at a temperature setting that allows the formation of condensate in the tubes or smokebox. This generally dictates a minimum setting of approximately 170°F on the low limit on systems with a 20°F system differential. On cold start up, condensation can be expected until the boiler warms up. If formation of condensate persists, the low limit should be adjusted upward until condensate no longer forms.

② STEAM TRIM

Install the gauge glass trim in the two (2) ½" couplings located at the front right side of the boiler. Mount the pressure gauge in the ½" threaded connection located at the top of the front head. Install the safety valve in the connection at the top, rear centerline of the boiler. Install the drain valve in the connection at the bottom rear centerline of the boiler. The connections are labeled in Figure 3A.

③ WATER TRIM

Install the combination pressure-temperature gauge, drain valve and pressure relief valve as shown in Figure 5. Connections for the trim are labeled in Figure 3B.

④ BURNER INSTALLATION

Refer to burner manufacturer's installation manual furnished with the E-Series boiler for proper installation, fuel piping, wiring, burner adjustment and service instructions.

⑤ TANKLESS HEATER

A. IF BOILER IS ORDERED WITH TANKLESS HEATER, CONNECT TANKLESS HEATER PIPING AS SHOWN IN Fig. 6. See Table II for Tankless Heater Ratings.

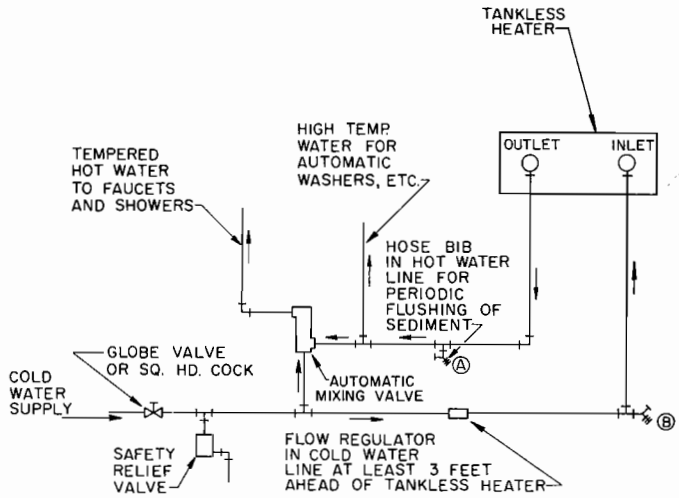
WARNING

Install an automatic mixing valve at the tankless heater outlet to avoid risk of burns or scalding due to excessively hot water at the fixtures. Adjust and maintain the mixing valve in accordance with the manufacturer's instructions.

B. THE FOLLOWING GUIDELINES SHOULD BE FOLLOWED WHEN PIPING THE TANKLESS HEATER:

1. FLOW REGULATION — If flow through the heater is greater than its rating, the supply of adequate hot water may not be able to keep up with demand. For this reason a flow regulator matching the heater rating should be installed in the cold water line to the heater. The flow regulator should preferably be located below the inlet so that the regulator is not subjected to excess temperatures that may occur during "off" periods when it is possible for heat to be conducted back through the supply line. The flow regulator also limits the flow of supply water regardless of inlet pressure variations in the range of 20 to 125 psi.

2. TEMPERING OF HOT WATER — Installation of an automatic mixing valve will lengthen the delivery of the available hot water by mixing some cold water with the hot. This prevents excessive and possibly scalding hot water at the fixtures. In addition, savings of hot water will be achieved since the user will not waste as much hot water while seeking water temperature to his liking. Higher temperature hot water required by dishwashers and automatic washers is available by piping the hot water from the heater prior to entering the mixing valve. The mixing valve should be "trapped" by installing it below the cold water inlet to heater to prevent lime formation in the valve.



SCHEMATIC TANKLESS HEATER PIPING

SCHEMATIC TANKLESS HEATER PIPING

FIG. 6

3. FLUSHING OF HEATER — All water contains some sediment which settles on the inside of the coil. Consequently, the heater should be periodically backwashed. This is accomplished by installing hose bibs as illustrated and allowing water at city pressure to run into hosebib A, through the heater, and out hosebib B until the discharge is clear. The tees in which the hosebibs are located should be the same size as heater connections to minimize pressure drop.

4. HARD WATER — May be applicable to some city water and particularly to well water. Have your water analyzed by a qualified water treatment specialist to determine if a water softner, conditioner or filtration is required. Treated water will ensure longer tankless heater life and performance and is also beneficial to all the piping and fixtures in the building.

TABLE II
TANKLESS HEATER RATINGS
(Steam and Water Boilers)

Heater Coil Number	For Use on the Following Boiler Sizes:	Rated Capacity Gallons Heated 40° to 140°F with Boiler Water Temperature @			Heater Coil Pull Space Inches
		180°F GPM	180°F GPH	212°F GPH	
INA-200	E20	3.5	210	325	16
INA-210	All Sizes Except E20	3.5	210	325	24¼
INA-300	All Sizes Except E20	5.0	300	466	29
INA-360	All Sizes Except E20	6.0	360	560	24¼
INA-450	All Sizes Except E20	7.5	450	700	29
INA-600	E60 and Larger	10.0	600	933	45
INA-750	E60 and Larger	12.5	750	1165	49
INA-900	E40 and Larger	15.0	900	1400	41
INA-1125	E60 and Larger	18.7	1125	1750	49
INA-1350	E70 and Larger	22.5	1350	2100	59
INA-1500	E80	25.0	1500	2330	69

SECTION III OPERATING INSTRUCTIONS

① ALWAYS INSPECT INSTALLATION BEFORE STARTING BURNER.

② FILL HEATING SYSTEM WITH WATER.

IMPORTANT

Any time that raw water is introduced into the boiler it must be heated to at least 180°F immediately to dissipate the dissolved gases which can otherwise cause internal corrosion to the boiler.

A. STEAM BOILERS — Fill boiler to normal water line as shown on figure 3A. Water should be visible in the gauge glass. After boiler is in operation, make up water should be added slowly to maintain the water level.

B. HOT WATER BOILERS — In a hot water heating system, the boiler and entire system (other than the expansion tank) must be full of water for satisfactory operation. Water should be added to the system until the boiler pressure gauge registers normal system design operating pressure. To ensure that the system is full, water should come out of all air vents when opened.

WARNING

ON A HOT WATER SYSTEM THE PRESSURE MUST NOT EXCEED 30 POUNDS UNLESS THE BOILER IS ESPECIALLY DESIGNED FOR A HIGHER MAXIMUM WORKING PRESSURE. IF BOILER PRESSURE EXCEEDS PRESSURE SETTING OF SAFETY RELIEF VALVE, VALVE WILL RELIEVE IMMEDIATELY, BUT CAUSE OF RELIEF MUST BE INVESTIGATED AND CORRECTED. EXCESS PRESSURE IS DANGEROUS, IN ADDITION, COULD CAUSE DAMAGE TO HEATING SYSTEM, PERSONAL INJURY OR SERIOUS PROPERTY DAMAGE.

DO NOT draw water from boiler while in use. When adding water while boiler is in operation, do not open supply valve fully but add water slowly.

③ ADJUST BURNER according to the burner manufacturer's specifications. Refer to burner manufacturer's installation manual furnished with the boiler.

④ TEST CONTROLS

WARNING

Before Installation of the boiler is considered complete the operation of the boiler controls should be checked, particularly the low water cutoff and the high limit control.

A. CHECK OPERATING CONTROL OPERATION. Raise and lower operating control setting as required to start and stop burner.

B. WARNING — CHECK HIGH LIMIT CONTROL Jumper Operating Control Terminals. Allow burner to operate until shutdown by limit. Installation is not considered complete until this check has been made. REMOVE JUMPER.

C. CHECK LOW WATER CUTOFF control with water level at normal water line (see Figure 3A). Raise operating control setting to allow burner to operate. Open boiler drain to allow water level to drop to bottom of sight glass until burner operation is shut down by low water cutoff.

Close boiler drain and refill to normal water line. Unless boiler is equipped with a manual reset low water cutoff, burner should automatically restart during fill. Reset operating control.

IMPORTANT

PROBE AND FLOAT TYPE LOW WATER CUT-OFF DEVICES REQUIRE ANNUAL INSPECTION AND MAINTENANCE. Refer to step ④ of Service Instructions for proper cleaning instructions.

D. CHECK OPERATING CONTROL on a boiler equipped with a tankless heater. With burner off, draw hot water until burner starts, then turn off hot water and check burner shutdown.

⑤ CLEANING A NEW STEAM BOILER

Oil, greases & sediments which accumulate in a new boiler and piping must be removed from the system in order to prevent an unsteady water line and carry over of the water into the supply main above boiler. Operate the boiler with steam in the entire system for a few days allowing the condensate to return to the boiler. If the condensate can temporarily be wasted, operate boiler only for the length of time it takes for condensate to run clear. If the latter cannot be achieved or if the condensate is returned to the boiler, boil out the boiler using the SURFACE BLOWOFF connection. Refer to figure 3A, note 3 for location of surface blowoff connection.

A. Drain boiler until water is just visible in gauge glass. Run temporary pipe line from the surface blow-off or safety valve connection to an open drain or some other location where hot water may be discharged safely. Do not install valve in this line.

NOTICE

Certain state and local codes may restrict the use of some of the chemicals listed for cleaning and maintaining the boiler. Check with local authorities before proceeding to use any chemicals.

B. Drain about 5 gallons of hot water from boiler into a container and dissolve into it the appropriate amount of a recommended boilout compound. Additional containers may be required to dissolve sufficient chemicals for large models. Remove safety valve and add solution to boiler water through exposed tapping.

C. Close all valves leading to and from the system to isolate the cleaning solution from the system.

D. Start burner and operate sufficiently to boil the water without producing steam pressure. Boil for about 5 hours. Open boiler feed pipe sufficiently to permit a steady trickle of water from the surface blowoff pipe. Continue this slow boiling and trickle of overflow for several hours until the water coming from the overflow is clear.

E. Stop burner and drain boiler in a manner and to a location that hot water can be discharged with safety.

F. When the boiler has cooled down to 120°F or less refill boiler to normal water line. If water in gauge glass does not appear to be clear, repeat steps A through E, boiling out the boiler for a longer time.

G. Remove temporary piping, plug tapping and/or reinstall safety valve. Boil or bring water temperature to 180°F promptly in order to drive off any dissolved gases in the fresh water.

⑥ CLEANING A WATER BOILER

The oil and grease which accumulate in a new hot water boiler can be washed out in the following manner.

A. Remove safety relief valve using extreme care to avoid damaging it.

NOTICE

Certain state and local codes may restrict the use of some of the chemicals listed for cleaning and maintaining the boiler. Check with local authorities before proceeding to use any chemicals.

B. Add an appropriate amount of recommended boilout compound.
C. Add solution through exposed tapping, and reinstall safety valve.
D. Fill the entire system with water.
E. Start firing the boiler.
F. Circulate the water through the entire system.
G. Vent the system, including the radiation.
H. Allow boiler water to reach operating temperature, if possible.
I. Continue to circulate the water for a few hours.
J. Stop firing the boiler.
K. Drain the system in a manner and to a location that hot water can be discharged with safety.
L. When the boiler has cooled down to 120°F or less, remove plugs from all available returns and wash the water side of the boiler as thoroughly as possible, using a high-pressure water stream.
M. Refill the system with fresh water, and bring water temperature to 180°F promptly in order to drive off any dissolved gases.

⑦ WATER BOILER OPERATION

The following guidelines relating to system water temperature fluctuation and flow through the boiler must be observed.

A. It is important to operate your boiler in such a manner as to prevent temperature fluctuation of more than 40°F at any time. Rapid temperature changes within the boiler can create stresses in the boiler metal. These stresses can cause damage to the boiler by loosening tubes, or in more severe instances can crack tube sheet ligaments, furnaces, or waterlegs.
B. It is equally important to insure that there is circulation through the boiler of at least 1/2 GPM/BHP at all times when the burner is firing.

⑧ BOILER WATER TREATMENT

Boiler water treatment will help maximize the effectiveness and prolong the life of pressure vessels.

The general objectives of boiler water treatment are:

A. Remove corrosive gases from feedwater and boiler water.
B. Prevent sludge and scale deposits on the water side heating surfaces.
C. Prevent foaming and carryover.

Consult with a local water treatment company regularly engaged in the treatment of boiler water for advice on maintaining the proper feedwater, boiler water, and condensate chemistry.

NOTICE

Certain state and local codes may restrict the use of some of the chemicals listed for cleaning and maintaining the boiler. Check with local authorities before proceeding to use any chemicals.

⑨ MAKE PH OR ALKALINITY TEST.

After boiler and system have been cleaned and refilled as previously described, test the pH of the water in the system. This can easily be done by drawing a small sample of boiler water and testing with hydrion paper which is used in the same manner as litmus paper, except it gives specific readings. A small color chart on the side of the hydrion dispenser gives the reading in pH. Hydrion paper is inexpensive and obtainable from any chemical supply house or through your local druggist. The pH should be higher than 7, but lower than 11. Add some of the washout chemical (caustic soda), if necessary, to bring the pH within the specified range.

⑩ IMPORTANT

If, during normal operation, it is necessary to add water to this boiler more frequently than once a month consult a qualified service technician to check your system for leaks. A leaky system will increase the volume of make-up water supplied to the boiler which can significantly shorten the life of the boiler. Entrained in make-up water are dissolved minerals and oxygen. When the fresh, cool make-up water is heated in the boiler the minerals fall out as sediment and the oxygen escapes as a gas. Both can result in reduced boiler life.

Problems caused by oxygen and mineral contamination of boiler water are not covered by Burnham's standards warranty. Therefore, it is in everyone's best interest to prevent this type of failure. The maintenance of system integrity is the best method to achieve this.

SECTION IV — SERVICE INSTRUCTIONS

① IMPORTANT — See Item ⑩ under Operating Instructions if it becomes necessary to add water to the boiler more frequently than once a month.

② GENERAL — Inspection should be conducted annually. Service as frequently as specified in paragraphs below. Before service or maintenance is performed complete boiler shutdown/cooldown procedure.

③ BOILER SHUTDOWN AND COOLDOWN PROCEDURE

NOTE: This procedure is generally required in preparation for corrective or preventative maintenance on the unit. This procedure must be supervised by an individual who is thoroughly qualified in operation and maintenance of the equipment at hand. This is written with Low Pressure Heating Boilers in mind, but the principles are applicable to Hot Water Boilers as well.

A. Decrease plant load as low as possible.

B. Turn burner switch off. If control power from burner is used to support accessories, leave on until boiler/system has cooled down.

C. Shut and lock manual gas and oil valves as applicable.

D. In single boiler installations, some small steam loads can remain on to assist in a controlled cooldown of the boiler (i.e. deaerator). In multiple boiler installations, shut the non-return valve and back up valve. Lock them shut.

E. Allow the boiler feed pump to remain active. As the boiler cools down, the water level is reduced by demand or shrink. It is best to be aware of boiler water level at all times.

F. When boiler pressure has decreased to 5 to 10 psi on the pressure gauge, open the boiler manual vent valve on the top of the boiler. This is to act as a sentinel against an increase in pressure and to prevent the boiler from going into a vacuum. Lock the valve open.

NOTE: Depending on the size of the boiler, the large mass of heating surfaces that are still hot can cause the boiler water temperature to increase, even if the gauge pressure is "0". It is better to allow the entire system to cool gradually. Never force cool the boiler or system, as damage can also be inflicted due to "thermal shock."

G. When boiler and water are below 120 degrees, secure power to the unit and lock out the circuit breakers.

H. If required, open front and rear doors for observations of fireside surfaces.

I. Drain boiler down as far as required. (Usually completely.) Make sure the vent valve on the top of the boiler remains open. Open and lock the float control low water cutoff drain valves. These will serve as an additional vent.

J. Shut and lock all boiler feed valves, and any blow down valves that can be affected by other boilers in the same facility (i.e., bottom blow down valves can tie into a common blow down separator in a multiple boiler installation).

K. If necessary to remove handhole and/or manhole plates for water side inspection or maintenance, use extreme caution. Loosen the nuts securing the arch enough to allow the plate to drop approximately 1/8 inch when tapped loose with a mallet. Once again, ensure the pressure in the boiler is "0" before loosening the plate. Remove the plate the remainder of the way. Wear gloves and eye protection at all times.

④ CLEAN THE BOILER HEATING SURFACES AND FLUE at least once each year, preferably at the end of the heating season.

A. CLEAN THE VENT SYSTEM - Vent system should be checked annually for:

1. Obstructions.
2. Accumulations of soot.
3. Deterioration of vent pipe or vent accessories due to condensation or other reasons.
4. Proper support - no sags, particularly in horizontal runs.
5. Tightness of joints.

Remove all accumulations of soot with wire brush and vacuum. Remove all obstructions. Replace all deteriorated parts and support properly. Seal all joints.

B. CLEAN THE BOILER HEATING SURFACES

At the end of heating season, clean boiler heating surfaces thoroughly. Access to boiler firetubes may be gained by removing the front and rear smokeboxes. Remove turbulators and clean firetubes with flue brush furnished with boiler. Replace turbulators as shown in Figure 7. Remove soot and rust and reseal the boiler.

C. PROPER REMOVAL AND INSTALLATION PROCEDURES FOR REAR REVERSING CHAMBER LINER (See Figures 8 & 9)

Removal:

1. Remove nuts, washers and reversing chamber cover plate.
2. Reversing chamber liner often can be removed in one piece by inserting several fingers through the observation port opening to support the weight of the liner as it is pulled clear of the wrapper.
3. **IMPORTANT:** The 2" ceramic fiber strip **must** be replaced whenever the reversing chamber liner has been removed.
4. Remove all traces of fiber and adhesive from the rear tube sheet. Also remove any fiber that adheres to the front edge of the liner.

INSTALLATION:

1. Apply adhesive (i.e., waterglas) to the perimeter of rear tube sheet and position the 2" ceramic fiber (cerafelt) strip.
2. If the reversing chamber liner was removed in one piece and is not cracked, it may be reused. If damaged, the reversing chamber liner must be replaced. Insert the reversing chamber liner until it is seated uniformly against the ceramic fiber strip on the rear tube sheet.
3. **IMPORTANT:** The blanket on the cover plate and the bolt hole gasket may be reused, if both are in good condition. If damaged, they must be replaced.
4. Install Cover Plate, washer and nuts. Sufficiently tighten for gas tight seal.

⑤ MAINTENANCE OF LOW WATER CUTOFF DEVICES

IMPORTANT

PROBE AND FLOAT TYPE LOW WATER CUTOFF DEVICES REQUIRE ANNUAL INSPECTION AND MAINTENANCE.

A. PROBE TYPE LOW WATER CUTOFF - Although these devices are solid state in the operation, the probe' is exposed to possible contamination in the boiler water and subject to fouling.

It is important to physically remove the probe from the boiler tapping annually and inspect that probe for accumulation of scale or sediment.

Follow these steps to inspect, clean and/or replace the probe:

1. Turn off electric service to the boiler.
2. Drain boiler water to a level below the tapping for the probe.
3. Disconnect wiring connections between the low water cutoff control and the probe.
4. Dismount the low water cutoff control from the probe.
5. Unscrew the probe from the boiler tapping.
6. Inspect that portion of the probe that is exposed to the boiler water for scale or sediment buildup.
7. Light deposits may be removed by wiping the probe with a damp cloth. Wiping the probe with a cloth soaked in vinegar will remove more tenacious lime deposits. The most stubborn deposits may be removed from the probe by using a diluted amount (3 part of water to 1 part) of phosphoric acid (H_2P0_4).

CAUTION — Exercise caution when handling phosphoric acid and follow the instruction label on its container.

8. Wire brushing of the probe is not recommended.
9. Clean the pipe threads of the probe to remove old, hardened pipe dope and other foreign matter.
10. Apply a moderate amount of good quality pipe dope to the pipe threads on the probe, leaving the two end threads bare. Do not use PTFE (Teflon) tape.
11. Screw the probe into the boiler tapping.
12. Mount the low water cutoff control on the probe.
13. Reconnect the control to probe wiring.
14. Fill the boiler to its normal waterline.
15. Add boiler water treatment compound as needed (see Section III Item 8).
16. Restore electric service to the boiler.
17. Fire burner to heat the water in the boiler to drive off free oxygen.
18. WARNING — BEFORE RETURNING BOILER TO SERVICE: Follow the low water cutoff check out procedure in Section III Item 4 Part C.

B. FLOAT TYPE LOW WATER CUTOFF - During the heating season, if an external low water cutoff is on the boiler, the blow off valve should be opened once a month (use greater frequency where conditions warrant), to flush out the sediment chamber so the device will be free to function properly.

Low water cutoffs and water feeders should be dismantled annually by qualified personnel, to the extent necessary to insure freedom from obstructions and proper functioning of the working parts. Inspect connecting lines to boiler for accumulation of mud, scale, etc., and clean as required. Examine all visible wiring for brittle or worn insulation and make sure electrical contacts are clean and that they function properly. Give special attention to solder joints on bellows and float when this type of control is used. Check float for evidence of collapse and check mercury bulb (where applicable) for mercury separation or discoloration.

DO NOT ATTEMPT TO REPAIR MECHANISMS IN THE FIELD. Complete replacement mechanisms, including necessary gaskets and installation instructions, are available from the manufacturer.

⑥ CHECK BURNER AND CONTROLS at least once a year.

See Item ④ under Operating Instructions for control checks. See Burner Manual for burner tests and adjustments.

⑦ LUBRICATE BOILER COMPONENTS according to manufacturer's instructions. Generally, this involves the burner and circulator. This includes the type of lubricant to use, frequency of lubrication, and points to lubricate.

⑧ CHECK SAFETY VALVE at the start of each heating season and once or twice during the season to be sure it is in working condition. To do this, fasten wire or cord to lever of valve and pull lever standing a safe distance away from valve.

⑨ GENERAL MAINTENANCE CONSIDERATIONS

A. Keep radiators and convectors clean.

B. If a hot water radiator is hot at the bottom but not at the top, it indicates that air has accumulated inside and should be vented. To vent radiator, hold small cup under air vent (located near top of radiator), open vent until water escapes and then close.

C. If much water is added to system, it is advisable to heat system to a high temperature and vent again. This will make less venting necessary during the winter.

D. Where an expansion tank is used, make sure that neither the tank nor its drain pipe is exposed to freezing temperatures. Never place valves in piping leading to or from expansion tank.

E. Boiler and system cleaning will help assure trouble free operation. See Item ⑤ & ⑥ under Operating Instructions for procedure.

⑩ ATTENTION TO BOILER WHILE NOT IN OPERATION

IMPORTANT

A. IF BOILER IS NOT USED DURING WINTER TIME, IT MUST BE FULLY DRAINED TO PREVENT FREEZE DAMAGE.

B. STEAM BOILERS-Procedure for taking steam boilers off line at the end of the heating season. Drain off boiler water until it runs clear while holding the boiler temperature between 180 to 200°F. Then refill to the top of the gauge glass, and add necessity of adequate water treatment.

C. WATER BOILERS-Procedure for taking water boilers off line at the end of the heating season. While the boiler temperature is still between 180 to 200°F, drain water from the bottom of the boiler until it runs clear. Then refill the system to normal water pressure, and add necessity of adequate water treatment.

D. Note any time raw water is introduced into the boiler it must be immediately heated to 180°F to drive off dissolved gases. If water treatment is used, sufficient water treatment compound should be added to condition the make up water.

(11) REPAIR PARTS

Give boiler series and model number when ordering repair parts. All repair parts can be ordered through the commercial steel sales office. See figures 8 and 9 for rear smokebox and reversing chamber part descriptions.

Burnham Corporation
Commercial Steel Boilers
P.O. Box 3079
Lancaster, PA 17604
Phone: (717) 293-5846
Fax: (717) 293-5977

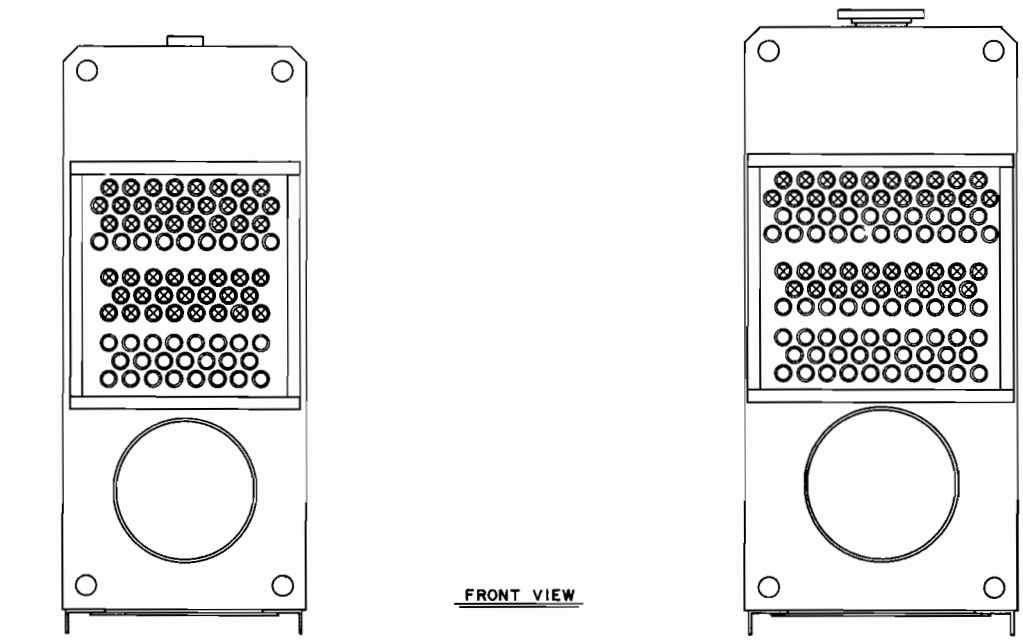
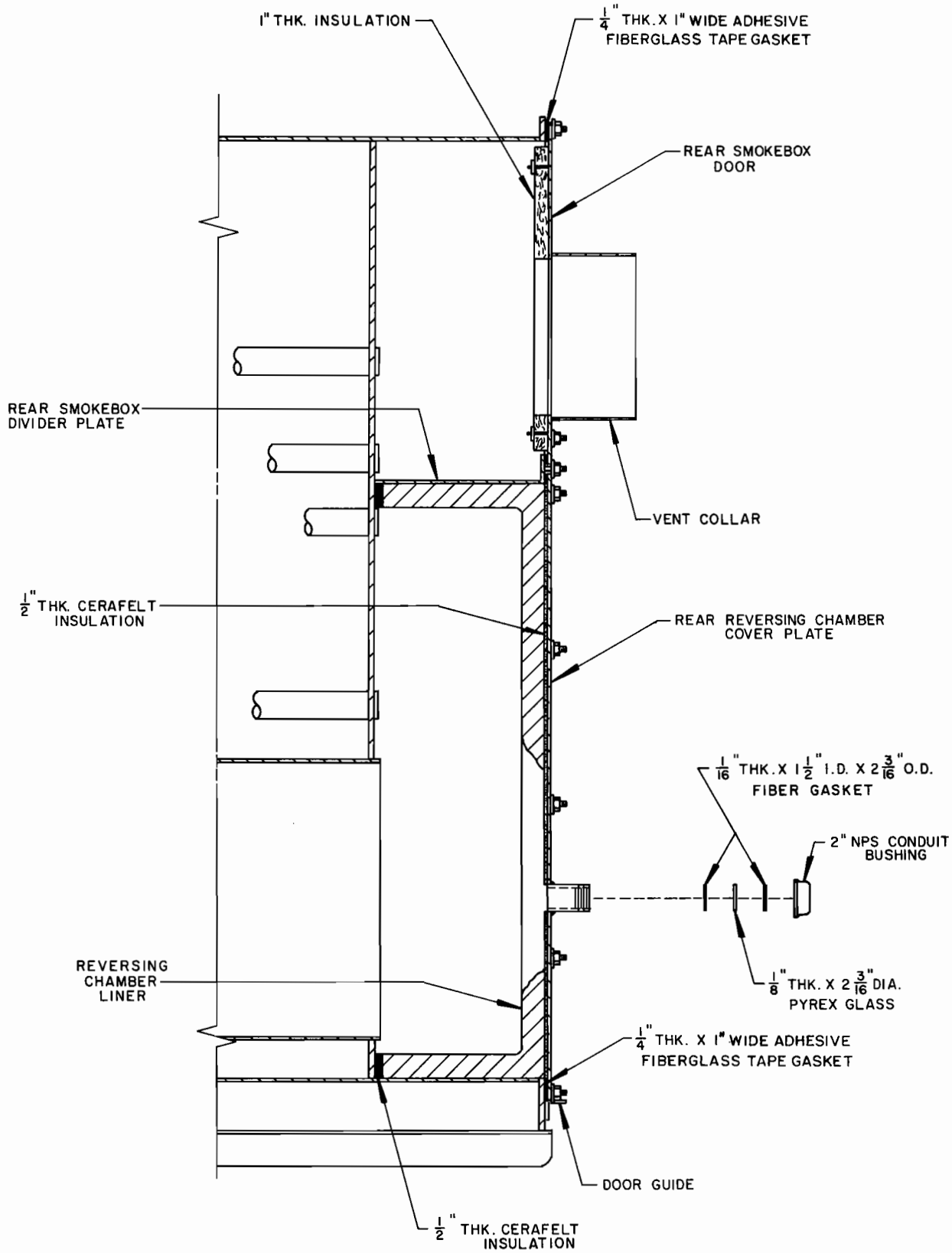
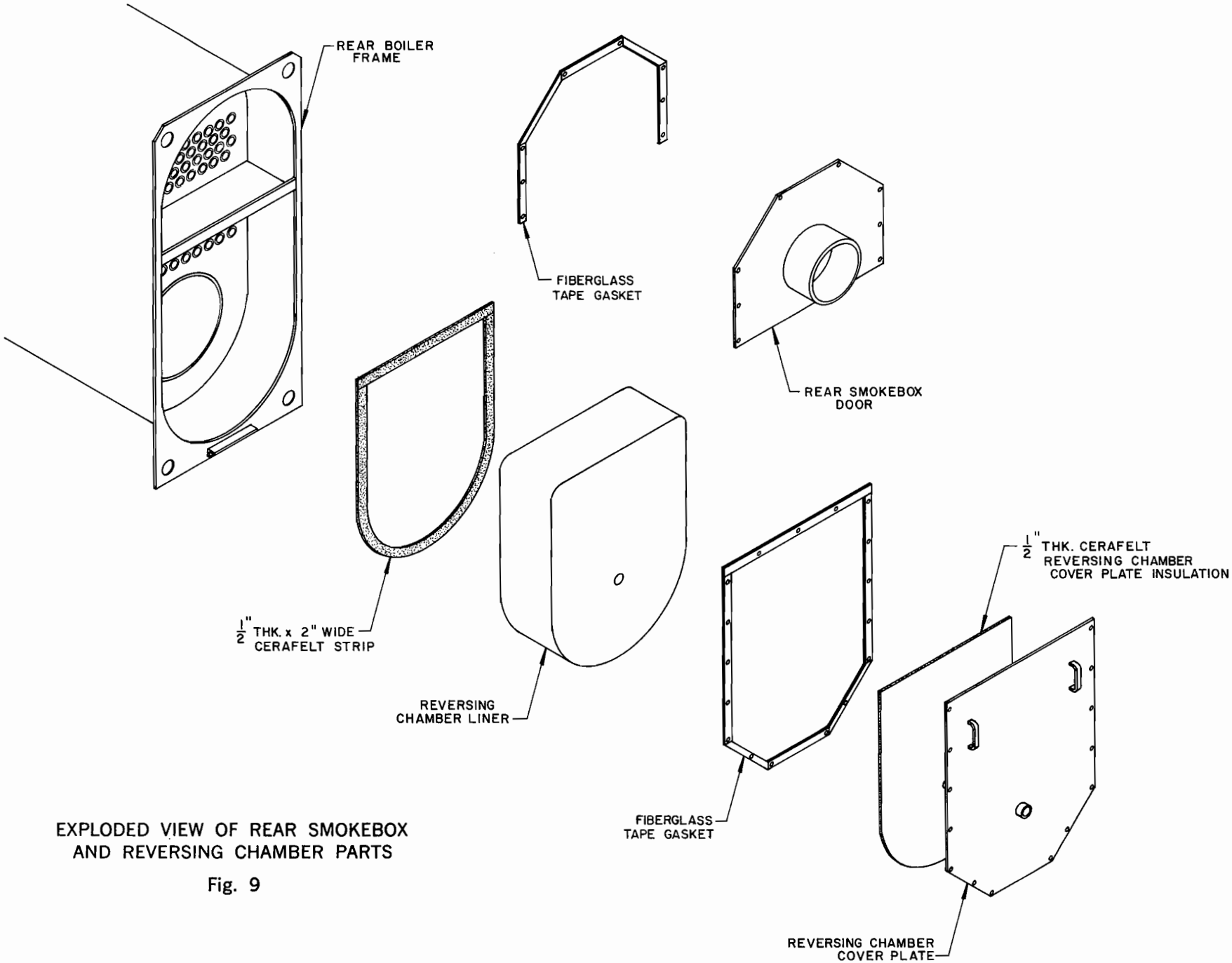


Fig. 7
FIRETUBE CONFIGURATION
VERSUS
TURBULATOR LOCATIONS



REAR SMOKEBOX AND REVERSING CHAMBER DETAIL

Fig. 8



EXPLODED VIEW OF REAR SMOKEBOX AND REVERSING CHAMBER PARTS

Fig. 9

PERIODIC TESTING RECOMMENDED CHECK LIST

Item	Frequency	Accomplished by	Remarks
Gages, monitors, and indicators	Daily	Operator	Make visual inspection and record readings in log
Instrument and equipment settings	Daily	Operator	Make visual check against recommended specifications
Firing rate control	Weekly Semiannually Annually	Operator Service technician Service technician	Verify factory settings Verify factory settings Check with combustion test
Flue, vent, stack, or outlet dampers	Monthly	Operator	Make visual inspection of linkage, check for proper operation
Igniter	Weekly	Operator	Make visual inspection, check flame signal strength if meter-fitted (see "Combustion safety controls")
Fuel valves			
Pilot and main	Weekly	Operator	Open limit switch — make aural and visual check — check valve position indicators and check fuel meters if so fitted
Pilot and main gas or main oil	Annually	Service technician	Perform leakage tests — refer to instructions
Combustion safety controls			
Flame failure	Weekly	Operator	Close manual fuel supply for (1) pilot, (2) main fuel cock, and/or valve(s); check safety shutdown timing; log
Flame signal strength	Weekly	Operator	If flame signal meter installed, read and log; for both pilot and main flames, notify service organization if readings are very high, very low, or fluctuating; refer to instructions
Pilot turndown tests	As required/annually	Service technician	Required after any adjustments to flame scanner mount or pilot burner; verify annually — refer to instructions
Refractory hold in	As required/annually	Service technician	See "Pilot turndown tests"
Low-water fuel cutoff and alarm	Daily/weekly Semiannually	Operator Operator	Refer to instructions Perform a slow drain test in accordance with ASME Boiler and Pressure Vessel Code Section VI
High limit safety control	Annually	Service technician	Refer to instructions
Operating control	Annually	Service technician	Refer to instructions
Low draft, fan, air pressure, and damper position interlocks	Monthly	Operator	Refer to instructions

(continued on next page)

PERIODIC TESTING RECOMMENDED CHECK LIST (Cont'd)

Item	Frequency	Accomplished by	Remarks
Atomizing air/steam interlock	Annually	Service technician	Refer to instructions
High and low gas pressure interlocks	Monthly	Operator	Refer to instructions
High and low oil pressure interlocks	Monthly	Operator	Refers to instructions
High and low oil temperature interlocks	Monthly	Operator	Refer to instructions
Fuel valve interlock switch	Annually	Service technician	Refer to instructions
Purge switch	Annually	Service technician	Refer to instructions
Burner position interlock	Annually	Service technician	Refer to instructions
Rotary cup interlock	Annually	Service technician	Refer to instructions
Low fire start interlock	Annually	Service technician	Refer to instruclions
Automatic changeover control (dual fuel)	At least annually	Service technician	Under supervision of gas utility
Safety valves	As required	Operator	In accordance with procedure in Section VI, ASME Boiler and Pressure Vessel Code, Recommended Rules for Care and Operation of Heating Boilers
Inspect burner components	Semiannually	Service technician	Refer to instructions