

Smith

CAST IRON BOILERS

SERIES 28HE GAS OR OIL BOILER INSTALLATION & OPERATING INSTRUCTIONS



DESIGNED AND TESTED ACCORDING TO A.S.M.E. BOILER AND PRESSURE VESSEL CODE, SECTION IV FOR A MAXIMUM ALLOWABLE WORKING PRESSURE OF: 15 PSI STEAM OR 80 PSI WATER.

TO INSTALLER

NOTE: READ THESE INSTRUCTIONS CAREFULLY. THEY WILL SAVE YOU VALUABLE TIME WHEN ASSEMBLING THE BOILER.

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

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

WHAT TO DO IF YOU SMELL GAS:

- Do not try to light any appliance.
- Do not touch any electrical switch. Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

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

INSTALLER, THESE INSTRUCTIONS TO BE AFFIXED ADJACENT TO THE BOILER.
CONSUMER, RETAIN THESE INSTRUCTIONS FOR FUTURE REFERENCE PURPOSES.

FOR JACKET ASSEMBLY AND BURNER SET UP SEE SEPARATE INSTRUCTIONS.

Smith
CAST IRON BOILERS

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BEFORE YOU START

This manual covers the assembly, installation, operation and maintenance of a Series 28HE low pressure steam or hot water boiler.

The 28HE Series boilers are supplied completely knocked down for field assembly, knocked down but with an assembled block or as complete factory assembled packaged boilers. All boiler components should be inspected for damage upon receipt. Any damage should be immediately reported to the trucker or wholesaler. All boiler components should be stored in a clean dry area. To obtain the safe, dependable, efficient operation and long life for which this boiler was designed, these instructions must be read, understood and followed.

The Series 28HE boilers have been design certified by CSA. Each unit has been constructed and hydrostatically tested for a maximum working pressure of 15 psi for steam, 80 psi for water, in accordance with Section IV of the A.S.M.E. Boiler and Pressure Vessel Code for cast iron boilers.

All aspects of the boiler installation must conform to the requirements of the authority having jurisdiction, or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1/NFPA 54-latest revision or to the Installation of Oil Burning Equipment, ANSI/NFPA 31.

Where required by the authority having jurisdiction, the installation must conform to the Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1.

In Canada, the installation must be in accordance with the requirements of CAN/CGA B149.1 or .2, Installation Code for Gas Burning Appliances and Equipment.

In the Commonwealth of Massachusetts the installation of a gas burner must be performed by a licensed plumber or gas fitter.

The owner should maintain a record of all service work performed with the date and a description of the work done. Include the name of the service organization for future reference.

Direct all questions to your Smith Cast Iron Boiler distributor or contact the Smith Customer Service Department. Always include the model and serial numbers from the rating plate of the boiler in question.

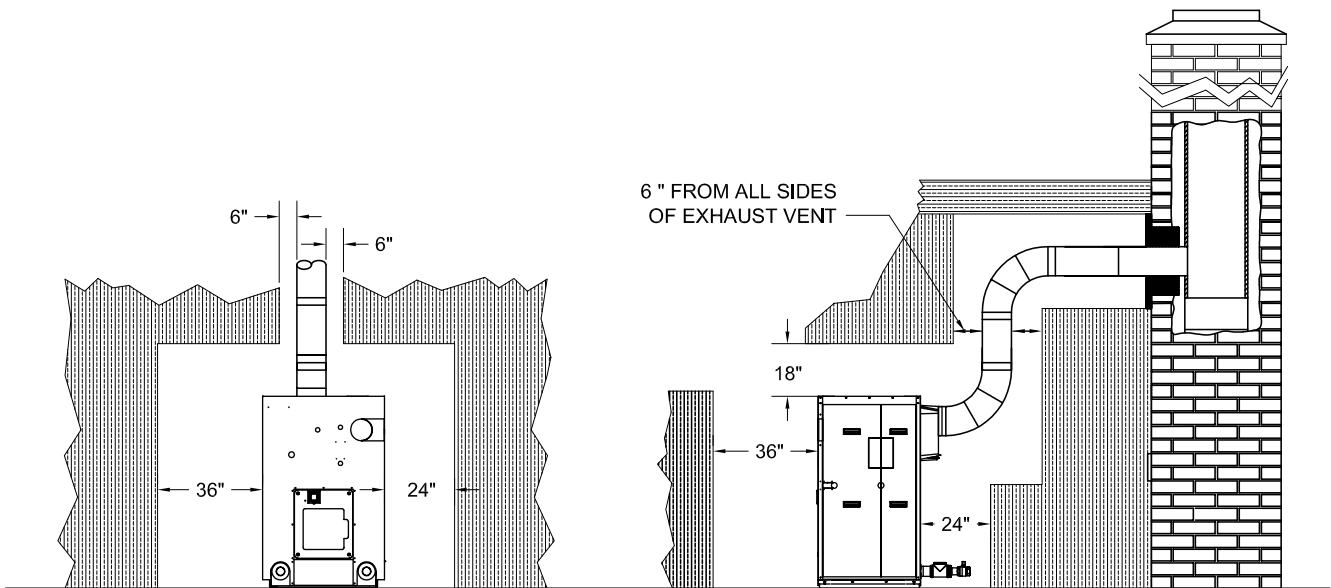
BOILER RATINGS & CAPACITIES

Before undertaking the installation of the 28HE Series boiler check the boiler rating plate to ensure that the boiler has been sized properly for the job. The "Net I=B=R Ratings" specify the equivalent amount of direct cast iron radiation that the boiler can supply under normal conditions. Also ensure that the boiler has been set up for the type of fuel available at the installation site.

BOILER LOCATION

1. Locate the boiler in an area that provides good access to the unit. **A minimum distance of 6 in, 0.15m must be maintained between the boiler and combustible construction.** Servicing may require the removal of jacket panels so service clearances should be maintained. Allow a minimum clearance of **3 ft, 0.9 m** between adjacent construction and the left side, front and smoke hood. A minimum clearance of **2 ft, 0.6 m** should be maintained between adjacent construction and the right side and back of the boiler. Accessibility clearances should take precedence over minimum clearances to combustible construction, Figure 1.
2. An optimum site will be level, central to the piping system, close to a chimney and have adequate fresh air for combustion.
3. The boiler should be installed on a level, flat, concrete floor or pad that is structurally sound and will support the weight of the boiler. If a concrete pad is used it must be at least 2" thick. Never install the boiler on a concrete floor or pad that contains wires, cables, water pipes or hoses. This boiler is designed for non combustible floors!

Figure 1 -Service Clearances to Adjacent Construction



WARNING: Never install a 28HE boiler on top of combustible flooring without consulting the local building authorities for proper installation guidelines! A minimum clearance of 6 in, 0.15 m must be maintained between the boiler and combustible construction. Failure to comply with this warning may result in a fire causing extensive property damage, severe personal injury or death!

4. DO NOT install this boiler in a location that would subject any of the electrical components to direct contact with water or excessive moisture during operation or servicing.
5. DO NOT place this boiler in a location that would restrict the introduction of combustion air into the boiler.

WARNING: Never store combustible materials, gasoline or any product containing flammable vapors or liquids in the vicinity of the boiler. Failure to comply with this warning can result in an explosion or fire causing extensive property damage, severe personal injury or death!

COMBUSTION AIR & VENTILATION

WARNING: This boiler must be supplied with combustion and ventilation air in accordance with Section 5.3, Air for Combustion & Ventilation, of the latest revision of the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and all applicable local building codes. Canadian installations must comply with CAN/CGA B149.1 or .2 Installation Code. Failure to provide adequate combustion air for this boiler can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

To operate properly and safely this boiler requires a continuous supply of air for combustion. An adequate supply of air must be available to replace the air used by the combustion process. NEVER store objects on or around the boiler.

CAUTION: Never use an exhaust fan in the boiler room. The boiler room must never be under a negative pressure or improper burner operation will occur!

NOTE: Forced make-up air supplied to the boiler room must be approved by the local authorities. A minimum of 30 ft³/GAL, 0.22 m³/L for oil or 20 ft³/100 MBH (Therm), 0.024 m³/kW for gas must be provided.

All Air From Inside The Building

If the boiler is to be located in a confined space minimum clearances of **24 in, 610 mm** must be maintained between the boiler and any adjacent construction. When installed in a confined space, two permanent openings communicating with an additional room(s) are required. The combined volume of these spaces must have sufficient volume to meet the criteria for an unconfined space. The total air requirements of all fuel burning equipment or any type of exhaust fan must be considered when making this determination.

Each opening must have a minimum free area of **1 in²/1000 Btu/hr, 140 in²/GPH, 2200 mm²/kW** based on the total input rating of ALL fuel burning equipment in the confined area. Each opening must be no less than **100 in², 64,516 mm²** in size. The upper opening must be within **12 in, 305 mm** of, but not less than **3 in, 76 mm** from, the top of the enclosure.

The bottom opening must be within **12 in, 305 mm** of, but not less than **3 in, 76 mm** from, the bottom of the enclosure.

All Air From Outside The Building

When installed in a confined space **Two** permanent openings communicating directly with, or by ducts to, the outdoors or spaces that freely communicate with the outdoors must be present. The upper opening must be within **12 in, 305 mm** of, but not less than **3 in, 76 mm** from, the top of the enclosure. The bottom opening must be within **12 in, 305 mm** of, but not less than **3 in, 76 mm** from, the bottom of the enclosure.

Where directly communicating with the outdoors or communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of **1 in²/4000 Btu/hr, 35 in²/GPH, 550 mm²/kW** of the total input rating of all of the equipment in the enclosure.

Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of **1 in²/2000 Btu/hr, 70 in²/GPH, 1100 mm²/kW** of the total input rating of all of the equipment in the enclosure. When ducts are used, they must have the same cross-sectional area as the free area of the opening to which they connect. When calculating the free area necessary to meet the make-up air requirements of the enclosure, consideration must be given to the blockage effects of louvers, grills and screens. Screens must have a minimum mesh size of **1/4 in, 6.4mm**. If the free area through a louver or grill is not known the louver or grille should be sized per Table 1.

Table 1 - Make-up Air Louver Sizing

Input (MBH)	Required Cross Sectional Area (in ²)		
	1/4" Wire Screen	Metal Louvers	Wooden Louvers
		75% Free Area	25% Free Area
1000	250	333	1000
1200	300	400	1200
1400	350	467	1400
1600	400	533	1600
1800	450	600	1800
2000	500	667	2000
2200	550	733	2200
2400	600	800	2400
2600	650	867	2600
2800	700	934	2800
3000	750	1000	3000
3200	800	1066	3200
3400	850	1134	3400
3600	900	1200	3600
3800	950	1267	3800
4000	1000	1334	4000
4200	1050	1400	4200
4400	1100	1467	4400
4600	1150	1533	4600
4800	1200	1600	4800

CHIMNEY & VENT PIPE CONNECTIONS

WARNING: The vent installation must be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1/NFPA 54-latest revision, the ASHRAE Equipment Handbook on Venting or applicable provisions of the local building codes. Canadian installations must comply with CAN/CGA B149.1 or .2 Installation Code. Improper venting of this boiler can result in excessive levels of carbon monoxide which can result in severe personal injury or death!

CAUTION: The products of combustion from a 28 HE must be safely vented to the outdoors while ensuring that the flue gasses do not cool prematurely. It's critical that the chimney system be properly designed to handle the relatively cool flue gas temperatures. An oversized or uninsulated chimney will cause the moisture in the flue gases to condense resulting in damage to the chimney system unless it's specifically designed for condensate. If this is the case a suitable condensate drain must be used to protect the boiler from condensate.

NOTE: Our warranty does not cover corrosion damage to the boiler or its vent system caused by flue gas condensate!

Chimney Inspection & Sizing

If this boiler will be connected to a masonry chimney, a thorough inspection of the chimney must be performed. Ensure that the chimney is clean, properly constructed, lined and properly sized, see Figure 2. Table 2 lists the equivalent breeching and flue sizes required for the 28HE boilers.

Table 2 - Equivalent Breeching & Chimney Size

Boiler Model	Breeching Size		Chimney Size	
	in	mm	in	mm
28HE-4	10	254	10	254
28HE-5	10	254	10	254
28HE-6	10	254	10	254
28HE-7	12	305	12	305
28HE-8	12	305	12	305
28HE-9	14	356	14	356
28HE-10	14	356	14	356
28HE-11	14	356	14	356
28HE-12	14	356	14	356
28HE-13	14	356	14	356
28HE-14	16	406	16	406
28HE-15	16	406	16	406
28HE-16	16	406	16	406
28HE-17	18	406	18	406
28HE-18	18	457	18	457

Note: These sizes are based on a 20 foot chimney height.

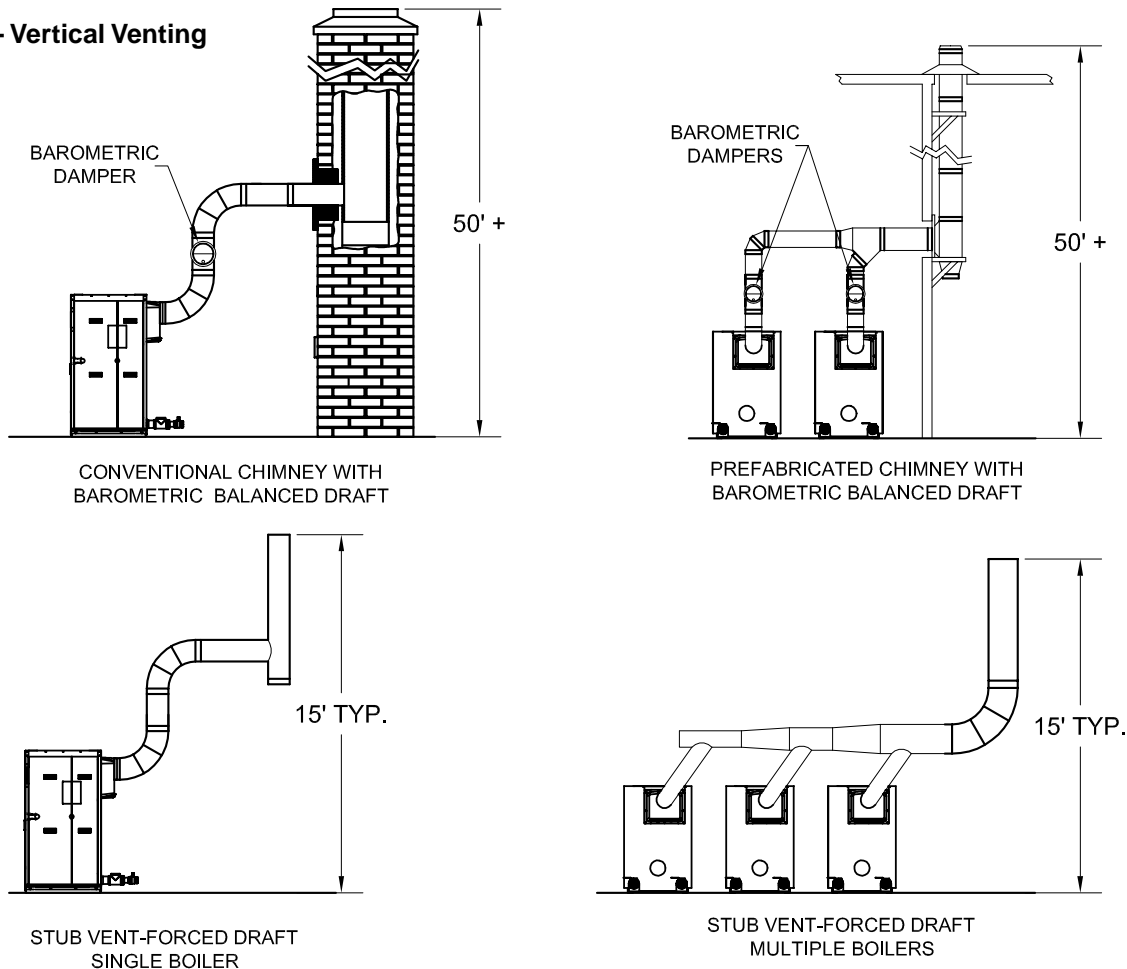
The 28HE is designed for pressurized operation with a back pressure of **0.10 in, 2.54 mm W.C.** before the smoke hood slide damper. If the vent configuration results in a back pressure greater than this, the burner capacity may have to be verified. Contact the Smith Technical Service Department to verify the burner capacity.

The chimney must be able to provide 0.10" WC at the boiler outlet. If the chimney is 50 ft. or taller it may produce excessive draft (approx. - 0.25" WC) and a barometric draft regulator may be needed.

When more than one appliance is connected to the same chimney flue the flue must be large enough to safely vent the combined output of all the appliances.

WARNING: If an appliance using any type of a mechanical draft system operating under positive pressure is connected to a chimney flue, never connect a Category I appliance to this flue. Doing so can result in the accumulation of carbon monoxide which can cause severe personal injury or death!

Figure 2- Vertical Venting



VENT CONNECTIONS

WARNING: Never modify or alter any part of the boiler's smoke hood. This includes the removal or alteration of any baffles. Never install a vent pipe of a diameter different than that of the boiler smoke hood outlet. Failure to comply with this warning can result in severe personal injury or death.

Locate the boiler as close to the chimney as possible. Use the shortest, straightest vent connector possible for the installation. If horizontal runs exceed **5 ft, 1.5 m** they must be supported at **3 ft, 0.9 m** intervals with overhead hangers. Use a single wall stainless or single wall galvanized steel vent pipe the same diameter as the flue collar to connect the boiler to a masonry chimney. When using an approved metal chimney system use the appropriate vent connector. The vent connector should be sloped up toward the chimney at a minimum rate of **1/4 in/ft, 2 cm/m**. On masonry chimneys the connector must terminate flush with the inside of the chimney flue. Fasten each single wall vent connection with at least 3 corrosion resistant sheet metal screws.

The vent materials used in positive pressure vent systems must be certified to UL 1738 for installations in the United States, ULS636 for installations in Canada. The following manufactures have systems that meet these requirements:

Heat-Fab, Inc.
38 Hayward Street
Greenfield, MA 01301, (800) 772-0739.

Z-Flex U.S., Inc.
20 Commerce Park
North, Bedford, NH 03110-6911, (800) 654-5600.

Protech Systems Inc.
26 Gansevoort Street
Albany, NY 12202 (518) 463-7284

WARNING: Breeching under positive pressure must be certified to UL 1738 for installations in the United States, ULS636 for installations in Canada. Type B1 vent SHALL NOT be used. Failure to comply with this warning can result in severe personal injury or death.

Always provide a minimum clearance of 6 inches between single wall metal vent pipe and all combustible materials.

WARNING: Failure to maintain minimum clearances between vent connectors and any combustible material can result in a fire causing extensive property damage, severe personal injury or death!

COMMON VENT SYSTEMS

If an existing boiler is removed from a common venting system, the common venting system may then be too large for the proper venting of the remaining appliances 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.

Au moment du retrait d'une chaudière existante, les mesures suivantes doivent être prises pour chaque appareil toujours raccordé au système d'évacuation commun et qui fonctionne alors que d'autres appareils toujours raccordés au système d'évacuation ne fonctionnent pas: système d'évacuation

- a) Seal any unused openings in the common venting system.

Sceller toutes les ouvertures non utilisées du système d'évacuation.

- b) 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.

Inspecter de façon visuelle le système d'évacuation pour déterminer la grosseur et l'inclinaison horizontale qui conviennent et s'assurer que le système est exempt d'obstruction, d'étranglement de fuite, de corrosion et autres défaillances qui pourraient présenter des risques.

- c) 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 exhaust, so they will operate at maximum speed. Do not operate a summer exhaust fan for a boiler installation. Close fireplace dampers.

Dans la mesure du possible, fermer toutes les portes et les fenêtres du bâtiment et toutes les portes entre l'espace où les appareils toujours raccordés du système d'évacuation sont installés et les autres espaces du bâtiment. Mettre en marche les sècheuses, tous les appareils non raccordés au système d'évacuation commun et tous les ventilateurs d'extraction comme les hottes de cuisinière et les ventilateurs des salles de bain. S'assurer que ces ventilateurs fonctionnent à la vitesse maximale. Ne pas faire fonctionner les ventilateurs d'été. Fermer les registres des cheminées.

- d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.

Mettre l'appareil inspecté en marche. Suivre les instructions d'allumage. Régler le thermostat de façon que l'appareil fonctionne de façon continue.

- e) 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.

Faire fonctionner le brûleur principal pendant 5 min ensuite, déterminer si le coupetirage déborde à l'ouverture de décharge. Utiliser la flamme d'une allumette ou d'une chandelle ou la fumée d'une cigarette, d'un cigare ou d'une pipe.

- f) 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 condition of use.

Une fois qu'il a été déterminé, selon la méthode indiquée cidessus, que chaque appareil raccordé au système d'évacuation est mis à l'air libre de façon adéquate. Remettre les portes et les fenêtres, les ventilateurs, les registres de cheminées et les appareils au gaz à leur position originale.

- g) Any improper operation of the venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z223.1/NFPA 54. 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 Appendix F in the National Fuel Gas Code, ANSI Z223.1/NFPA 54 and or CSA B149 Installation Codes.

Tout mauvais fonctionnement du système d'évacuation commun devrait être corrigé de façon que l'installation soit conforme au National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) aux codes d'installation CAN/CGA-B149. Si la grosseur d'une section du système d'évacuation doit être modifiée, le système devrait être modifié pour respecter les valeurs minimales des tableaux pertinents de l'appendice F du National Fuel Gas Code, ANSI Z223.1/NFPA 54 et (ou) des codes d'installation CSA-B149.

BOILER ASSEMBLY

Locate the boiler installation site based on the guidelines set forth in the BOILER LOCATION section.

WARNING: Never install a 28HE boiler on top of combustible flooring without consulting the local building authorities for proper installation guidelines! Failure to comply with this warning can result in a fire causing extensive property damage, severe personal injury or death!

Packaged Boilers/Factory Assembled Sections

A careful inspection of all assemblies should be made to detect possible shipping damage. Packaged boilers and factory assembled blocks of sections are hydrostatically tested at the factory to insure pressure tightness. A hydrostatic retest should be performed before any piping connections are made to detect leaks caused by shipping.

NOTE: All assembled boiler sections shall pass the hydrostatic tests prescribed in Section IV of the ASME Boiler and Pressure Vessel Code.

CAUTION: Do not connect any boiler controls during the pressure test or they will be damaged!

Completed boilers must be tested as follows:

Steam Boilers – the assembled boiler sections shall be subjected to a hydrostatic test pressure of not less than **45 psig, 315 kPa**.

Water Boilers – the assembled boiler sections shall be subjected to a hydrostatic test pressure of not less than 1 1/2 times the maximum allowable working pressure.

The hydrostatic pressure shall not exceed the required test pressure by more than **10 psig, 70 kPa** during the test.

WARNING: Never leak test the boiler using compressed air! Failure to comply with this warning may result in property damage, severe personal injury or death!

1. Plug all openings in the boiler and fill it with water.
2. Bleed any air off through one of the top tapings then increase the pressure as outlined above.
3. Maintain the test pressure while carefully checking for leaks. If a leak is found it must be eliminated, see Table 4 and supporting text. Once the assembled boiler sections pass the hydrostatic test drain them and remove the plugs from any tapings that will be used in service.

NOTE: The shipping lugs, lifting lugs and metal banding should be removed before installing the jacket on factory assembled sections.

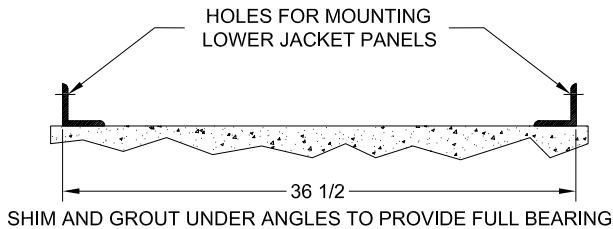
CAUTION: Remove the left jacket panels on fully packaged boilers and ensure that the cleanout covers are secure and gas tight. Loose covers could damage the boiler.

Assembly of Knocked-Down Boilers

Drilled and tapped steel angles are furnished to provide a level footing, ease of section assembly and a point of jacket attachment.

1. Set the angles as shown in Figure 3. They must be parallel and level. Grout under the angles to provide a continuous bearing surface.

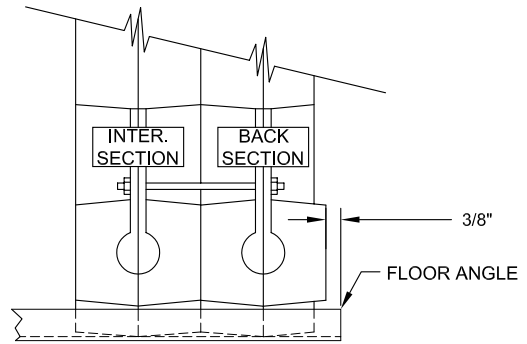
Figure 3 - Steel Angle Placement



2. Carefully place the back section in position on the angles as shown in Figure 4.

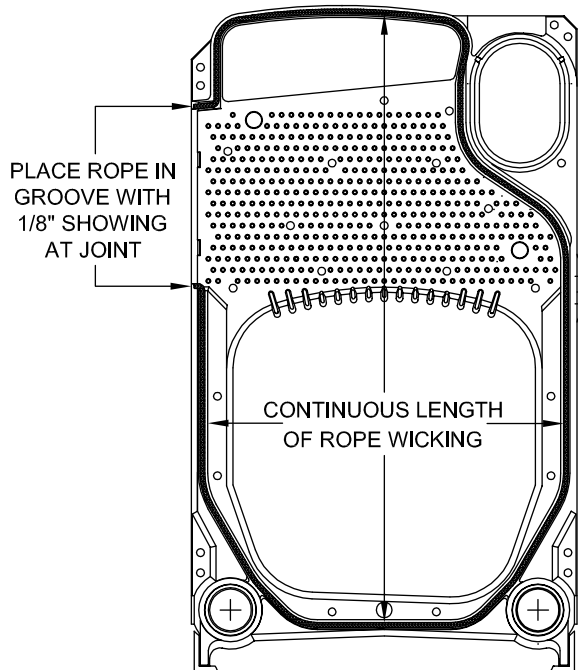
WARNING: The section MUST be fully supported to prevent it from falling! Failure to comply with this warning may result property damage, severe personal injury or death!

Figure 4 - Section Placement



3. Clean the hydronic port connector sealing surfaces and the rope grooves with a wire brush to remove any rust or debris.
4. Apply two coats of the spray adhesive supplied with the boiler to the rope groove. Allow time for the first coat to dry before applying the second coat. When the second coat is tacky press the rope into the rope groove. Trim the rope off leaving **1/8 in., 3.2 mm** extending beyond the surface of the cast iron section, Figure 5.

Figure 5 - Rope Installation



5. Insert the large port connector **with its steel inner ring into the upper port.**
6. Insert the two round port connectors into the lower ports.

NOTE: Apply the spray adhesive supplied with the boiler to the port recess to hold the port connector in place if necessary.

7. Select the correct intermediate section and carefully move it into place against the back section, Figure 4.

CAUTION: Any steam uptake and heater sections must be located as shown in Table 3. Failure to comply with this caution may result in poor boiler performance and prevent the jacket from fitting! Only one intermediate section with an external leg boss has been included. It should be located toward the front of the boiler for optional low water cutoff use. See Table 3.

NOTE: A putty knife or similar tool can be used to hold the port connectors in place while the intermediate section is positioned. It must be removed before the sections make contact or the port connector will be damaged resulting in a leak!

8. Insert the four draw rods through the casting bosses. Thread nuts onto one end of the rods. Place washers on the other end of the rods before threading nuts onto them. Snug the nuts finger tight. Use a spirit level to ensure that the first two sections are plumb and properly aligned, Figure 6. Check the rope to insure that it's properly positioned. Once the sections are plumb and the rope and port connectors are properly positioned follow the torque sequence shown in Table 4.

Figure 6 - Section Alignment

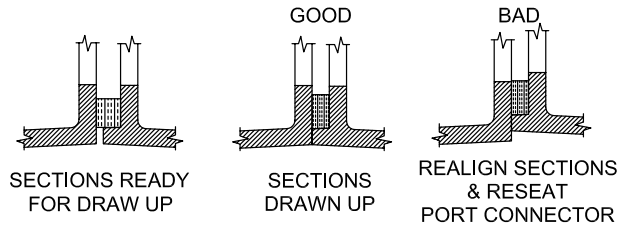


Table 4 - Section Torque Sequence

Step	Rod Position	Torque	
		ft lbs	Nm
1	Upper Right	25	34
2	Lower Left	25	34
3	Lower Right	25	34
4	Upper Left	10	14
5	Upper Right	50	68
6	Lower Left	50	68
7	Lower Right	50	68
8	Upper Right	75	102
9	Lower Left	75	102
10	Lower Right	75	102
11	Upper Left	30	42
12	Upper Right	125	169
13	Lower Left	125	169
14	Lower Right	125	169
15	Upper Right	125	169
16	Upper Left	40	54

NOTE: With these initial torques the sections may not be metal to metal, which is acceptable. If any of the ports leak during the hydrostatic test the torque can be increased to 200 ft lbs, 271 Nm on the upper right rod. The torque on the lower left and right rods can be increased to 150 ft lbs, 203 Nm. Once the sections are metal to metal additional torque will not improve the seal.

Table 3 - Section Locations

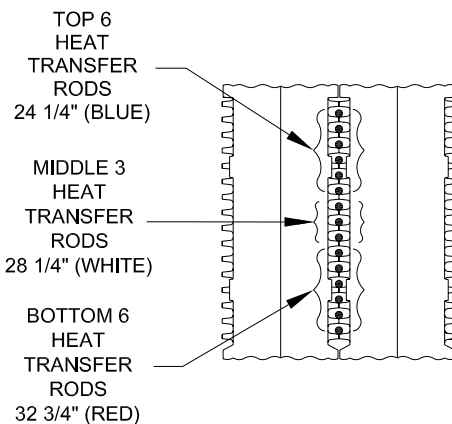
Boiler Model	Section Location Numbered From Front To Back																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
28HE-4	F	T	H	B							F	Front Section						
28HE-5	F	H	T	H	B						T	Intermediate Section w/ 5" Tapping & Boss						
28HE-6	F	T	H	T	H	B					H	Intermediate Section w/ Heater Opening						
28HE-7	F	T	H	P	T	H	B				P	Intermediate Section, Plain						
28HE-8	F	T	H	P	H	T	H	B			B	Back Section						
28HE-9	F	T	H	P	H	P	T	H	B									
28HE-10	F	H	T	H	P	H	P	T	H	B								
28HE-11	F	H	T	H	P	T	P		T	H	B							
28HE-12	F	H	T	H	P	T	H	P	H	T	H	B						
28HE-13	F	H	T	H	P	H	T	P	P	H	T	H	B					
28HE-14	F	H	T	H	P	H	T	H	P	H	P	T	H	B				
28HE-15	F	H	T	H	P	H	P	T	H	P	H	P	T	H	B			
28HE-16	F	H	T	H	P	H	P	H	T	H	P	H	P	T	H	B		
28HE-17	F	H	T	H	P	H	P	H	T	H	P	H	P	H	T	H	B	
28HE-18	F	H	T	H	P	H	P	H	P	T	H	P	H	P	H	T	H	B

9. Assemble the rest of the sections following steps 3 through 8 above.
10. Hydrostatically test the boiler by following the instructions on page 8.
11. **While the boiler is being filled confirm that all of the draw rods are properly torqued and that there are no leaks.**
12. If any leaks are found tighten the draw rods on that section until the leak stops.

Heat Transfer Rod Installation, Figure 7

The high efficiency 28HE comes with design certified heat transfer rod sets. Each tube of 15 heat transfer rods will baffle one flue. In order to obtain the high efficiency for which the boiler was designed, the heat transfer rods must be properly installed, Figure 7.

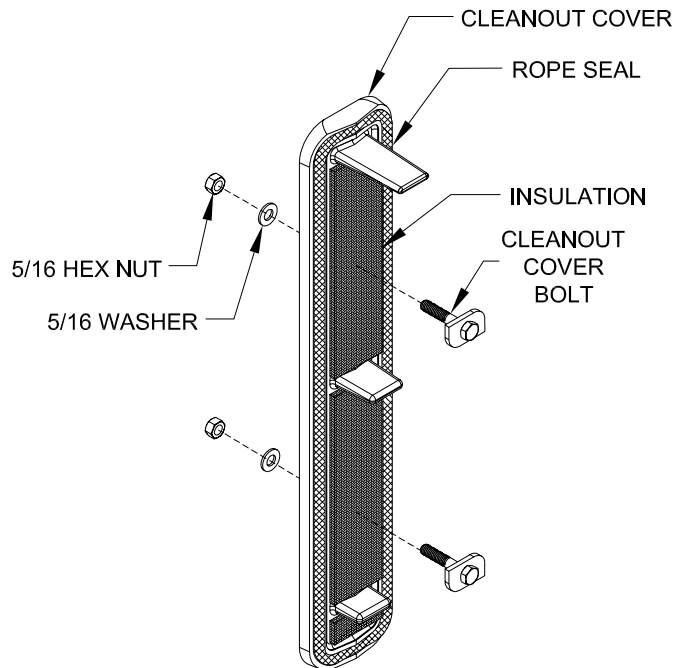
Figure 7 -Heat Transfer Rod Installation



Cleanout Cover Installation

1. The cleanout covers come insulated from the factory. Inspect the covers to ensure that the insulation is not damaged or missing. If it is call the Smith Customer Service Department.
2. Trim the 1/2" rope that's sticking out around the cleanout opening flush with the castings to insure an air-tight seal, see Figure 5.
3. Install the cleanout cover bolts from the baffled side of the cleanout cover and start the nuts, Figure 8.
4. Rotate the bolts so the cam heads fit between the cleanout cover bosses on the castings.
5. Insert the cleanout cover and tighten the nuts to **15 ft lbs, 21 Nm**.
6. Apply a bead of high temperature silicone caulk around the perimeter of the cleanout cover to ensure an air tight seal.

Figure 8 - Cleanout Cover Assembly

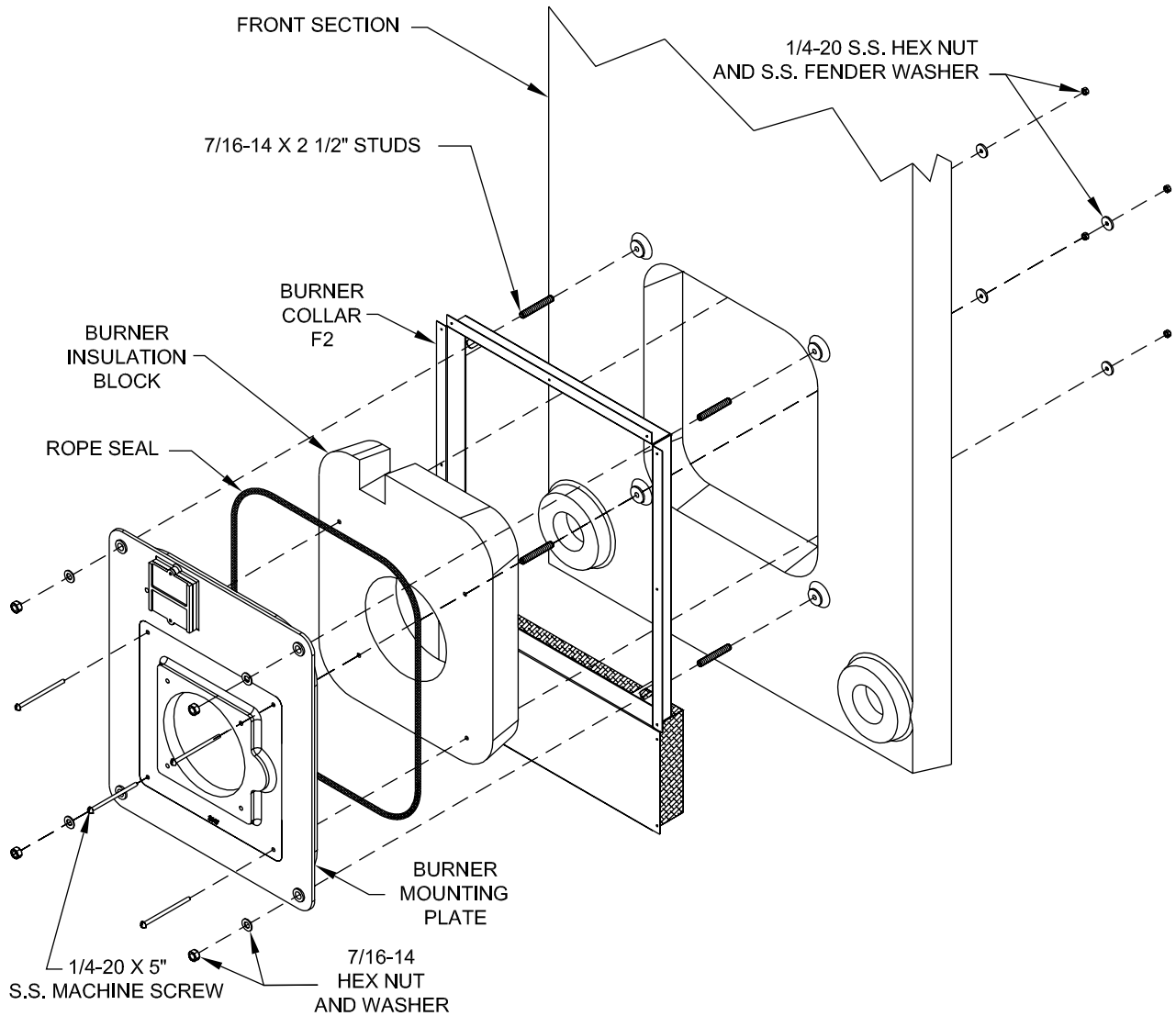


Burner Mounting Plate Installation, Figure 9

1. Apply two coats of the spray adhesive supplied with the boiler to the rope groove on the plate. Allow time for the first coat to dry then apply the second coat. When the second coat is tacky lay the 3/8" rope into the rope groove and press in place.
2. Screw the four 7/16-14 x 2 1/2" studs into the tapped holes in the boiler front section, Figure 9.
3. Install the burner mounting plate insulation block in the burner opening in the front section of the boiler. The small observation port cutout must be on the top, left side.
4. Position the front jacket panel frame over the four studs, Figure 9.
5. Align the four holes in the burner mounting plate with the 7/16" studs and force the burner insulation block inward until the studs extend far enough through the burner mounting plate holes so the nuts can be started. Lightly tighten the nuts.
6. Carefully insert the 1/4-20 x 5" machine screws through the holes in the burner mounting plate and insulation block, Figure 9. Reach through the inside of the burner opening and install the stainless steel fender washers and nuts and snug the nuts down.

CAUTION: The burner insulation block must be supported from the inside to prevent it from tearing. Don't force the bolts through the block or over tighten the nuts or the block with be damaged!

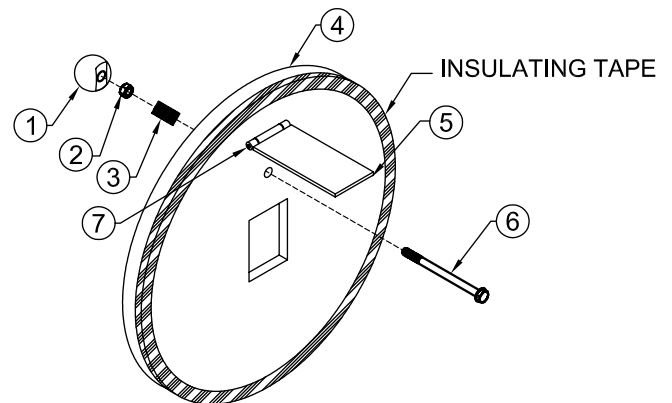
Figure 9 - Burner Mounting Plate Details



Observation Port Assembly, Figure 10

1. Position the hinged end of the steel flapper door, item 5, over the boss on the observation port cover, item 4.
2. Drive the expansion pin, item 7, through the hinge bosses to secure the door to the cover.
3. Insert the hex bolt, item 6, through the hole in the observation port cover.
4. Install the spring, nut and knob, items 3, 2 & 1 on the bolt as shown. Use the nut, item 2, as a jam nut against the knob, item 1.
5. Apply the insulating tape to the back of the observation port cover as shown.

Figure 10 - Observation Port Assembly

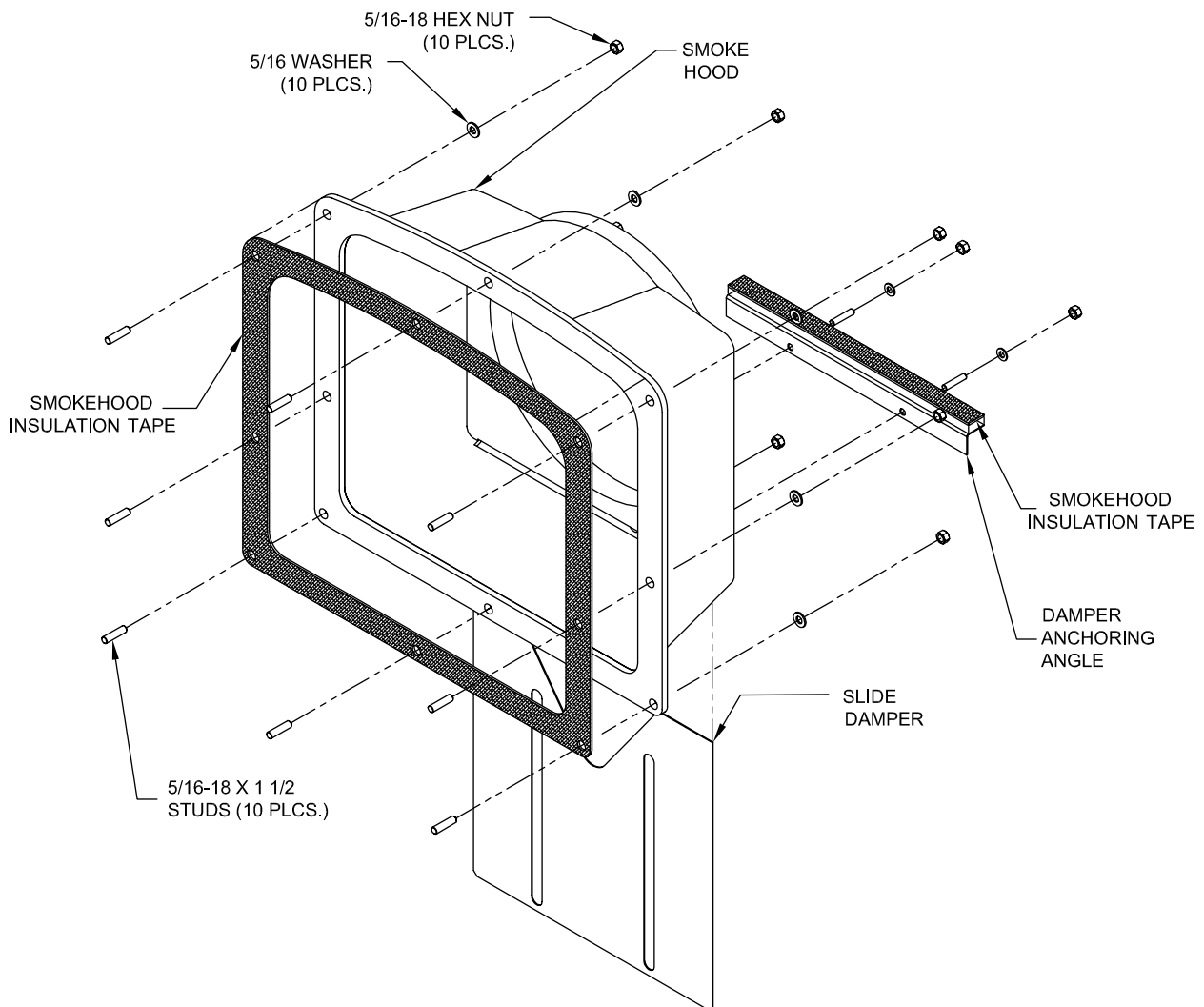


Observation Port Installation

1. Screw the four 5/16-18 x 1 1/2" studs into the tapped holes around the observation cover opening in the back section.
2. Place the observation port cover assembly over the studs and install the washers and nuts. Tighten the nuts uniformly.

Smokehood Installation, Figure 11

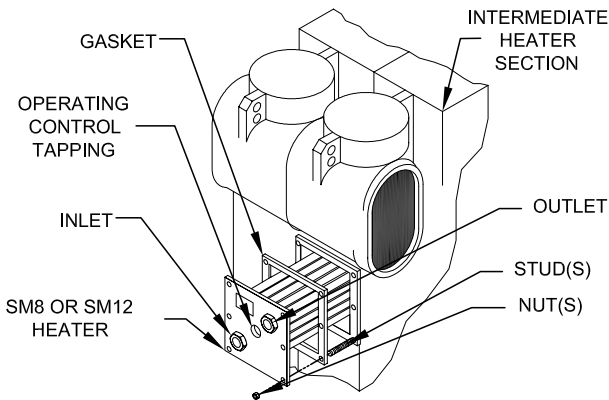
1. Screw the four 5/16-18 x 1 1/2" studs into the tapped holes around the smokehood opening in the back section.
2. Apply smokehood insulation tape to smokehood.
3. Place the smokehood over the studs and install the washers and nuts. Tighten the nuts uniformly.
4. Apply the 1/8" x 3/4" x 18" strip of insulating tape to the damper anchoring angle, Figure 11.
5. Fully open the slide damper and leave it ready for adjustment during burner light off.

Figure 11 - Smokehood Assembly

Tankless Heater Installation - Optional

1. Clean the heater flange to remove any rust or debris.
2. Install the four 7/16" x 1 1/2" studs into the tapped holes in the tankless heater flange on the section, Figure 12.

Figure 12 - Tankless Heater Installation



3. Place the heater gasket over the studs and carefully install the heater.
4. Install the nuts and tighten evenly to ensure uniform compression of the gasket.

5. Install the operating control in one of the heater mounting plates to ensure quick burner response when there is a demand for hot water. Figure 13 illustrates an acceptable piping arrangement for multiple heaters.

Burner Mounting

1. Clean the burner mounting flange to remove any rust or debris.
2. Install the four 3/8" x 1 1/4" studs into the tapped holes in the burner mounting plate.
3. Use a hacksaw blade, or some other suitable tool, to properly size the opening in the burner mounting plate insulation block to match the burner air tube end diameter.

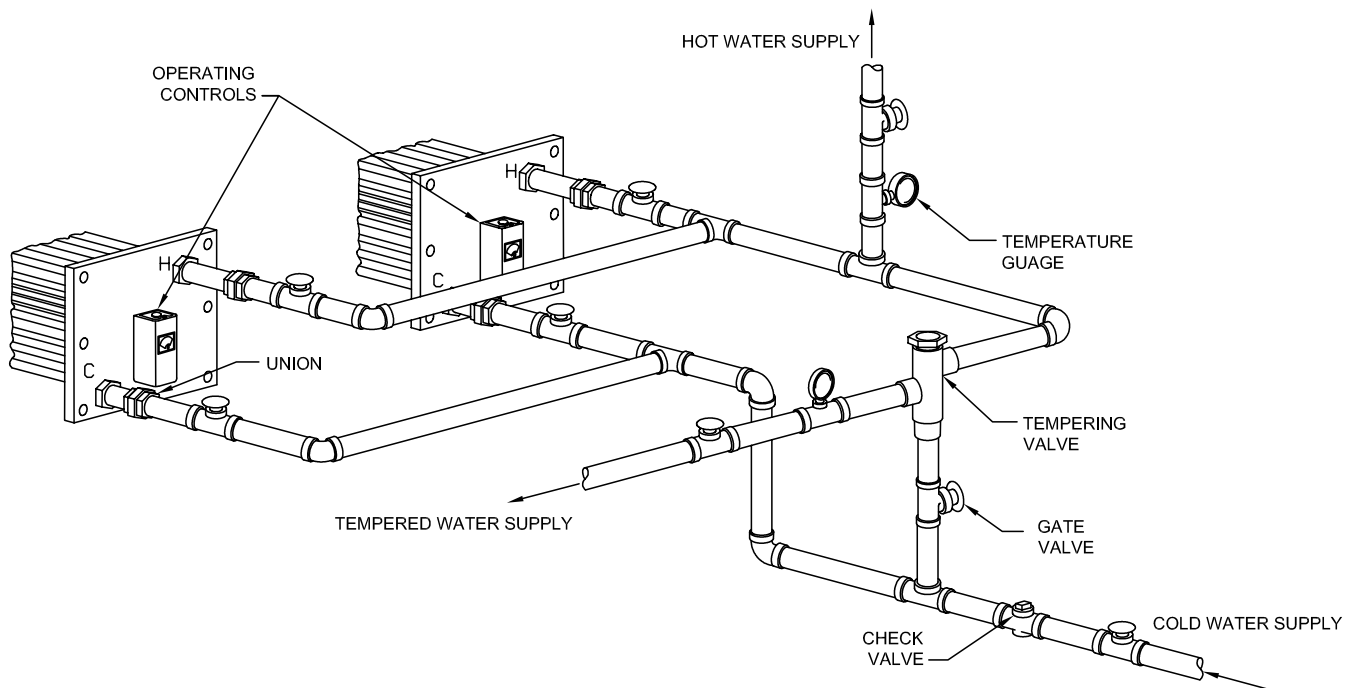
NOTE: The opening should be a close fit, but not too snug or the insulation block may be damaged upon burner insertion!

4. Place the burner gasket, supplied with the burner, over the studs and carefully insert the burner into the opening in the burner mounting plate.

CAUTION: Most burners require support to the floor. Follow the burner manufacturer's instructions or the burner may be damaged!

5. Install the 3/8" washers and nuts and tighten securely.

Figure 13 - Multiple Tankless Heater Piping



GENERAL PIPING REQUIREMENTS

CAUTION: Never use automotive antifreeze in the boiler or heating system. If antifreeze is necessary it must be formulated specifically for hydronic heating systems, such as ethylene or propylene glycol. Failure to comply with this caution will void the warranty!

All heating system piping must be installed by a qualified technician in accordance with the latest revision of the ANSI/ASME Boiler and Pressure Vessel Code, Section IV. Also ANSI/ASME CSD-1, Standard for Controls and Safety Devices for Automatically Fired Boilers where required. All applicable local codes and ordinances must also be followed. A minimum clearance of 1" must be maintained between heating system pipes and all combustible construction.

CAUTION: Improper piping of this boiler can result in poor performance and premature failure of the boiler voiding the warranty! Improper piping can also cause flooding and extensive property damage!

Ensure that the boiler is level from front to back and from side to side. Use metal shims to level the boiler. NEVER use wood, plastic or other combustible materials as shims.

If a boiler is installed above any radiation elements it must be fitted with a low water cutoff device.

NOTE: Install the observation port assembly before making any return piping connections as access may be blocked by piping.

Figure 14 - Front Section Tapping Locations

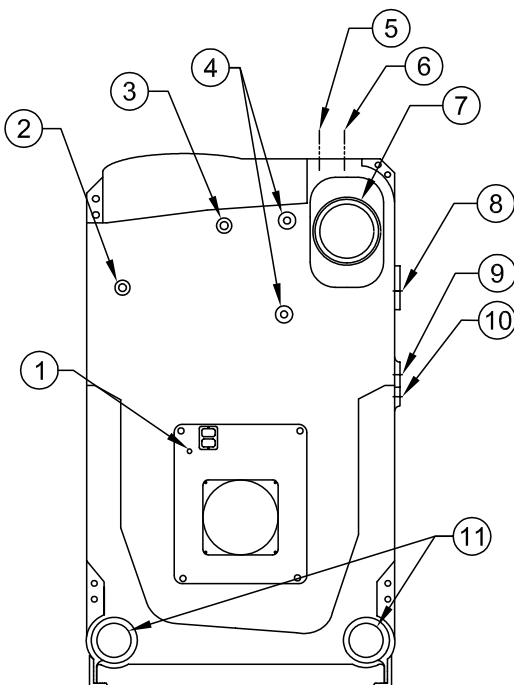


Figure 15 - Back Section Tapping Locations

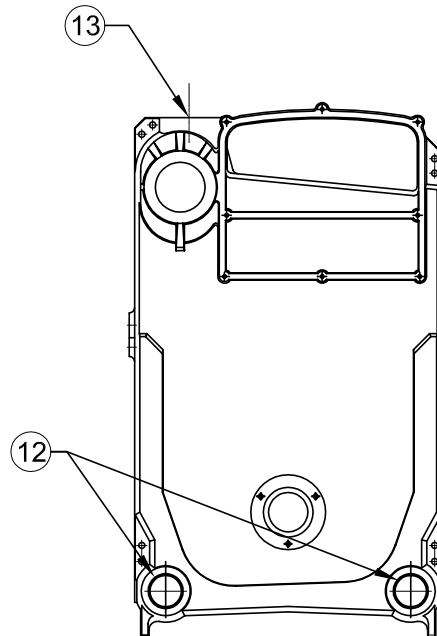


Table 5 - Water & Steam Tappings

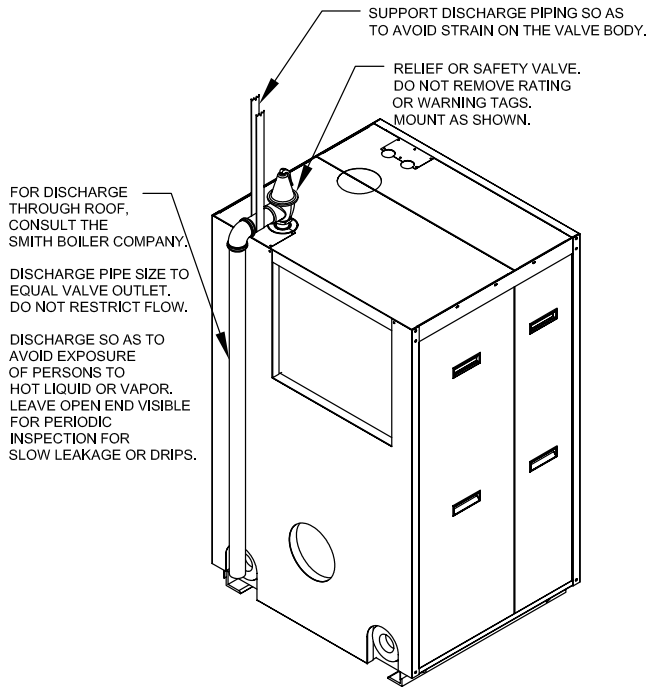
Tapping	Size	Water	Steam
1	1/8"	Chamber Pressure	Chamber Pressure
2	3/4"		Probe LWCO
3	3/4"	Temp./Pressure Gage	
4	3/4"	Operating Control - Top	Water Glass
5	3/4"	Manuel Reset High Limit	Manuel Reset High Limit & Steam Gage
6	1"	Air Removal	Water Column - Top
7	6"	Water Supply	Skim Tapping
8	3/4"	Tankless Heater Operating Control	
9	1 1/2"		Inspection Tapping - Top
10	1"	Water Column - Bottom	Water Column - Bottom
11	4"	Boiler Drain	Boiler Drain/Blowoff
12	4"	Return	Return
13		Relief Valve	Safety Valve

Relief & Safety Valve Piping

Install the pressure relief or safety valve in the 3" NPT opening in the top of the back section, Figure 14.

WARNING: The discharge of the pressure relief or safety valve must be piped close to the floor to prevent scalding in the event of a discharge, see Figure 16. The discharge piping must be sized the same as the pressure relief or safety valve outlet. Never install any type of valve between the boiler and the pressure relief or safety valve! Failure to comply with this warning can result in an explosion causing extensive property damage, severe personal injury or death!

Figure 16 - Relief & Safety Valve Piping



WATER BOILER PIPING

The supply and return connections should be sized to suit the system, see Figures 14, 15, 17, 18 and Tables 5 & 6. Do not pipe the supply from the bottom port or the return to the top port, the boiler will not work properly. Typical water boiler piping arrangements are shown in Figures 19 & 20. Swing joints should be used.

Install 3" nipples into the two 3" NPT tapings in the front section and cap them.

NOTE: See CLEANING OF WATER BOILERS on page 18 before proceeding!

Supply Piping

Install a reducing bushing in the 6" NPT tapping in the front section to obtain the correct supply pipe size, Figure 14 and Tables 5 & 6.

Table 6 - Water Boiler Piping

Boiler Size # Sections	Return Size NPT	Supply Size NPT
4 & 5	3	3
6 through 9	4	4
10 through 18	5	5

Note: Sizes based on 20°F, 11.1°C, ΔT for the system.

Return Piping 4 through 9 Section Boilers

Install 3" x 4" NPT bushings in the two 4" NPT tapings at the bottom of the back section. Install two 3" NPT x 6" nipples per Figure 17. Assemble the rest of the return yoke as shown in Figure 17.

Table 7- Boiler Water Content

Boiler Model	Water Boilers		Steam Boilers	
	Gallons	Liters	Gallons	Liters
28HE-4	123	466	104	394
28HE-5	150	568	126	477
28HE-6	177	670	148	560
28HE-7	204	772	170	644
28HE-8	231	875	192	727
28HE-9	258	977	214	810
28HE-10	285	1079	236	893
28HE-11	312	1181	258	977
28HE-12	339	1283	280	1060
28HE-13	366	1386	302	1143
28HE-14	392	1484	324	1227
28HE-15	419	1586	346	1310
28HE-16	446	1689	368	1393
28HE-17	473	1791	399	1511
28HE-18	500	1893	412	1560

Return Piping 10 Through 18 Section Boilers

Install two 4" NPT x 6" nipples per Figure 17. Assemble the rest of the return yoke as shown in Figure 17.

Control Installation

Locate the temperature & pressure gage, low water cutoff, high limit and operating controls per Figures 14 & 18. Optional controls must be installed in accordance with the control manufacturers instructions and Figures 14 & 18.

Note: The front jacket panel MUST be installed before any controls are attached to the front boiler section!

CAUTION: The controls must be mounted in the correct location and according to the control manufacturer's instructions or the boiler may not function properly!

Water Column Piping

A variety of water level controls are available for the 28HE. The water column piping needed to properly mount each control is available from Smith. Figure 18 shows a typical water column piping arrangement. The 1" NPT x 7 1/2" nipple is always installed in the lower water column tapping, Figures 14 & 18 and Table 5.

Piping For Use With Cooling Units

The boiler, when used in connection with a refrigeration system, must be installed so the chilled medium is piped in parallel with the boiler. Appropriate valves must be used to prevent the chilled water from entering the boiler, see Figure 21.

When a boiler is connected to a heating coil that may be exposed to refrigerated air from an air handling device, the piping system must be equipped with flow-control valves or some other automatic means of preventing gravity circulation of the boiler water during the cooling cycle.

Figure 17 - Optional Return Yoke

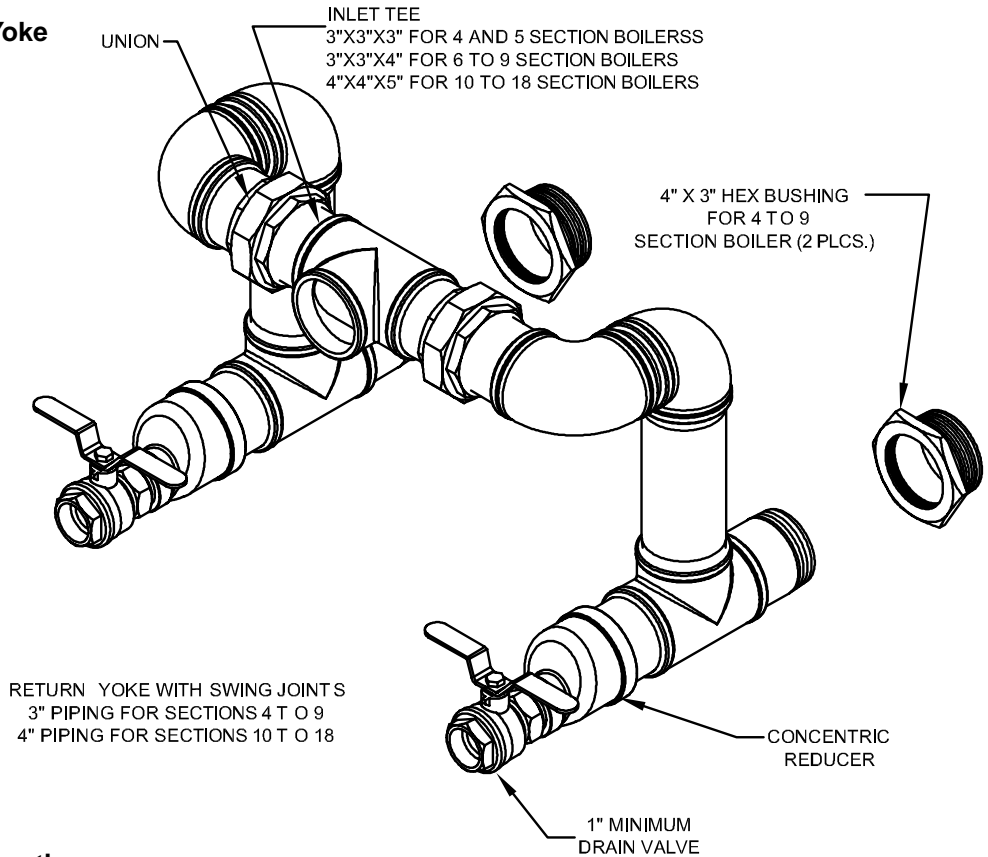


Figure 18 - Boiler Control Locations

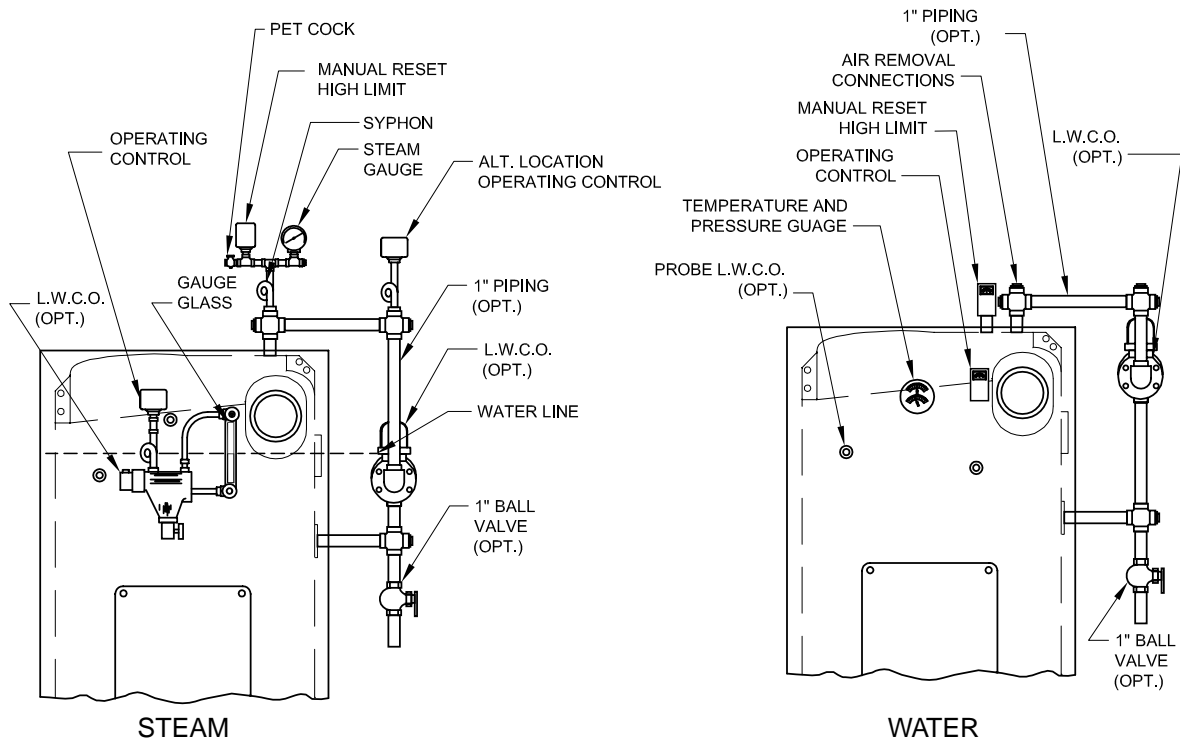


Figure 19 - Typical Single Water Boiler Piping

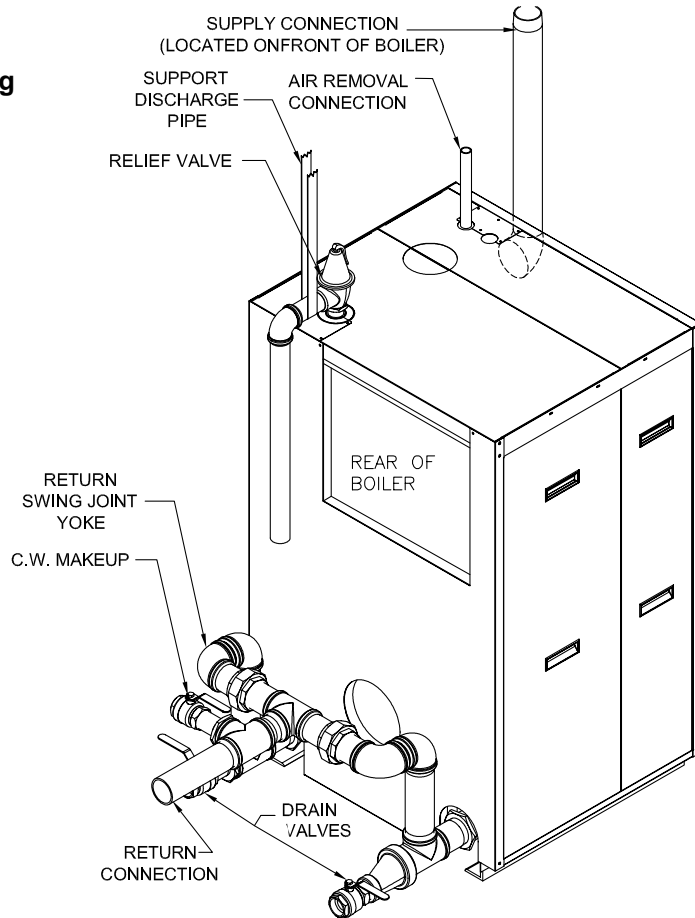


Figure 20 - Typical Multiple Water Boiler Piping

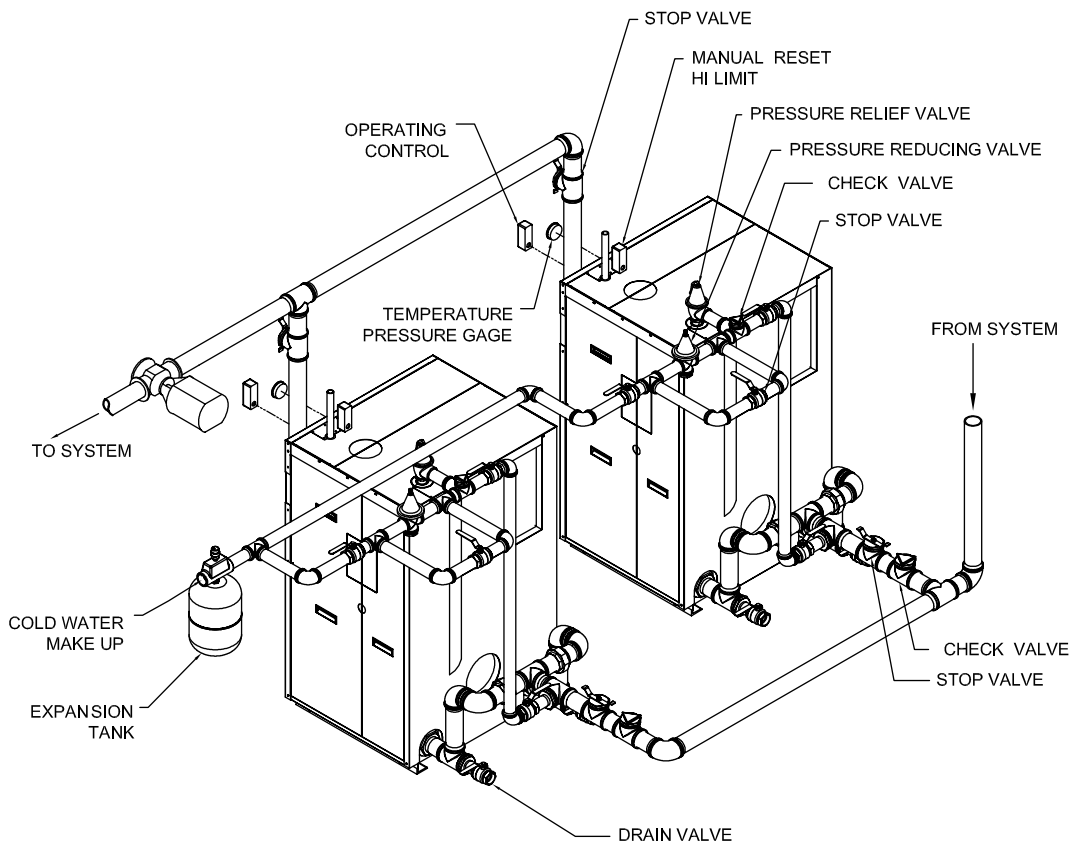
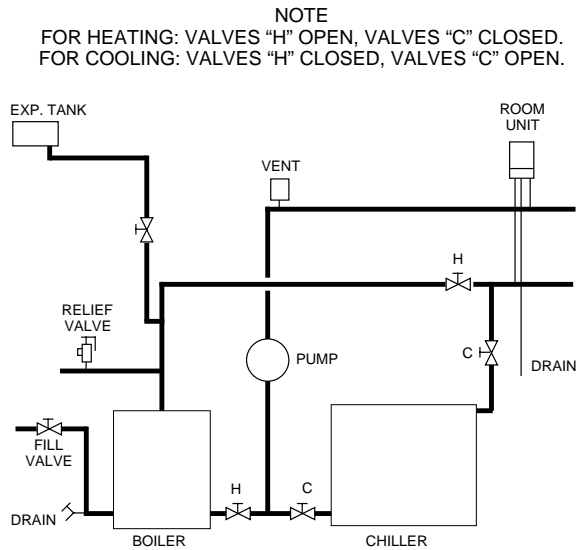


Figure 21 - Chilled Medium Diagram



Cleaning of Water Boilers

Normally the cleaning of water boilers is unnecessary unless there is unusually heavy contamination of the boiler or system.

The burner must be installed and made operational along with the operating, limit and other safety controls. The burner on oil boilers must be adjusted to prevent sooting of the boiler flues.

Final burner adjustment should be made after the boiler has been properly cleaned.

WARNING: The pressure relief valve must be installed and piped to the floor to prevent scalding in the event of a discharge, see Figure 16. The discharge piping must be sized the same as the pressure relief valve outlet. Never install any type of valve between the boiler and the pressure relief valve! Failure to comply with this warning can result in an explosion causing extensive property damage, severe personal injury or death!

1. Install ball valves on the two 3" NPT nipples in the bottom of the front section and pipe to a suitable drain.
2. Fill the boiler 3/4 full with water.
3. Make a cleaning solution by mixing **1 lb, 0.45 kg** each of caustic soda and trisodium phosphate for every **50 ga, 189 L** of water, see Table 7.

NOTE: The water content of the heating system must be added to the boiler water content.

CAUTION: Avoid skin contact with cleaning solution to prevent injury! If eye or skin contact occurs flush with large quantities of water.

NOTE: Some locations do not allow this solution to be used. Check with the local authority having jurisdiction.

4. Mix the cleaning chemicals with water to create a concentrated solution. Pour the cleaning solution through one of the top tapings in the front section and plug it.
5. Immediately fill the rest of the boiler and the heating system with water.
6. Fire the boiler and maintain a water temperature of **160°F to 200°F, 71°C to 93°C** it may be necessary to cycle the boiler.
7. Run all of the system pumps during the cleaning procedure.

WARNING: Monitor the boiler pressure constantly during the cleaning procedure. Do not allow the boiler pressure to exceed the pressure listed on the pressure relief valve or a discharge of hot water and steam will occur!

8. Shut the boiler off and allow the boiler to cool to **100°F, 38°C**. Open the 3" ball valves and drain the boiler and heating system.
9. Remove the 3" ball valve and install 3" pipe caps in the ends of the 3" NPT nipples.
10. Refill the boiler and heating system with water.

STEAM BOILER PIPING

Steam Boiler Piping Connections

Table 3 contains the steam riser location schedule. Riser, equalizer and header pipe sizes are located in Table 8. A typical single boiler piping arrangement is shown in Figure 22. Figures 23 & 24 contain typical piping diagrams for steam boilers in a battery.

NOTE: See CLEANING OF STEAM BOILERS before connecting the return piping.

CAUTION: Improper placement of steam risers will result in poor steam quality!

Table 8 - Steam Boiler Piping Sizes

Boiler Model	Number of 5" NPT Risers	Header Size, NPT	Equalizer Size, NPT
4 & 5	1	5"	2 1/2"
6 & 7	2	5"	2 1/2"
8 Through 10	2	6"	4"
11 Through 18	3	8"	4"

The steam piping should be pitched so the condensate flows in the direction of steam travel. The return tapings should be yoked to equalize the return flow, Figure 17. Swing joints should be used.

Table 9 - Steam Boiler Capacities

Boiler Model	I=B=R Gross Output		Evaporation Rate		Minimum Feed Water Pumping Rate		Condensate Receiver Capacity	
	MBH	kW	GPM	L/hr	GPM	L/hr	Gallons	Liters
28HE-S-4	900	264	1.9	7.3	3.9	14.8	37	140
28HE-S-5	1166	342	2.5	9.5	5.0	18.9	48	182
28HE-S-6	1433	420	3.1	11.7	6.2	23.5	59	223
28HE-S-7	1699	498	3.7	13.8	7.3	27.6	69	261
28HE-S-8	1965	576	4.2	16.0	8.4	31.8	80	303
28HE-S-9	2232	654	4.8	18.1	9.6	36.3	91	345
28HE-S-10	2498	732	5.4	20.3	10.7	40.5	102	386
28HE-S-11	2764	810	5.9	22.5	11.9	45.1	113	428
28HE-S-12	3031	888	6.5	24.7	13.0	49.2	124	469
28HE-S-13	3297	966	7.1	26.8	14.2	53.8	135	511
28HE-S-14	3563	1044	7.7	29.0	15.3	57.9	145	549
28HE-S-15	3830	1122	8.2	31.2	16.5	62.5	156	591
28HE-S-16	4096	1200	8.8	33.3	17.6	66.6	167	632
28HE-S-17	4362	1278	9.4	35.5	18.7	70.8	178	674
28HE-S-18	4629	1356	9.9	37.6	19.9	75.3	189	716

Note: These recommendations are considered normal for compact buildings. Where buildings are spread out, additional receiver capacity may be necessary because of the extended time required for condensate to return to the receiver.

Figure 22 - Typical Single Boiler Steam Piping

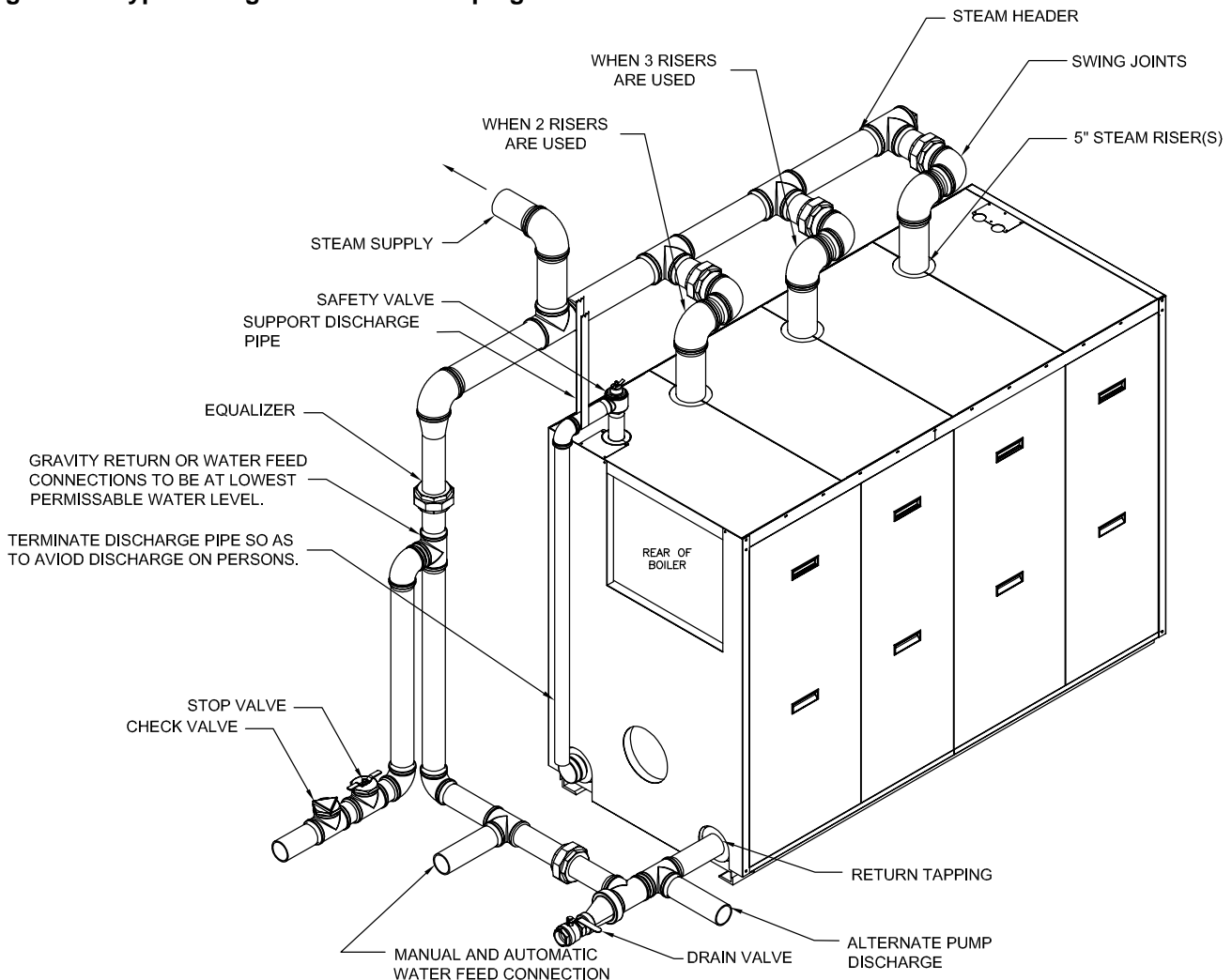


Figure 23 - Typical Steam Piping - Gravity Return for Multiple Boilers

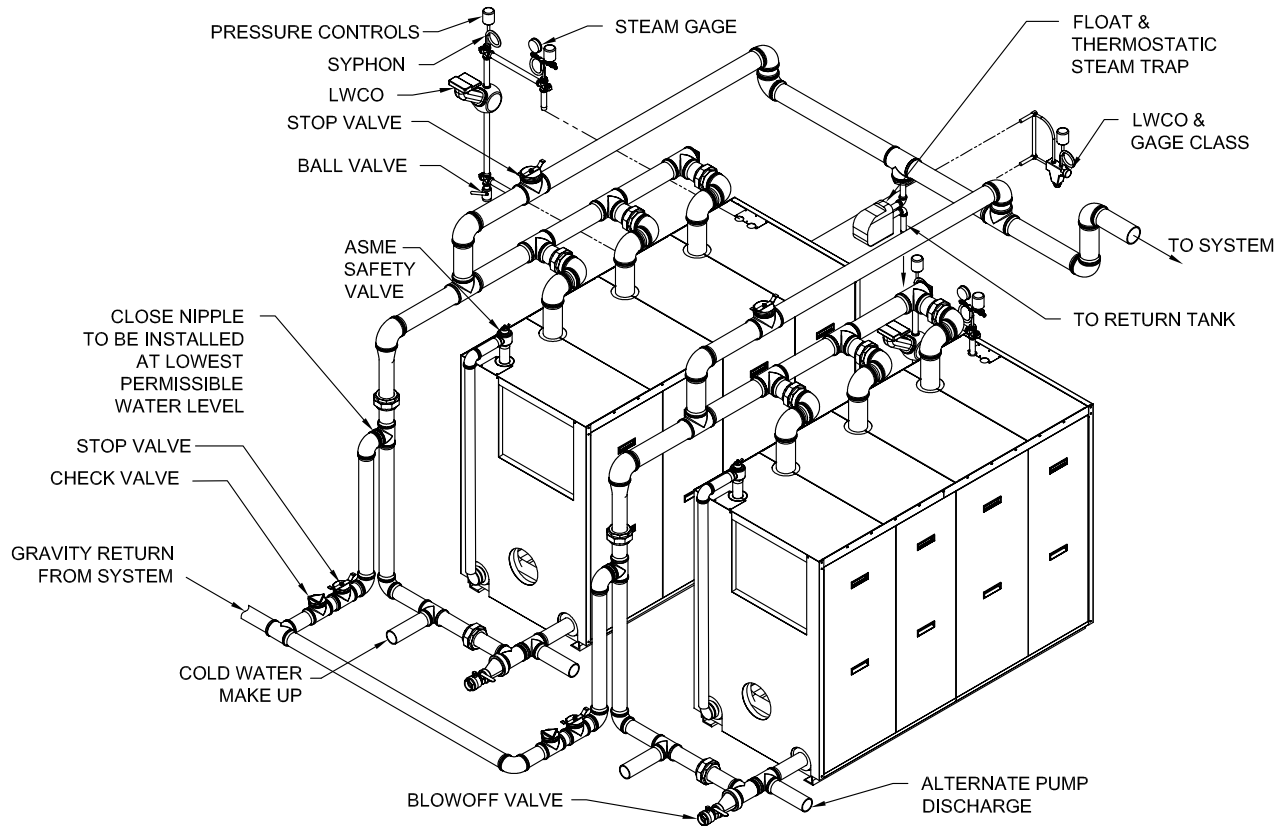
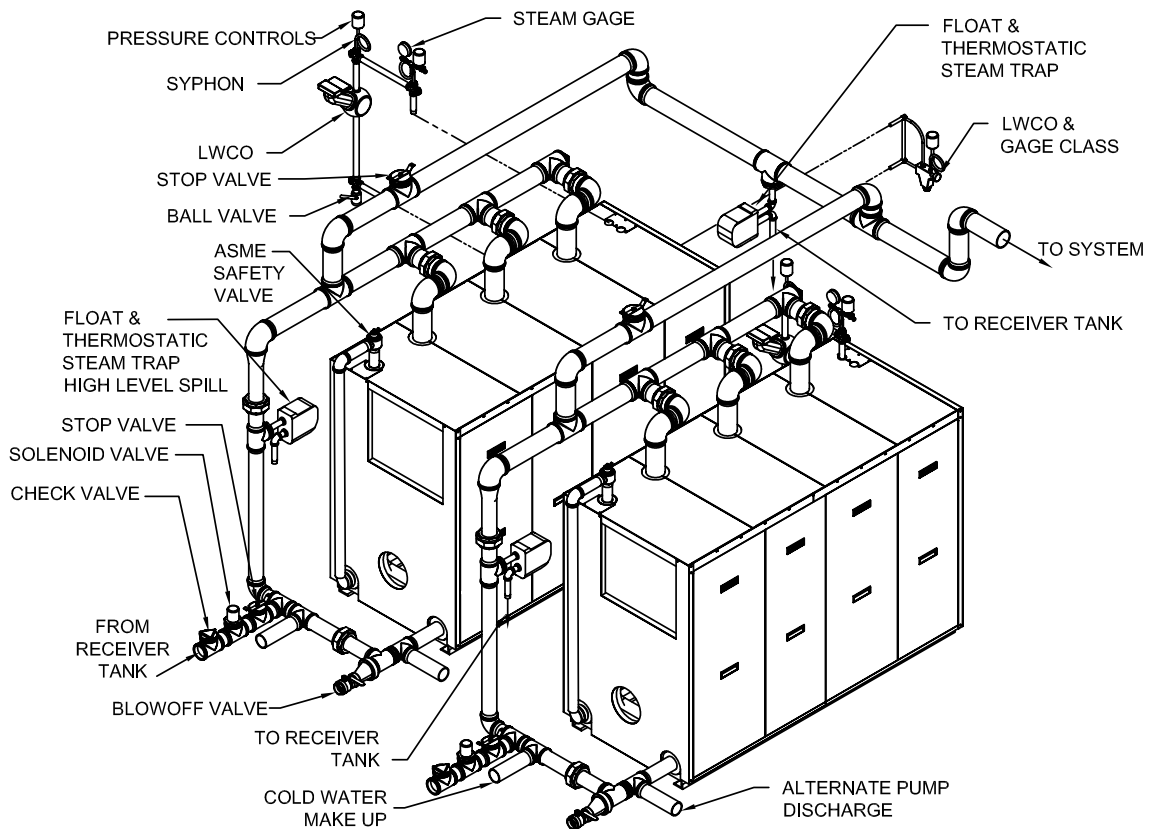


Figure 24 - Typical Steam Piping - Pumped Return for Multiple Boilers



Install 3" nipples into the two 3" NPT tappings in the front section and install ball valves so the boiler can be blown down.

The feed water requirements for steam boilers at full input are shown in Table 9. The addition of water to the boiler should be controlled by sensing the actual boiler water level. 1" NPT water column tappings are provided on the front section for the mounting of the required water level controls, see Figure 18.

CAUTION: Makeup water connections must be made to the return piping and not to the boiler or the boiler may be damaged voiding the warranty!

Cleaning of Steam Boilers

The burner must be installed and made operational along with the operating, limit and other safety controls. The burner on oil boilers must be adjusted to prevent sooting of the boiler flues. Final burner adjustment should be made after the boiler has been properly cleaned.

CAUTION: Failure to properly clean the boiler can result in foaming and surging and prevent proper operation of the boiler! Boiler damage can occur voiding the warranty!

NOTE: Do not connect the boiler to the return piping until the system piping has been thoroughly flushed or recontamination of the boiler can occur.

1. Plug the 4" NPT return tappings in the back section and any other unused tappings, see step 5 below.

WARNING: The safety valve must be installed and piped to the floor to prevent scalding in the event of a discharge, see Figure 16. The discharge piping must be sized the same as the safety valve outlet. Never install any type of valve between the boiler and the safety valve! Failure to comply with this warning can result in an explosion causing extensive property damage, severe personal injury or death!

2. Fill the boiler with water to a level **1 in., 25.4 mm** below the normal water level line of **50 1/2 in., 1.28 m** from the floor.
3. Pipe a skimmer off the 6" NPT tapping in the front section using 1 1/2" NPT pipe.
4. Make a cleaning solution by mixing **1 lb, 0.45 kg** each of caustic soda and trisodium phosphate for every **50 ga, 189 L** of water, see Table 7.

CAUTION: Avoid skin contact with cleaning solution to prevent injury! If eye or skin contact occurs flush with large quantities of water.

NOTE: Some locations do not allow this solution to be used. Check with the local authority having jurisdiction.

5. Mix the cleaning chemicals with water to create a concentrated solution. Pour the cleaning solution through one of the top tappings in the front section and plug it.
6. Immediately fire the boiler and maintain a steam pressure of **0 to 2 psig, 0 to 13.8 kPa**. It may be necessary to cycle the boiler.

WARNING: Monitor the boiler pressure constantly during the cleaning procedure. Do not allow the boiler pressure to exceed 15 PSI, 103 kPa or a discharge of hot water and steam will occur!

7. Adjust the water feed to prevent the build up of pressure within the boiler. Continue the skimming process until the discharge runs clear.
8. Shut the boiler off and allow the boiler to cool to **100°F, 34°C**. Remove the skim piping and plug the tapping. Open the blowdown valve and flush the boiler until the discharge runs clear.
9. Close the blowdown valve and fill the boiler with water to a level **1 in., 25 mm** below the normal water level line.
10. Check the traps and vents for proper operation.

BURNER INSTALLATION

WARNING: The burner must be installed in accordance with the burner manufactures instructions. Check the boiler rating plate to make sure that the boiler is for the type of fuel that will be used. If it isn't, do not connect the burner to the fuel supply. Failure to comply with this warning can result in extensive property damage, severe personal injury or death!

Follow the burner manufacturer's installation instructions for the proper installation, fuel piping, wiring, burner adjustment and servicing. Mount the burner per the instructions on page 13.

When applicable, provisions for vent, bleed and gas relief lines must be made in accordance with the latest revision of ANSI Z223.1/NFPA 54.

WARNING: Never use an open flame to test for gas leaks. Always use an approved leak detection method. Failure to comply with this warning can cause extensive property damage, severe personal injury or death!

Whenever the gas supply piping is pressure tested the boiler gas controls must be protected. If the test pressure is equal to, or less than **1/2 psig, 3.5 kPa** isolate the boiler by closing the manual shut off valve in the gas supply pipe to the boiler. If the test pressure is greater than, or equal to **1/2 psig, 3.5 kPa**, disconnect the boiler and its individual shut-off valve from the gas supply.

ELECTRICAL WIRING

Electrical Power Connections

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

The electrical connections to this boiler must be made in accordance with all applicable local codes and the latest revision of the National Electrical Code, ANSI/NFPA-70. Installation should also conform with CSA C22.1 Canadian Electrical Code Part I if installed in Canada. Install a separate circuit properly rated for the boiler. A shut-off switch should be located at the boiler.

The boiler must be grounded in accordance with the authority having jurisdiction, or if none, the latest revision of the National Electrical Code, ANSI/NFPA-70.

Line voltage field wiring of any controls or other devices must conform to the temperature limitation of type T wire at **95°F, 35°C** above room temperature. Use copper conductors with a minimum size of #14 awg.

BOILER OPERATION

WARNING: Before proceeding read and fully understand the instructions contained in this manual. Do not attempt to operate this boiler if it has not been installed in accordance with the guidelines set forth in this manual. Failure to comply with this warning can result in extensive property damage, severe personal injury or death!

CAUTION: The supply temperature of a boiler set for a 20°F, 11°C temperature rise must not be below 140°F, 60°C for an oil boiler, 149°F, 65°C for a gas boiler. Failure to protect the boiler from low return water temperatures will damage the boiler, voiding the warranty!

Water Boilers

Fill the boiler and all of the radiation with water to the required system pressure. Completely purge the system of air and adjust the system pressure as needed.

CAUTION: Thermal shock of water boilers must be avoided! Water circulation must be established before the burner is fired. If hot standby is required, special piping and operation procedures are necessary, consult your Smith representative. Failure to protect the boiler from thermal shock can damage the boiler, voiding the warranty!

Steam Boilers

Fill the boiler with water to the normal water level line of **50 1/2 in., 1.28 m** from the floor.

If the boiler is connected to a hot steam line, keep the cold boiler valved off line and fire the burner until the boiler pressure exceeds the system pressure by **1 to 2 psig, 7 to 14 kPa**. Slowly open the main isolation valve on the boiler to bring it on line.

CAUTION: Never place a cold boiler into service on a hot steam line or severe damage to the boiler and piping can occur voiding the warranty!

Steam entering a cold boiler will cool quickly and can cause severe steam hammer and boiler flooding. Idle boilers not valved off from the system should have an overflow installed to prevent it from being flooded.

If an overflow trap is not installed per Figure 25, and the boiler becomes flooded, the flooded boiler must be heated to a near steaming condition, **210°F, 99°C**, then drained to the correct water level.

Water and Steam Boilers

Follow the burner manufactures lighting instructions that were supplied with the burner.

WARNING: Never attempt to start the burner if the combustion chamber contains excess oil or gas, when the boiler is full of vapor or the combustion chamber is very hot. Failure to comply with this warning can result in an explosion causing extensive property damage, severe personal injury or death!

A properly adjusted gas burner on high fire will produce a CO₂ of 8.5 to 9.5% with a CO level under 300 ppm. When firing on oil at high fire, the burner should be adjusted to produce a CO₂ of 11.0 to 12.0% with a zero smoke. The flue gas samples should be taken at the smoke hood. Confirm proper burner adjustment with a calibrated combustion analyzer.

CAUTION: If the flue gas temperature exiting the smoke hood is less than 320°F, 160°C at full rated input, the number of heat transfer rods in the boiler must be reduced. Failure to protect the boiler from low flue gas temperatures will shorten the life of the boiler and breaching and void the warranty!

Flue Temperature Adjustment

1. Shut the boiler off and remove the left side jacket panels and cleanout covers, Figure 8.
2. Remove the bottom heat transfer rod from each flue.
3. Replace the cleanout covers and fire the boiler for at least 15 minutes.
4. Check the flue temperature. If it's greater than 320°F, 160°C, reseal the cleanout covers and install the left side jacket panels.
5. If the flue temperature is still less than 320°F, 160°C, repeat steps 1 through 4.

BOILER CHECKING & ADJUSTMENT

CAUTION: Never increase the input to the boiler above that for which it is rated. Doing so can cause premature failure of the boiler!

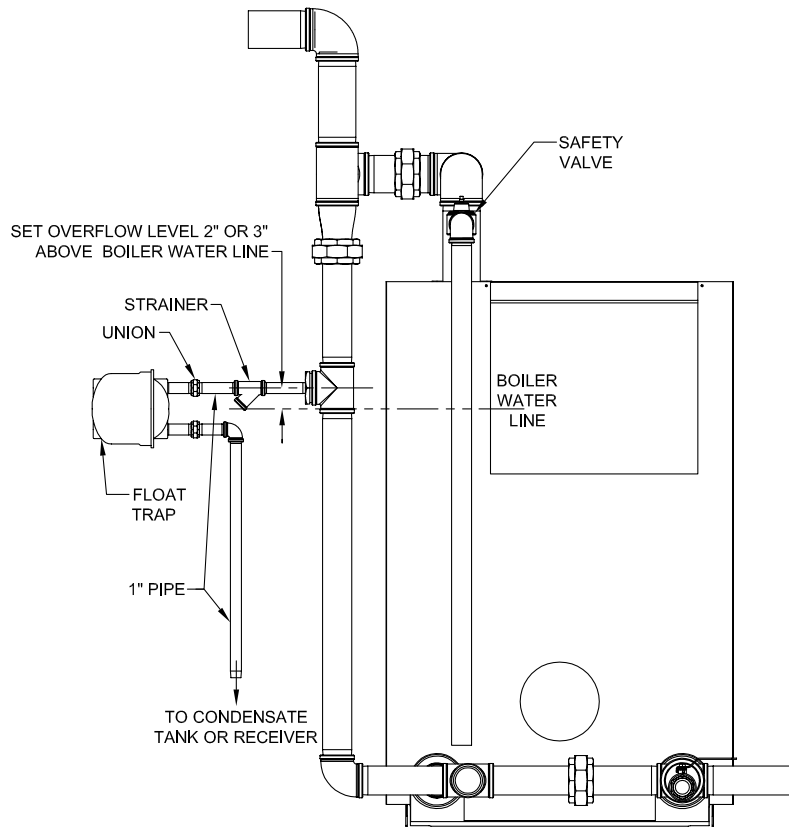
Low Water Cutoff

Ensure that the low water cutoff device(s) function(s) properly. Test in accordance with the manufacturer's instructions included with the device(s).

HI Limit

The aquastat high limit controls the maximum water temperature in the boiler. It is adjustable from 140°F, 60°C to 240°F, 116°C. If the water temperature reaches the set temperature before the demand for heat has been met, the aquastat high limit should shut the boiler off. The water temperature should never exceed the maximum set point of 240°F, 116°C. The aquastat high limit cannot be repaired. If it fails to function properly replace it.

Figure 25 - Recommended Overflow Trap Piping



BOILER MAINTENANCE

WARNING: Servicing, inspection and adjustment of the boiler must be done by a trained technician in accordance with all applicable local and national codes. Improper servicing or adjustment can result in property damage, severe personal injury or death!

The boiler should be cleaned and inspected once a year, before each heating season.

Heat Exchanger Cleaning

A flue temperature over **550°F, 288°C**, indicates that the boiler needs to be cleaned.

1. Shut off the electrical power and the fuel supply to the boiler.
2. Remove the left side jacket panels.
3. Remove the cleanout covers, Figure 8.
4. Remove the heat transfer rods, Figure 7, and clean them with a wire brush if they're dirty.
5. Clean each flue passage with a wire brush.
6. If heavy deposits are present, pull the burner and vacuum out the combustion chamber.
7. Vacuum out the burner base and clean and inspect all of the components. Replace any damaged or badly corroded parts.
8. Install the heat transfer rods in the correct order, Figure 7.

9. Inspect the cleanout cover insulation and rope seal. If damaged or deteriorated replace them.
10. Install the clean out covers and reseal them with a silicone caulk rated for **500°F, 260°C**.
11. Install the left jacket panels and remount the burner.
12. Restore electrical power and fuel to the boiler.

Vent System

Thoroughly inspect the vent system for any signs of blockage, corrosion or leakage.

Immediately replace any unsound vent system piping.

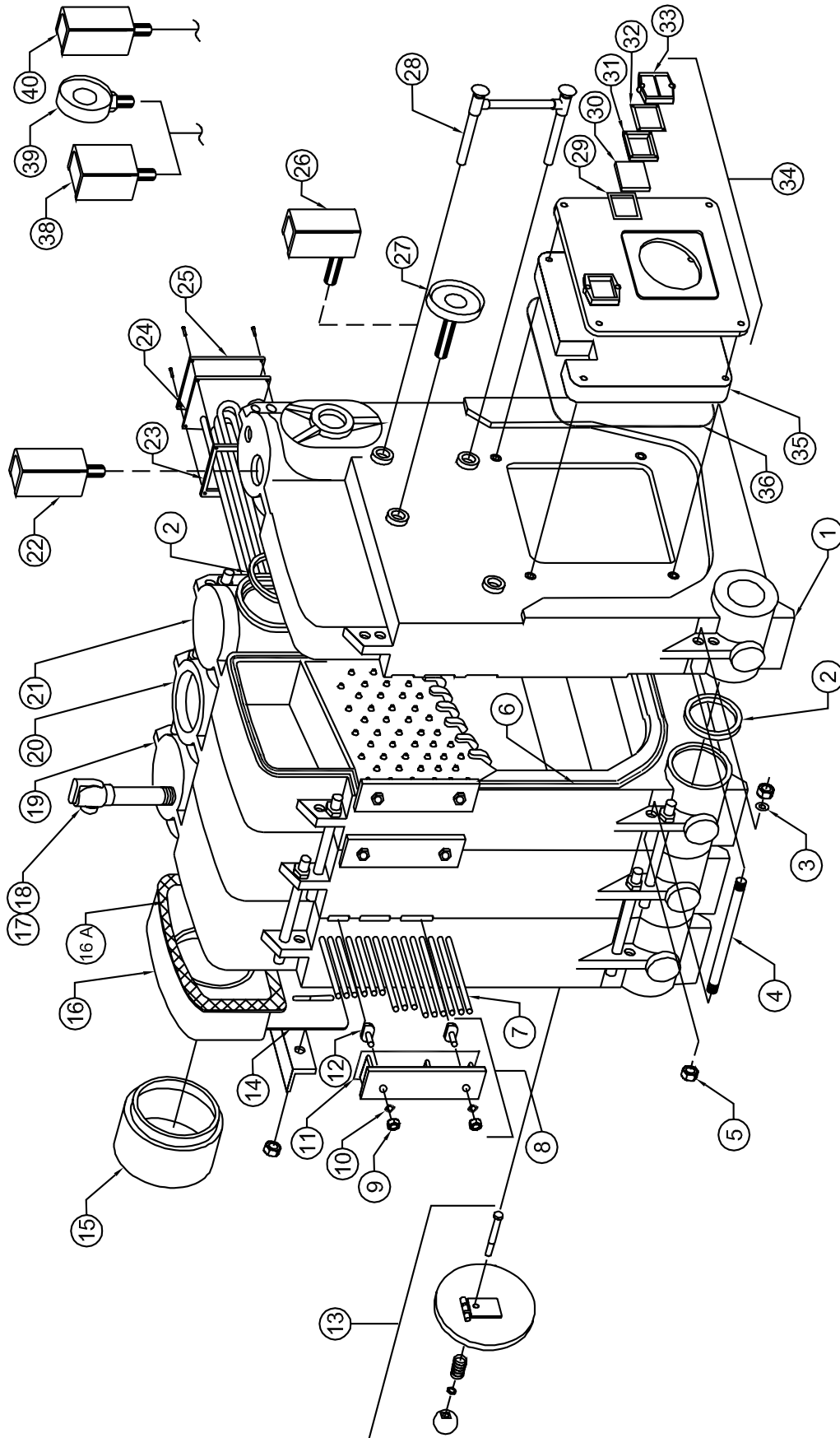
Controls

1. Low water cutoff devices must be serviced per the manufacture's instructions.
2. The relief valve should vent water when the test lever is lifted. It should not weep or discharge water at normal system pressure.

WARNING: Never try to clean or repair the relief valve! If the valve fails to operate properly, replace it! Failure to comply with this warning can result in an explosion causing extensive property damage, severe personal injury or death!

3. Use a combustion analyzer to ensure that the burner is adjusted properly, see BOILER OPERATION.

Figure 26 - Boiler Assembly



Ref #	Name of Part	Part #	Number of Sections with Item Quantities Below															
			4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	Front Section	3621	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
2	Graphite Port Connector Set	60375	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
3	Draw Rod Washers	62099	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	
4	5/8" x 11" Draw Rods	60102	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	
5	Draw Rod Hex Nuts	60877	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	
6	Rope, 1/2" x 12 1/2 feet	70660	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
7	Heat Transfer Rod Set	70063	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
8 ⁽²⁾	Cleanout Cover Assembly	70360	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
9	Cleanout Cover Nut	60245	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	
10	Cleanout Cover Washer	62095	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	
11	Cleanout Cover Rope Seal, 3/8" x 45"	76538	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
12	Cleanout Cover Bolt	61415	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	
13	Rear Observation Port Assembly	70614	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
14	Slide Damper	69371	1	1	1	1	1											
		69372							1	1	1	1	1					
		69373												1	1	1	1	1
15	Flue Outlet Increaser, 16" to 18"	69904														1	1	
16 ⁽¹⁾	Smoke Hood Assembly, 10"	70633	1	1	1													
	Smoke Hood Assembly, 12"	70611				1	1											
	Smoke Hood Assembly, 14"	70612							1	1	1	1	1					
	Smoke Hood Assembly, 16"	70613												1	1	1	1	
16A	Smokehood insulating tape	74301	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
17	3/4" Water Relief Valve, 40 lb.	61997	1															
	1" Water Relief Valve, 40 lb.	61998		1	1													
	1 1/4" Water Relief Valve, 40 lb.	61999				1	1	1	1									
	1 1/2" Water Relief Valve, 40 lb.	62000								1	1	1	1					
	2" Water Relief Valve, 40 lb.	62002												1	1	1	1	
18	1 1/4" Steam Safety Valve, 15 lb.	61983	1	1														
	1 1/2" Steam Safety Valve, 15 lb.	61984			1	1												
	2" Steam Safety Valve, 15 lb.	61985					1	1	1	1	1							
	2 1/2" Steam Safety Valve, 15 lb.	61986										1	1	1	1	1		
	3" Steam Safety Valve, 15 lb.	61987															1	
19	Back Section	3630	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
20	Intermediate Section w/ 5" Tapping & Boss	3624	Section quantities based on model ordered															
21	Intermediate Section, Plain with Boss	3622	Section quantities based on model ordered															
	Intermediate Section, Plain w/o Boss	3658																
	Int. Section w/ Heater Opening w/o Boss	3623																
22	Hi Limit Control, L4006E	50507	One per water boiler															
23	Tankless Cover Plate & Coil Gasket	60327	Quantities based on model ordered															
24	Tankless Heater, 8 GPM, 30 L/H	50653																
	Tankless Heater, 12 GPM, 45 L/H	50655																
25	Tankless Cover Plate with Gasket	70628	Quantities based on model ordered															
26	Operating Control, L4007A	50510	One per water boiler															
27	3 1/2" Temperature/Pressure Gage	60267	One per water boiler															
28	Gauge Glass, 5/8" x 11 1/2"	61931	One per steam boiler															
29	Observation Glass Gasket, Inner	60317	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
30	Observation Glass	60326	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
31	Observation Glass Gasket, Outer	60318	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
32	Observation Glass Holder	60314	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

⁽¹⁾ Smokehood assembly includes the smokehood, slide damper, angle bracket and hardware.

⁽²⁾ Cleanout cover assembly includes the cleanout cover, insulation, rope and mounting hardware.

Ref #	Name of Part	Part #	Number of Sections with Item Quantities Below														
			4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
33	Observation Glass Cover Plate	3420	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ns	Rear Observation Port Hardware	71301	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
34 ⁽³⁾	Burner Mounting Plate Assembly, 9"	70641	Burner mounting plate determined by burner selection														
	Burner Mounting Plate Assembly, 10 1/4"	70640															
	Burner Mounting Plate Assembly, 12 1/2"	70510															
	Burner Mounting Plate Assembly, 10 1/4"	70672															
	Burner Mounting Plate Assembly, 7 3/4"	70669															
ns	Burner Mounting Plate Hardware	71267	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	Burner Mounting Plate Insulating Block	69645	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
36	Burner Mounting Plate Rope Seal, 3/8 x 7 ft.	76540	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ns	Burner Mtg. Plate Ins. Block Hardware	71268	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
37	Operating Control, PA404A	50493	One per steam boiler														
38	3 1/2" Steam Gage	60269	One per steam boiler														
39	Hi Limit Control, L404C	50494	One per steam boiler														
n/s	Can of Spray Adhesive	70492	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2
n/s	Flue Brush	60090	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

(3) Burner mounting plate assembly includes the burner mounting plate with the observation glass and cover.

WARNING

Any appliance that burns natural gas, propane gas, fuel oil, wood or coal is capable of producing carbon monoxide (CO).

Carbon Monoxide (CO) is a gas which is odorless, colorless and tasteless but is very toxic.

If your Smith boiler is not working properly, or is not vented properly, dangerous levels of CO may accumulate. CO is lighter than air and thus may travel throughout the building. **BRIEF EXPOSURE TO HIGH CONCENTRATIONS OF CO, OR PROLONGED EXPOSURE TO LESSER AMOUNTS OF CO MAY RESULT IN CARBON MONOXIDE POISONING.**

EXPOSURE CAN BE FATAL AND EXPOSURE TO HIGH CONCENTRATIONS MAY RESULT IN THE SUDDEN ONSET OF SYMPTOMS INCLUDING UNCONSCIOUSNESS.

Symptoms of CO poisoning include the following:

dizziness	vision problems	shortness of breath
headaches	loss of muscle control	unclear thinking
nausea	weakness	unconsciousness

The symptoms of CO poisoning are often confused with those of influenza, and the highest incidence of poisoning occurs at the onset of cold weather or during flu season. A victim may not experience any symptoms, only one symptom, or a few symptoms. Suspect the presence of carbon monoxide if symptoms tend to disappear when you leave your home.

The following signs may indicate the presence of carbon monoxide:

- Hot gases from appliance, venting system, pipes or chimney, escaping into the living space.
- Flames coming out around the appliance.
- Yellow colored flames in the appliance.
- Stale or smelly air.
- The presence of soot or carbon in or around the appliance.
- Very high unexplained humidity inside the building.

If any of the symptoms of CO poisoning occur, or if any of the signs of carbon monoxide are present, **VACATE THE PREMISES IMMEDIATELY AND CONTACT A QUALIFIED HEATING SERVICE COMPANY OR THE GAS COMPANY OR THE FIRE DEPARTMENT.**

To reduce the risk of CO poisoning, have your heating system "tuned up" by a licensed heating contractor or the gas company -- preferably before each heating season. Also have the service company check your chimney or vent pipes for blockage.

Your home should also be adequately ventilated, particularly if you have insulated your home.

**ONLY QUALIFIED, LICENSED SERVICE CONTRACTORS
SHOULD PERFORM WORK ON YOUR SMITH BOILER.**

WARNING

Install, operate and maintain unit in accordance with manufacturer's instructions to avoid exposure to fuel substances or substances from incomplete combustion which can cause death or serious illness. The State of California has determined that these substances may cause cancer, birth defects, or other reproductive harm. Also, install and service this product to avoid exposure to airborne particles of glasswool fibers and/or ceramic fibers known to the State of California to cause cancer through inhalation.

In an effort to continually improve our products, Smith reserves the right to make changes without notice.

Smith
CAST IRON BOILERS

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