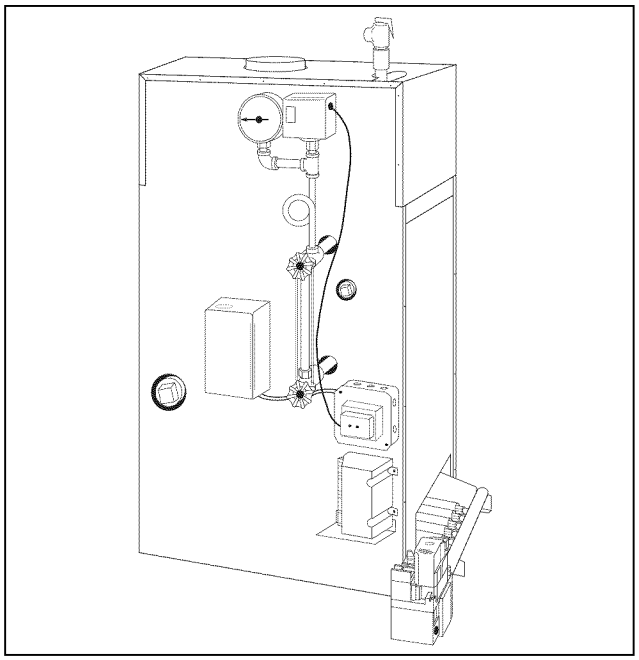
VSB2-605
42-9187

HydroTherm®

VS-B SERIES INSTALLATION, OPERATION & MAINTENANCE MANUAL AND REPLACEMENT PARTS LIST

Gas-Fired Steam Cast Iron Boilers 85,000 to 165,000 Btuh Input Intermittent Pilot/Vent Damper And Standing Pilot/Vent Damper



DESIGN SB CERTIFIED

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SECTION 1: INTRODUCTION

The following terms are used throughout this manual to bring attention to the presence of potential hazards or to important information concerning the product:

DANGER: Indicates an imminently hazardous situation which, if not avoided, will result in death, serious injury or substantial property damage.

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor injury or property damage.

NOTE: Used to notify of special instructions on installation, operation or maintenance which are important to equipment but not related to personal injury hazards.

CODE COMPLIANCE

Boiler installations 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-latest edition. Where required by the authority having jurisdiction, the installation must also conform to the American Society of Mechanical Engineers Code for "Controls and Safety Devices for Automatically Fired Boilers", ANSI/ASME CSD-1.

All electrical wiring must be in accordance with National Electric Code ANSI/NFPA No.70-latest edition and any additional state or local code requirements. If an external source is utilized, 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 National Electrical Code, ANSI/NFPA No.70-latest edition. UL listed power limited circuit cable is almost universally approved for safety controls on heating equipment, either internally or externally, without protection of conduits or raceway.

VENTING REQUIREMENTS

When connecting to gas vents or chimneys, vent installations shall be in accordance with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1-latest edition, or applicable provisions of the 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.

When two or more appliances vent into a common flue, the area of the common flue should be at least equal to the area of the largest flue plus 50% of the areas of the additional flue or vent connectors.

When existing boiler is removed from common venting system, common venting system is likely to be too large for proper venting of appliances remaining connected to it. At time of removal of existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while other appliances remaining connected to the common venting system are not in operation:

1. Seal all unused openings in common venting system.

2. Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.

3. Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.

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

5. Test for spillage at draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from 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 previous conditions of use.

7. Any improper operation of the common venting system should be corrected so the installation conforms with National Fuel Gas Code, ANSI Z223.1-latest edition. 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 G in the National Fuel Gas Code, ANSI Z223.1-latest edition.

CHIMNEY REQUIREMENTS

DANGER: A chimney which does not meet modern safety standards will result in a fire or deadly carbon monoxide poisoning of the building residents.

Chimney condition is of paramount importance for a safe and efficient boiler installation. All new and replacement installations must include a chimney inspection by a qualified individual or agency. Chimney construction materials must be compatible with the fuel being used.

Particular attention should be paid on all oil-to-gas conversions. Soot may have accumulated in chimney and/or degraded chimney liner. Most utilities require complete chimney cleaning. Others may require installation of new liner, spill switches or other chimney upgrades. Check with local utility for required safety precautions.

COMBUSTION AIR REQUIREMENTS

Provisions for combustion air must be in accordance with the National Fuel Gas Code ANSI Z223.1 - latest edition, as well as all applicable local codes. If the boiler is installed in an unconfined space, adequate air will be available via normal infiltration. However, if building construction is unusually tight or the boiler is installed in a confined space (a space whose volume is less than 50 cubic feet per 1000 Btu/hr of gas input for all fuel burning equipment), adequate air for combustion must be provided by two openings: one located about 6" below the ceiling, the other about 6" above the floor. When communicating directly with the outside or through a vertical duct, each opening must have a minimum free area of one square inch per 4000 Btu/hr of gas input. Horizontal ducts to the outside must have a minimum free area of one square inch per 2000 Btu/hr of gas input. When ventilation is provided by openings in doors, etc. to adjoining spaces having adequate infiltration, each opening must have a minimum free area of one square inch per 1000 Btu/hr of gas input.

WARNING: Adequate fresh air must be provided for combustion. Improper boiler operation and inadequate venting of deadly flue gases may otherwise result.

NOTE: Boiler employs atmospheric combustion. Combustion air must not be contaminated with halogenated hydrocarbon vapors, aerosol propellants or freon. Otherwise, boiler heat exchanger will be subject to corrosion, reducing boiler life.

WATER TREATMENT

Water treatment is recommended in areas where water quality is a problem. A local water treatment company should be consulted to determine the requirements for your particular system and locality.

NOTE: Boiler is not for use in systems where water is replenished. Minerals in the water can build up on the heat transfer surfaces and cause overheating and subsequent failure of the heat exchanger.

NOTE: Boiler utilizes EPDM synthetic rubber seals. Water treatment chemicals and system cleaning chemicals must be compatible with this and all other construction materials.

SHIPMENT OF BOILER

Each boiler is shipped in a single carton.

Optional Vent Damper

When ordered, the vent damper is shipped in an individual carton packaged with the boiler. Mounting of the damper and flue outlet extension are required.

SECTION 2: BOILER INSTALLATION

STEP 1: LOCATING/SETTING BOILER

Boiler may be installed in an alcove (see dimensions in Figure 2.1). Locate boiler so connecting flue pipe between draft hood and chimney is as short as possible.

Observe the following minimum clearances to combustibles: 18" on sides...alcove at front...28" at top 18" at rear...6" from flue pipe in any direction. Maintain a minimum 1" clearance between hot water piping and combustible materials. Local code requirements may specify greater clearances and must be adhered to.

Remove boiler from carton and set it in position. Install on non-combustible floor only, unless local codes permit use and fabrication of a fireproof base (see Figure 2.2).

Remove all packing material from boiler. Check that burners, draft diverter and controls are in proper position.

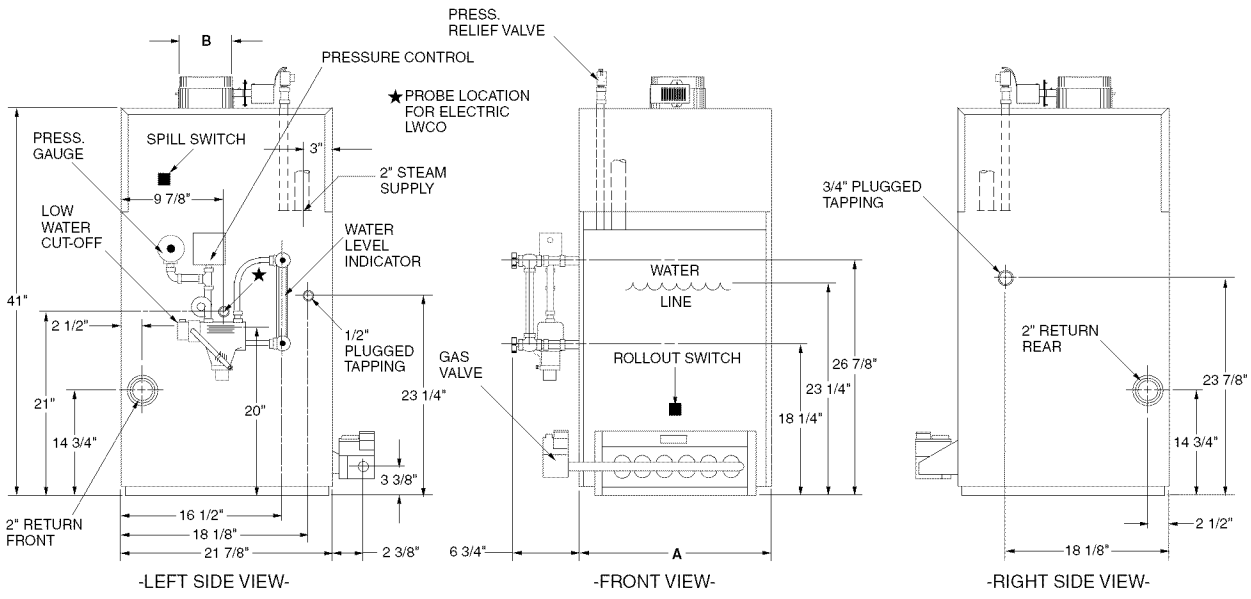
Boiler shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (low water cut-off replacement, condensate trap, control replacement.).

NOTE: Do not loosen tie rods on boiler absorption unit. They are intended to accommodate thermal expansion. Loss of boiler's structural integrity and water leaks/damage may result.

WARNING: Never install boiler on carpeting as heat damage and/or fire may result.

BOILER MODEL	DIMENSIONS	
	A	B
VS-85	15 3/8"	5"
VS-110	18 7/8"	6"
VS-135	18 7/8"	6"
VS-165	22 3/8"	7"

MINIMUM CLEARANCES TO COMBUSTIBLES
Top: 28"
Rear: 18"
Left & Right: 18"
Front: ALCOVE



NOTE: OPTIONAL FLOAT LOW WATER CUT-OFF SHOWN.

FIGURE 2.1: MODEL VS-B BOILER DIMENSIONS

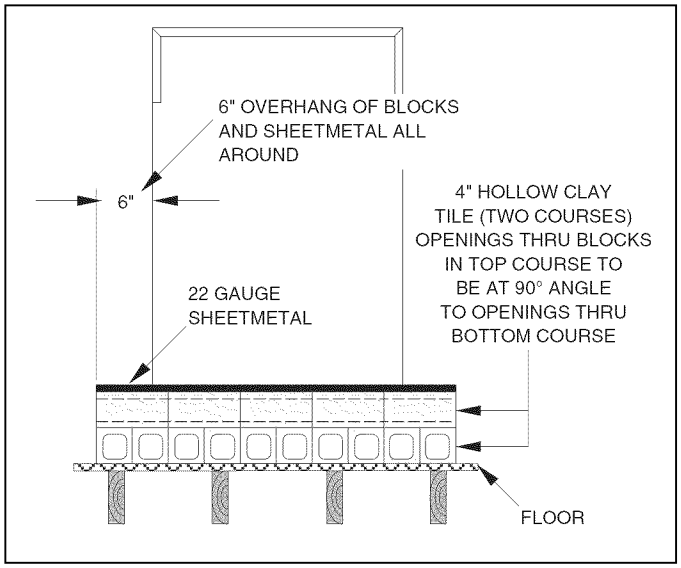


FIGURE 2.2: RECOMMENDED FIREPROOF BASE

STEP 2: INSTALLING STEAM PIPING

Typical piping connections are shown in Figure 2.3. All external piping must be supported by hangers, not by the boiler or its accessories.

Supply outlet must run full size from the boiler to a header at least 24" above top of boiler. Condensate return piping should be connected to boiler through a "Hartford Loop." Install gate valves in supply and return.
Proper steam piping practices must be followed at all times. Maintain proper clearances between piping and combustible material.

The supply and return lines should be equipped with drain cocks to drain sediment and sludge from lowest points of boiler.

STEP 3: INSTALLING HYDRONIC COMPONENTS

A low-water cutoff must be installed to protect the unit from dry fire.

Screw extension nipple into 3/4" tapping on top of the absorption unit and install relief valve into top of nipple with the spindle in the vertical position (i.e., with the valve discharge in the horizontal).

WARNING: No Valve of any type may be installed between the boiler and the relief valve to prevent accidental explosion from over-pressure.

Most localities require the discharge piping to terminate within 6" of the floor. Check local code requirements if in doubt. Discharge piping must be of same size or larger than the relief valve outlet and should be run as short and straight as possible. Elbows in the discharge piping should be placed as close to the valve as possible. If valve discharge is to be drained away, the discharge piping must not be hard-piped to the drain piping (i.e., an open funnel or similar arrangement must be used).

CAUTION: Piping must be installed from the relief valve discharge so there will be no danger of scalding personnel.

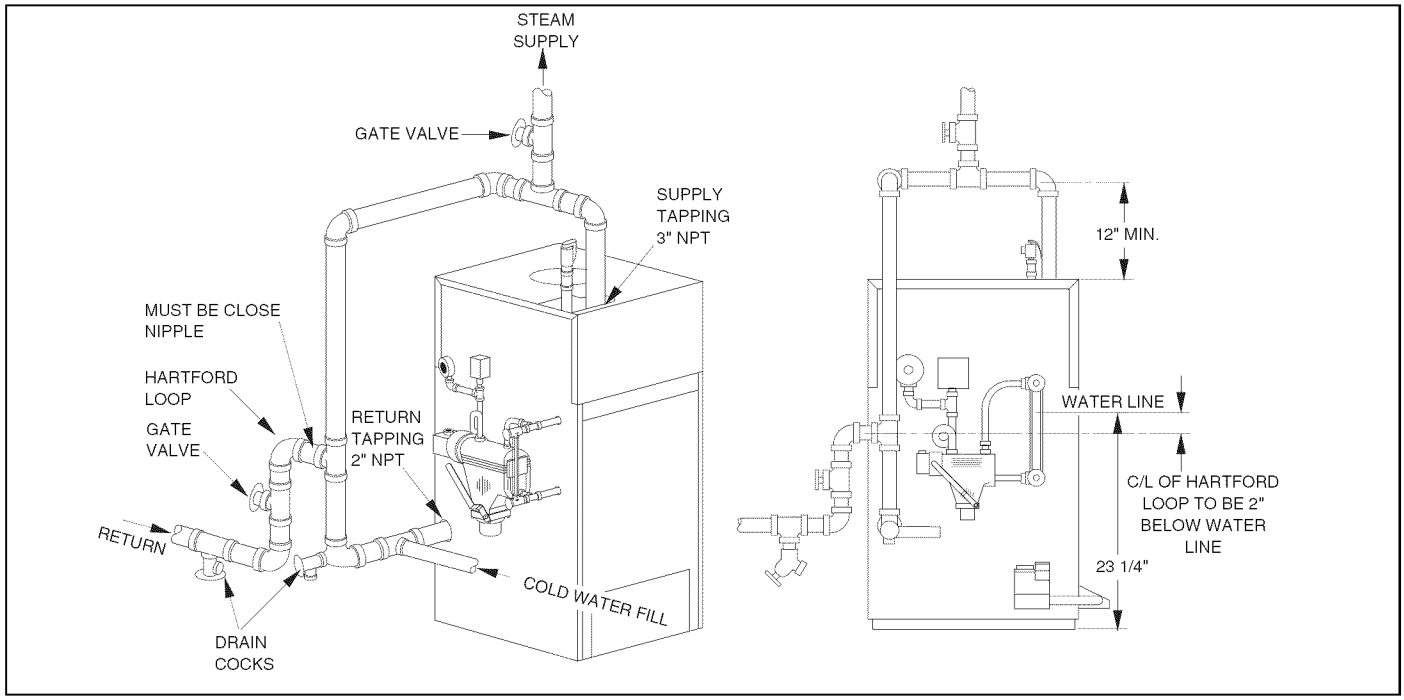


FIGURE 2.3: TYPICAL STEAM BOILER PIPING

STEP 4: VENTING BOILER

A factory-mounted spill switch is provided on all VS-B boilers (see Figures 2.4 & 2.4A).

DANGER: Draft diverter, vent outlet and vent damper as supplied must not be altered in any way, as proper boiler operation would be jeopardized. Flame rollout, fire or carbon monoxide poisoning will result.

The flue or vent connectors must be installed flush with the inside chimney liner surface and sealed in place with furnace cement. Horizontal positions of the single wall and type B venting systems shall be supported by use of strap hangers or their equivalent. Vent supports should be placed a maximum of 15 feet apart and as required to prevent sagging. The vent connectors shall be pitched 1/4" per foot upwards towards the chimney or vent termination.

INSTALLING VENT DAMPER

DANGER: Only the boiler may be served by the vent damper. Do not attempt to use it to vent an additional appliance. This will cause fire or carbon monoxide poisoning.

The vent damper must be mounted directly on top of the draft diverter.The vent outlet extension must be installed between the damper and the outlet to allow the damper plate to open and close.

Locate the motor on the right side and position the cable so that it does not touch the metal surface of the draft diverter (see Figure 2.4). If necessary, turn angle connector on vent damper upward until cable clears; tighten locknut to secure.The direction of the flow arrow imprinted on the vent damper must point upward. The damper position indicator, which is located on the side of the vent damper opposite the motor, must be visible.

CAUTION: A minimum of 6" between vent damper and combustible materials must be maintained. The vent damper must be accessible for servicing and checking position indicator.

Remove hairpin shipping clip which holds damper blade in closed position and observe that damper blade rotates slowly to open position. Do not force it closed as it may damage the gear train and void the warranty. The blade should move freely and without obstruction.

Secure the vent damper housing to the draft diverter outlet with sheet metal screws or pop rivets. Refer to Figure 2.5 for fastener locations. Install flue pipe over top of vent damper and secure to damper housing with sheet metal screws or pop rivets.

Attach vent damper cable to cable clamp on boiler front panel and join the Molex connector (see Figures 2.4 & 2.4A).

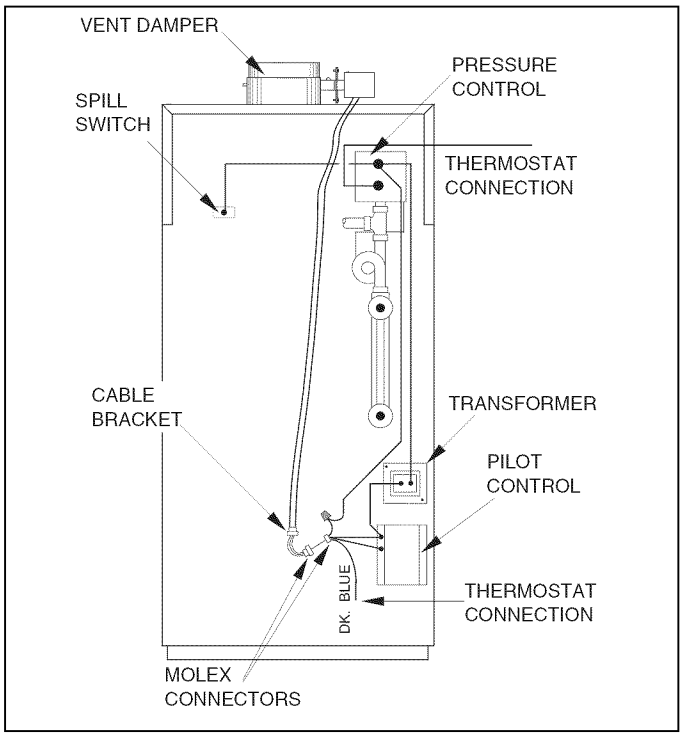


FIGURE 2.4: VENT DAMPER INSTALLATION FOR INTERMITTENT PILOT

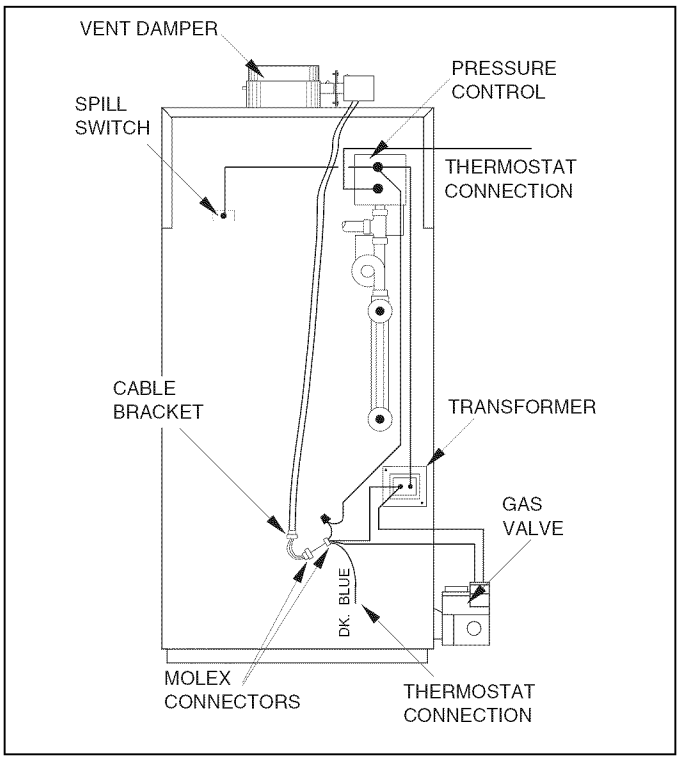


FIGURE 2.4: VENT DAMPER INSTALLATION FOR STANDING PILOT

ADDITIONAL CHIMNEY REQUIREMENTS

Chimney condition is of paramount importance for a safe and efficient boiler installation. All installations must include a chimney inspection by a qualified individual or agency. Chimney construction materials must be compatible with the fuel being used (see Figure 2.5A).

Particular attention should be paid on all oil-to-gas conversions. Soot may have accumulated in chimney and/or degraded chimney liner. Most utilities require complete chimney cleaning. Others may require installation of new liner, spill switches or other chimney upgrades. Check with local utility for required safety precautions.

DANGER: A chimney which does not meet modern safety standards will result in a fire or deadly carbon monoxide poisoning of the building residents.

STEP 5: INSTALLING/TESTING GAS PIPING

Connect the gas piping from the meter to the boiler using a pipe size which will result in a pressure drop of less than 0.3" W.C. for natural gas or 0.5" W.C. for propane. See Figure 2.7 for the appropriate gas pipe sizing and example.

Good piping practices should be followed at all times. See Figure 2.6 for a typical gas piping arrangement. All piping must be supported by hangers, not by the boiler or its accessories.

Install a full-sized sediment trap at the low point in gas line upstream of gas valve. Install a non-restrictive lubricated plug valve in the gas line close to the boiler. Install a ground joint union at the gas valve inlet to allow for servicing. Check local codes and utilities for any special requirements and procedures.

Pipe joint compound (pipe dope) must be compatible with the fuel (natural gas or propane) being used.

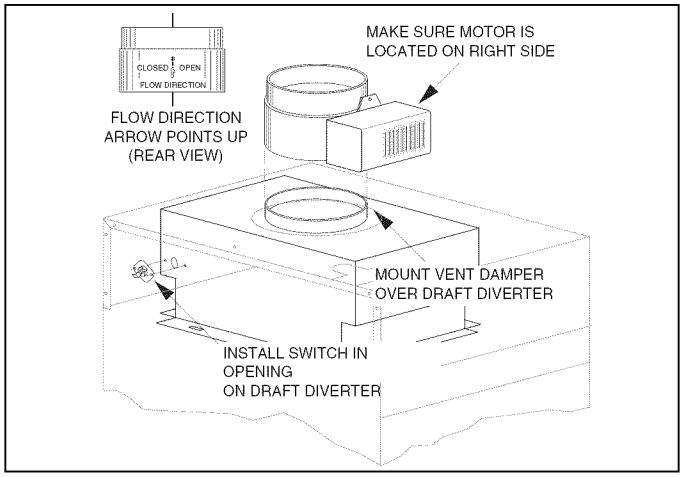


FIGURE 2.5: ATTACHING VENT DAMPER TO DRAFT DIVERTER & FLUE PIPE

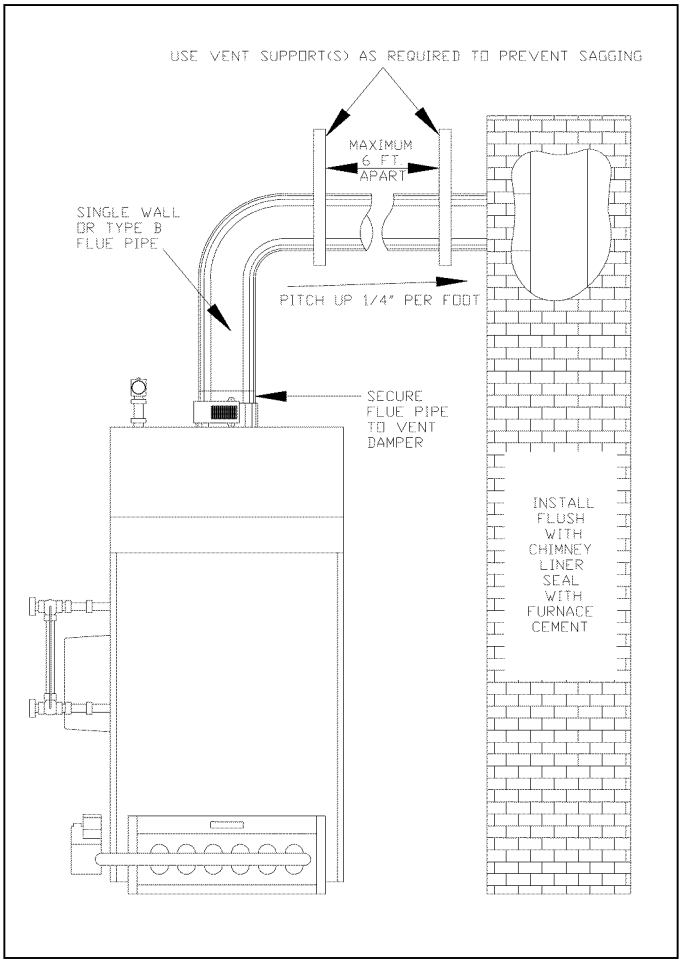


FIGURE 2.5A: VENTING

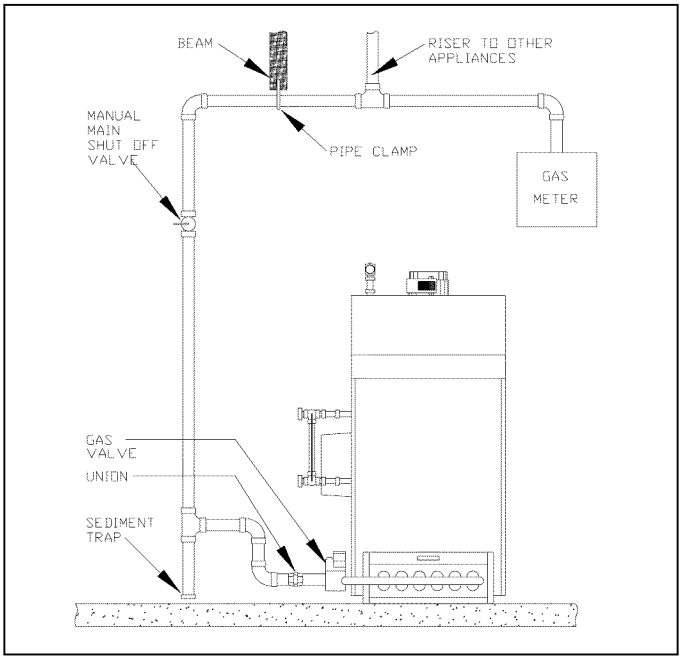


FIGURE 2.6: TYPICAL GAS PIPING

Maximum Capacity of Pipe in Cubic Feet of Natural Gas per Hour for Gas Pressures of 0.5 Psig or Less and a Pressure Drop of 0.3 Inch Water Column

(Based on a 0.60 Specific Gravity Gas)

Nominal Iron Pipe Size, Inches	Internal Diameter, Inches	Length of Pipe, Feet													
		10	20	30	40	50	60	70	80	90	100	125	150	175	200
1/4"	.326	32	22	18	15	14	12	11	11	10	9	8	8	7	6
3/8"	.493	72	49	40	34	30	27	25	23	22	21	18	17	15	14
1/2"	.622	132	92	73	63	56	50	46	43	40	38	34	31	28	26
3/4"	.824	278	190	152	130	115	105	96	90	84	79	72	64	59	55
1"	1.049	520	350	285	245	215	195	180	170	160	150	130	120	110	100
1-1/4"	1.380	1,050	730	590	500	440	400	370	350	320	305	275	250	225	210
1-1/2"	1.610	1,600	1,100	890	760	670	600	560	530	490	460	410	380	350	320
2"	2.067	3,050	2,100	1,650	1,450	1,270	1,150	1,500	990	930	870	780	710	650	610
2-1/2"	2.469	4,800	3,300	2,700	2,300	2,000	1,850	1,700	1,600	1,500	1,400	1,250	1,130	1,050	980
3"	3.026	8,500	5,900	4,700	4,100	3,600	3,250	3,000	2,800	2,600	2,500	2,200	2,000	1,850	1,700
4"	4.026	17,500	12,000	9,700	8,300	7,400	6,800	6,200	5,800	5,400	5,100	4,500	4,100	3,800	3,500

Maximum Capacity of Pipe in Thousands of Btu per Hour of Undiluted Liquefied Petroleum Gases (at 11 Inches Water Column Inlet Pressure)

(Based on a Pressure Drop of 0.5 Inch Water Column)

Nominal Iron Pipe Size, Inches	Length of Pipe, Feet											
	10	20	30	40	50	60	70	80	90	100	125	150
1/2"	275	189	152	129	114	103	96	89	83	78	69	63
3/4"	567	393	315	267	237	217	196	185	173	162	146	132
1"	1071	732	590	504	448	409	378	346	322	307	275	252
1-1/4"	2205	1496	1212	1039	937	834	771	724	677	630	567	511
1-1/2"	3307	2299	1858	1559	1417	1275	1180	1086	1023	967	866	787
2"	6221	4331	3465	2992	2646	2394	2205	2047	1921	1811	1606	1498

Example: Boiler Model VS-135B is to be installed. The distance from the existing gas meter to the installation site is 30 ft. What pipe size must be used? The local utility indicates the heating value of natural gas being supplied is 1000 Btu per cu.ft. Determine cubic feet of gas per hour for above boiler model:

$$\frac{\text{135,000 Btu per hour}}{\text{1000 Btu per cu.ft.}} = \text{135 cu.ft. per hour}$$

1. Find 30 ft. in upper portion of the table for natural gas under "Length of Pipe, Feet" heading.
2. Moving down the column, match required capacity. Higher capacity is acceptable. In our case it is 152 cu.ft.
3. Move to left-hand column "Nominal Iron Pipe Size, Inches," to read required pipe size. In our case it is 1/2".

FIGURE 2.7: GAS PIPE SIZING TABLES & EXAMPLE

TESTING GAS PIPING

DANGER: Before placing gas piping into service, carefully test it to assure every joint is gas tight. Bubble test all joints with a soap solution. NEVER TEST WITH AN OPEN FLAME AS FIRE OR EXPLOSION WILL RESULT.

For any pressure testing in excess of 1/2 psi, the boiler and its individual shutoff valve must be isolated from the piping system by disconnecting them and capping the outlet(s). For any pressure testing equal to or less than 1/2 psi, the boiler must be isolated from the piping system by closing its manual shutoff valve.

Minimum pressure required at the gas valve inlet is 5" W.C. for natural gas and 11" W.C. for propane. Maximum pressure allowable at the gas valve inlet is 12" W.C. If the gas pressure is above these limits, a pressure regulator must be installed. If the gas pressure is

STEP 6: WIRING BOILER

WARNING: Turn off electrical power supply before servicing. Contact with live electric components can cause electric shock or death.

All electrical and control wiring must be installed in accordance with the codes listed in Section 1 of this manual. Follow the wiring diagram for your particular installation as shown in Figures 2.8, 2.9, 2.10 and 2.11.

For vent damper-equipped models, connect thermostat to blue leads (see Figure 2.4).

NOTE: If any of original wire supplied with boiler must be replaced, use similar wire of 105 C rating. Otherwise, insulation may melt or degrade, exposing bare wire.

NOTE: Boiler transformer must not be used to power external accessories (i.e., zone valves, relays, etc.) Otherwise, transformer will be overloaded and burn out.

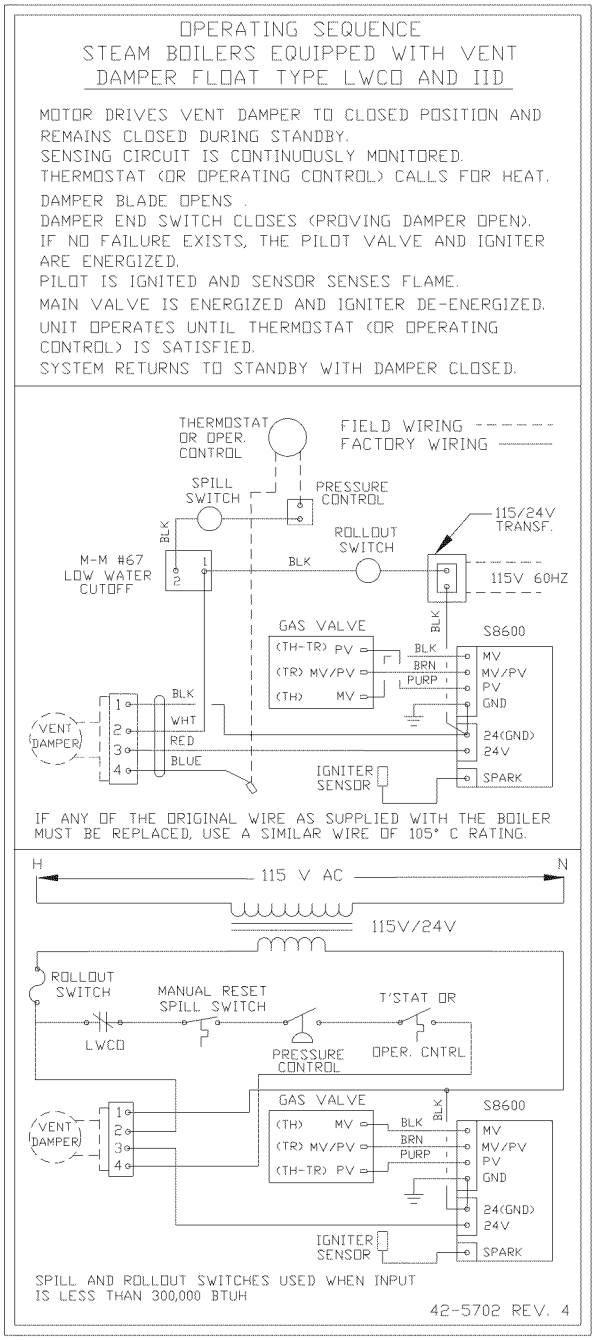


FIGURE 2.8: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS EQUIPPED WITH INTERMITTENT PILOT, VENT DAMPER & M & M #67 LOW WATER CUT-OFF

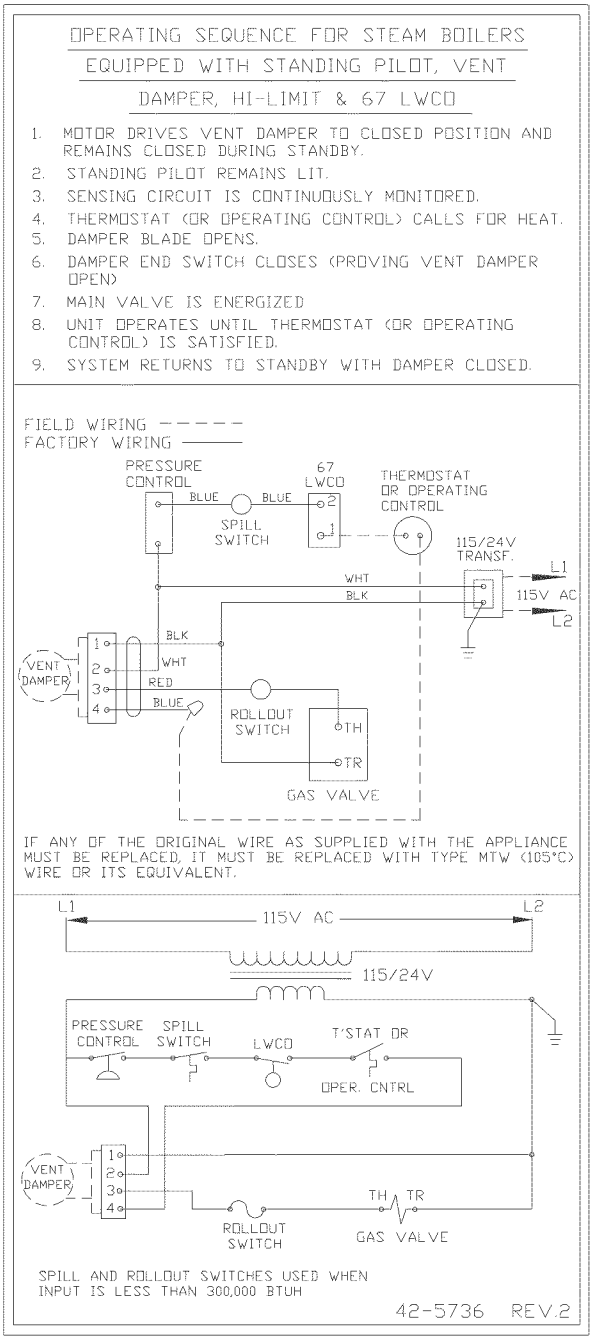


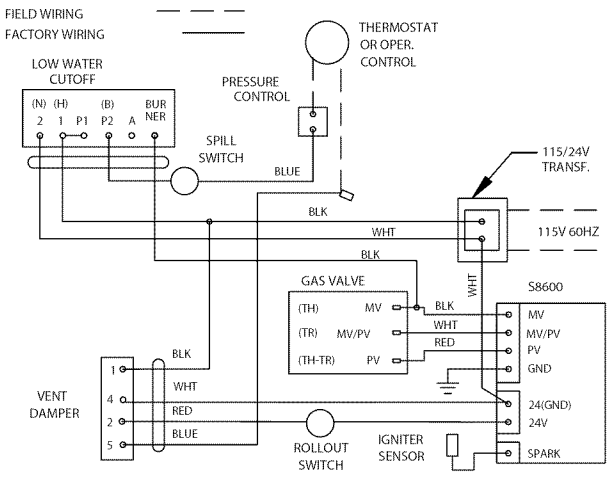
FIGURE 2.9: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS EQUIPPED WITH INTERMITTENT PILOT, VENT DAMPER & M & M #67 LOW WATER CUT-OFF

OPERATING SEQUENCE

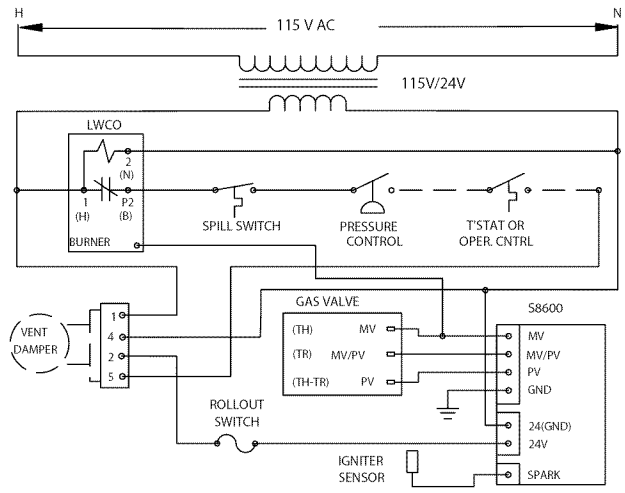
STEAM BOILERS EQUIPPED WITH VENT DAMPER,

CG-400 SERIES LWCO AND IID

1. MOTOR DRIVES VENT DAMPER TO CLOSED POSITION AND REMAINS CLOSED DURING STANDBY.
2. SENSING CIRCUIT IS CONTINUOUSLY MONITORED.
3. THERMOSTAT (OR OPERATING CONTROL) CALLS FOR HEAT.
4. DAMPER BLADE OPENS .
5. DAMPER END SWITCH CLOSES (PROVING DAMPER OPEN).
6. IF NO FAILURE EXISTS, THE PILOT VALVE AND IGNITER ARE ENERGIZED.
7. PILOT IS IGNITED AND SENSOR SENSES FLAME.
8. MAIN VALVE IS ENERGIZED AND IGNITER DE-ENERGIZED.
9. UNIT OPERATES UNTIL THERMOSTAT (OR OPERATING CONTROL) IS SATISFIED.
10. SYSTEM RETURNS TO STANDBY WITH DAMPER CLOSED.



IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, USE A SIMILAR WIRE OF 105∞ C RATING.



SPILL AND ROLLOUT SWITCHES ON 3 THRU 6 SECTION ONLY

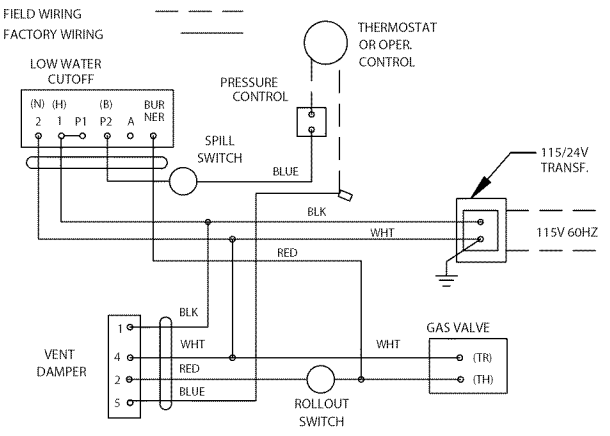
60393 REV.2

OPERATING SEQUENCE FOR SREAM BOILERS

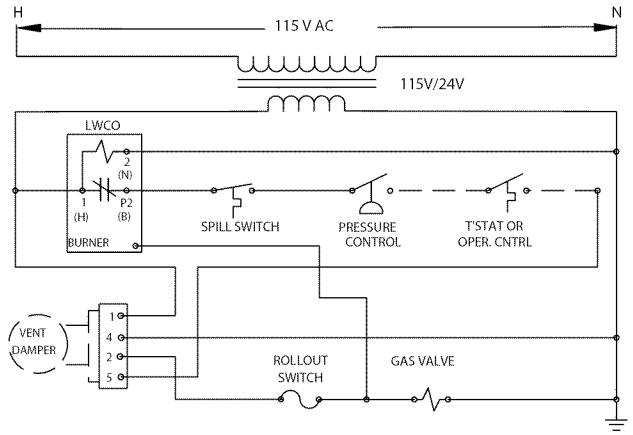
EQUIPPED WITH STANDING PILOT, VENT DAMPER

HI-LIMIT & CG-400 SERIES LWCO

1. MOTOR DRIVES VENT DAMPER TO CLOSED POSITION AND REMAINS CLOSED DURING STANDBY.
2. STANDING PILOT REMAINS LIT.
3. SENSING CIRCUIT IS CONTINUOUSLY MONITORED.
4. THERMOSTAT (OR OPERATING CONTROL) CALLS FOR HEAT.
5. DAMPER BLADE OPENS .
6. DAMPER END SWITCH CLOSES (PROVING DAMPER OPEN).
7. MAIN VALVE IS ENERGIZED.
8. UNIT OPERATES UNTIL THERMOSTAT (OR OPERATING CONTROL) IS SATISFIED.
9. SYSTEM RETURNS TO STANDBY WITH DAMPER CLOSED.



IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, USE A SIMILAR WIRE OF 105∞ C RATING.



NATURAL GAS 3 THRU 7 SECTION.
LP GAS 3 THRU 9 SECTION.
SPILL & ROLLOUT SWITCHES ON 3 THRU 6 SECTION ONLY.

60392 REV.2

FIGURE 2.10: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS EQUIPPED WITH INTERMITTENT PILOT, VENT DAMPER & 400 SERIES LWCO

FIGURE 2.11: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS EQUIPPED WITH STANDING PILOT, VENT DAMPER & 400 SERIES PS804 LWCO

SECTION 3: START-UP & OPERATION

SEQUENCE OF OPERATION

For sequence of operation of the particular boiler being installed, refer to Figures 2.8, 2.9, 2.10 AND 2.11 in Section 2 of this manual.

Spill and rollout switches are mounted on all VS-B boilers (U.S. only) manufactured after December 31, 1990.

For boilers with a spill switch, the switch detects the escape of combustion products through the draft diverter relief opening and interrupts the power to the gas valve preventing unsafe boiler operation. Escape of flue products could be caused by a blocked or collapsed chimney or inadequate chimney draft. This is a manual reset-type device and can be reactivated by depressing the spill switch reset button mounted in the front of the boiler's draft diverter (see Figure 2.1 for switch location).

For boilers with a flame rollout switch, the switch prevents flame rollout from the boiler combustion chamber, caused by blocked boiler flue passageways, by interrupting power to the gas valve to prevent unsafe boiler operation. This is a single use device and must be replaced if it is tripped (see Figure 2.1 for switch location). Flue passages must be inspected by a qualified installer if this problem occurs, prior to switch replacement.

WARNING: If boiler cannot be restored to normal operation after re-setting of spill switch, or if flame rollout switch has tripped, do not attempt to put the boiler in operation. Immediately contact a qualified service professional.

PRIOR TO START-UP

Fill system with water until the water level indicator (sight glass) is approximately 2/3 full. This water level is 23" from the surface on which the boiler sits.

SYSTEM START-UP & ADJUSTMENTS

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

WARNING: Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Otherwise fire or explosion may result.

1. Check combination gas valve on boiler and make sure it is in the OFF position.

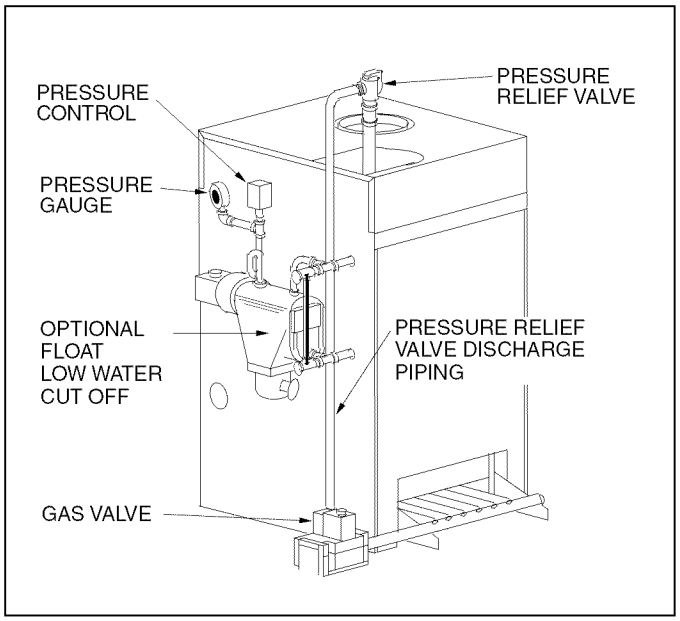


FIGURE 3.1: STEAM CONTROL ARRANGEMENT

2. For vent damper-equipped models, with the thermostat set to call for heat, observe that vent damper position indicator rotates to the open position (see Figure 2.5). Damper must be in the open position when appliance main burner is operating.

   a. After damper opens, spark should appear at the pilot ignition electrodes.

   b. Set thermostat to no longer call for heat. Spark should stop. Observe that damper position indicator rotates to the closed position.

   c. Set thermostat to call for heat.

3. Light the boiler. For Model VS-B boilers with intermittent pilot, see lighting instruction on Page 15.

4. Observe pilot and main burner flame (see Figure 3.2). All burner ports should be ignited and burn with a steady blue flame.

CAUTION: Never leave the job with yellow burning flames. This condition indicated poor combustion and will quickly carbonize the boiler, reducing efficiency and boiler life. It may also be an indication of improper venting or combustion air supply. If unable to adjust flame properly, consult your local utility.

5. Boilers are shipped from the factory with the primary air shutters on the main burner wide open. It is recommended these air shutters be left in the wide open posi-

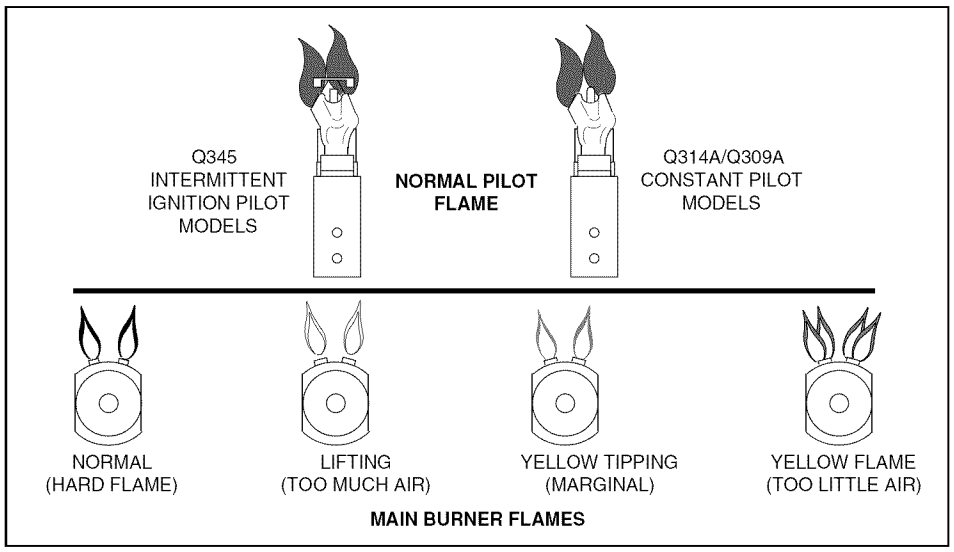


FIGURE 3.2: BURNER FLAME COMPARISON/PILOT FLAME

tion unless there is lifting of the flame above the burner ports. If there is lifting, the air shutters should be gradually closed until the lifting is eliminated. It may also be necessary to adjust the primary air shutters if the input rate is reduced by a change in the orifices.

6. After burner has been in operation for about 10 minutes, check gas input rate to boiler as follows:

a. Make sure all appliances served by the meter are turned off during timing of gas input rate to the boiler.

b. Measure the time in seconds that it takes for the boiler to use 10 cubic feet of gas. Divide 36,000 by the number of seconds (this is the number of cubic feet of gas used per hour). Multiply this figure by the heating value of the gas to obtain Btu input per hour.

Example: A VS-110B boiler takes 5 minutes, 27 seconds to use 10 cubic feet of natural gas. The local utility indicated the heating value of the natural gas being supplied is 1000 Btu/cu ft. Therefore:

5 minutes, 27 seconds = 327 seconds.

$$\frac{36{,}000}{327} \times 1000 = 110{,}000 \text{ Btu/hr}$$

Therefore, the boiler input is correct.

NOTE: Before calculating the input of the heating equipment, obtain the heating value of the gas from the local utility.

7. If input needs to be corrected, adjust combination gas valve pressure regulator. (Regulator is factory set at 3-1/2" W.C. for natural gas and 10" W.C. for propane.) Turn adjusting screw clockwise to increase gas flow (increase input). Turn adjusting screw counterclockwise to decrease gas flow (decrease input). In no case should final manifold pressure setting vary more than $\pm$ .3" from factory-set pressures. If rated input cannot be obtained with adjustment, gas supply pressure or orifice size may be cause. Consult local utility and Hydrotherm.

8. Gas burner orifices supplied with boiler have been carefully designed to provide correct gas input rate for most gas conditions typically found in the U.S. Occasionally, however, local gas characteristics may not allow unit to be properly adjusted for input. If this is the case, local utility or Hydrotherm may recommend orifices be changed. When changing orifices follow the procedures detailed in Section 4 of this manual.

9. Start and stop burners several times by raising and lowering the thermostat setting.

10. After boiler has been firing long enough to raise boiler pressure above minimum setting of the primary pressuretol limit, check limit by turning its setting from maximum to minimum setting. This should turn boiler off. Return limit to desired setting.

11. Check boiler safety shutoff controls.

a. For boilers with standing pilot, with boiler firing, disconnect thermocouple lead from the valve. The valve should close.

b. For boilers with intermittent pilot, with boiler firing, disconnect wire connected to the "PV" terminal on the Honeywell S8600 control. The gas valve should close.

12. On initial start-up and prior to each heating season, boiler must be cleaned with a commercially available steam boiler cleaner (see "Steam Boiler Cleaning Instructions" in Section 4 of this manual).

WARNING:

If you do not follow these instructions exactly, a fire or explosion may result with property damage, personal injury, or loss of life.

A. Before Operating smell all around the 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 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.

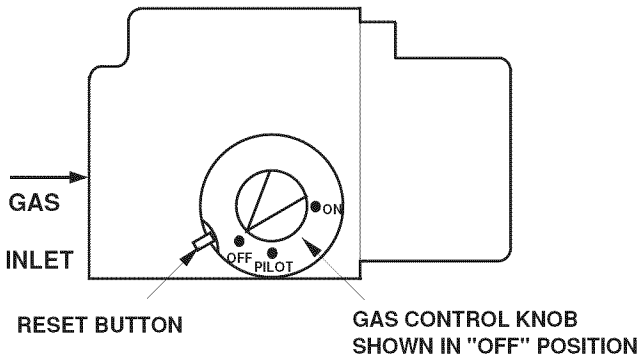
B. Use only your hand to push in or turn the gas control knob, never use tools. If the knob will not push in or turn by hand, don't try to repair it; call a qualified service technician. Force or attempted repair may result in a fire or explosion.

C. 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 the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

Honeywell VR8200
Natural or Propane Gas

1. **STOP!** Read the safety information above.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. Remove control access panel (if applicable).
5. Rotate gas control knob clockwise to "OFF".
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you smell gas, **STOP!** Follow "A" in the safety information above. If you don't smell gas, go to next step.
7. Remove the pilot access panel located below and behind the gas control unit (if applicable).
8. Find pilot — follow metal tube from gas control. The pilot is between the two burner tubes behind the pilot access panel (if applicable).
9. Turn gas control knob counterclockwise to "PILOT".
10. Push down and hold the red button next to the control knob. Immediately light the pilot with a match. Continue to hold the red button down for about one (1) minute after the pilot is lit. Release button and it will pop back up. Pilot should remain lit. If it goes out, repeat steps 5 through 10.
    - If button does not pop up when released, stop and immediately call your service technician or gas supplier.
    - If the pilot will not stay lit after several tries, turn the gas control knob to "OFF" and call your service technician or gas supplier.
11. Replace pilot access panel.
12. Turn gas control knob counterclockwise to "ON".
13. Replace control access panel (if applicable).
14. Turn on all electric power to the appliance.
15. Set thermostat to desired setting.

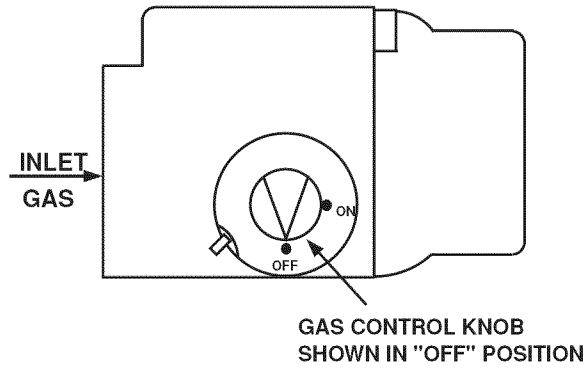


CONTINUOUS PILOT – HONEYWELL VR8200

OPERATING INSTRUCTIONS

Intermittent Pilot – Honeywell VR8204
Natural or Propane Gas

1. **STOP!** Read the safety information on page 13.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
5. Remove control access panel (if applicable).
6. Rotate gas control knob clockwise to "OFF".
7. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas **STOP!** Follow "A" on page 13. If you don't smell gas, go to next step.
8. Turn gas control knob counterclockwise to "ON".
9. Replace control access panel (if applicable).
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Appliance" and call your service technician or gas supplier.



INTERMITTENT PILOT – HONEYWELL VR8204

TO TURN OFF APPLIANCE

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Turn gas control knob counterclockwise to “OFF” Do not force.

SECTION 4: MAINTENANCE

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury exposure to hazardous materials or loss of life. Installation and service must be performed by a qualified installer, service agency or the gas supplier who must read and follow the supplied instructions before installing, servicing or removing this boiler, This boiler contains crystalline silica materials that have been identified as carcinogenic or possibly carcinogenic to humans when inhaled.

This boiler has been designed to provide years of trouble free performance in normal installations. Examination by the homeowner at the beginning of each heating season, and in mid-heating season, should assure continued good performance. In addition, the boiler should be examined by a qualified service professional at least once every year.

DANGER:To avoid fire and explosion hazards: Do not store anything against the boiler or allow dirt or debris to accumulate in the area immediately surrounding the boiler. Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Lint, paper or rags must not be allowed to accumulate near the burners. Do not place clothing on boiler casing to dry.

NOTE: Do not draw water from heating system for cleaning. Minerals in the water can build up on the heat transfer surfaces and cause overheating and subsequent failure of the cast iron sections.

NOTE: To reduce the risk of fouling, the low water cut-off should be blown down at least once a week during heating season.

BEFORE EACH HEATING SEASON

1. Remove and inspect draft diverter and smoke pipe (connecting draft diverter to chimney or vent) for obstructions, soot accumulation, rust or corrosion. Clean and replace as necessary. Check tightness of joints; seal all joints where necessary.

2. Check boiler flue passageways in the boiler sections for any blockage or soot accumulation. Remove draft diverter, jacket top and flue collector. Using a flashlight, examine all flue passageways.

a. If passageways are free of soot and obstructions, replace collector and seal with furnace cement.
b. If passageways need cleaning, remove flueway baffles and burners as described in paragraph 3 below. Insert long-handle bristle flue brush down between section tubes and upward through sections from combustion chamber in both diagonal directions to remove carbon from finned surfaces. Vacuum debris. Replace the draft diverter and seal with furnace cement.
c. Reinstall jacket top panel and draft diverter.

3. Check and clean burner assembly. Remove burner access panel. Lift burners up and to rear until burners are disengaged from orifices. Brush top of burners with soft bristle brush and blow out with air or vacuum.

4. Check gas manifold for proper position and reassemble burners to the manifold. Line up holes in burners with the orifices, and slide assembly back into position. BE SURE TO REINSTALL BURNERS WITH BURNER PORTS ON THE TOP SURFACE (UPRIGHT).

5. When a low water cut-off has been utilized, follow the manufacturer's maintenance instructions. As a minimum, Inspect the probe and test the operation of electronic controls at least once a year. Remove, clean and inspect the probe. Float type controls should be flushed once a month during heating season. If the LWCO fails to operate properly it must be replaced.

6. Follow "System Start-Up & Adjustments" procedures in Section 3 of this manual.

STEAM BOILER CLEANING INSTRUCTIONS

The following procedures must be followed on initial start-up and if the presence of sediment, sludge or impurities hamper proper boiler operations.

1. With gate valves closed on supply and return lines, start burner and allow boiler to become pressurized so that the pressuretol may be adjusted and set for limit cut-off desired (normally about 3 psi). Turn off burner and allow pressure to drop to 0 psi., then proceed with the following cleaning procedure.

2. Remove the pressure relief valve.

3. Add caustic soda (lewis lye) through this opening at the rate of one pound per thousand square feet of radiation capacity. Scout, Squirk or similar steam boiler cleaners may be used instead of lye. Trisodium phosphate (1/4#) is also an excellent cleaner.

4. Provide pipe connection (full size) from pressure relief valve opening to a convenient drain to serve as a vent.

5. Fill the boiler with a manual fill valve until water starts to trickle from this pipe.

6. Fire boiler at sufficient rate to generate and maintain steam. Entrain water and impurities will then discharge (with steam) from open vent. Add water as necessary so that the low water cutoff does not shut off burner.

7. Continue this process for a minimum of one hour. The process should continue until the steam is dry (no water coming from the vent when the water in the gauge glass is at a normal level, approximately 2/3 full). The time required could vary up to 3 hours.

8. Turn gas valve to off position. While boiler is still hot, drain completely through boiler drain. Make sure that all low points in the return line are also completely drained. These areas could trap chemicals and dirt.

9. Close boiler drain and refill with clean untreated warm water. If warm water is not used, fill very slowly so as not to crack boiler sections. Fill until water overflows through vent pipe and runs clear.

10. Completely drain boiler again.Refill with clean untreated water to normal level.

11. Remove vent drain piping and reinstall pressure relief valve. Open gate valves on supply and return lines. Turn on burner. System is now ready to operate.

HOW TO CHANGE ORIFICES

1. Shut off power supply and gas supply to the boiler.

2. Remove burner access panel. Lift burners up and to rear until burners are disengaged from orifices.

3. Check orifices for proper drill size. Size is stamped onto the body of the brass orifice (see Figure 4.1). Size can also be checked by using a pin gauge.

4. All orifices are screwed into the manifold and may be removed by using a 5/8" wrench or socket.

Boiler Model	VS-85B	VS-110B	VS-135B	VS-165B
(1) Nat. Gas Drill Size	41	41	37	38
(2) Prop. Gas Drill Size	53	53	52	52

FIGURE 4.1: VS-B ORIFICE SIZES

5. Reverse procedures above to install orifices and burners. BE SURE TO REINSTALL BURNERS WITH BURNER PORTS ON TOP SURFACE (UPRIGHT).

HEATING SYSTEM PROBLEMS & CAUSES

No Heat

1. Blown fuse or circuit breaker.
2. Switch turned off.
3. Pilot outage
4. IID system malfunction.
5. Flue damper not open.
6. Water level too low.

Insufficient Heat

1. Incorrect thermostat anticipator setting.
2. Low pressuretol setting.
3. Boiler undersized or underfired.
4. Insufficient radiation.

Odor, Excessive Moisture In Building

1. Leak in piping.
2. Carbon build-up in flueways.
3. Blocked chimney.

Yellow Flame, Carbon Build-Up

1. Unit overfired.
2. Air shutter misadjustment.
3. Wrong orifices.
4. Burning in burner mixing tube.

Noise

1. Ignition or ignition noise due to incorrect air shutter adjustment.
2. Whistle due to burr on orifices.
3. Burner "fluteings" due to air shutter opening too wide.

Overheating

1. Wrong thermostat anticipator setting.
2. Bad thermostat location.
3. Bad thermostat.

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

Verify proper operation after servicing.

VS-B SERIES REPLACEMENT PARTS LIST

ORDERING INFORMATION: When ordering parts, provide model and serial number shown on unit rating plate as well as part number and name as shown in parts list. Parts may be obtained from your local Hydrotherm heating contractor.

MODEL VS-A SERIES REPLACEMENT PARTS LIST

REF NO.	NAME OF PART	PART NO.	VS-85B	VS-110B	VS-135B	VS-165B
1	Side Panel - L.H. - Base Ass'y	BM-8055	1	1	1	1
2	Side Panel - R.H. - Base Ass'y	BM-8053	1	1	1	1
3	Rear Panel - Base Ass'y	BM-8063	1			
	Rear Panel - Base Ass'y	BM-8064		1	1	
	Rear Panel - Base Ass'y	BM-8065				1
4	Front - Base Ass'y	BM-8056	1			
	Frontl - Base Ass'y	BM-8057		1	1	
	Frontl - Base Ass'y	BM-8058				1
6	Manifold Bracket - L.H. - Side	03-7345	1	1	1	
	Manifold Bracket - L.H. - Side	03-7347				1
7	Manifold Bracket - R.H. - Side	03-7346	1	1	1	
	Manifold Bracket - R.H. - Side	03-7348				1
8	Burner Support Bracket	03-7366	1			
	Burner Support Bracket	03-7368		1	1	
	Burner Support Bracket	03-7369				1
9	Jacket Support Bracket - L.H. - Side	03-7135	1	1	1	1
10	Jacket Support Bracket - R.H. - Side	03-7136	1	1	1	1
11	Burner	03-7114	2	3	3	4
12	Burner w/Pilot Bracket	03-7118	1	1	1	1
13	Base Door Ass'y	03-7517-1	1			
	Base Door Ass'y	03-7518-1		1	1	
	Base Door Ass'y	03-7519-1				1
14	Igniter Sensor - N.G. - Q345	62-3668	1	1	1	1
	Igniter Sensor - L.P. - Q345	BM-9613	1	1	1	1
–	Pilot Orifice - N.G. (BCR18)	62-3326	1	1	1	1
	Pilot Orifice - L.P. (BBR10)	62-3327	1	1	1	1
15	Manifold	24-1411	1			
	Manifold	24-1413		1	1	
	Manifold	24-1414				1
16	Gas Valve - 24 V Nat. Gas VR8204 H 1006	02-1543	1	1	1	1
	Gas Valve - 24 V L.P. Gas VR8204 H 1014	02-1546	1	1	1	1
17	Burner Orifice - #37 (N.G.)	25-1121			4	
	Burner Orifice - #38 (N.G.)	25-1137				5
	Burner Orifice - # 41 (N.G.)	25-1134	3	4		
	Burner Orifice - # 52(L.P)	25-1129			4	5
	Burner Orifice - # 53 (L.P.)	25-1128	3	4		
18	Hold Down Bracket	03-7296	4	4	4	4
19	Section, Rear	BM-9677	1	1	1	1
20	Section, Intermediate	01-1703	1	2	2	3
21	Section, Front (No Coil Opening)	BM-9672	1	1	1	1
22	Abs. Unit Ass'y	BM-3182	1			
	Abs. Unit Ass'y	BM-3183		1	1	
	Abs. Unit Ass'y	BM-3184				1
23	Port Seal - 5"	59-2004	2	3	3	4
24	Port Seal - 2"	59-2003	2	3	3	4
25	3/8 - 16 X 8 1/2" Lg. Tie Rod	44-1018	1			
	3/8 - 16 X 12" Lg. Tie Rod	44-1010		1	1	
	3/8 - 16 X 15 1/2" Lg. Tie Rod	44-1019				1

REF NO.	NAME OF PART	PART NO.	VS-85B	VS-110B	VS-135B	VS-165B
26	3/8 - 16 X 12" Lg. Tie Rod	44-1010	3			
	3/8 - 16 X 15 1/2" Lg. Tie Rod	44-1019		3	3	
	3/8 - 16 X 18 1/2" Lg. Tie Rod	44-1063				3
27	3/8 - 16 Hex. Nut	57-2601	7	7	7	7
28	3/8 Flat Washer	57-4602	7	7	7	7
29	Pipe Plug - 2" Sq. Hd.	56-4552	1	1	1	1
30	Pipe Plug - 1" Sq. Hd.	56-4601	1	1	1	1
31	Bushing - 3" X 2"	56-4217	1	1	1	1
32	Flue Baffle	BM-8080	2	3	3	4
33	Nipple - 1/2" X 4" (Brass)	53-1085	2	2	2	2
34	Low Water Cut-Off (CG400)	21-2018	1	1	1	1
35	Pigtail - 1/4"	56-5400	1	1	1	1
36	Tee - 1/4"	56-1000	1	1	1	1
37	Nipple - 1/4" X Close	53-1026	1	1	1	1
38	Pressuretrol	02-4807	1	1	1	1
39	Tee - 1/2" X 1/2" X 1/4"	56-1351	1	1	1	1
40	Press. Gauge	20-3002	1	1	1	1
41	Water Gauge	20-2005	1	1	1	1
42	Nipple - 3/4" X 14"	53-1136	1	1	1	1
43	Coupling - 3/4"	56-5001	1	1	1	1
44	Pressure Relief Valve - 15 P.S.I.	22-1401	1	1	1	1
45	Draft Diverter	BM-8081	1			
	Draft Diverter	BM-8082		1		
	Draft Diverter	BM-8083			1	
	Draft Diverter	BM-8084				1
46	5/16 - 18 X 1 1/4 Lg. Weld Screw	57-5908	4	4	4	4
47	5/16 - 18 Hex. Nut	57-2602	4	4	4	4
48	Transformer - 115/24V	26-3005	1	1	1	1
49	Junction Box - 4" X 4"	58-1800	1	1	1	1
-	Silicone Sealant 11 oz. (Not Shown)	10-6627	1	1	1	1
-	Fiberglass Rope - 5ft. (Not Shown)	10-6651	1	1	1	1

REF NO.	NAME OF PART	PART NO.	VS-85B	VS-110B	VS-135B	VS-165B
	ALTERNATE LOW WATER CUT-OFF AND CONNECTING FITTINGS (SEE FIGURE 2)					
58	Low Water Cut-Off (Hon. RW700A)	BM-1223	1	1	1	1
59	Water Gauge	20-2005	1	1	1	1
60	Nipple - 1/2" X 3 1/2" (Brass)	53-1107	1	1	1	1
61	Coupling - 1/2" (Brass)	56-5012	1	1	1	1
62	Tee-1/2" X 1/2" X 1/4" (Brass)	56-1352	1	1	1	1
63	Nipple - 1/2" X 4" (Brass)	53-1106	1	1	1	1
	ALTERNATE LOW WATER CUT-OFF/FEEDER AND CONNECTING FITTINGS (SEE FIGURE 2)					
64	Low Water Cut-Off & Feeder (M-M#47-2)	21-2002	1	1	1	1
65	Water Gauge	20-2005	1	1	1	1
66	Tail Piece	21-2300	1	1	1	1
67	Bushing - 1/2" X 1/4"	56-4201	1	1	1	1
68	Bushing - 2" X 1/2"	56-4208	1	1	1	1
69	Coupling - 1/2" (Brass)	56-5012	2	2	2	2
70	Union - 1/2"	56-4800	1	1	1	1
71	Elbow - 1/2"	56-3303	2	2	2	2
72	Nipple - 1/2'" X 2"	53-1078	1	1	1	1
73	Nipple - 1/2" X 3" (Brass)	53-1111	2	2	2	2
74	Nipple - 1/2" X Close	53-1076	1	1	1	1
75	Nipple - 1/2" X 3"	53-1080	2	2	2	2
	PARTS FOR VS-B JACKET ASSEMBLY (SEE FIGURE 3)					
-	Jacket-Complete	BM-2648	1			
	Jacket-Complete	BM-2649		1	1	
	Jacket-Complete	BM-2650				1
58	Front Panel	BM-2651	1	1	1	1
59	Rear Panel	BM-2652	1	1	1	1
60	Side Panel-L.H.	BM-2653	1			
	Side Panel-L.H.	BM-2654		1	1	
	Side Panel-L.H.	BM-2655				1
61	Side Panel-R.H.	BM-2656	1			
	Side Panel-R.H.	BM-2657		1	1	
	Side Panel - R.H.	BM-2658				1
62	Top Panel	BM-2659	1			
	Top Panel	BM-2660		1	1	
	Top Panel	BM-2661				1
64	Ignition Control S8600M	BM-8143	1	1	1	1
65	Vent Damper W/Harness Ass'y.	02-5865	1			
	Vent Damper W/Harness Ass'y.	02-5866		1	1	
	Vent Damper W/Harness Ass'y.	02-5854				1
66	Spill Switch (Manual Reset)	58-2524	1	1	1	1
67	Rollout Switch (Thermal Fuse)	58-1895	1	1	1	1
	Cable Bracket - Not Shown	03-7144	1	1	1	1

PARTS FOR STANDING PILOT

REF NO.	NAME OF PART	PART NO.	VS-85B	VS-110B	VS-135B	VS-165B
17	Pilot Ass'y NG-Q314ALB, Q309A, BCR18	BM-8072	1	1	1	1
	Pilot Ass'y LP-Q314ALB, Q309A, BBR10	BM-8073	1	1	1	1
18	Pilot Orifice NG (BCR18)	62-3326	1	1	1	1
	Pilot Orifice LP (BBR10)	62-3327	1	1	1	1
19	Thermocouple Q309A	04-1302	1	1	1	
	Thermocouple Q309A (3 FT)	04-1306				1
20	Pilot Line w/ Fittings	BM-8078	1	1	1	
	Pilot Line w/ Fitting	BM-8079				1
22	Gas Valve - NG VR8200H1129	02-1540	1	1	1	1
	Gas Valve - LP VR8200H1137	02-1541	1	1	1	1
56	Transformer 115/24V 20VA	26-3005	1	1	1	1

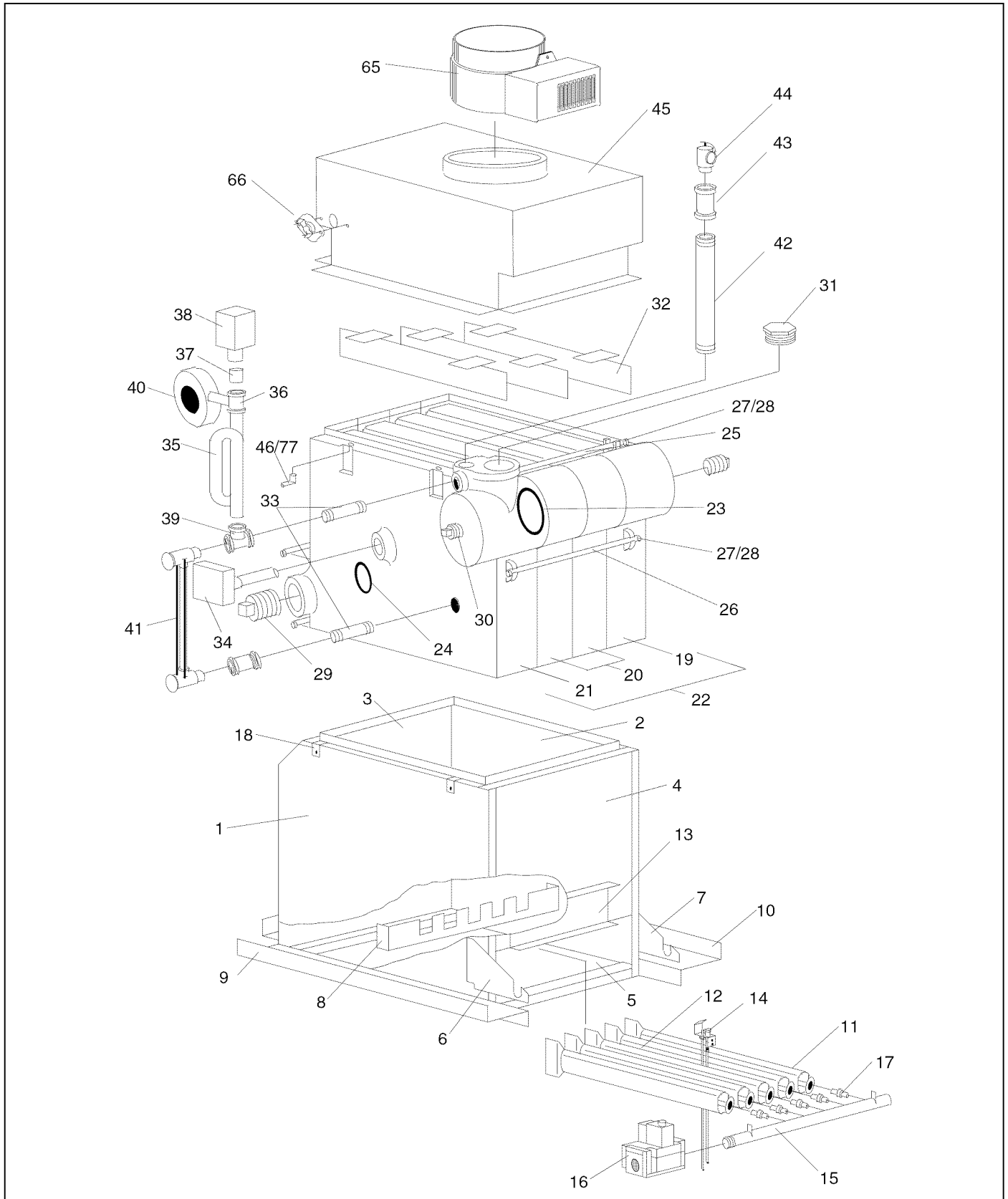


FIGURE 1: VS-B GENERAL ASSEMBLY

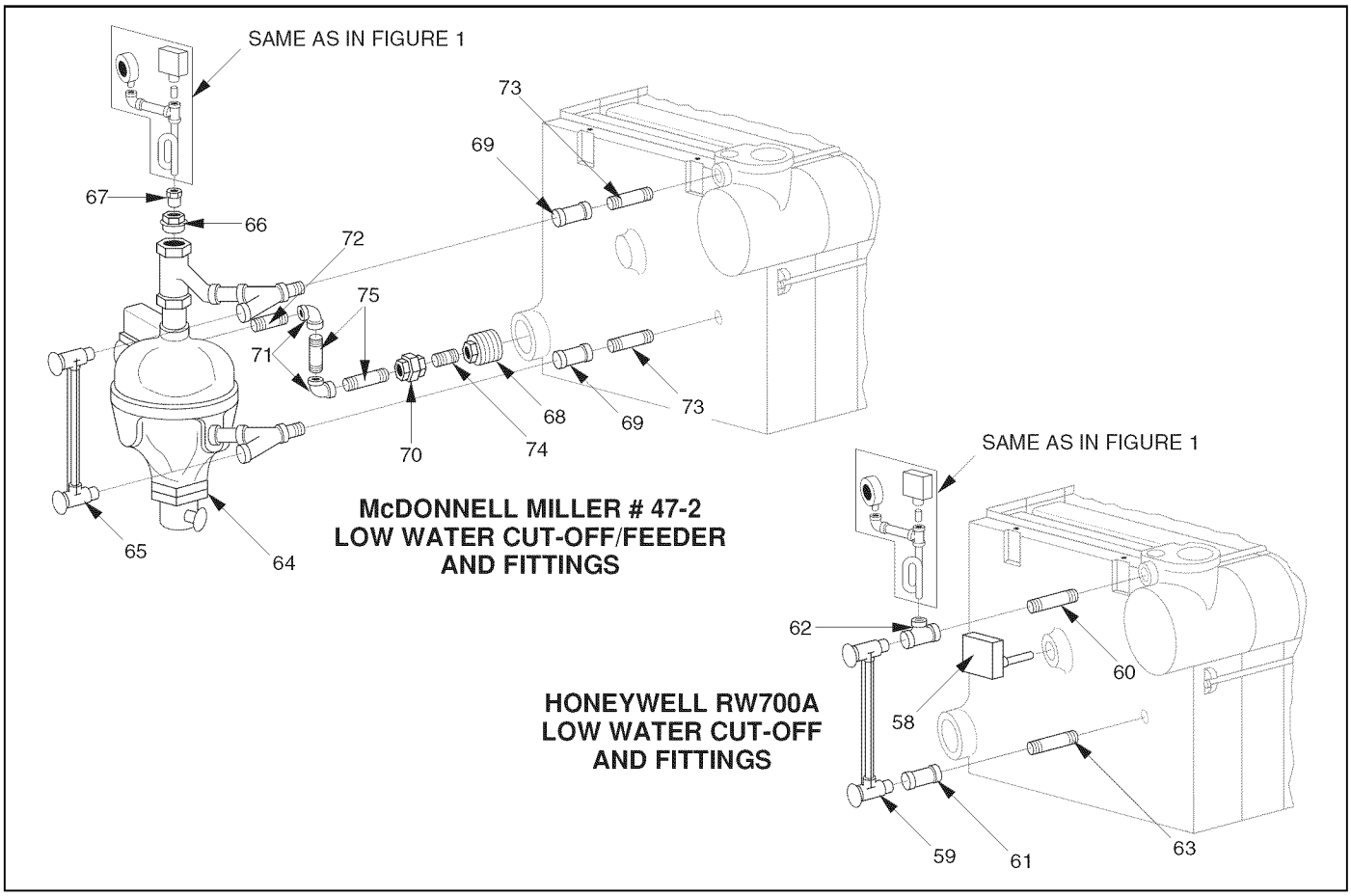


FIGURE 2: LOW WATER CUT-OFF AND FITTINGS

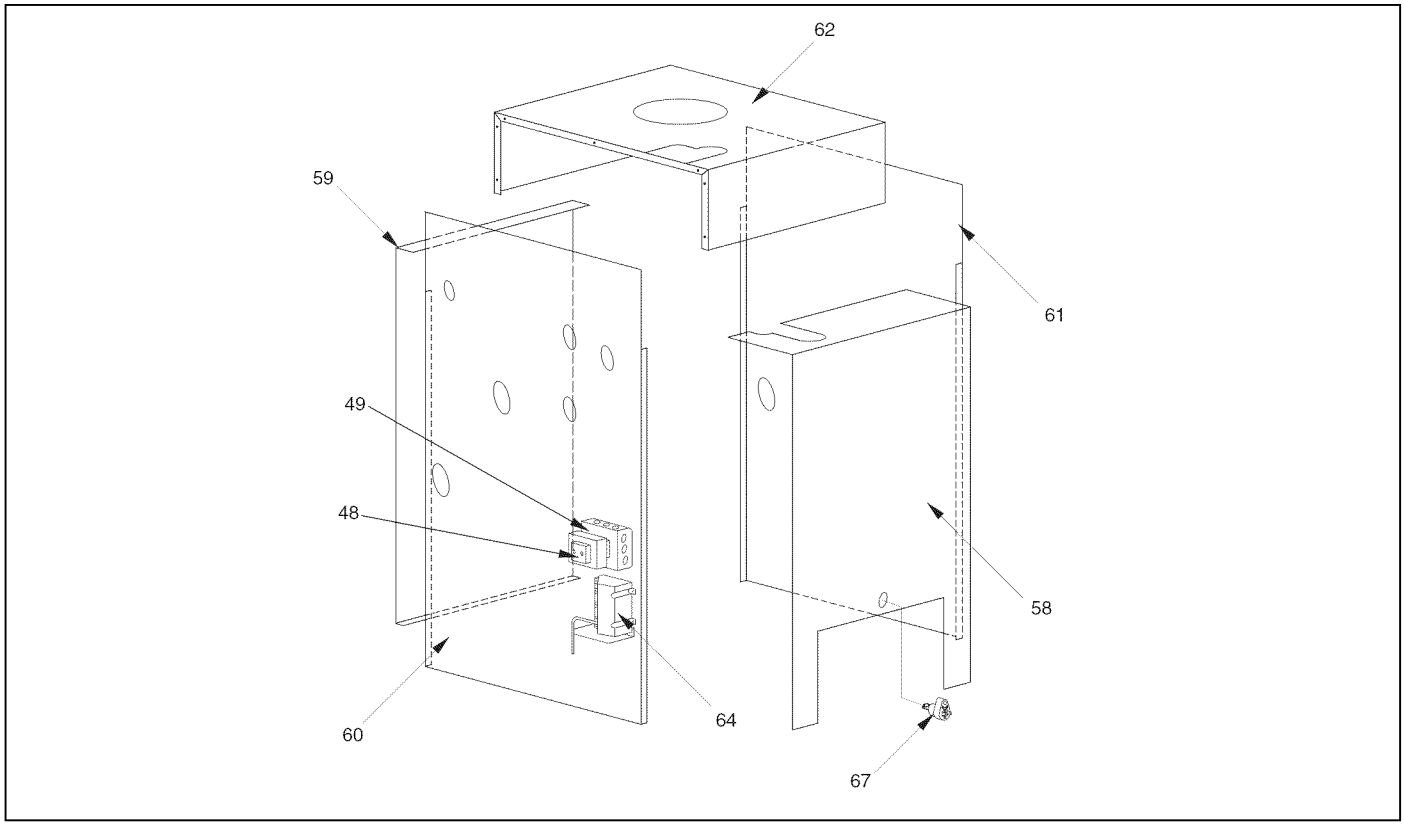


FIGURE 3: JACKET ASSEMBLY

NOTES

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