

# Installation, Start-Up, and Operating Instructions

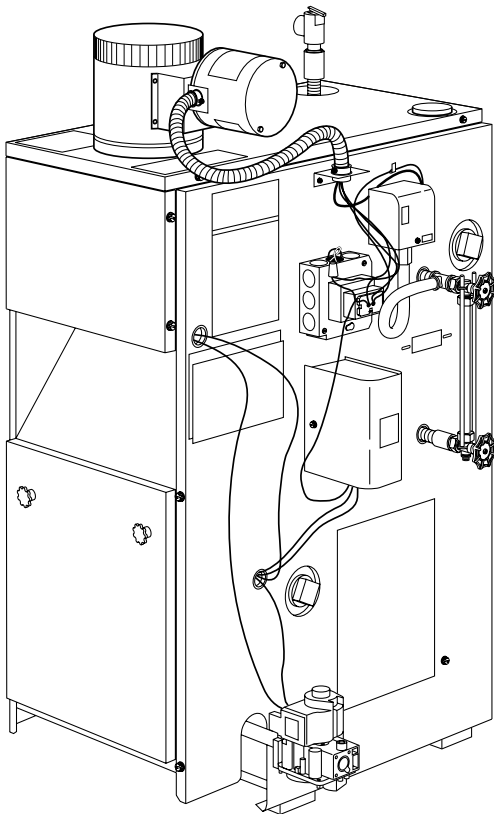
Gas-Fired  
Natural Draft Steam Boilers  
Sizes 70,000 through 299,000

BS1 and BS2  
Series B



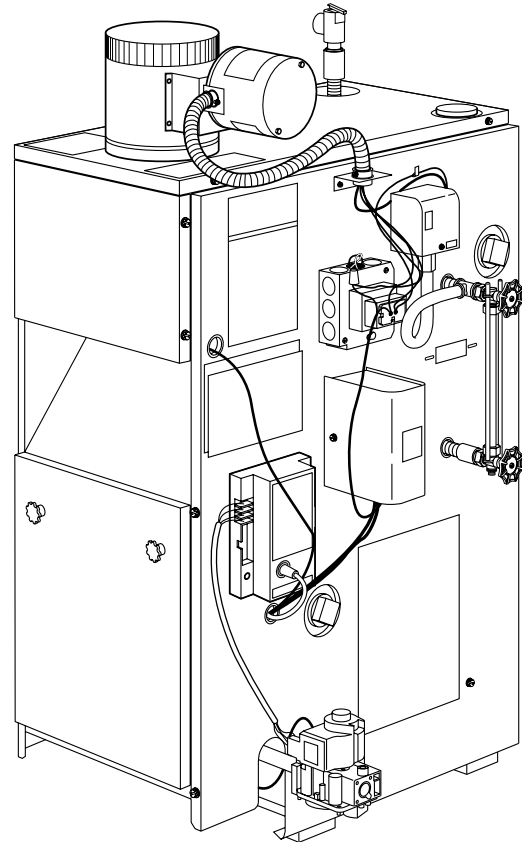
**NOTE:** Read the entire instruction manual before starting the installation. These instructions must be affixed on or adjacent to the boiler. This symbol → indicates a change since the last issue.

**MODEL BS1**  
Continuous Pilot



A95139

**MODEL BS2**  
Electronic Intermittent Ignition



A90003


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## SAFETY CONSIDERATIONS

Installing and servicing heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair, or service heating equipment. Untrained personnel can perform basic maintenance functions such as maintaining water level. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in literature, on tags, and on labels attached to or shipped with unit and other safety precautions that may apply.

→ Follow all safety codes. In the United States, follow all safety codes including the National Fuel Gas Code (NFGC) NFPA 54-2002/ANSI Z223.1-2002. Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

Recognize safety information. This is the safety-alert symbol . When you see this symbol on unit or in instructions and manuals, be alert to potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with safety-alert symbol. DANGER identifies most serious hazards which **will** result in severe personal injury or death. WARNING signifies hazards which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **would** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

## INTRODUCTION

These Gas-Fired Steam Boilers are low-pressure, sectional cast iron boilers design certified by the American Gas Association (A.G.A.) for use with natural and propane gases. They are constructed and hydrostatically tested for a maximum working pressure of 15 psi in accordance with the American Society of Mechanical Engineers (A.S.M.E.) Boiler and Pressure Vessel Code Section IV Standards for cast iron heating boilers.

Check to be sure boiler size is correct before starting installation. See rating and capacity tables shown in Fig. 1. Also be sure new boiler is for the type of gas being used. Check rating plate on right side of boiler.

The boiler must be supplied with correct type of gas, fresh air for combustion, and a suitable electrical supply. Boiler must also be connected to a suitable chimney and an adequate piping system. Finally, a properly located thermostat is needed for control of heating system. If there are any doubts as to the various requirements, check with local authorities and obtain professional help where needed. Take time to complete all the steps for SAFE and PROPER operation of heating system.

If this boiler is installed in a building under construction, special care must be taken to insure a clean combustion air supply during the construction process. Airborne particulates such as from drywall dust and from fiberglass insulation can clog the burner ports and cause incomplete combustion and sooting.

These boilers are designed for use in closed heating systems where all of the steam is returned to boiler as condensate and the amount of make-up water required is minimal. These boilers are not designed for or intended for use in open systems or process applications using 100 percent make-up water. Damage to boiler resulting from such use shall not be covered under the warranty.

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

Before installing the boiler in the United States, refer to the current edition of the NFGC. For further information, the NFGC is available from National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269; American Gas Association, 1515 Wilson Boulevard, Arlington, VA 22209; or from Literature Distribution.

The installation must conform with requirements of the authority having jurisdiction, or in absence of local codes, to the NFGC.

The following steps are all necessary for proper installation and safe operation of boiler.


1. LOCATING THE BOILER
2. FRESH AIR FOR COMBUSTION
3. INSTALLATION—SYSTEM PIPING
4. CHIMNEY AND VENT PIPE CONNECTION
5. GAS SUPPLY PIPING
6. ELECTRICAL WIRING
7. CHECKING AND ADJUSTING

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→  **WARNING: To prevent fires or explosions, keep boiler area clean and free from combustible materials, gasoline, and other flammable vapors and liquids.**

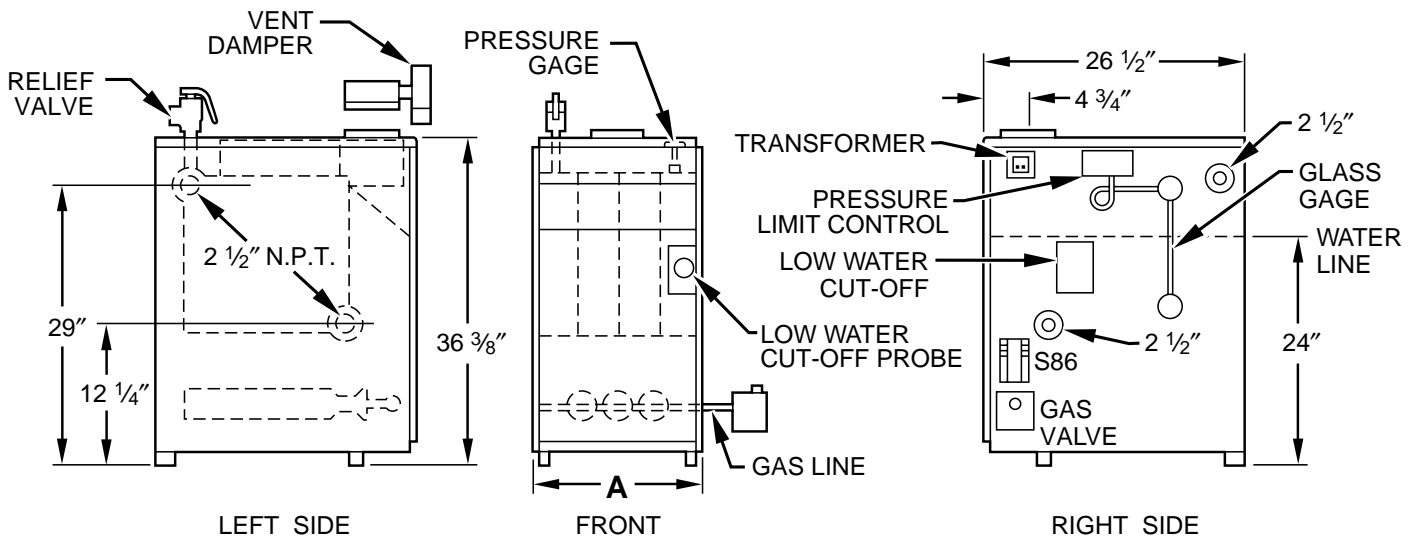
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 **WARNING: Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury or property damage. Consult a qualified installer, service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product. Boilers with cast iron burners are not to be converted to propane gas. Failure to follow this warning could result in electrical shock, fire, personal injury, or death.**

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## BOILER RATINGS AND CAPACITIES



**Natural Gas-Fired Steam Boilers**

A90064

BOILER MODEL NUMBER		NO. OF SECTIONS	NATURAL GAS*				DIMENSIONS (IN.)	
Intermittent Ignition with Vent Damper	Standing Pilot with Vent Damper		AGA Input MBH	Heating Capacity MBH	Net I=B=R Rating MBH	Net I=B=R Rating Sq Ft Radiation	Flue Diameter	Width A
BS2AAN000075ABAA	BS1AAN000075ABAA	3	75	62	47	196	5	11-1/4
BS2AAN000112ABAA	BS1AAN000112ABAA	4	112	91	68	283	6	14-1/2
BS2AAN000150ABAA	BS1AAN000150ABAA	5	150	122	92	383	6	17-3/4
BS2AAN000187ABAA	BS1AAN000187ABAA	6	187	153	115	479	7	21
BS2AAN000225ABAA	BS1AAN000225ABAA	7	225	183	137	571	7	24-1/4
BS2AAN000262ABAA	BS1AAN000262ABAA	8	262	214	161	671	7	27-1/2
BS2AAN000299ABAA	BS1AAN000299ABAA	9	299	245	184	767	7	30-3/4

**Fig. 1—Dimensional Drawing and Boiler Ratings and Capacities**

The ratings marked "Net I=B=R Rating" indicate the amount of equivalent direct cast iron radiation each boiler will take care of under normal conditions and thermostatic control. The Net I=B=R Steam Ratings shown are based on an allowance of 1.333 in accordance with the factors in the I=B=R Code as published by The Hydronics Institute.

Selection of boiler size should be based upon "Net I=B=R Rating" being equal to or greater than installed radiation in sq ft. Consult manufacturer before selecting a boiler for installations having unusual piping and pickup requirements.

Specifications and dimensions are subject to change without notice.

### LOCATING THE BOILER

**NOTE:** This unit **MUST** be set on a concrete or other non-combustible material base or floor.

1. Select level location as centralized with piping system and as near chimney as possible.
2. Place crated boiler at selected location. Remove crate by pulling crate sides from top and bottom boards. When boiler is to be installed on a combustible floor, a combustible floor base must be used.

This boiler must **NOT** be installed on carpeting.

3. Boiler is to be level. Metal shims may be used under base legs for final leveling.
4. The floor supporting boiler must be non-combustible. If it is combustible, place the boiler on a factory-approved combustible floor base. We use a 2-in. Cladlite™ pad as a combustible floor base. These are available from your local supplier. Use a minimum 24-in. X 30-in. pad for 2-5 section boilers and a minimum 30-in. X 30-in. pad for 6-7 section boilers. The boiler must be centered on combustible floor base.
5. Additional clearances for service may exceed clearances for fire protection clearances shown on the unit. An 18-inch clearance should be maintained on any side where passage is required to access another side for cleaning, servicing, inspecting, or replacement of any part that may need attention. An 18-inch clearance is recommended on the control side for servicing.
6. Determine boiler room size. Rooms that are large in comparison with the size of boiler are defined as rooms having a volume equal to or greater than 16 times the volume of the boiler. Where room ceiling height is greater than 8 ft, volume of room shall be figured on the basis of 8 ft ceiling height. Determination of room size should be based on total volume of all gas fired equipment installed in that room. (See Table 1.) Refer to section 6.3 of NFPA, Central Heating Boilers and Furnaces for further information, including approved methods for reducing clearances in large rooms.

7. Table 2 shows minimum clearances from combustible materials.

**Table 1—Room Large In Comparison With Boiler**

BOILER SIZE (SECTIONS)	BOILER VOLUME (CU FT)	MINIMUM ROOM VOLUME REQUIRED TO BE LARGE ROOM (CU FT)*
3	6.3	100.4
4	8.1	129.4
5	9.9	158.4
6	11.7	187.4
7	13.5	216.4
8	15.3	245.4
9	17.2	274.5

\* For room with single boiler only.

**Table 2—Minimum Clearances From Combustible Materials and For Servicing**

PART OF BOILER	ALCOVE OR ROOM NOT LARGE IN COMPARISON WITH BOILER (IN.)	ROOM LARGE IN COMPARISON WITH BOILER (IN.)
Top	6	6
Rear	6	6
Control Side	7	6
Opposite Control Side	6	6
Front	18	18
Flue/Vent Connector	6	6
Boiler Piping	1	1

### FRESH AIR FOR COMBUSTION

Provision for combustion and ventilation air must be in accordance with Section 5.3 of NFGC, Air for Combustion and Ventilation, or applicable provisions of local building codes.

Canadian installations must be installed in accordance with NSCNPIC and all authorities having jurisdiction.

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**⚠ WARNING:** Be sure to provide enough fresh air for combustion. Enough air ensures proper combustion and ASSURES THAT NO HAZARD WILL DEVELOP DUE TO LACK OF OXYGEN. Failure to follow this warning can cause a fire, personal injury, or death.

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You must provide for enough fresh air to assure proper combustion. The fire in the boiler uses oxygen. It must have a continuous supply. The air in a house contains only enough oxygen to supply the burner for a short time. Outside air must enter the house to replace the oxygen used by the burner. Study the following examples to determine your fresh air requirements.

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**⚠ CAUTION:** Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products. Excessive exposure to contaminated combustion air will result in safety and performance related problems.

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→ **⚠ CAUTION:** If a fireplace or a kitchen or bathroom exhaust fan is used, an outside air intake should be installed. These devices rob the boiler and water heater of combustion air which can cause fire, personal injury or death.

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### PROCEDURE 1—BOILER LOCATED IN UNCONFINED SPACE

#### EXAMPLE 1:

An unconfined space is defined as a space whose volume is not less than 50 cubic feet per 1,000 Btu per hour of the total input rating of all appliances installed in that space.

If your boiler is in an open area (unpartitioned basement) in a conventional house, the air that leaks through cracks around doors and windows will usually be adequate to provide air for combustion. The doors should not fit tightly. Do not caulk cracks around windows.

Equipment located in buildings of unusually tight construction shall be provided with air for combustion, ventilation, and dilution of flue gases using methods described in example 2B or shall be specially engineered. The authority having jurisdiction must approve specially engineered installations.

## PROCEDURE 2—BOILER LOCATED IN CONFINED SPACE

### EXAMPLE 2A: ALL AIR FROM INSIDE THE BUILDING

The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Each opening shall have a minimum free area of one square inch per 1,000 Btu per hour of the total input rating of all gas utilization equipment in the confined space, but not less than 100 square inches. One opening shall be within 12 inches of top and one within 12 inches of bottom of enclosure. The minimum dimension of air openings shall not be less than 3 inches.

### EXAMPLE 2B: ALL AIR FROM OUTDOORS

The confined space shall communicate with the outdoors in accordance with examples 1 or 2. The minimum dimension of air openings shall not be less than 3 in. Where ducts are used, they shall be of the same cross-sectional area as the free area of the openings to which they connect.

1. Two permanent openings, one commencing within 12 inches of top, and one commencing within 12 inches of bottom of enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors
  - a. Where directly communicating with the outdoors or where communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 sq. in. per 4000 Btu per hour of total input rating of all equipment in enclosure. (See Table 3A.)
  - b. Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of 1 sq. in. per 2000 Btu per hour of total input rating of all equipment in enclosure. (See Table 3B.)
2. One permanent opening commencing with 12 inches of top of enclosure shall be permitted where equipment has clearance of at least 1 inch from sides and back and 6 inches from front of appliance. The opening shall directly communicate with the outdoors or shall communicate through a vertical or horizontal duct to the outdoors or spaces (crawl or attic) that freely communicate with the outdoors and shall have a minimum free area of:
  - a. 1 sq. inch per 3000 Btu per hour of total input of all equipment located in enclosure (see Table 3C), and
  - b. Not less than the sum of the areas of all vent connectors in the confined space.

**Table 3A—Fresh Air Duct Capacities for Vertical Ducts (Btuh)\***

Fresh Air Duct Size (In.)	100% FREE AREA 1/4-in. Mesh Screen	75% FREE AREA Metal Louvers	25% FREE AREA Wood Louvers
3" X 12"	144,000	108,000	36,000
8" X 8"	256,000	192,000	64,000
8" X 12"	384,000	288,000	96,000
8-1/2" X 16"	512,000	384,000	128,000

\* 1 Square Inch per 4,000 Btuh

**Table 3B—Fresh Air Duct Capacities for Horizontal Ducts (Btuh)\***

Fresh Air Duct Size (In.)	100% FREE AREA 1/4-in. Mesh Screen	75% FREE AREA Metal Louvers	25% FREE AREA Wood Louvers
3" X 12"	72,000	54,000	18,000
8" X 8"	128,000	96,000	32,000
8" X 12"	192,000	144,000	48,000
8-1/2" X 16"	256,000	192,000	64,000

\* 1 Square Inch per 2,000 Btuh

**Table 3C—Fresh Air Duct Capacities for Vertical or Horizontal Ducts (Btuh)\***

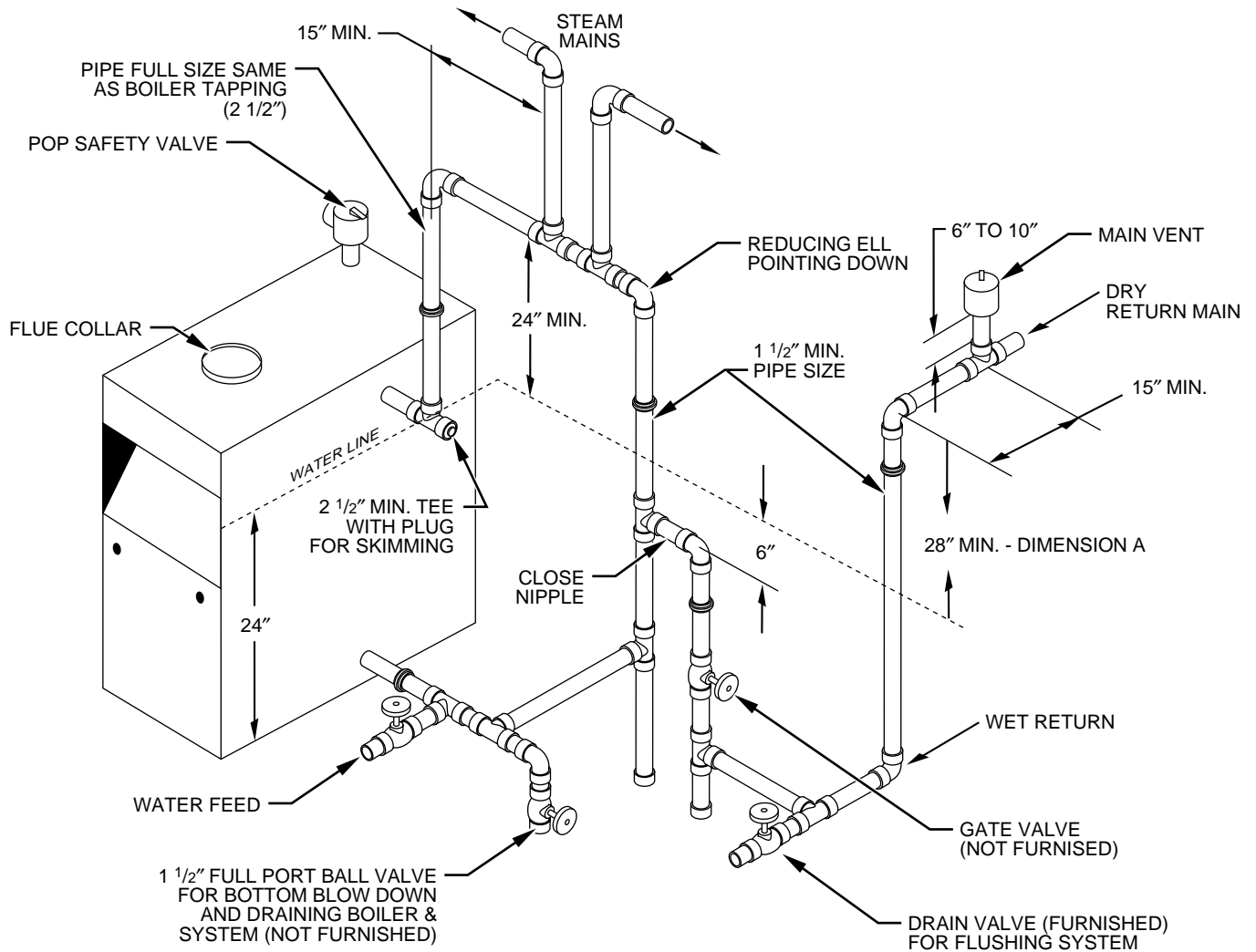
Fresh Air Duct Size (In.)	100% FREE AREA 1/4-in. Mesh Screen	75% FREE AREA Metal Louvers	25% FREE AREA Wood Louvers
3" X 12"	108,000	81,000	27,000
8" X 8"	192,000	144,000	48,000
8" X 12"	288,000	216,000	72,000
8-1/2" X 16"	384,000	288,000	96,000

\* 1 Square Inch per 3,000 Btuh

## INSTALLATION—SYSTEM PIPING

The near boiler piping (piping around boiler) must be considered as part of boiler for proper water level control and to produce dry steam. Correct near boiler piping is crucial to proper operation of boiler and heating system. Follow these recommendations carefully.

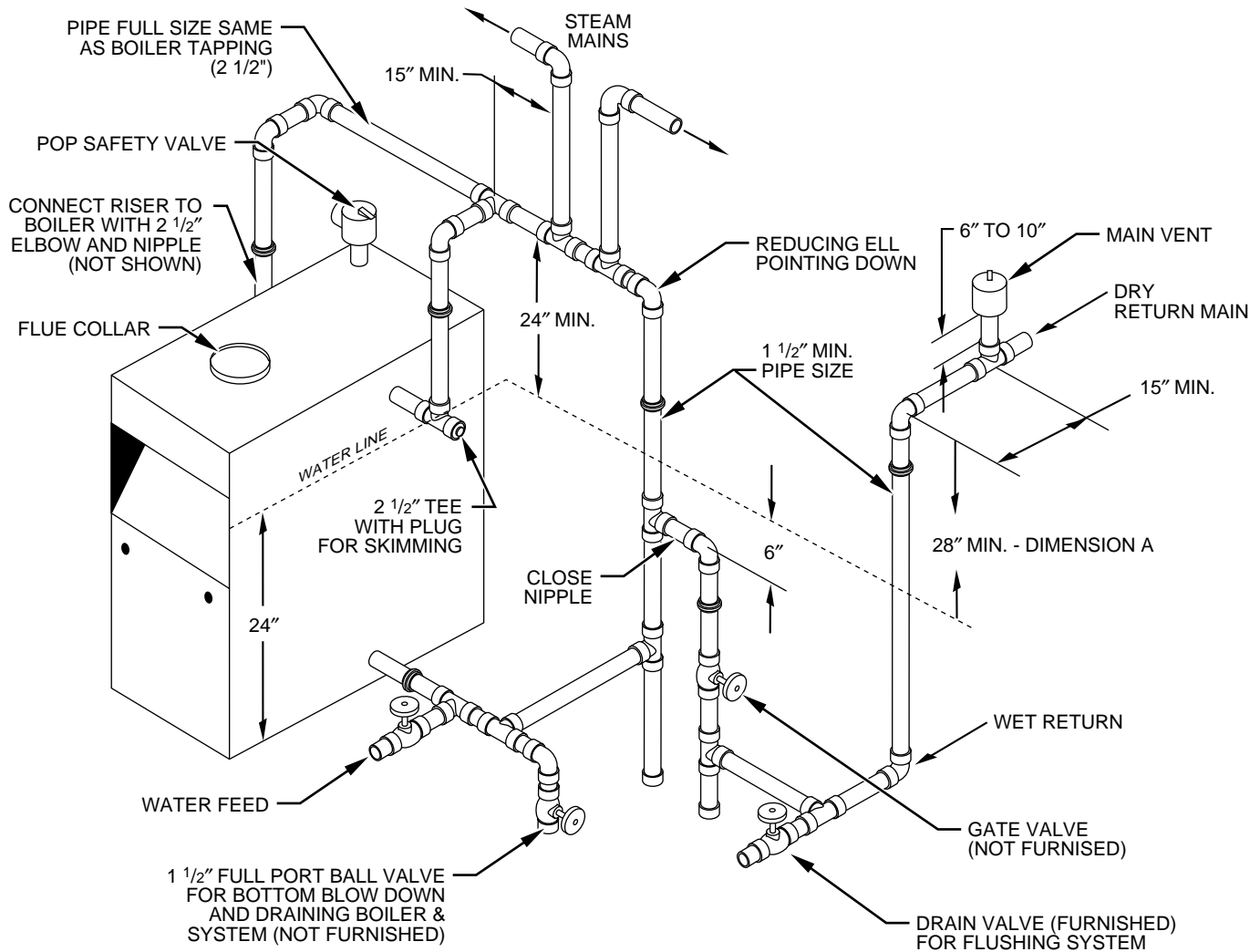
1. Place boiler in selected location as near chimney as possible.
2. Install relief valve using factory-supplied 3/4-in. coupling into 3/4-in. pipe nipple on top of boiler. Make a discharge pipe using 3/4-in. pipe (field supplied) to carry water or steam to a nearby drain. Do not connect discharge pipe directly to drain but leave an air gap. The downstream end of discharge pipe must be unthreaded. No shutoff of any description shall be placed between relief valve and boiler, or on discharge pipes between such safety valves and the atmosphere. Installation of relief valve shall conform to requirements of the ANSI/ASME Boiler and Pressure Vessel Code, Section IV. The manufacturer is not responsible for any water damage.



**Fig. 3—Recommended Near Boiler Piping Using 1 Supply Tapping**

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3. This boiler is equipped with two 2-1/2-in. supply connections and two 2-1/2-in. return connections, 1 each on both the left and right sides of boiler. Unused connections must be plugged with factory-supplied 2-1/2-in. plugs.
4. Recommended near boiler piping for gravity return systems is shown in Fig. 3. This configuration uses 1 supply and 1 return tapping. This setup can be used on any size boiler in this series. The supply and return connections may be piped both into the same side (either left or right) or 1 into each side of boiler.
5. For installers choosing to use both supply tapplings, refer to Fig. 4 for CORRECT way to pipe system. Fig. 5 shows WRONG way to pipe a header with 2 risers.
  - a. Headers must be fitted with header offsets or swing joints, or be equipped with expansion joints, so that thermal expansion and contraction of header will not damage boiler. Headers shall not be welded.
  - b. System takeoffs from header must be between equalizer and riser to header nearest equalizer. System takeoffs must never be between 2 risers.
6. System takeoffs from header must never be bullheaded. If steam main goes in 2 directions, there must be 2 takeoffs from header, 1 for each main.
7. All boilers in gravity return systems MUST be equipped with a Hartford Loop as shown in Fig. 4 and 5.
8. When piping vertical risers from boiler to header, bottom of header must be a minimum of 24 in. above water level line on right side of boiler.
9. Steam riser(s) and header shall be 2-1/2-in. pipe size.
10. Equalizer line shall be a minimum 1-1/2-in. pipe size.
11. The near boiler piping shall include a 2-1/2-in. tee with a plug located on supply line for skimming (surface blowdown). (See Fig. 3 or 4.)
12. The near boiler piping shall include a 1-1/2-in. ball valve in return piping for bottom blowdown and draining. (See Fig. 3 or 4.)
13. For gravity return systems, bottom of lowest steam carrying pipe, be it dry return or end of steam main, must be at least 28 in. above normal water level line on right side of boiler. This is known as "Dimension A."



**Fig. 4—Recommended Near Boiler Piping Using 2 Supply Tapplings**

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14. For pumped return systems, follow condensate pump or boiler feed pump manufacturer's instructions for proper installation and hookup.
15. In connecting cold water supply to water inlet valve, make sure that a clean water supply is available. When water supply is from a well or pump, a sand strainer should be installed at pump.

**PROCEDURE 1—FOR USE WITH COOLING UNITS**

1. This boiler, when used in connection with chilled water systems, must be installed so that chilled water is piped in parallel with the heating boiler. Appropriate valves must be used to prevent chilled water from entering the heating boiler. (See Fig. 6.)
2. When this boiler is connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation, piping system shall be equipped with flow control valves or other automatic means to prevent gravity circulation of boiler water during cooling cycles.

**CHIMNEY AND VENT PIPE CONNECTION**

For boilers connected to gas vents or chimneys, vent installations shall be in accordance with Part 7 NFGC, Venting of Equipment and applicable provisions of local building codes.

**PROCEDURE 1—CHECKING CHIMNEY**

This is a very important part of the heating system. It must be clean, the right size, properly constructed, and in GOOD CONDITION. No boiler can function properly with a bad chimney. Inspect chimney and verify that construction and size of chimney meet all applicable provisions of the NFGC and local building codes. Fig. 7 gives an idea how a boiler might be vented to a chimney. Note that height (HT) is measured from vent pipe to top.

**PROCEDURE 2—CHIMNEY SIZING**

Chimney sizing and all other aspects of vent installation must be in accordance with Part 7, NFGC Venting of Equipment and applicable provisions of local building codes.

**PROCEDURE 3—CONNECTING VENT DAMPER AND VENT CONNECTOR**

Refer to Fig. 1 flue diagram for size and location of vent (flue opening). Use 28 gauge (minimum) galvanized pipe to connect to chimney.



# THIS PIPING CONFIGURATION IS INCORRECT TO SHOW COMMON MISTAKES

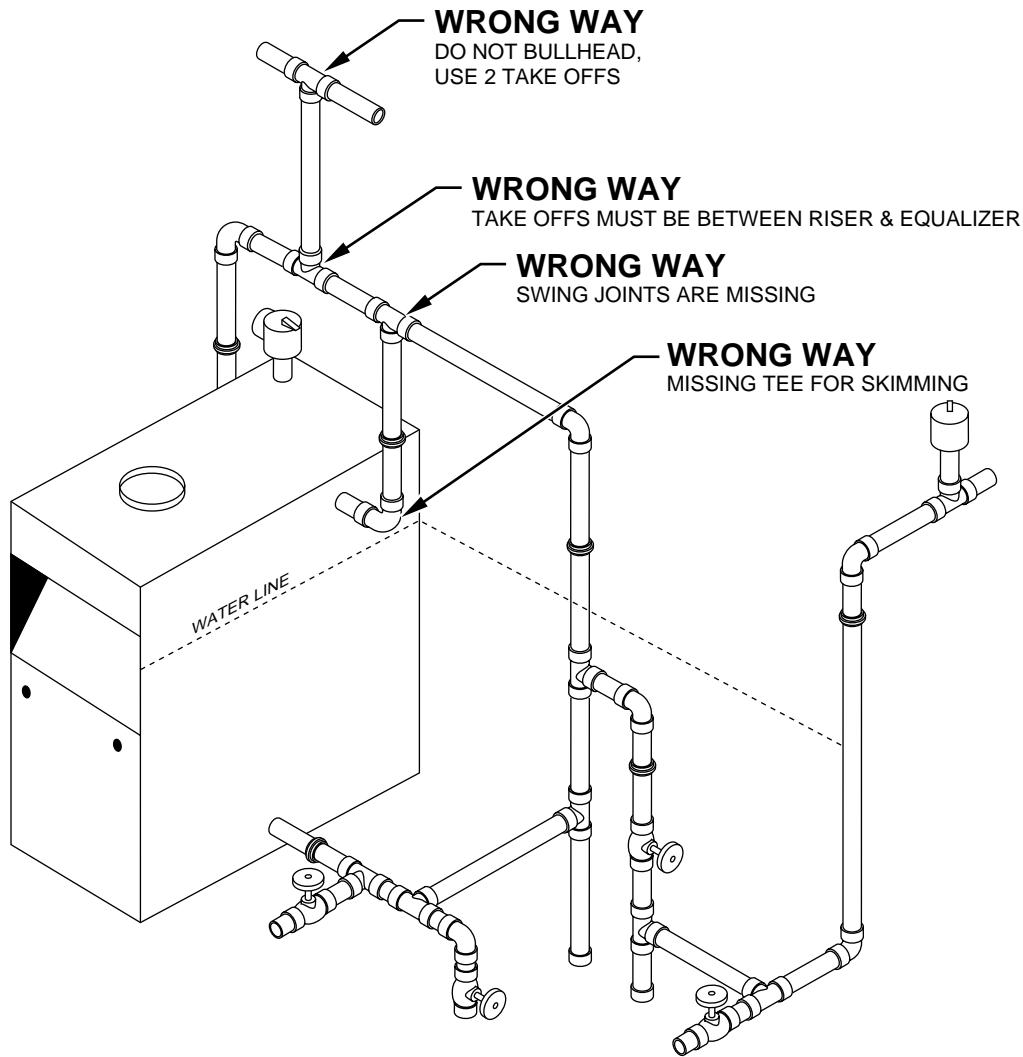
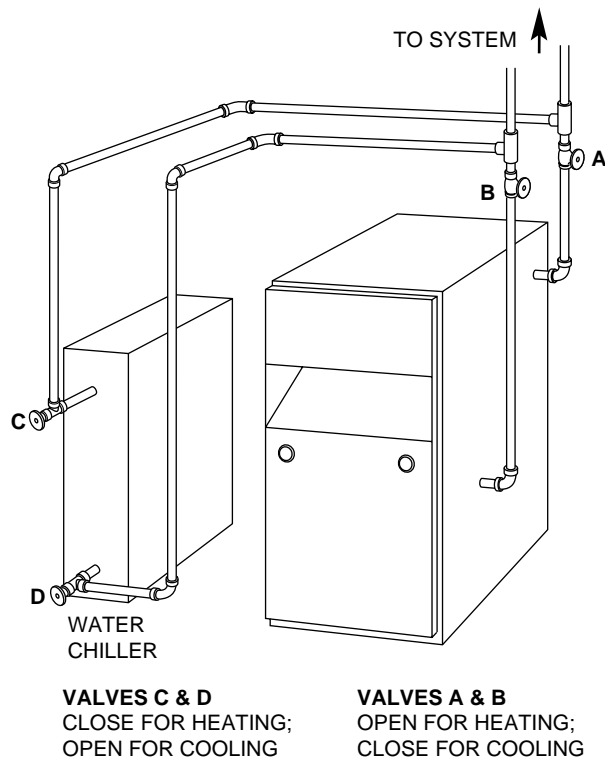


Fig. 5—Common Near Boiler Piping Mistakes

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**Fig. 6—Chilled Water Piping**

**IMPORTANT:** The damper blade on factory-supplied vent damper has a 1/2-sq in. hole (approximately 3/4-in. diameter). On boilers equipped with standing pilot, the hole **MUST** be left open. On boilers equipped with intermittent ignition, the hole should be plugged using plug supplied with vent damper.

1. Position factory-supplied vent damper on top of flue outlet collar. Fasten damper securely to flue outlet collar with at least 2 sheet metal screws. Make sure damper blade has clearance to operate inside of diverter.

**As An Option:**

The damper may be installed in any horizontal or vertical position, closer to flue outlet collar preferred. Follow diagrams shown in Fig. 8, 9, and 10.

2. Install vent damper to service only single boiler for which it is intended. The damper position indicator shall be in a visible location following installation. Locate damper so that it is accessible for servicing.
3. The damper must be in open position when appliance main burners are operating.
4. The boiler is equipped with a factory-wired harness that plugs into vent damper. The thermostat must be connected to black wires marked "24 volt thermostat" on boiler.
5. Vent pipe must be same size as flue outlet collar.
6. Slope pipe up from boiler to chimney not less than 1/4 in. per ft.
7. Run pipe as directly as possible with as few elbows as possible.
8. Do not connect to fireplace flue.
9. End of vent pipe must be flush with inside face of chimney flue. Use a sealed-in thimble for chimney connection.
10. Horizontal run should not be longer than 3/4 the chimney height (HT). (See Fig. 7.)

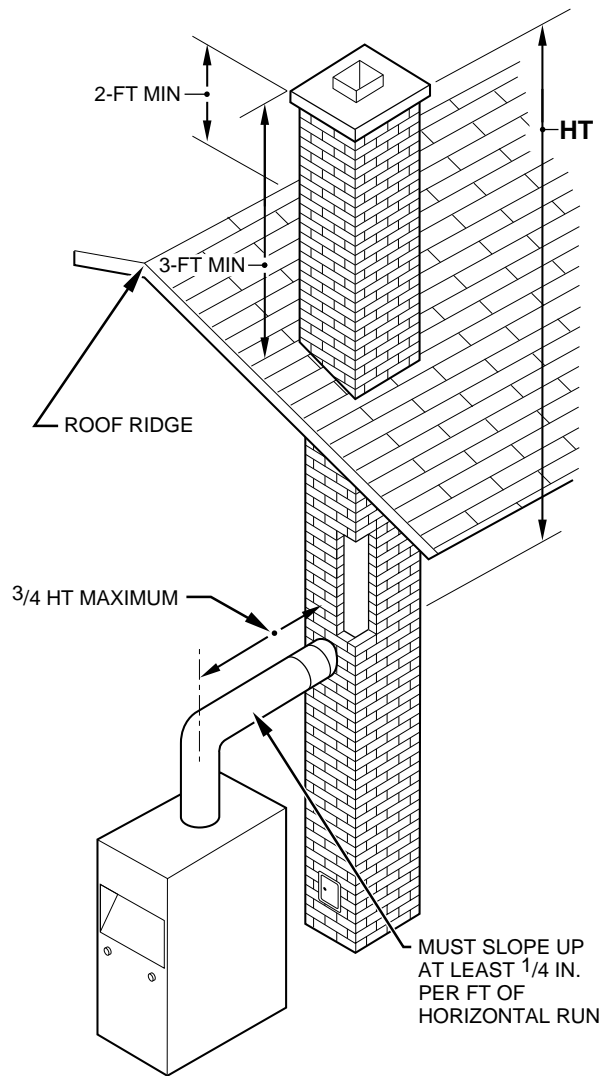
The sections of vent pipe should be fastened with at least 3 sheet metal screws to make the piping rigid. Horizontal portions of vent system must be supported to prevent sagging. Use stovepipe wires every 5 ft to support pipe from above. If vent pipe must go through a crawlspace, double-wall vent pipe should be used. Where vent pipe passes through a combustible wall or partition, use a ventilated metal thimble. The thimble should be 4 in. larger in diameter than vent pipe.

**PROCEDURE 4—MINIMUM VENT PIPE CLEARANCE**

Wood and other combustible materials must not be closer than 6 in. from any surface of single-wall metal vent pipe. Listed Type-B vent pipe or other listed venting systems shall be installed in accordance with their listing.

**PROCEDURE 5—REMOVING EXISTING BOILER FROM COMMON VENTING SYSTEM**

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



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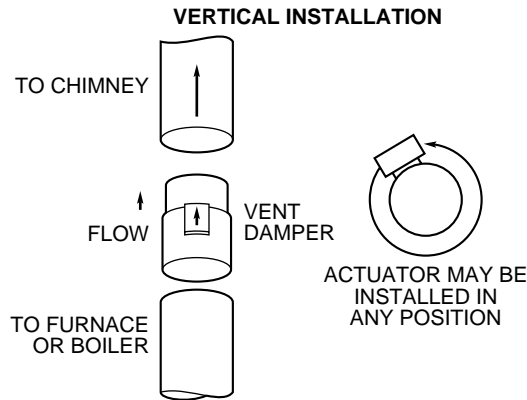
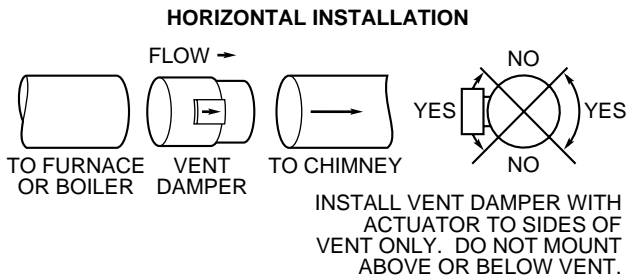
**Fig. 7—Typical Masonry Chimney Requirements**

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

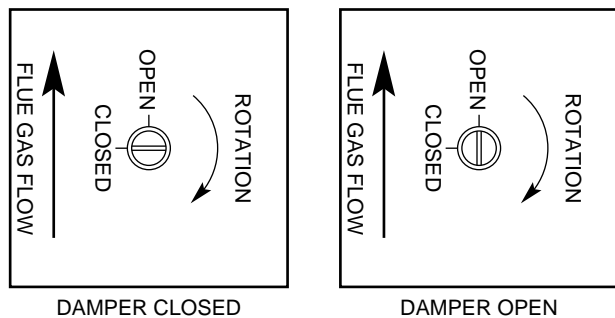
1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion, or other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all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

For boilers connected to gas vents or chimneys, vent installations shall be in accordance with Part 7, NFGC Venting of Equipment and applicable provisions of local building codes.

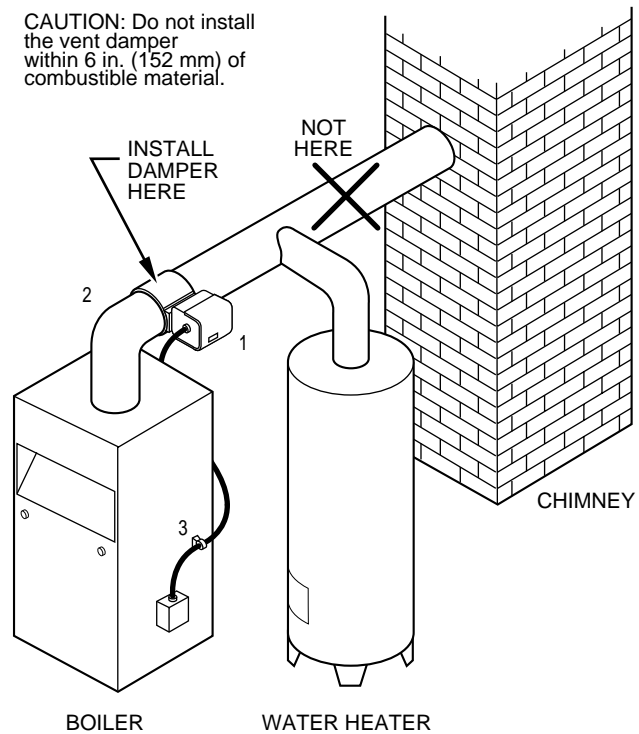
Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure.



**Fig. 8—Horizontal and Vertical Vent Damper Installation**



**Fig. 9—Vent Damper Position Indicator**



1. Install the vent damper to service only the single appliance for which it is intended. If improperly installed, a hazardous condition, such as an explosion or carbon monoxide poisoning, could result.
2. Do not install the vent damper on vent pipe curve.
3. Do not run wires near high temperature surfaces. Use stand-off brackets if necessary.

**Fig. 10—Typical Installation for Vent Damper (Note Caution and Footnotes)**

### VENT DAMPER OPERATION

#### PROCEDURE 1—AUTOMATIC OPERATION OF VENT DAMPER

For safe, efficient operation, vent damper and all flue product carrying areas of appliance must be checked annually with particular attention given to deterioration from corrosion or other sources. If corrosion or other deterioration is observed, contact your heating contractor for repairs. Check vent damper operation as follows:

1. When boiler is off, check that vent damper position indicator points to CLOSED position. (See Fig. 9.)
2. Adjust thermostat or controller up to call for heat and check that vent damper indicator points to OPEN position. (See Fig. 9.)
3. Adjust thermostat or controller down again and check that vent damper position indicator returns to CLOSED position.
4. If system has central air conditioning, set thermostat to COOL and adjust it down to call for cooling. Cooling system should operate.
5. Return thermostat to desired setting.

The vent damper must be inspected at least once a year by a trained, experienced service technician. The name of the person who originally installed vent damper is shown on installation label.

#### PROCEDURE 2—MANUAL OPERATION OF VENT DAMPER

The vent damper may be placed in OPEN position to permit burner operation by using the HOLD DAMPER OPEN switch located on damper controller. The thermostat controls burner firing as before while damper remains open. DO NOT turn damper open manually or motor damage will result. Set switch to AUTOMATIC OPERATION to close vent damper during burner off cycle.

For further information and for a vent damper troubleshooting guide, refer to the manual packaged with vent damper.

### GAS SUPPLY PIPING

#### PROCEDURE 1—CHECKING GAS SUPPLY

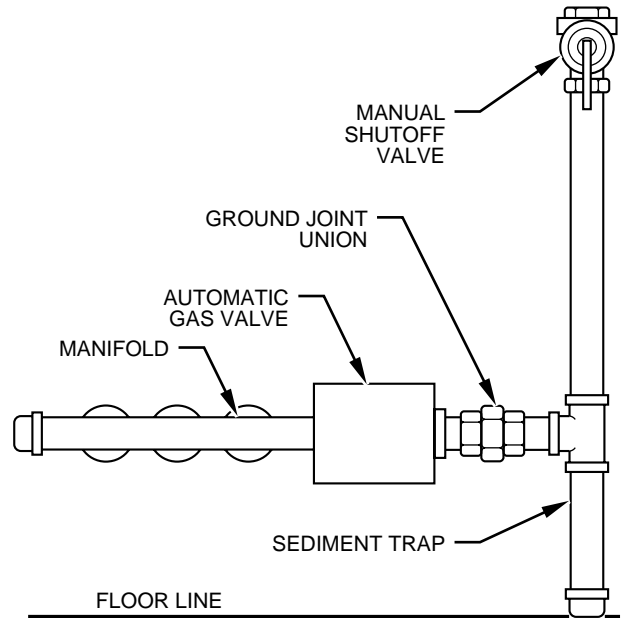
The gas pipe to boiler must be correct size for length of run and Btuh input of all gas utilization equipment connected to it. See Table 4 for proper size. Be sure gas line complies with local codes and gas company requirements.

**Table 4—Gas Pipe Sizes**

NATURAL GAS				
Length of Pipe (Ft)	Pipe Capacity—Btuh Input Includes Fittings			
	1/2 in.	3/4 in.	1 in.	1-1/4 in.
20	92,000	190,000	350,000	625,000
40	63,000	130,000	245,000	445,000
60	50,000	105,000	195,000	365,000
LP GAS				
Length of Pipe (Ft)	Pipe Capacity—Btuh Input Includes Fittings			
	Copper Tubing*		Iron Pipe	
	5/8 in.	3/4 in.	1/2 in.	3/4 in.
20	131,000	216,000	189,000	393,000
40	90,000	145,000	129,000	267,000
60	72,000	121,000	103,000	217,000

\* Outside diameter.

**NOTE:** The length of pipe or tubing shown should be measured from gas meter or propane second-stage regulator.



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**Fig. 11—Gas Piping at Boiler**

The boiler and its individual shutoff valve must be disconnected from gas supply piping system during any pressure testing of gas supply piping system at test pressures in excess of 0.5 psig (3.5 kPa).

The boiler must be isolated from gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 0.5 psig (3.5 kPa).

**PROCEDURE 2—CONNECTING GAS PIPING**

Refer to Fig. 11 for general layout at boiler. It shows the basic fittings needed. The gas line enters boiler from right side.

The following rules apply:

1. Use only those piping materials and joining methods listed as acceptable by the authority having jurisdiction or in the absence of such requirements, by the NFGC.
2. Use pipe joint compound suitable for LP gas on male threads only.
3. Use ground joint unions.
4. Install a sediment trap upstream of gas controls.
5. Use 2 pipe wrenches when making connection to gas valve to keep it from turning.
6. Install a manual shutoff valve in vertical pipe about 5 ft above floor.
7. Tighten all joints securely.
8. Propane gas connections should only be made by a licensed propane installer.
9. Two-stage regulation should be used by propane installer.
10. Propane gas piping should be checked by propane installer.

**PROCEDURE 3—CHECKING GAS PIPING**

Upon completion of piping, check immediately for gas leaks. Open manual shutoff valve. Test for leaks by applying soap suds (or a liquid detergent) to each joint. Bubbles forming indicate a leak. **CORRECT EVEN THE SMALLEST LEAK AT ONCE.**

**⚠ WARNING:** Never use a match or open flame to test for leaks. Use a soap-and-water solution. A failure to follow this warning could result in fire, explosion, personal injury, or death.

**ELECTRICAL WIRING**

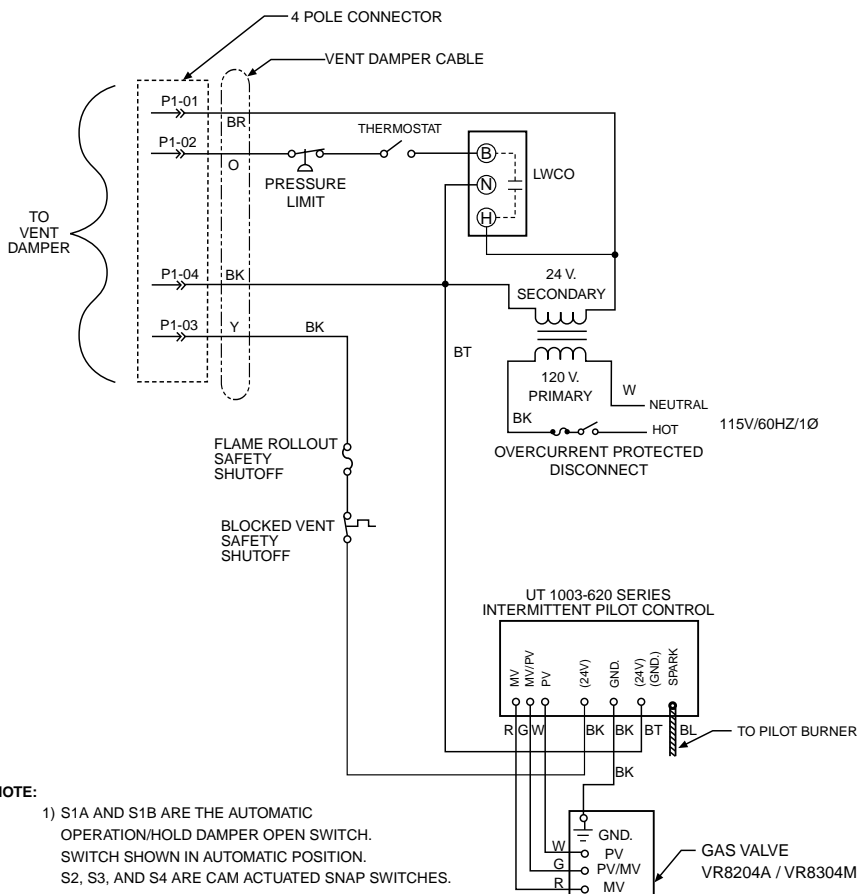
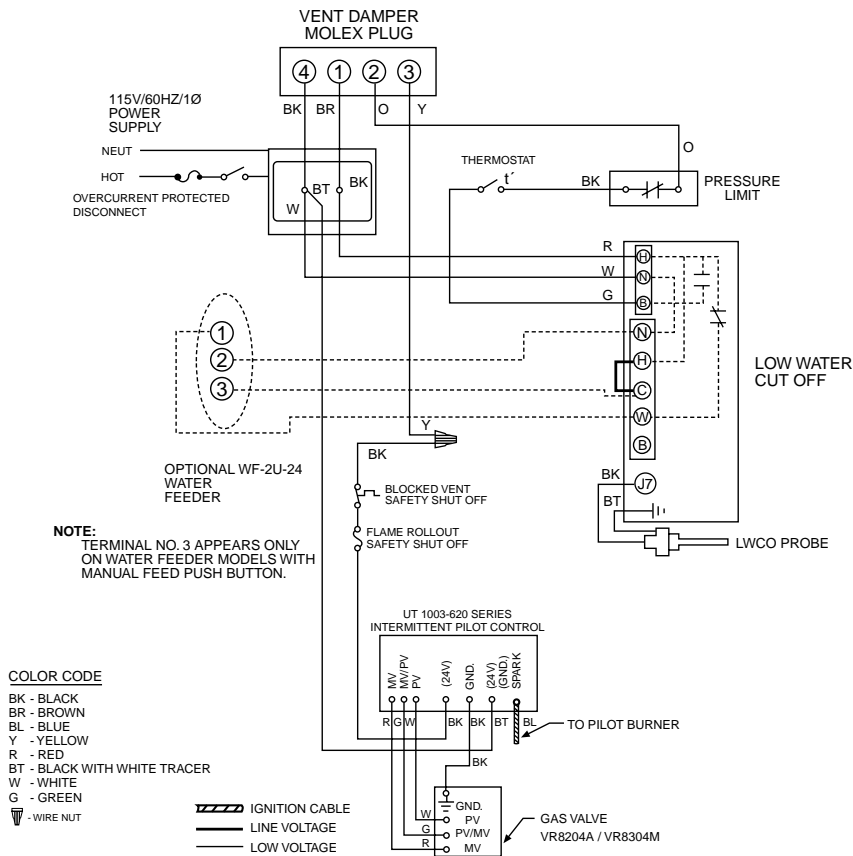
See Fig. 12-15 for wiring diagrams of the various models.

**PROCEDURE 1—ELECTRIC POWER SUPPLY**

**⚠ WARNING:** Turn off electric power at fuse box before making any line voltage connections. Follow local electric codes. Failure to follow this warning could result in electrical shock, personal injury, or death.

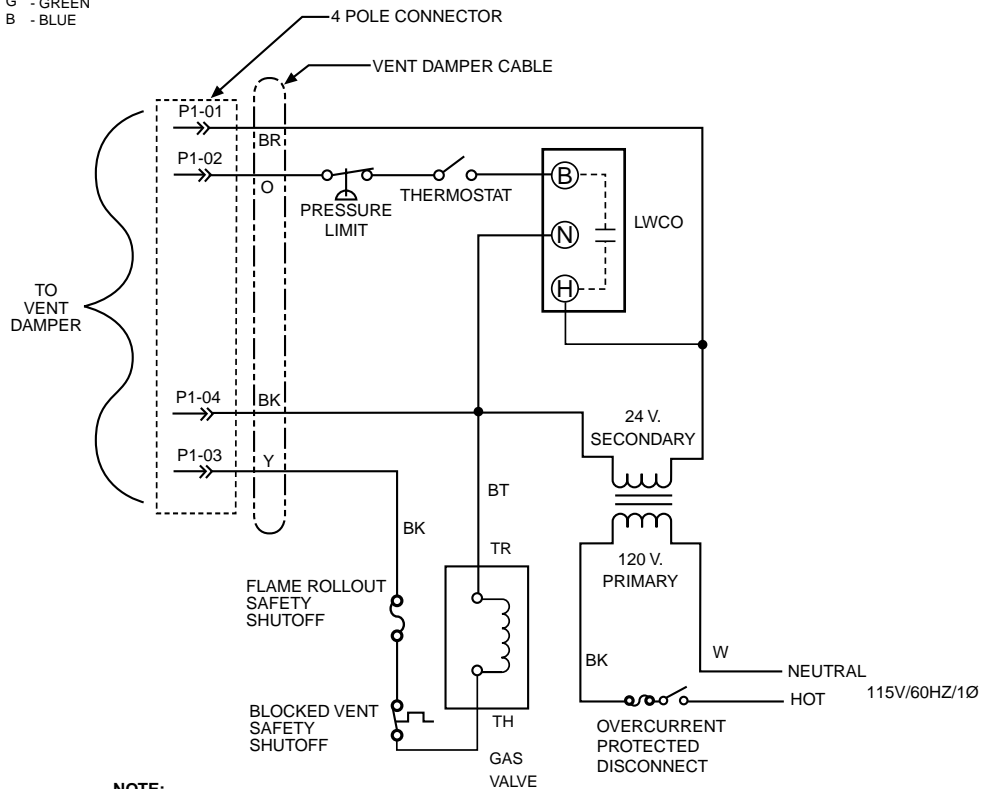
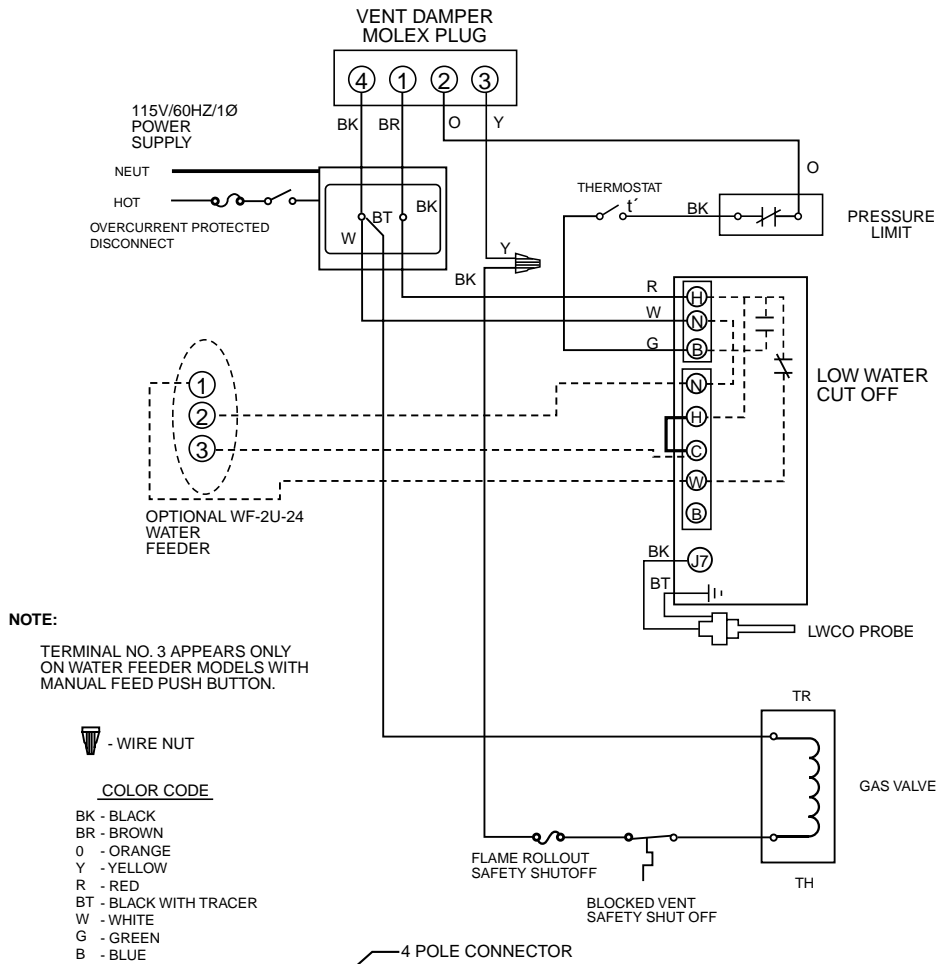
All electrical work must conform to local codes as well as the National Electrical Code (NEC) ANSI/NFPA-70-2002.

Run a separate 120-v circuit from a separate overcurrent protective device in electrical service entrance panel. This should be a 15-amp circuit. Locate a shutoff switch at boiler. It must be turned off during any maintenance. Connect 120-v electrical supply to primary leads on 24-v transformer. Solder and tape or securely fasten these connections with wire nuts.



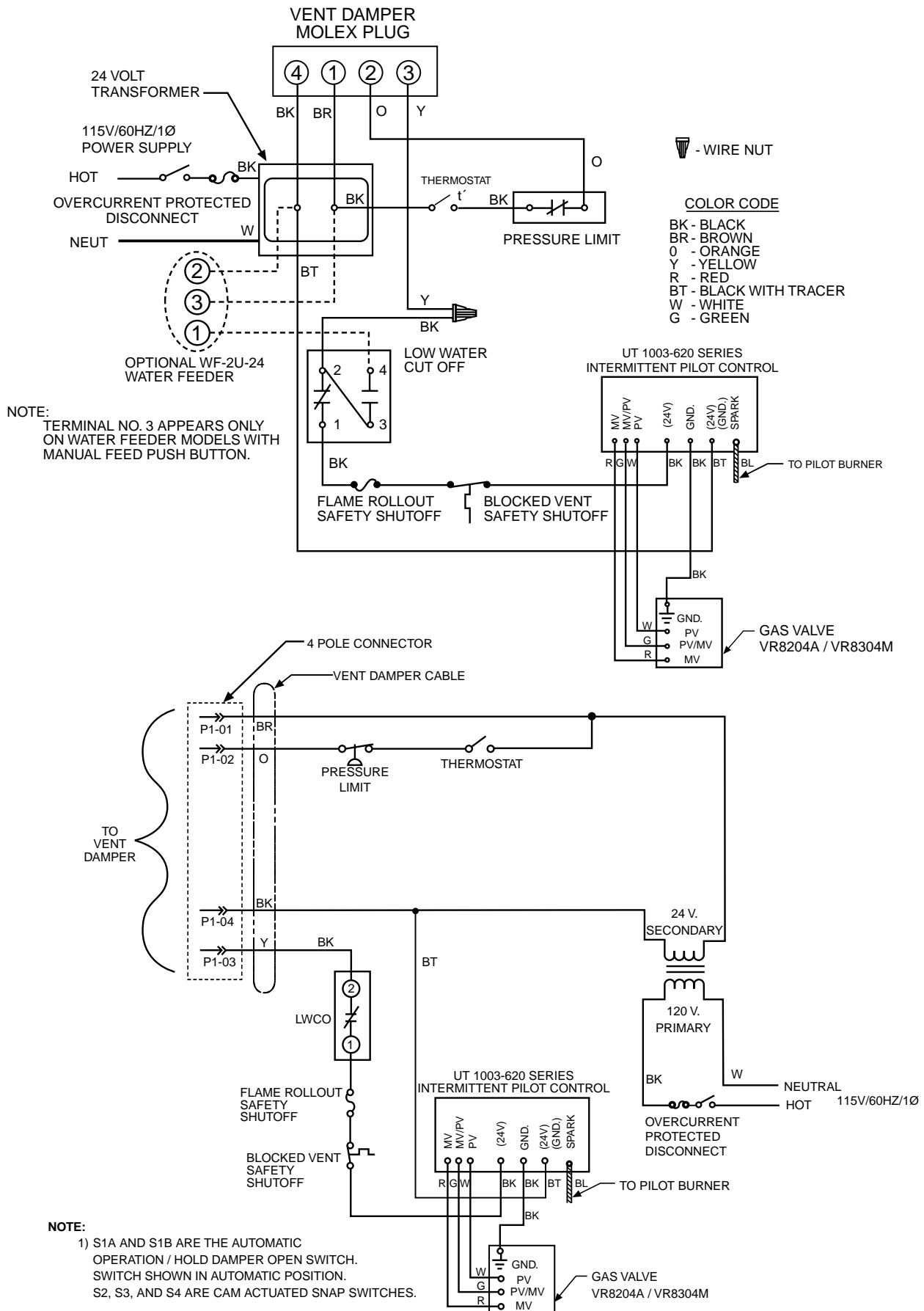
**NOTE:** If any of the original wire as supplied with this appliance must be replaced, it must be replaced with type 105°C thermoplastic wire or its equivalent.

→ Fig. 12—Wiring Diagram for Intermittent Ignition Boilers with PS-802 Probe-Type Low Water Cut-Off



**NOTE:** If any of the original wire as supplied with this appliance must be replaced, it must be replaced with type 105°C thermoplastic wire or its equivalent.

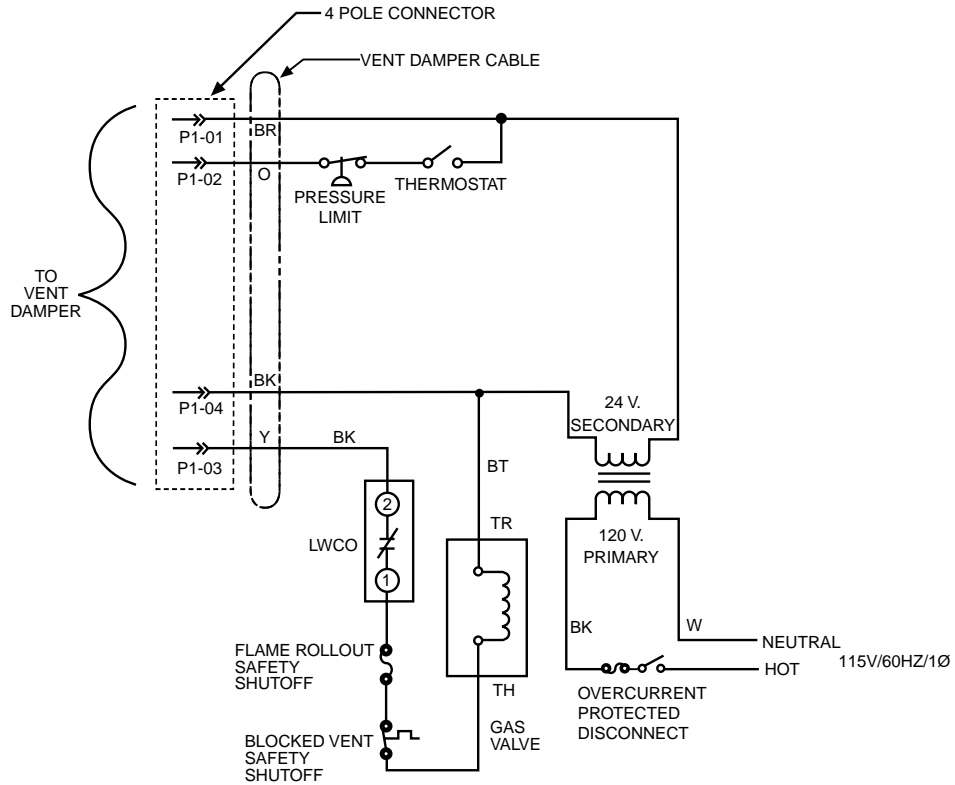
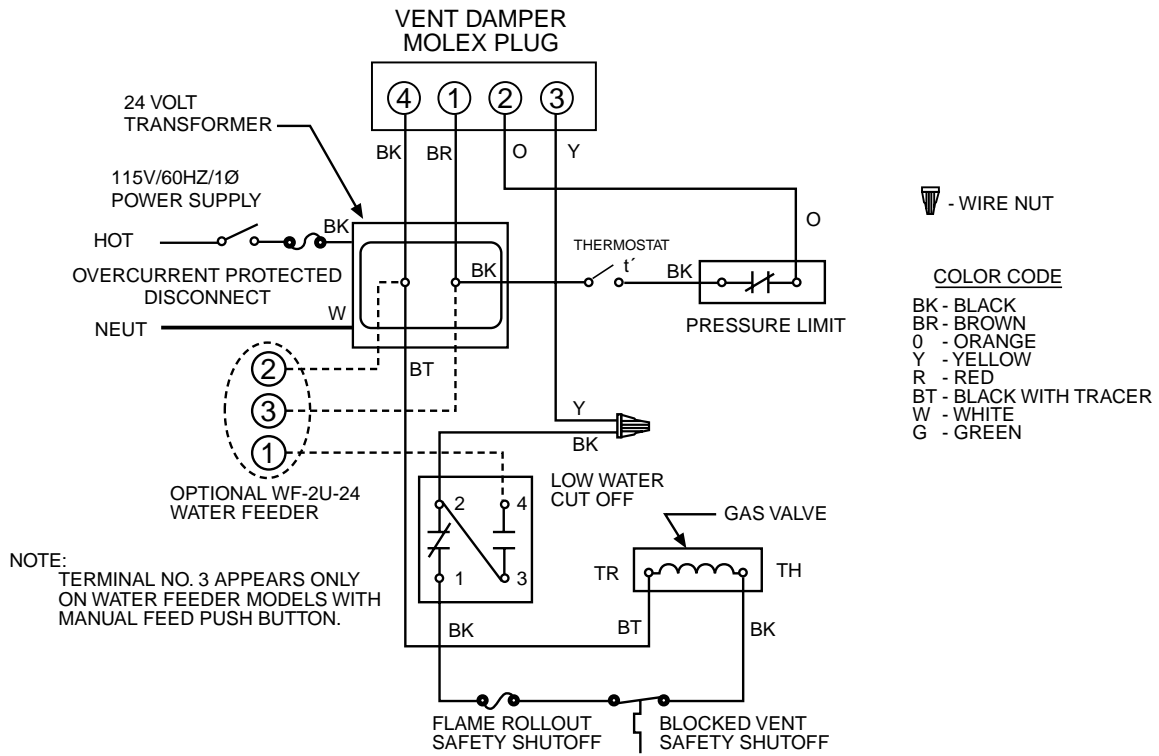
→ Fig. 13—Wiring Diagram for Standing Pilot Boilers with PS-802 Probe-Type Low Water Cut-Off



**NOTE:** If any of the original wire as supplied with this appliance must be replaced, it must be replaced with type 105°C thermoplastic wire or its equivalent.

**Fig. 14—Wiring Diagrams for Intermittent Ignition Boilers with Float-Type Low Water Cut-Off**



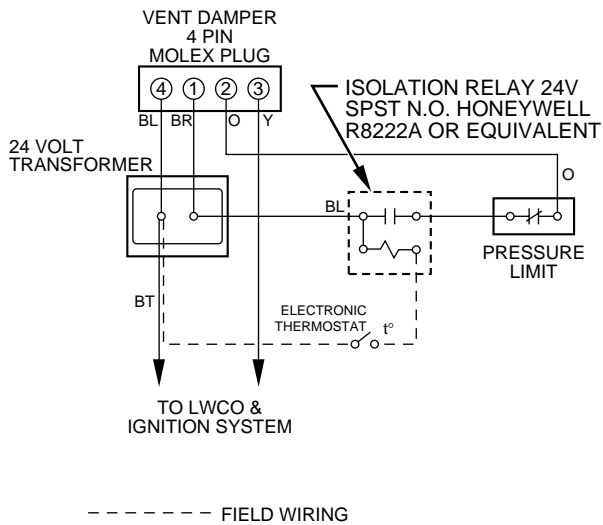


**NOTE:**

1) S1A AND S1B ARE THE AUTOMATIC OPERATION / HOLD DAMPER OPEN SWITCH. SWITCH SHOWN IN AUTOMATIC POSITION. S2, S3, AND S4 ARE CAM ACTUATED SNAP SWITCHES.

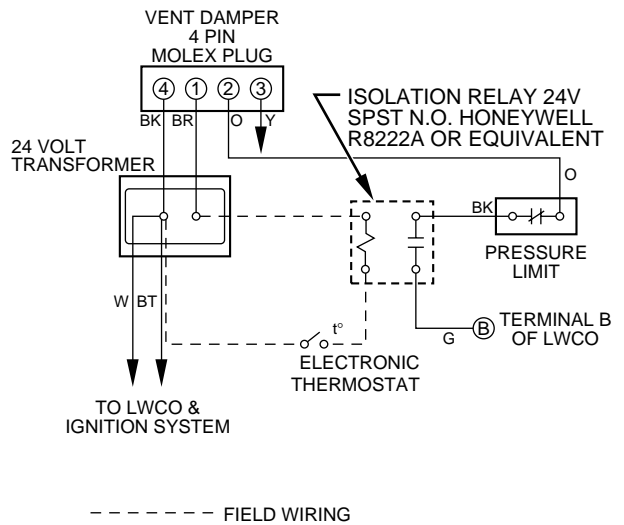
**NOTE:** If any of the original wire as supplied with this appliance must be replaced, it must be replaced with type 105°C thermoplastic wire or its equivalent.

**Fig. 15—Wiring Diagrams for Standing Pilot Boilers with Float-Type Low Water Cut-Off**



**Fig. 16—Isolation Relay Wiring for Steam Boilers with 67D-1 Float-Type Low Water Cut-Off and Using Electronic Thermostat**

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**Fig. 17—Isolation Relay Wiring for Steam Boilers with PS-802 Probe-Type Low Water Cut-Off and Using Electronic Thermostat**

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The boiler, when installed, must be electrically grounded in accordance with requirements of the authority having jurisdiction, or in the absence of such requirements, with the NEC. Run a 14 gauge or heavier copper wire from boiler to a grounded connection in service panel or a properly driven and electrically grounded ground rod.

**PROCEDURE 2—INSTALLING THERMOSTAT**

The thermostat location has an important effect on the operation of boiler system. BE SURE TO FOLLOW INSTRUCTIONS INCLUDED WITH THERMOSTAT.

Locate thermostat about 5 ft above floor on an inside wall. It may be mounted directly on wall or on a vertically mounted outlet box. It should be sensing average room temperature so avoid the following:

**DEAD SPOTS:**

- Behind doors
- Corners and alcoves

**HOT SPOTS:**

- Concealed pipes
- Fireplace
- TV sets
- Radios
- Lamps
- Direct sunlight
- Kitchens

**COLD SPOTS:**

- Concealed pipes or ducts
- Stairwells—drafts
- Doors—drafts
- Unheated rooms on other side of wall

Set heat anticipator at 0.7 amps for boilers equipped with standing pilot and at 0.9 amps for boilers equipped with intermittent ignition. The 24-v thermostat leads shall be connected to the 2 wires tagged "24 volt thermostat" on boiler. For boilers with 67D-1 float-type low water cut-off, both wires are black. One wire is located on secondary of 24-v transformer. The second wire is located on pressure limit control. For boilers with PS-802 probe-type low water cut-off, 1 wire is green and is located on terminal B of the PS-802. The second wire is black and is located on pressure limit control.

**PROCEDURE 3—ELECTRONIC THERMOSTATS**

Certain types of electronic thermostats may lose their memory or shut down. With PS-802 probe-type low water cut-offs, this may occur each time the low water cut-off detects a low water condition. With 67D-1 float-type low water cut-offs, this may occur each time thermostat calls for heat, due to the internal circuit in vent damper. If this is the case, an isolation relay is required for thermostat circuit. A 24-v single-pole single-throw (SPST) normally open (N.O.) relay is required such as Honeywell R8222A or equivalent. See Fig. 16 or 17 and wire as shown.

**PROCEDURE 4—VENT DAMPER**


The boiler is equipped with a factory-wired harness with a 4-pin Molex plug which plugs into 4-pin Molex receptacle inside vent damper operator. The vent damper must be connected for boiler to operate.

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

## CONTROLS AND ACCESSORIES

### PROCEDURE 1—RELIEF VALVE

The relief valve should open automatically if boiler steam pressure exceeds pressure rating of valve (15 psig). Should it ever fail to open under this condition, shut down boiler. If valve discharge occurs or valve fails to open as described above, contact an authorized contractor or qualified service technician to replace relief valve and inspect heating system to determine the cause as this may indicate an equipment malfunction. Run a pipe from safety valve outlet (pipe must be same size as outlet, and open end must not be threaded) to an open drain, tub, sink, or other suitable drainage point not subject to freezing.

→  **CAUTION: Failure to do so may cause water damage or injury should relief valve release. Do not cap off drain line from this valve!**

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### PROCEDURE 2—STEAM PRESSURE GAUGE

Every system should have a pressure gauge installed in boiler. This gauge enables monitoring of pressure in system. If safety devices fail to shut off boiler at proper settings, notify service technician immediately.

### PROCEDURE 3—WATER LEVEL GAUGE

The water level in boiler can be seen through glass tube in water level gauge at side of boiler. Correct cold boiler water level is stamped on side jacket panel. The water level should be checked regularly for proper level.

### PROCEDURE 4—STEAM PRESSURE CONTROL

The steam pressure limit control (pressuretrol) shuts off gas to main burners when steam pressure in boiler reaches cut-off setpoint (the sum of cut-in and differential set points). Burners refire when steam pressure drops to cut-in setpoint. System pressure requirements are based on size and condition of pipes and load.

### PROCEDURE 5—LOW WATER CUT-OFF (LWCO)

On right side jacket panel of boiler, there are 3 holes for glass water level gauge. The top hole is common for both types of LWCOs and is used for upper gauge glass fitting. The middle hole (9 in. down from top hole) is used for bottom gauge glass fitting for the Model 67D-1 float-type LWCO. The lowest hole (12-1/4 in. down from top hole) is used for bottom gauge glass fitting for the Model PS-802 probe-type LWCO. The hole that is not being used is covered with a sheet metal knockout.

#### A. Model 67D-1

This is a float-operated switch which shuts down gas burners if water falls below visible bottom of gauge glass.

#### B. Model PS-802

This is an electronic probe-type LWCO. The probe is located inside boiler. The LWCO shuts down burners if water loses contact with probe for a period of 10 sec.

Refer to manufacturer's instructions (enclosed) for more information.

### PROCEDURE 6—WATER FEEDER (OPTIONAL)

The model WF-2U-24 water feeder may be used with either of the available low water cut-offs. The water feeder's job is to maintain a safe minimum water level. It is used to keep boiler running by compensating for minor evaporative steam leaks and to prevent freeze-ups if the homeowners are away and a return line springs a leak.

McDonnell and Miller Model 101 water feeders may be used; however, the water feed rates are too high and need to be regulated or throttled, and wiring must be revised. Consult boiler manufacturer before using these or any other non-standard types of controls.

The automatic water feeder is a safety device not a convenience item. It is not designed to maintain a "normal" water line. The water feeder does not take the place of a responsible person monitoring and maintaining normal water line. Steam boilers require personal attention.

### PROCEDURE 7—VENT DAMPER

This is an automatic, motorized stack damper developed to increase efficiency of heating systems by reducing standby losses from boiler and conditioned air space. The damper closes chimney vent when burner is off and fully opens it when combustion is required.

### PROCEDURE 8—ROLLOUT SWITCH (FLAME ROLLOUT SAFETY SHUTOFF)

The rollout switch is a temperature-sensitive fuse link device. It is located on boiler base just outside fire box. In the event of heat exchanger flueway blockage causing flame to roll out of fire box, the fuse blows shutting down flow of gas to main burners. The fuse does not change in appearance when blown.

If rollout switch blows, it must be replaced with an exact replacement. Check heat exchanger flueways for blockage when restoring system to operating condition. Do not operate system without a rollout switch.


### PROCEDURE 9—SPILL SWITCH (BLOCKED VENT SAFETY SHUTOFF)

The spill switch is a manual-reset disc thermostat with a fixed setpoint (280°F) and normally-closed contacts. It is located at relief opening of draft diverter. In the event of chimney or venting system blockage causing products of combustion to spill out of relief opening, the spill switch disc heats up and spill switch contacts open shutting down flow of gas to main burners by removing power to gas valve.

In the event that spill switch contacts open, the reset button on back of switch pops up. The spill switch must be reset manually, after the switch has cooled off, by pushing the reset button down. Check venting system and chimney for blockage when restoring system to operating condition. DO NOT operate system without a spill switch.

## FOR YOUR SAFETY READ BEFORE OPERATING

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 **WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury, or death.**

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A. Some boilers are equipped with an intermittent ignition device which automatically lights the pilot. Do NOT try to light pilot by hand. Some boilers are equipped with a continuous pilot and must be lit manually. See lighting instructions in Continuous Pilot Boiler section. A match holder is included in parts bag.

B. BEFORE OPERATING, smell all around appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

**WHAT TO DO IF YOU SMELL GAS**

- Do not try to light any appliance.
- Do not touch any electric 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.

C. Use only your hand to turn gas control knob. Never use tools. If knob will not turn by hand, do not try to repair it. Call a qualified service technician. Force or attempted repair may result in a fire or explosion.

D. Do not use this appliance if any part has been under water. Immediately call a qualified service technician to inspect the appliance and to replace any part of control system and any gas control which has been under water.

**GAS VALVE OPERATING INSTRUCTIONS**

**PROCEDURE 1—INTERMITTENT IGNITION BOILER—VR8204A/VR8304M GAS VALVE**

**A. To Turn On Gas To Appliance**

1. STOP! Read safety information in For Your Safety Read Before Operating section.
2. Set thermostat to lowest setting.
3. Turn off all electrical power to appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do NOT try to light pilot by hand.
5. Remove lower front panel.
6. Turn gas control knob clockwise to OFF position. (See Fig. 18.)
7. Wait 5 minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in safety information in For Your Safety Read Before Operating section.
8. Turn gas control knob counterclockwise to ON position. (See Fig. 18.)
9. Replace lower front panel.
10. Turn on all electrical power to appliance.
11. Set thermostat to desired setting.
12. If appliance will not operate, follow instructions "To Turn Off Gas To Appliance" and call your service technician or gas supplier.

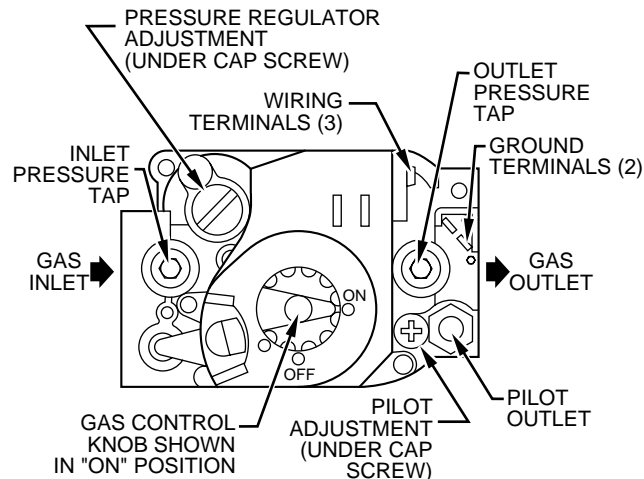
**B. To Turn Off Gas To Appliance**

1. Set thermostat to lowest setting.
2. Turn off all electric power to appliance if service is to be performed.
3. Turn gas control knob clockwise to OFF position. (See Fig. 18.) Do not force.

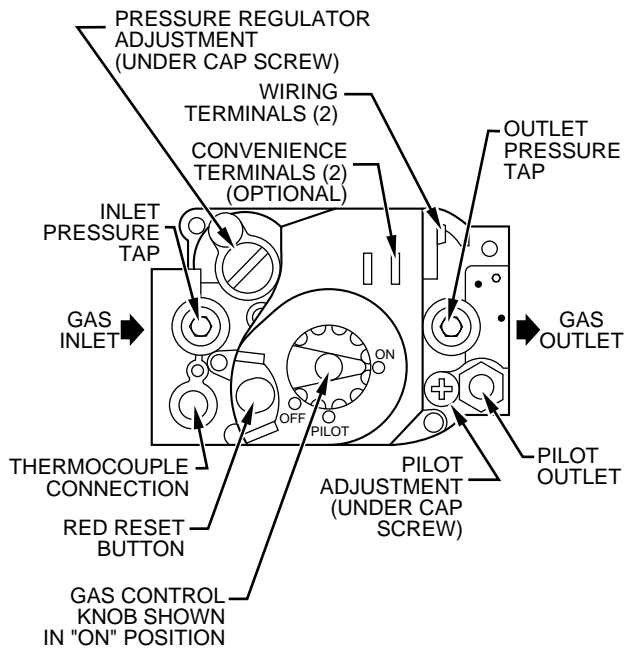
**PROCEDURE 2—CONTINUOUS PILOT BOILER—VR8200A/VR8300A GAS VALVE**

**A. To Turn On Gas To Appliance**

1. STOP! Read safety information in For Your Safety Read Before Operating section.
2. Set thermostat to lowest setting.
3. Turn off all electrical power to appliance.

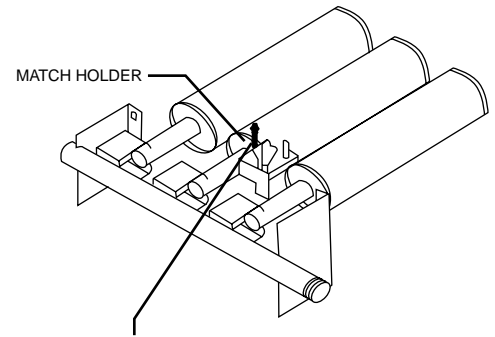


**Fig. 18—VR8204A/VR8304M Intermittent Ignition Gas Valve**



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**Fig. 19—VR8200A/VR8300A Continuous Pilot Gas Valve**



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**Fig. 20—Lighting Pilot**

4. Remove lower front panel.
5. Turn gas control knob clockwise to OFF position. (See Fig. 19.)
6. Wait 5 minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, STOP! Follow "B" in safety information in For Your Safety Read Before Operating section.
7. Find pilot. Follow metal tube from gas control. The pilot is between 2 burner tubes. (See Fig. 20.)
8. Turn knob on gas control counterclockwise to PILOT position. (See Fig. 19.)
9. Push down and hold red reset button while you light pilot burner with a match. After about 1 minute, release reset button. Pilot should remain lit. If it goes out, turn gas control knob clockwise to OFF position. To relight, repeat items 5-9.
  - If button does not pop up when released, stop and immediately call your service technician or gas supplier.
  - If pilot will not stay lit after several tries, turn gas control knob to OFF position and call your service technician or gas supplier.
10. After pilot remains lit when red reset button is released, turn gas control knob counterclockwise to ON position. (See Fig. 19.)
11. Replace lower front panel.
12. Turn on all electrical power to appliance.
13. Set thermostat to desired setting.

**B. To Turn Off Gas To Appliance**

1. Set thermostat to lowest setting.
2. Turn off all electrical power to appliance if service is to be performed.
3. Turn gas control knob clockwise to OFF position. (See Fig. 19.) Do not force.

**OPERATING BOILER**

**PROCEDURE 1—HOW A STEAM SYSTEM OPERATES**

The water in boiler is heated until it reaches boiling point. As water boils, it turns into steam. The steam rises from top of water through supply main to radiation units. As it passes through radiators, it releases its heat and condenses into water. The water returns to boiler through return main. Most residential systems operate at less than 1 lb steam pressure.

**PROCEDURE 2—FILLING SYSTEM WITH WATER**

On steam heating systems, boiler is partially filled with water. It is very important to proper operation of entire system that boiler be filled to proper level. The correct water level is about halfway up glass water level gauge as marked on boiler jacket. To fill:

1. Close boiler drain valve.
2. Open valves at top and bottom of glass water level gauge. Also open drain valve at bottom of gauge.
3. Open fill valve and allow water to run into boiler.

→ **CAUTION:** Never run water into a hot, empty boiler or thermal shock may crack boiler components (sections).

4. Allow boiler to fill until water runs out gauge drain valve, then close gauge drain valve.
5. Continue to fill boiler until water reaches indicated water line. This is about halfway up glass tube.

### PROCEDURE 3—WATER LEVEL

The normal water level is shown on right side of boiler and is 24 in. above the floor. The normal water level is determined when boiler is off and cold (when all of the water in system is inside boiler and return piping below water line) and everything above water line is air, no steam. When boiler is making steam, the water level drops 2-3 in. below normal water line.

### PROCEDURE 4—AUTOMATIC GAS VALVE

The automatic gas valve opens or closes according to heat requirements of thermostat and pressure limit control. It closes if pilot goes out. Each individual control must be operating correctly before any gas can pass to burners. Any 1 control can hold gas supply from burners regardless of demand of any other control.

### PROCEDURE 5—THERMOSTAT

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

**NOTE:** In the event of failure of any component, system will not operate or will go into safety lockout. The system is completely self-checking. On every call for heat, each component must be functioning properly to permit operation. On safety lockout, system has to be reset by setting thermostat to lowest setting for 1 minute, then back to normal setting.

Safe lighting and other performance criteria were met with gas manifold and control assembly provided on boiler when boiler underwent tests specified in ANSI Z21.13.

## CHECKING AND ADJUSTING

### PROCEDURE 1—PILOT BURNER ADJUSTMENT

Pilot flame should surround 3/8- to 1/2-in. of pilot sensor. (See Fig. 21.) If flame needs adjusting, proceed as follows:

1. Remove screw cover over pilot adjusting screw.
2. Insert small screwdriver and adjust flame as needed. Turn screw counterclockwise to increase flame and clockwise to decrease flame.
3. Replace screw cover over pilot adjusting screw.

### PROCEDURE 2—MAIN BURNER(S)

The main burners do not require primary air adjustment and are not equipped with primary air shutters. Main burner flames should form sharp blue inner cones in a softer blue out mantel, with no yellow. Puffs of air from blowing on the flame or stamping on the floor will cause the flames to turn orange momentarily. This is not unusual. Remain still when observing the main burner flames. If the flame appearance is not correct, check main burner orifices and the burner throat and flame ports for dust and lint obstruction. It may be necessary to remove the rollout shield to observe the main burner flames. Replace rollout shield after observation. (See Fig. 22.)

### PROCEDURE 3—GAS VALVE SAFETY SHUTDOWN TEST

#### A. Boilers Equipped with Continuous Pilot

With main burners firing, disconnect thermocouple from gas valve. (See Fig. 19.) Gas valve should immediately shut off main burners and pilot.

#### B. Boilers Equipped with Intermittent Ignition

With main burners firing, disconnect ignition cable from intermittent pilot control box. Gas valve should shut off main burners. **TURN OFF ELECTRIC POWER** to boiler before reconnecting ignition cable to prevent electric shock.

### PROCEDURE 4—STEAM PRESSURE CONTROL ADJUSTMENT

The steam pressure limit control (pressuretrol) shuts off gas to main burners when steam pressure in boiler reaches cut-off setpoint (the sum of cut-in and differential set points). Burners refire when steam pressure drops to cut-in setpoint. System pressure requirements are based on size and condition of pipes and load.

For good system operation, the cut-in setting of pressuretrol should never be less than twice the system pressure drop. In a typical single family residence with a clean 1-pipe heating system and cast iron radiation, this means that cut-in will usually be set at the minimum setting of 0.5 psi. Steam radiation is usually sized based on sq ft of equivalent direct radiation (EDR). This is based on a steam pressure in radiator of just less than 1 psi. Therefore, in example system from above, the differential adjustment would be set at 1 psi (the steam pressure required in radiators). This gives a cut-off setpoint of 1.5 psi.

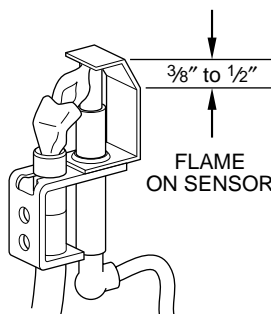


Fig. 21—Pilot Flame and Sensor

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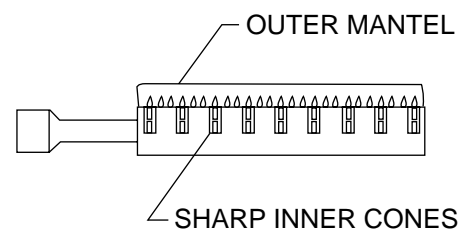


Fig. 22—Main Burner Flame

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The above is an example of a typical 1-pipe system. For larger systems or other types of systems such as 2-pipe systems or systems with convectors or fan coil units, pressure settings need to be determined on a system-by-system basis.

The cut-in setpoint is determined by system pressure drop to furthest radiator or terminal unit. Double the system pressure drop as a safety factor, resulting in the rule that cut-in setting should never be less than twice the system pressure drop.

The differential setpoint is the steam pressure required at terminal heating units.

Boiler now operates in correct pressure range. It maintains enough steam pressure to send steam out to furthest radiator, and not go over optimum steam pressure required at radiators.

## **PROCEDURE 5—CHECKING CONTROLS**

### **A. Low Water Cut-Off (LWCO)**

To check LWCO, turn power off to boiler or adjust thermostat to lowest setting. Drain water to below visible bottom of water gauge glass. Turn power on and adjust thermostat to call for heat. Gas valve should not open on a call for heat when water is low.

If boiler is equipped with optional WF-2U-24 water feeder, keep thermostat calling for heat after LWCO recognizes low water condition. After a 1-minute time delay, water feeder should start feeding water to boiler. The feeder should feed for 1 minute and then go into another 1-minute waiting period. This cycle of alternately waiting and feeding should repeat until:

#### **MODEL 67D-1 FLOAT-TYPE LOW WATER CUT-OFFS**

As water level raises the float above burner cut-off switch level, burners should ignite. The water feeder remains powered until water level raises the float to water feeder switch level satisfying water feeder.

#### **MODEL PS-802 PROBE-TYPE LOW WATER CUT-OFFS**

The water level rises until water in boiler makes contact with probe satisfying water feeder and igniting burners.

In either case, there should be between 1 and 2 in. of water visible in gauge glass when both the water feeder is satisfied and the burners are allowed to ignite.

The time delays in feed cycles are designed to prevent boiler from flooding due to slow return lines.

### **B. Pressure Limit**

To check pressure limit, run boiler until pressure reaches system demand. Then turn pressure screw and drop pressure setting until boiler shuts down. This shows that pressure limit is operating properly.

Refer to control manufacturer's instructions (enclosed) for more information.

### **C. Thermostat**

Check thermostat operation. When set above temperature indicated on thermometer, boiler should ignite. Make certain thermostat turns boiler off when room temperature reaches selected setting and starts boiler operating when room temperature falls a few degrees.

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

## **CLEANING BOILER**

It is very important to clean a new steam boiler after it has been installed and put into continuous operation. This must be done to remove any accumulation of oil, grease, sludge, etc. that may be present in system. These substances may cause boiler water to foam and surge, producing a very unsteady water line, throwing water into steam header, and possibly preventing steam generation. Follow the procedures below in order to remove these contaminants:

### **PROCEDURE 1—SKIMMING**

New boilers must be skimmed at the time of installation to remove threading oil and other impurities that float on surface of water.

1. Remove plug from skimmer tapping and pipe to a floor drain or bucket.
2. Raise water level to skimmer tapping.
3. Fire boiler to maintain a water temperature of 180-200°F.
4. Feed water to boiler to maintain water level. Adjust water feed rate to keep water continuously flowing out of skimmer tapping without water level going above or falling below tapping. Cycle burners to prevent boiling.
5. Continue skimming until water runs clear. This may take several hours.

### **PROCEDURE 2—BLOWDOWN**

1. Float-type low water cut-offs must be blown down after skimming. The float chamber of the low water cut-off must be flushed clean and maintained clear of sediment to allow free movement of float. This must be done frequently during initial operation of boiler and at least once a week thereafter. Follow instructions on tag attached to control.

Probe-type low water cut-offs require no maintenance at this time.

2. After blowing down low water cut-off and before blowing down boiler, fill boiler to water line. Fire burners and allow normal steam pressure to build up. Run a connection from boiler blowdown valve to a nearby sewer or floor drain or to a safe discharge point outside. SHUT OFF GAS BURNERS, open blowdown valve, and allow all water in boiler to drain out. Close blowdown valve. Allow boiler to cool thoroughly, then slowly refill boiler to water line. Repeat this item as many times as necessary until blowdown water is clear.
3. Following final blowdown, allow boiler to thoroughly cool, then add fresh water slowly up to normal water line. Start burners and maintain at least 180°F for 15 minutes to remove dissolved gases from fresh water. Shut off burners.

Now let boiler steam for a few days to give the majority of the system dirt a chance to work its way back to boiler. Check water in gauge glass. The gauge glass should be dry above water line. The water line should not bounce more than 1 in. when boiler is steaming. If water droplets carry over from top of gauge glass or excessive bouncing of water line occurs, boiler needs further cleaning. Take a water sample and boil it on stove to see if it foams. If it does, this also indicates boiler needs to be cleaned.

If cleaning is necessary, repeat skimming and blowdown procedures above. Usually a long skim is sufficient to clean boiler.

In more troublesome cases, it may be desirable to flush the system as well. This is accomplished by closing gate valve in the Hartford Loop and opening drain(s) at end of wet return(s). Run a hose from drain valve on wet return to a nearby floor drain or bucket. Run boiler at 2 lb. of steam pressure. Feed just enough water to compensate for waste condensate going down drain and to keep boiler from going off on low water cut-off. Run boiler until all waste condensate runs clear.

**NOTE:** Boiler cleaners and chemical cleaning additives are not recommended. If used and not rinsed properly, they will do more harm than good. The cleaning procedures laid out above clean out typical oils and impurities found in new boilers and in residential heating systems. The best thing for boiler and heating system is clean water with no additives.

In very extreme cases, it may be necessary to chemically clean and flush heating system. Consult boiler manufacturer before introducing any chemicals into boiler.

## **MAINTAINING BOILER**

### **PROCEDURE 1—WATER LEVEL**

Check water level every day or two. Verify water line shown by operating drain valve on gage. **BE SURE TOP AND BOTTOM VALVES ON GAUGE ARE ALWAYS OPEN SO THAT ACTUAL WATER LEVEL IS SHOWN AT ALL TIMES.**

The gauge glass should be dry above water line. The water line should not bounce more than about 1 in. when boiler is steaming. If water droplets carry over through top of gauge glass or excessive bouncing of water line occurs, boiler needs to be cleaned. Follow instructions in Cleaning Boiler section.

### **PROCEDURE 2—RELIEF VALVE**

Before testing, make certain discharge pipe is properly connected to valve outlet and arranged to contain and safely dispose of boiler discharge. Under normal operating conditions, a "try lever test" must be performed every month. A "try lever test" must also be performed at the end of any non-service period. Test at normal system operating pressure by holding test lever fully open for at least 5 sec to flush valve seat free of sediment and debris. Then release lever and permit valve to snap shut. If lift lever does not activate or there is no evidence of discharge, turn boiler off immediately and contact a licensed contractor or qualified service personnel.

### **PROCEDURE 3—LOW WATER CUT-OFF (LWCO)**

The low water cut-off interrupts electrical current to burner when water line in boiler drops to a low level.

#### **A. Float-Type Low Water Cut-Offs**

It is very important to keep float chamber free of sediment, a condition essential to dependability. To keep any accumulation from interfering with float action, "blow down" or flush out control regularly. This must be done 2-3 times during the first week after installation and once a week thereafter during heating season. Do it while boiler is in operation.

1. Note water level in gauge glass.
2. Open blow-off valve at bottom of control. Water will pour out flushing away sediment.
3. Drain until water is clear (about a pailful), then close valve.
4. If water level in gauge glass has dropped, add water to boiler to restore level.

Consult LWCO manufacturer's instructions included with boiler.

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

#### **B. Probe-Type Low Water Cut-Offs**

Check action of LWCO monthly to make sure it is providing proper protection. See Checking and Adjusting section. LWCO remote probes must be removed for periodic inspection and cleaning, preferably at beginning of each heating season. More frequent cleaning may be required on boilers requiring constant or very frequent additions of water.

### **PROCEDURE 4—BURNERS**

A visual check of pilot and main burner flames should be made at least once each year, preferably at beginning of each heating season. See Checking and Adjusting section.

### **PROCEDURE 5—BOILER FLUE PASSAGES**

Under normal operating conditions with burners properly adjusted, it should not be necessary to clean boiler flue gas passages. However, to assure trouble-free operation, we recommend that flue passages, burner adjustment, and operation of controls be checked **ONCE EACH YEAR** by a competent service technician.

**BEFORE THE START OF EACH SEASON** (or whenever system has been shut down for some time), recheck whole system for leaks and recheck boiler and vent pipe for leaks.

### **PROCEDURE 6—VENT PIPE**

The venting of this unit is very important. Piping should be checked at least once a season. If vent piping shows any signs of leaking, replace it immediately.

### **PROCEDURE 7—CLEANING BOILER FLUE PASSAGES AND BURNERS**

Flue passages between sections should be examined yearly and cleaned if necessary. To clean:

1. Remove burners, pilot, and vent pipe.
2. Remove top and front jacket panels.



3. Remove 2 screws attaching intermediate front panel to left and right side jacket panels.
4. Remove draft diverter and intermediate front panel as 1 unit.
5. Carefully remove cerafelt gasket strips.
6. Clean passageways between sections with a flexible handle wire brush. Remove dirt from bottom of boiler and between sections by vacuuming.
7. Make sure all flame ports in burners are open and clear. Shake out or blow out all loose dirt in burners.
8. Reseal seams between adjacent sections as necessary with 400°F RTV silicone sealant.
9. Reassemble all parts. Be sure to check tightness of pilot connections and condition of burner flames after reassembly. (See Fig. 21 and 22.)
10. Be sure vent pipe connections to chimney are secure and no obstructions are present.


#### **PROCEDURE 8—FOAMING, PRIMING, OR SURGING**

These terms are used to describe a fluctuating water line—when water leaves boiler with steam.

It is caused by any combination of the following:

1. Threading oil and organic matter in boiler water. (Mineral oil or core sand does not cause surging.) Follow instructions in Cleaning Boiler section.
2. Faulty quick vents that do not release air until a sizeable pressure is built up. If old style, replace. If dirty, clean so it is easy to blow through valve.
3. Improper header design—when steam flows in opposite direction of equalizer line on "Hartford Loop." Generally, a 15-in. horizontal run between riser and main takeoff allows entrained water to fall out of steam vapor so it can return to boiler. (See Fig. 3, 4, and 5.)
4. Adjustment of steam limit control to a wide differential increases difficulty if quick vents are old style, slow-releasing type, or dirty. Always set steam limit control differential as low as possible.
5. Soap and detergents in boiler water cause extreme surging. Boiler cleaners and chemical cleaning additives are not recommended. If used and not rinsed properly, they will do more harm than good. The cleaning procedures laid out in these instructions clean out typical oils and impurities found in new boilers and in residential heating systems. The best thing for boiler and heating system is clean water with no additives.

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→  **CAUTION: Never refill a hot boiler with cold water or thermal shock may crack boiler components (sections).**

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#### **PROCEDURE 9—BOILER WATER TREATMENT (OTHER THAN CLEANERS)**

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

In steam systems where less than 90 percent of steam is returned as condensate, or with very hard or corrosive make-up water, treatment may be desirable. Follow recommendations of local boiler water treatment specialist.

#### **PROCEDURE 10—BETWEEN HEATING SEASONS**

Boilers should not be drained between heating seasons. Steam boilers should be entirely filled with water during summer months to exclude air.

## SERVICE HINTS

You may avoid inconvenience and service calls by checking these points before you call for service.

### FOR YOUR SAFETY

#### WHAT TO DO IF YOU SMELL GAS

1. Do not try to light any appliance.
2. Do not touch any electric switch; do not use the phone.
3. Leave the building immediately, then call your gas supplier.
4. If you cannot reach the gas supplier, call the fire department.

IF SYSTEM IS NOT HEATING OR NOT GIVING ENOUGH HEAT. . .	
Possible Cause	What To Do
<b>Thermostat is not set correctly</b>	Reset thermostat above room temperature.
<b>Burner is not operating properly</b>	Check flame. If it is yellow, burner is not getting enough air. If flame is blue and noisy and seems to lift off burner, burner is getting too much air. Contact your service technician.
<b>No electric power to boiler</b>	Check overcurrent protection. Check to be sure electric power supply circuit is on.
<b>Controls out of adjustment</b>	Reset according to instructions.
<b>Radiators not heating properly</b>	Steam air vents are not operating properly. Check flow control valve (if used). It may be in closed position.
<b>Poor electrical contact</b>	Check all control terminals and wire joints.
<b>Rollout switch blown</b>	Have your service technician check heat exchanger for blockage. Replace rollout switch with exact replacement.
<b>Chimney flue is blocked</b>	Spill switch contacts are open requiring manual reset of spill switch. Have your service technician check and correct chimney problem.
<b>Vent damper not operating</b>	Consult troubleshooting guide in manual, packaged with vent damper.
IF BURNER IS NOISY. . .	
Possible Cause	What To Do
<b>Gas input amount is incorrect</b>	Contact your service technician.
IF WALLS OR WINDOWS SWEAT. . .	
Possible Cause	What To Do
<b>Not enough ventilation</b>	Contact your service technician.
<b>Chimney flue is blocked</b>	Have your service technician check and correct, if necessary.
IF RADIATORS ARE NOISY. . .	
Possible Cause	What To Do
<b>Air in system</b>	Refer to "Radiators Not Heating Properly" above.
RELIEF VALVE LEAKING. . .	
Possible Cause	What To Do
<b>Dirt on seat</b>	Open valve manually. Allow steam to blow and clear valve seat.

**HAVE YOUR SERVICE TECHNICIAN CHECK ANY PROBLEM YOU ARE UNABLE TO CORRECT.**

# REPAIR PARTS

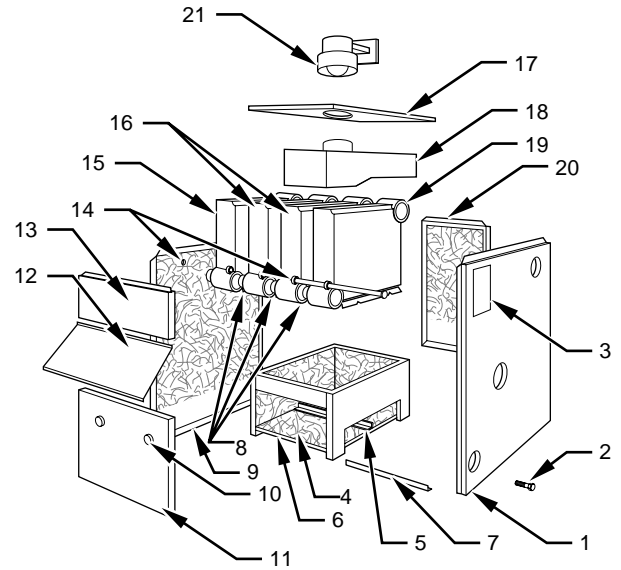
## GAS-FIRED STEAM BOILERS

**—IMPORTANT— READ THESE INSTRUCTIONS BEFORE ORDERING**

All parts listed in the following Parts List may be ordered through your nearest supplier.

When ordering parts, first obtain Model No. from data plate on boiler, then determine Part No. (not the Key No.) and Description of each part from the following illustrations and lists. Be sure to give all this information:

Part No. — Part Description — Boiler Model No.



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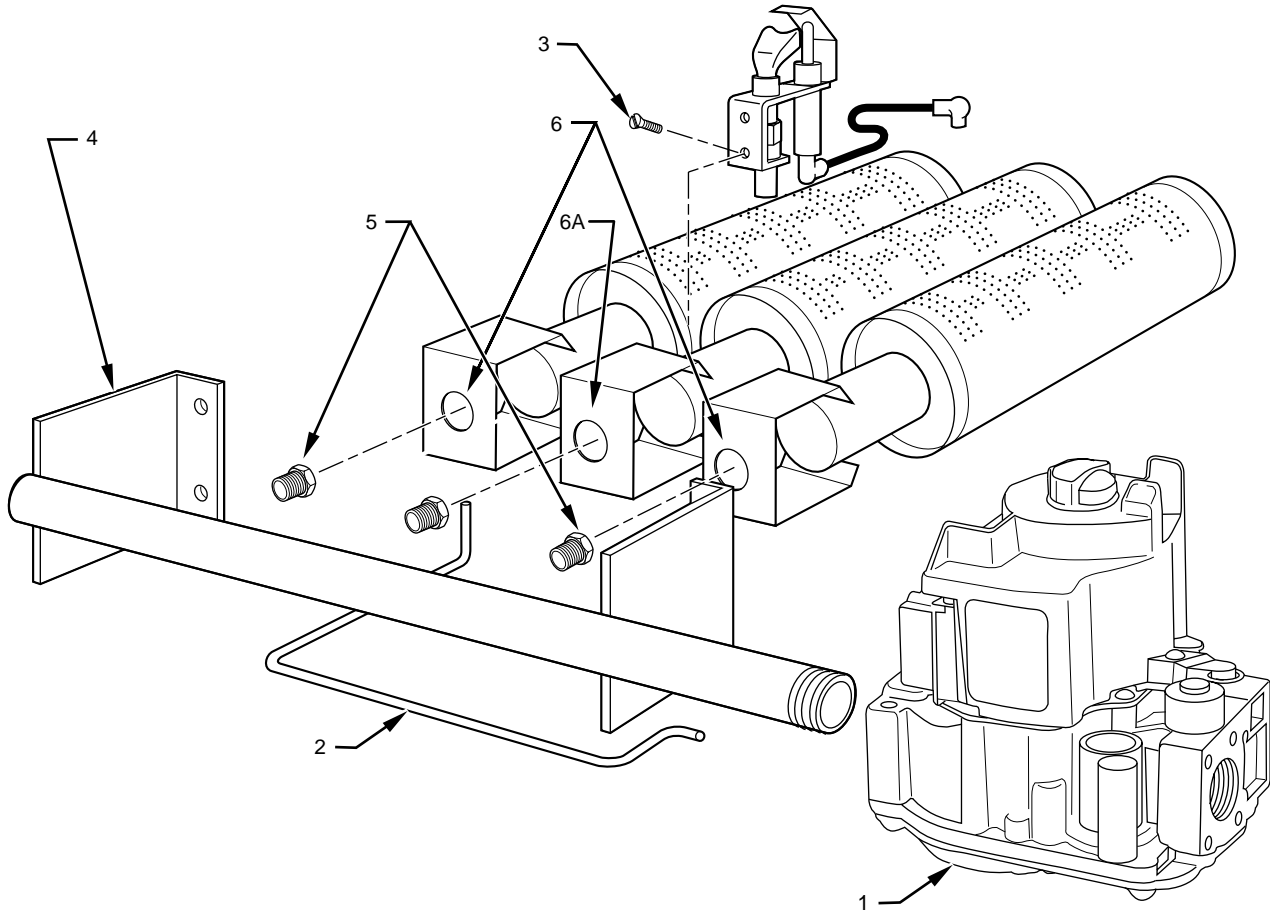
**Jacket—Section and Base Parts**  
This is a Repair Parts List—Not a Packing List

KEY NO.	DESCRIPTION	PART NO.							
		3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section	
1	Jacket, Right Side Panel	425-00-802	425-00-802	425-00-802	425-00-802	425-00-802	425-00-802	425-00-802	
2	No. 10 X 1/2-in. Sheet Metal Screw	146-95-074	146-95-074	146-95-074	146-95-074	146-95-074	146-95-074	146-95-074	
3	Rating Plate	146-94-001	146-94-016	146-94-016	146-94-016	146-94-016	146-94-016	146-94-016	
4	Base Insulation	Base Sides (2)	146-14-130	146-14-130	146-14-130	146-14-130	146-14-130	146-14-130	
		Base Front	146-14-113	146-14-114	146-14-115	146-14-116	146-14-117	146-14-118	146-14-119
		Base Rear	146-14-123	146-14-124	146-14-125	146-14-126	146-14-127	146-14-128	146-14-129
5	Base Baffle	425-00-643	425-00-644	425-00-645	425-00-646	425-00-647	425-00-648	425-00-649	
6	Base	425-00-663	425-00-664	425-00-665	425-00-666	425-00-667	425-00-668	425-00-669	
7	Jacket Tie Bar	425-00-653	425-00-654	425-00-655	425-00-656	425-00-657	425-00-658	425-00-659	
8	Push Nipple	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	433-00-976	
9	Jacket, Left Side Panel	425-00-801	425-00-801	425-00-801	425-00-801	425-00-801	425-00-801	425-00-801	
10	Knob, Service Door (Pair)	137-02-153	137-02-153	137-02-153	137-02-153	137-02-153	137-02-153	137-02-153	
11	Jacket, Service Door	425-00-823	425-00-824	425-00-825	425-00-826	425-00-827	425-00-828	425-00-829	
12	Jacket, Intermediate Panel	425-00-813	425-00-814	425-00-815	425-00-816	425-00-817	425-00-818	425-00-819	
13	Jacket, Front Panel	425-00-803	425-00-804	425-00-805	425-00-806	425-00-807	425-00-808	425-00-809	
14	1/4-in. Tie Rod, Nut	146-05-001	146-05-002	146-05-051	146-05-053	146-05-005	146-05-007	146-05-009	
15	Boiler Section, Left	410-00-013	410-00-013	410-00-013	410-00-013	410-00-013	410-00-013	410-00-013	
16	Boiler Section, Middle	410-00-015	410-01-015	410-01-015	410-01-015	410-01-015	410-01-015	410-01-015	
17	Jacket, Top Panel	425-00-843	425-00-844	425-00-845	425-00-846	425-00-847	425-00-848	425-00-849	
18	Draft Diverter	425-00-673	425-00-674	425-00-675	425-00-676	425-00-677	425-00-678	425-00-679	
19	Boiler Section, Right	410-00-014	410-01-014	410-01-014	410-01-014	410-01-014	410-01-014	410-01-014	
20	Jacket, Back Panel	425-00-833	425-00-834	425-00-835	425-00-836	425-00-837	425-00-838	425-00-839	
*	Jacket Complete	425-70-873	425-70-874	425-70-875	425-70-876	425-70-877	425-70-878	425-70-879	
*	Block Assembly (8, 14, 15, 16, 19)	410-00-330	410-01-430	410-01-530	410-01-630	410-01-730	410-01-830	410-01-930	
*	Combustible Floor Plate	146-14-031	146-14-031	146-14-031	146-14-031	146-14-032	146-14-032	146-14-032	
*	Cerafelt Gasket	146-14-018	146-14-018	146-14-018	146-14-018	146-14-018	146-14-018	146-14-018	
21	Vent Damper	118-20-05	118-20-06	118-20-06	118-20-07	118-20-07	118-20-07	118-20-07	
*	Base Assembly (4, 5, 6)	433-00-663	433-00-664	433-00-665	433-00-666	433-00-667	433-00-668	433-00-669	
*	Rollout Switch Bracket (Nat. Gas Only)	425-00-604	425-00-604	425-00-604	425-00-604	425-00-604	425-00-604	425-00-604	

\* Not illustrated.

# REPAIR PARTS

FOR USE WITH NATURAL GAS ONLY



A98238

## Gas Burners and Manifold Parts This is a Repair Parts List—Not a Packing List

KEY NO.	DESCRIPTION	PART NO.						
		3 Section	4 Section	5 Section	6 Section	7 Section	8 Section	9 Section
<b>ELECTRONIC INTERMITTENT IGNITION (Shown)</b>								
1	24-v Gas Valve, Elect. Inter. Ignition	146-62-052	146-62-052	146-62-052	146-62-058	146-62-058	146-62-058	146-62-058
2	Pilot Tube	146-15-005	146-15-005	146-15-005	146-15-005	146-15-005	146-15-006	146-15-006
3	10-32 X 1/2 Hex Head Screw	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307
4	Gas Manifold	146-16-033	146-16-034	146-16-035	146-16-013	146-16-014	146-16-015	146-16-016
5	Main Burner Orifice*	146-15-031	146-15-031	146-15-031	146-15-035	146-15-035	146-15-035	146-15-035
6	Main Burner, Regular†	146-15-532	146-15-532	146-15-532	146-15-532	146-15-532	146-15-532	146-15-532
6A	Main Burner, Pilot Mount	146-15-531	146-15-531	146-15-531	146-15-531	146-15-531	146-15-531	146-15-531
7	Pilot Burner	146-62-092	146-62-092	146-62-092	146-62-092	146-62-092	146-62-092	146-62-092
‡	Rollout Shield	42500933	934	935	936	937	938	939
<b>ALTERNATE PARTS FOR CONTINUOUS PILOT — 24V</b>								
1	24-v Gas Valve, Continuous Pilot	146-62-051	146-62-051	146-62-051	146-62-060	146-62-060	146-62-060	146-62-060
3	10-32 X 1/2 Hex Head Screw (2 req'd)	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307	146-95-307
7	Pilot Burner	146-62-053	146-62-053	146-62-053	146-62-053	146-62-053	146-62-053	146-62-053
‡	Thermocouple	146-62-037	146-62-039	146-62-039	146-62-039	146-62-039	146-62-036	146-62-036

Quantity is 1 unless otherwise noted.

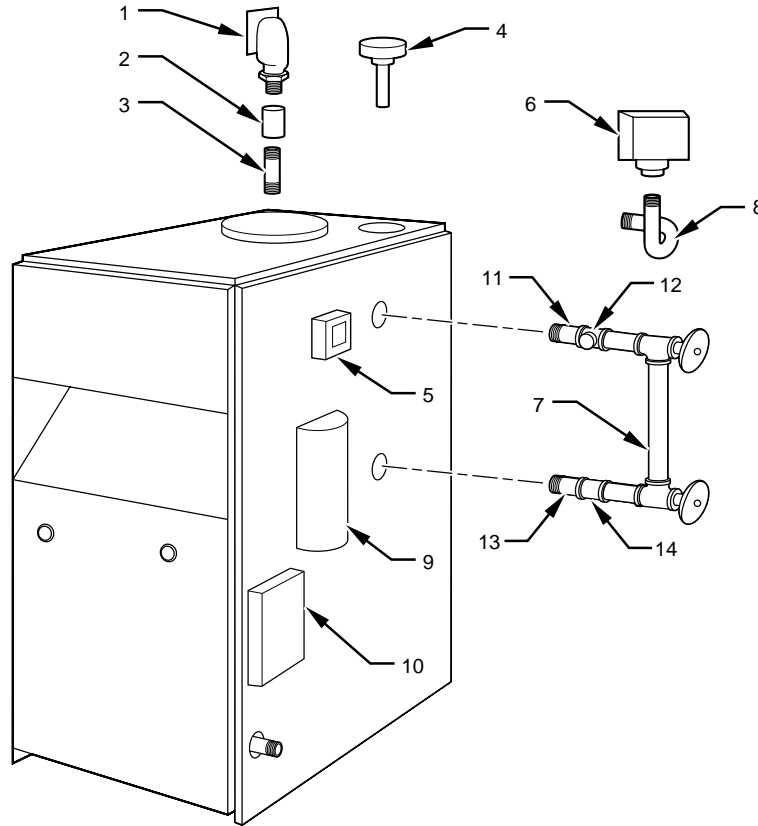
\* Requires 1 less than the number of sections.

† Requires 2 less than the number of sections.

‡ Not illustrated.

# REPAIR PARTS

## BOILER CONTROLS AND PIPING



A03137

KEY NO.	DESCRIPTION	PART NO.
1	3/4-in. Relief Valve	157-00-01
2	3/4-in. Coupling	115-00-01
3	3/4-in. X 6-1/2-in. Nipple	146-07-002
4	Steam Pressure Gauge	146-23-005
5	1/4-in. Coupling	146-93-054
6	1/4-in. X 3-in. Nipple	146-07-001
7	AT-140D Transformer, 24v	146-62-045
8	PA-404A Pressuretrol	146-62-015
9	Glass Water Gauge Set (Used with PS-802 LWCO)	146-22-005
*	Glass Water Gauge Set (Used with 67D-1 LWCO)	146-22-010
10	90° Pigtail (Used with PS-802 LWCO)	146-43-004
*	180° Pigtail (Used with 67D-1 LWCO)	146-43-005
11	PS-802 Low Water Cut-Off	128-00-01
*	67D-1 Low Water Cut-Off	146-26-042
12	Control, Intermittent Pilot UT 1003-620	146-62-070
*	S8600M Intermittent Pilot Control, Liquefied Petroleum Gas	146-62-071
13	1/2-in. X 3-in. Brass Nipple (PS-802 only)	131-00-03
14	1/2-in. X 1/2-in. X 1/4-in. Brass Tee (PS-802 only)	146-93-051
15	1/2-in. Brass Coupling (PS-802 only)	146-93-052
16	1/2-in. X 3 1/2-in. Brass Nipple (PS-802 only)	146-07-024
*	3/4-in. Drain Valve	146-22-000
*	WF-2U-24 Water Feeder (Optional)	163-00-01
*	Rollout Switch	146-29-002
*	Spill Switch (36TX16-6282) 280°F	146-60-002
*	5-in. Vent Damper (3 Section Boilers)	118-20-05
*	6-in. Vent Damper (4, 5 Section Boilers)	118-20-06
*	7-in. Vent Damper (6, 7, 8, 9 Section Boilers)	118-20-07
*	400°F Black Silicone Rubber Adhesive Sealant (10.3 oz cartridge)	146-06-024
*	Vent Damper Operator (Motor)	114-00-02

\* Not illustrated.



# SERVICE TRAINING

**Packaged Service Training** programs are an excellent way to increase your knowledge of the equipment discussed in this manual, including:

- Unit Familiarization • Maintenance
- Installation Overview • Operating Sequence

A large selection of product, theory, and skills programs is available, using popular video-based formats and materials. All include video and/or slides, plus companion book.

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