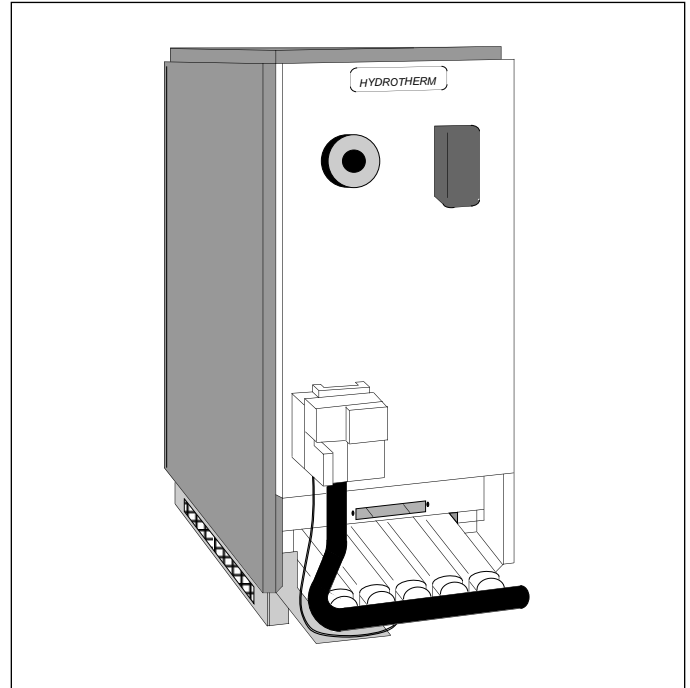


# HydroTherm®

## MODEL HC-D SERIES INSTALLATION, OPERATION & MAINTENANCE MANUAL & REPLACE- MENT PARTS MANUAL

**Gas-Fired Cast Iron Water Boilers  
65,000 to 165,000 Btuh Input  
Intermittent Pilot & Vent Damper**



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MEA# 90-77-E



# HydroTherm®

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IN CANADA: 5211 CREEKBANK ROAD, MISSISSAUGA, ONT. L4W 1R3 (905) 625-2991/FAX (905) 625-6610

**ANSI/ASME CODE COMPLIANCE:** Installation must conform to requirements of authority having jurisdiction or, in absence of such requirements, to National Fuel Gas Code ANSI Z223.1-latest edition and to National Electric Code NFPA-70-latest edition. Where required by authority having jurisdiction, installation must also conform to Standard for Controls and Safety Devices for Automatically Fired Boilers, ANSI/ASME CSD-1-latest edition.

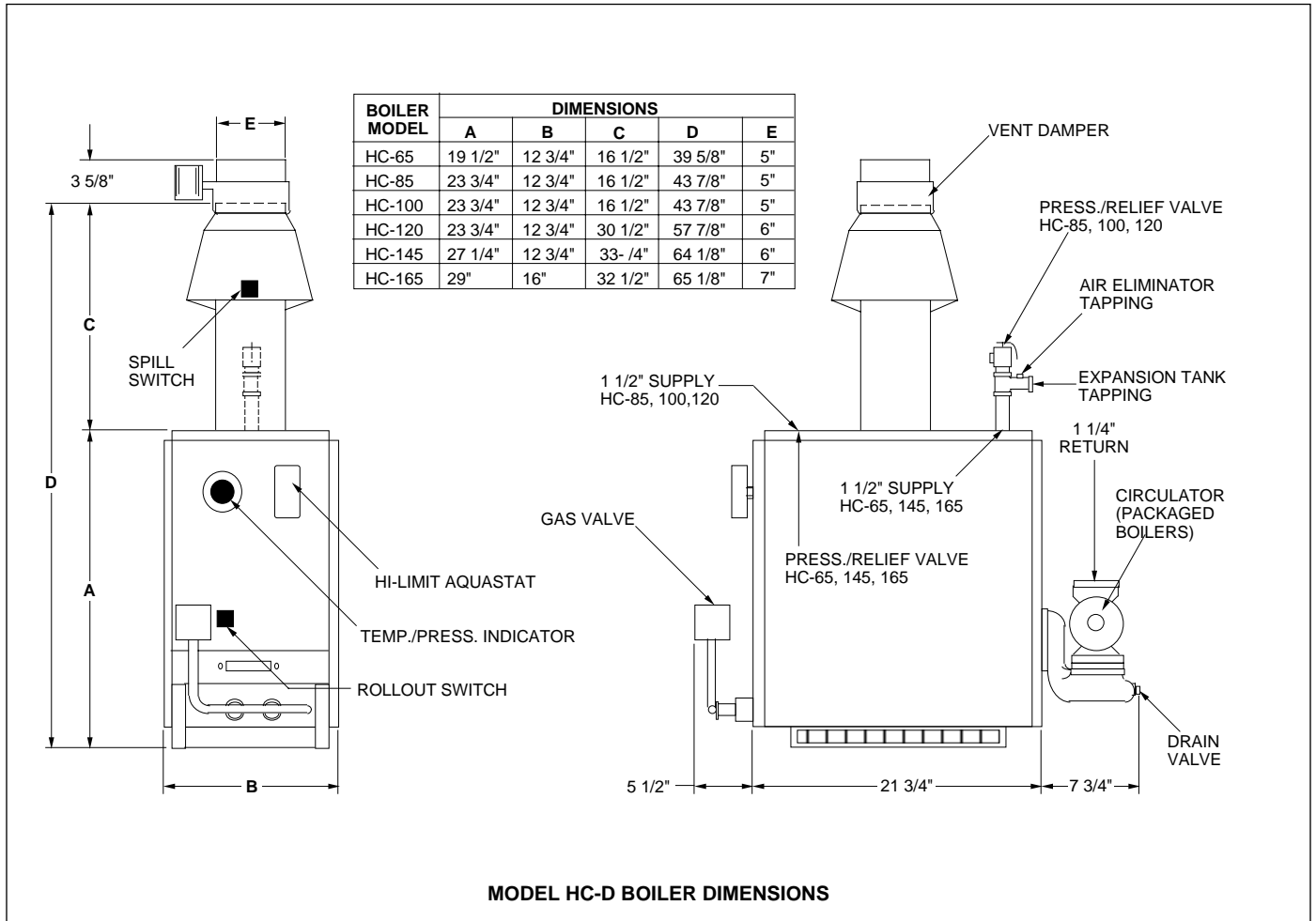
For Canada, the installation must be in accordance with Standards CAN/CGA-B149.1 or .2 Installation Codes for Gas Burning Appliances and Equipment and with Standard C.S.A. C22.1 Canadian Electrical Code, Part 1 and

Part 2, and/or local codes.

**BOILER SHIPMENT:** Each boiler is shipped in a single carton. There is a vent damper packed separately with the boiler.

**WARNING:** Installers must follow local regulations with respect to the installation of CO detectors and follow the manufacturer's stated maintenance schedule for this boiler!

**ATTENTION:** Observer les règlements régional à l'égard des détecteurs de monoxyde de carbone et observer entretien de manufacturier pour cette chaudière!



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 imminently hazardous situation which, if not avoided, could result in death, serious injury or substantial property damage.

**CAUTION:** Indicates a imminently 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.

# SECTION 1: BOILER INSTALLATION

## STEP 1: LOCATING & SETTING THE BOILER

**PROCEDURE A:** Check that provisions for combustion air are in accordance with National Fuel Gas Code ANSI Z223.1-latest edition and all applicable local codes.  
In Canada, follow CAN/CGA B149.1 or .2 installation codes.

**WARNING:** This boiler must be supplied with combustion air in accordance with Section 5.3, Air for Combustion & Ventilation, of the latest revision of the National Fuel Gas Code, ANSI Z223.1 and all applicable local building codes. Failure to provide adequate combustion air for this appliance can result in severe personal injury or death!

If boiler is installed in an unconfined space, adequate air will be available via normal infiltration.

If boiler is installed in a confined space (a space with a volume of less than 50 cubic feet per 1000 Btu/hr of gas input for all fuel burning equipment) or building construction is unusually tight, 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, each opening must have a minimum free area of one square inch per 4000 Btu/hr of gas input. When ventilation air 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.

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

**PROCEDURE B:** Check minimum clearances to combustibles are proper as shown. Local requirements may specify greater clearances & must be adhered to.

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

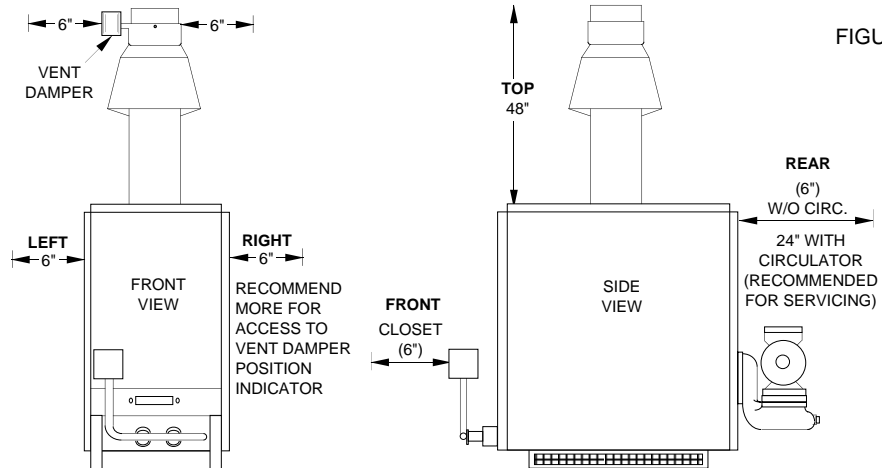


FIGURE 1.1

**WARNING:** Never install boiler on combustible flooring without combustible flooring pan or on carpeting as heat damage and/or fire may result.

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

**CAUTION:** Locate boiler so horizontal connecting flue pipe is as short as possible. Maximize height of vertical flue connector.

**PROCEDURE C:** Check component positioning.

1. Remove all packing material from boiler.
2. Check that burners and controls are in the proper position.
3. Check proper seating of baffle grid inside of dome opening (see Figure 1.2).

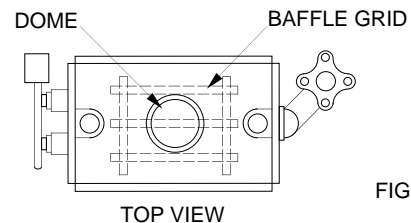


FIGURE 1.2

## STEP 2: INSTALLING & PURGING WATER PIPING

**NOTE:** Boiler must not be used without forced circulation, as overheating or failure of cast iron sections may result.

**PROCEDURE A:** Install vent tapping assembly, components and relief valve discharge piping. For Models HC-65, 145 & 165, supply outlet is at rear of boiler and vent fitting assembly tapping is at front of boiler.

**Relief Valve Discharge Piping:** Must terminate 6" above floor & be same size or larger than valve outlet.

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

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

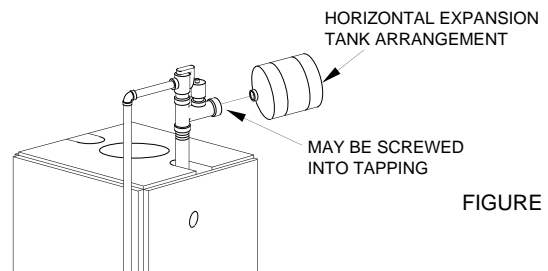
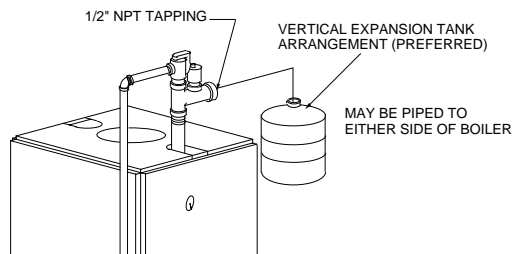
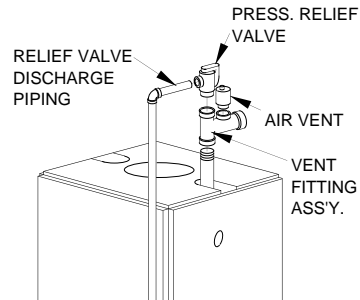


FIGURE 1.3

**PROCEDURE B:** Install supply and return water piping. For Models HC-65, 145 & 165, supply outlet is at rear of boiler and vent fitting assembly tapping is at front of boiler.

If boiler is installed above level of radiation, a low water cut-off must be used.

**ALL EXTERNAL PIPING MUST BE SUPPORTED BY HANGERS, NOT BY BOILER OR ACCESSORIES.**

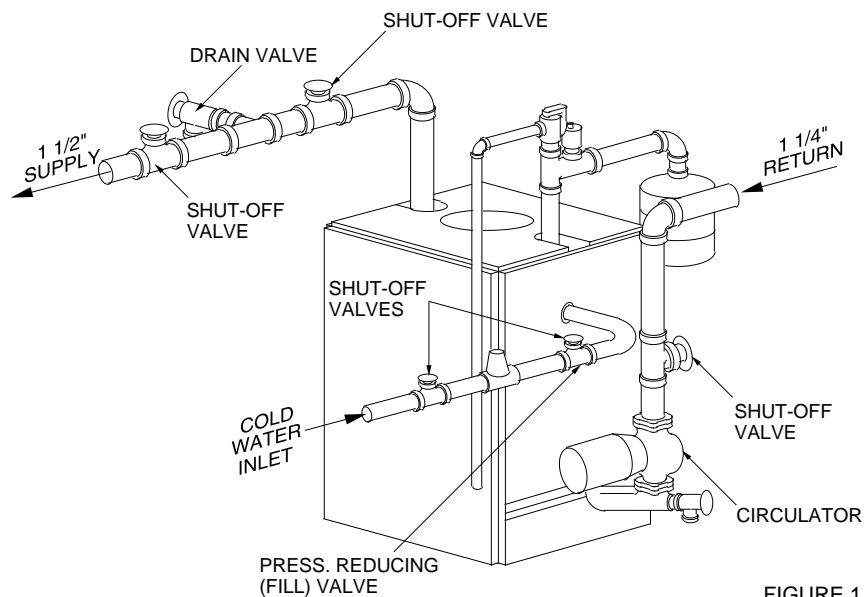


FIGURE 1.4

**CAUTION:** To prevent damage due to excessive condensation, one of the following piping options should be used.

### SYSTEM BYPASS

For systems using a circulator on the return as either a single zone, or multiple zones with zone valves, install a system bypass line between the supply and return on the suction side of the circulator (see Figure 1.5). Install a metering valve in this bypass line to regulate the amount of flow that will be diverted to the return. A plug valve offers the best control for this application. Although other valves may be less expensive, a plug valve will be easier to set accurately.

In the absence of a flow indicator, set the metering valve using temperature as a guide. The accompanying diagram suggests one scenario. This addition requires only two tees, a plug valve, and a small amount of pipe and offers the simplest approach to reliably control condensation. For this system and those that follow, be aware that you are using a percentage of the pump capacity to blend, but the friction loss for the entire pump flow has been reduced. In most cases, the standard pump packaged with the boiler has enough capacity to feed the baseboard distribution system and the bypass line.

### PUMP AWAY BYPASS

For systems that use a single circulator to pump away from the boiler, the bypass should be installed on the discharge side of the circulator (see Figure 1.6). Full temperature water supplies the baseboard distribution system as before. Half of the circulator's volume moves through the bypass, blending and heating the cooler return water. Again, the cost of installing the bypass is small and setting it by temperature can be accomplished with a contact thermometer.

### PUMPED BLEND

An additional circulator can also be used to provide a return water temperature blend. This method works well with systems with multiple zones with circulators (see Figure 1.7). The dedicated bypass circulator provides a strong blending flow without diminishing the flow available to any heating zone. Any residentially sized circulator is adequate for this purpose.

Each of these bypass solutions also has the added benefit of increasing circulation in the boiler which will maximize tankless coil output and increase the accuracy of temperature sensing controls.

### REVERSE ACTING AQUASTATS

An alternative for existing systems experiencing condensation that does not require re-piping the boiler utilizes a reverse acting aquastat, one that makes on temperature rise. This approach works best in single zone systems. Wired in series with the circulator, this control holds the circulator off until the boiler reaches an acceptable temperature and then starts system circulation (see Figure 1.8).

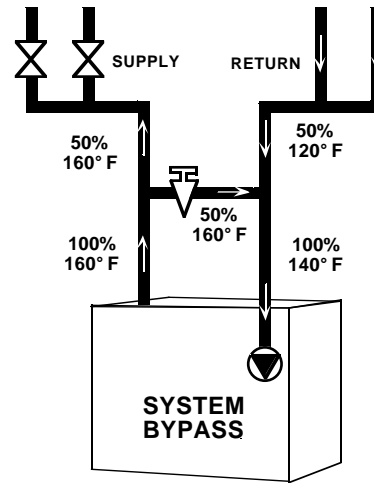


FIGURE 1.5

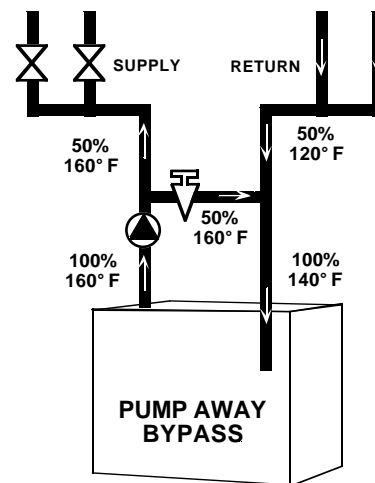


FIGURE 1.6

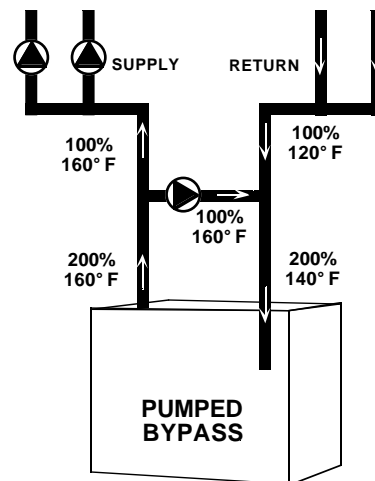
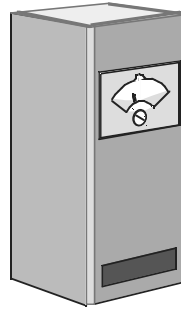


FIGURE 1.7

The most commonly available reverse acting aquastat is a Honeywell L4006B. The aquastat should be mounted in an immersion well directly installed in the boiler. The use of heat conductive grease (Honeywell part # 972545) in the immersion well is strongly recommended for fast and accurate temperature response. Set this adjustable aquastat to make at no less than 130° F. While this method can cause the circulator to cycle more frequently, setting the aquastat's differential to the maximum (25-30°F) will minimize short cycling.



**REVERSE  
AQUASTAT**  
SET AT 120° F

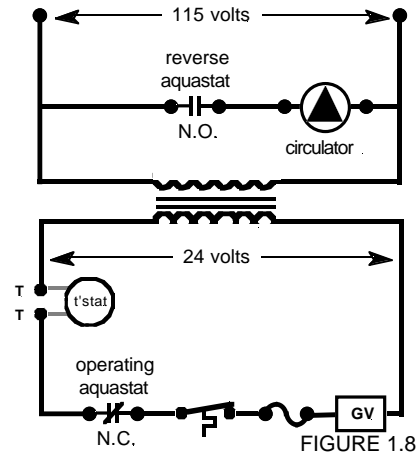


FIGURE 1.8

**PROCEDURE C: For combination heating and cooling installations only.**

If a hot water boiler is installed in connection with a water chiller, the chilled water must be piped in parallel with the boiler, using appropriate valves to prevent the chilled medium from entering the boiler (see Figure 1.9). When boilers are connected to heating coils located in air handling units where they may be exposed to refrigerated air circulation, such boiler piping system shall be equipped with flow-control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

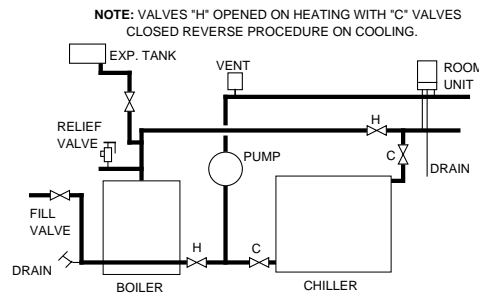


FIGURE 1.9

**PROCEDURE D: Completely fill & purge heating system. Make sure that all heating system manual air vents are closed.**

1. Check flow direction arrows on hydronic components are facing in proper direction.
2. Attach hose to drain valve "B" and close valve "A". Open valves "C", "D", "E" and "F" and drain valve "B". Fill system with water until water runs out of the hose in a steady stream (no visible air bubbles).
3. Close valves "C" and "D". Open valve "A". When water runs out of the hose in a steady stream (no visible air bubbles), close drain valve "B".
4. Open valves "C" and "D".

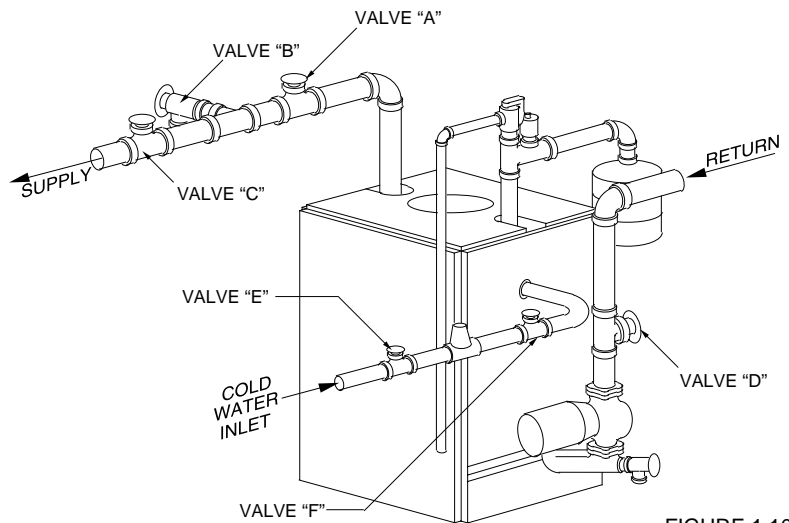


FIGURE 1.10

**FOR WATER TREATMENT & FREEZE PROTECTION REQUIREMENTS,  
SEE "SECTION 3: MAINTENANCE" IN THIS MANUAL**

## STEP 3: VENTING THE BOILER

**DANGER:** Draft hood and vent outlet must not be altered, as proper operation would be jeopardized; flame rollout, fire or carbon monoxide poisoning will result.

**NOTES:** Additional venting and chimney requirements are provided on page 8.  
For boilers equipped with intermittent pilot install plug supplied in damper package into damper vane hole. For standing pilot boilers discard plug.

### PROCEDURE A: Mount draft hood and spill switch on boiler.

1. Install draft hood on boiler. If draft hood shroud has a hole near the relief opening, mount draft hood so hole faces to the front of the boiler.
2. HC-D boilers are equipped with factory-mounted spill switch harness/mounting bracket assembly; spill switch is provided in bag on boiler front.
3. Install mounting bracket on outside surface of draft hood shroud with the screws provided (HARNESS MUST BE ON OUTSIDE OF SHROUD). Install spill switch in hole in shroud (on outside surface) with the screws provided.

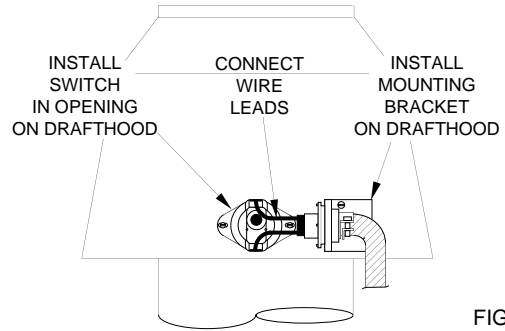


FIGURE 1.11

4. Plug wiring leads from harness/bracket assembly onto flat terminals on spill switch.

**NOTE:** Boiler will not operate unless wiring leads to spill switch are connected.

### PROCEDURE B: Install vent damper. (For French version, see Appendix A at rear of manual.)

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

#### 1. Mount damper on top of draft hood.

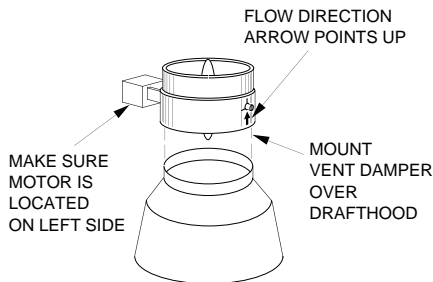


FIGURE 1.12

#### 2. Secure damper to draft hood.

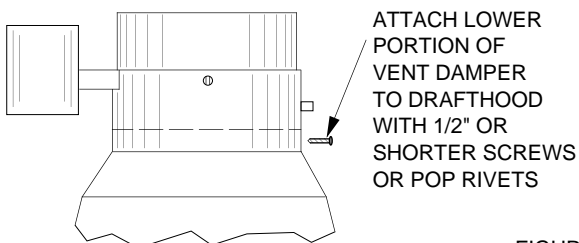


FIGURE 1.13

#### 3. Connect wire harness.

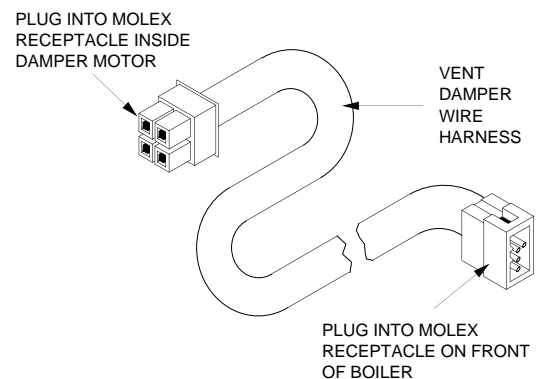


FIGURE 1.14

**PROCEDURE C: Install flue pipe between vent damper and chimney (6" minimum clearance required between flue pipe and combustibles).**

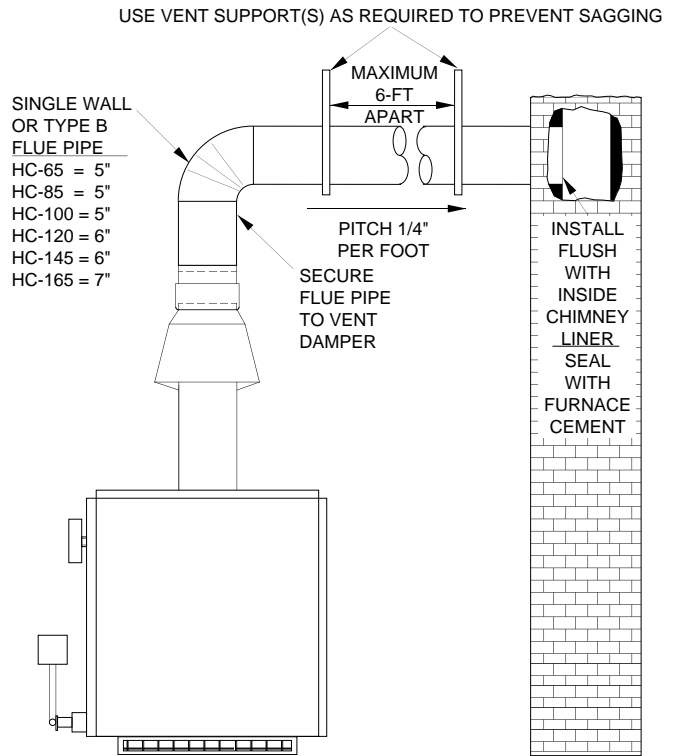


FIGURE 1.15

**ADDITIONAL 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 an existing boiler is removed from a 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, following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while other appliances remaining connected to 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 in-spected. 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 installation conforms with the 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. For Canada, the provisions of CAN/CGA B149.1 or .2 shall apply.

**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.

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 4: INSTALLING & TESTING GAS PIPING

**PROCEDURE A: Select gas 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, following example below.**

**Example:** Boiler Model HC-120D is to be installed. Distance from existing gas meter to installation site is 20 ft. What pipe size must be used? Local utility indicates heating value of natural gas being supplied is 1020 Btu per cu.ft. Determine cubic feet of gas per hour for above boiler model:

$$\frac{120,000 \text{ Btu per hour}}{1020 \text{ Btu per cu.ft.}} = 117.6 \text{ cu.ft. per hour}$$

1. Find 20 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 acceptable. In our case it is 190 cu.ft.
3. Move to left-hand column "Nominal Iron Pipe Size, Inches"; read required pipe size. In our case it is 3/4".

**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 of Water Column Inlet Pressure)**

(Based of 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

FIGURE 1.16

**PROCEDURE B: Connect gas piping from meter to boiler following good piping practices. Pipe joint compound must be compatible with the fuel (NG or LP) being used. Check local codes and utilities for any requirements.**

**All piping must be supported by hangers, not by boiler or accessories.**

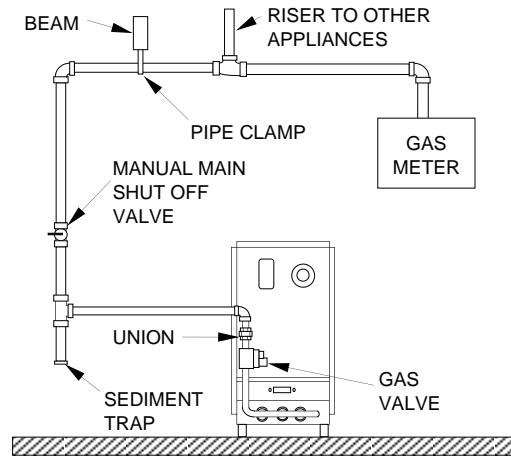


FIGURE 1.17

**PROCEDURE C: Test 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 MAY 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 this limit, a pressure regulator must be installed. If the gas pressure is below these limits, contact the local utility.

**WHEN TESTING IS COMPLETED, CLOSE MAIN GAS SHUT-OFF VALVE & SET BOILER COMBINATION GAS VALVE IN "OFF" POSITION.**

## STEP 5: WIRING THE BOILER

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

All electrical wiring must be in accordance with requirements of authority having jurisdiction or, in absence of such requirements, to National Electric Code NFPA-70-latest edition. If external source is utilized, boiler must be electrically grounded in accordance with the requirements of authority having jurisdiction or, in absence of such requirements, with National Electric Code NFPA-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.

For Canada, all electrical connections are to be made in accordance with Standard C.S.A. C22.1 Canadian Electrical Code, Part 1 and Part 2 and/or local codes.

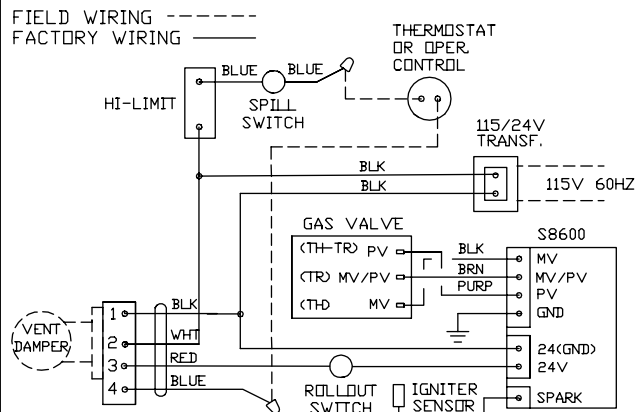
**NOTE: If any original wire supplied with the boiler must be replaced, use similar wire of 105 C rating. Otherwise, insulation may melt or degrade, exposing bare wire.**

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

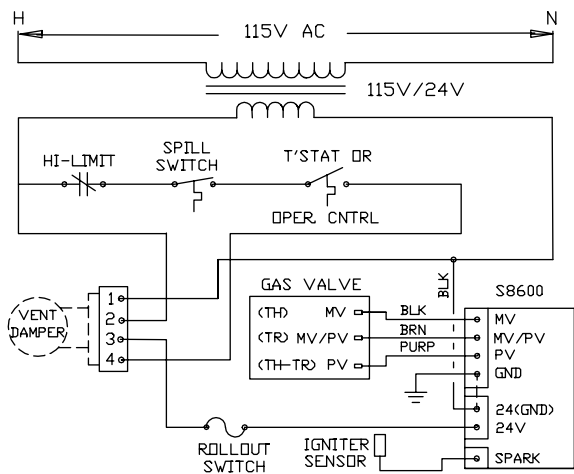
A separate 115V (60Hz) power supply is recommended for the boiler. Use standard 15-amp fuse and 14-gauge wire from power supply to boiler. Follow the wiring diagram for your particular installation as shown in Figures 1.18 through 1.24.

**OPERATING SEQUENCE  
FOR BOILERS EQUIPPED WITH VENT DAMPER  
AND HONEYWELL ELECTRONIC IGNITION CONTROL**

MOTOR DRIVES VENT DAMPER TO CLOSED POSITION AND REMAINS CLOSED DURING STANDBY. SENSING CIRCUIT IS CONTINUOUSLY MONITORED. THERMOSTAT (OR OPERATING CONTROL) CALLS FOR HEAT. DAMPER BLADE OPENS. DAMPER END SWITCH CLOSSES (PROVING DAMPER OPEN). IF NO FAILURE EXISTS, THE PILOT VALVE AND IGNITER ARE ENERGIZED. PILOT IS IGNITED AND SENSOR SENSES FLAME. MAIN VALVE IS ENERGIZED AND IGNITER DE-ENERGIZED. UNIT OPERATES UNTIL THERMOSTAT (OR OPERATING CONTROL) IS SATISFIED. 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.



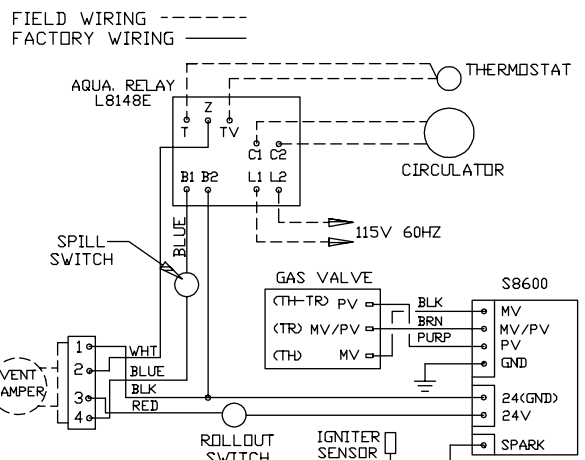
SPILL AND ROLLOUT SWITCHES USED WHEN INPUT IS LESS THAN 300,000 BTUH

42-5705 REV.5

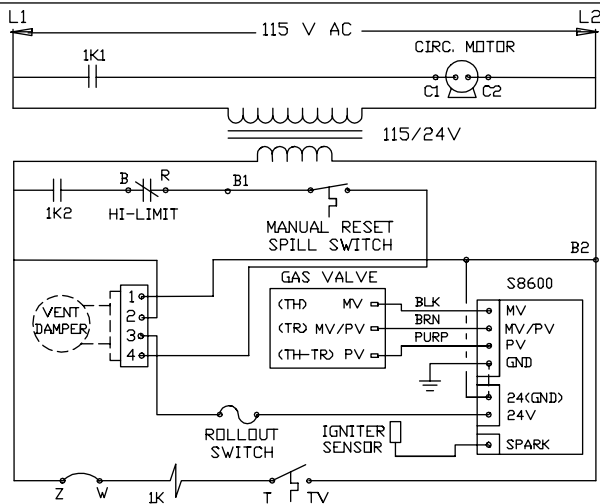
**FIGURE 1.18: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS WITH IID & VENT DAMPER**

**OPERATING SEQUENCE FOR BOILERS  
EQUIPPED WITH VENT DAMPER, HONEYWELL  
ELECTRONIC PILOT CONTROL AND L8148E**

MOTOR DRIVES VENT DAMPER TO CLOSED POSITION AND REMAINS CLOSED DURING STANDBY. SENSING CIRCUIT IS CONTINUOUSLY MONITORED. THERMOSTAT CALLS FOR HEAT. DAMPER BLADE OPENS. DAMPER END SWITCH CLOSSES (PROVING DAMPER OPEN). IF NO FAILURE EXISTS, THE PILOT VALVE AND IGNITER ARE ENERGIZED. PILOT IS IGNITED AND SENSOR SENSES FLAME. MAIN VALVE IS ENERGIZED AND IGNITER DE-ENERGIZED. UNIT OPERATES UNTIL THERMOSTAT IS SATISFIED. 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.



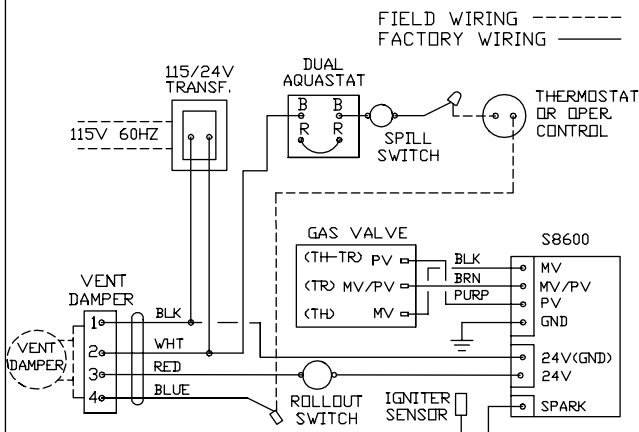
SPILL AND ROLLOUT SWITCHES USED WHEN INPUT IS LESS THAN 300,000 BTUH

42-5707 REV. 5

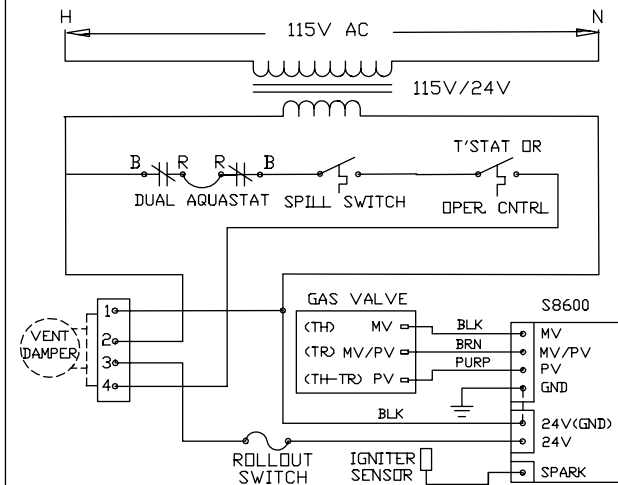
**FIGURE 1.19: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS WITH IID, VENT DAMPER & L8148E AQUASTAT RELAY**

**OPERATING SEQUENCE  
FOR BOILERS EQUIPPED WITH VENT DAMPER,  
HONEYWELL ELECTRONIC IGNITION CONTROL  
AND DUAL AQUASTAT**

MOTOR DRIVES VENT DAMPER TO CLOSED POSITION AND REMAINS CLOSED DURING STANDBY. SENSING CIRCUIT IS CONTINUOUSLY MONITORED. THERMOSTAT (OR OPERATING CONTROL) CALLS FOR HEAT. DAMPER BLADE OPENS. DAMPER END SWITCH CLOSSES (PROVING DAMPER OPEN). IF NO FAILURE EXISTS, THE PILOT VALVE AND IGNITER ARE ENERGIZED. PILOT IS IGNITED AND SENSOR SENSES FLAME. MAIN VALVE IS ENERGIZED AND IGNITER DE-ENERGIZED. UNIT OPERATES UNTIL THERMOSTAT (OR OPERATING CONTROL) IS SATISFIED. 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.



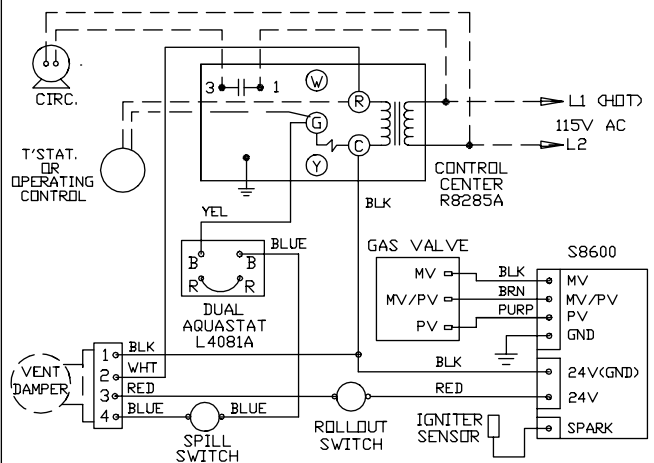
SPILL AND ROLLOUT SWITCHES USED WHEN INPUT IS LESS THAN 300,000 BTUH.

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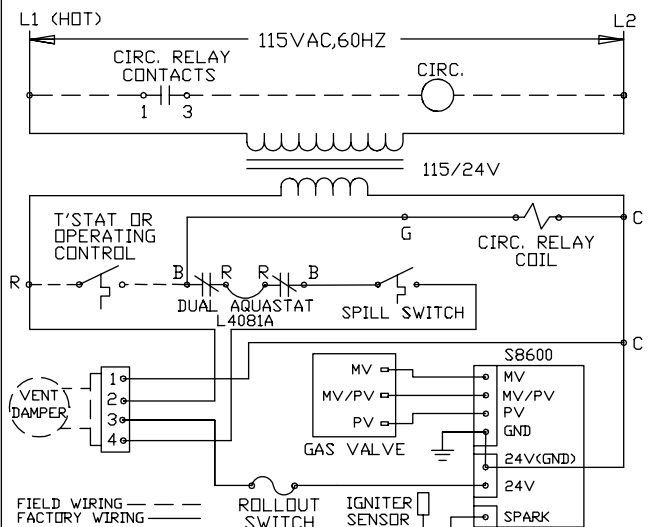
**FIGURE 1.20: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS WITH IID, VENT DAMPER & DUAL AQUASTAT L4081A**

**OPERATING SEQUENCE  
FOR BOILERS EQUIPPED WITH VENT DAMPER,  
HONEYWELL ELECTRONIC IGNITION CONTROL,  
CONTROL CENTER, AND DUAL AQUASTAT**

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



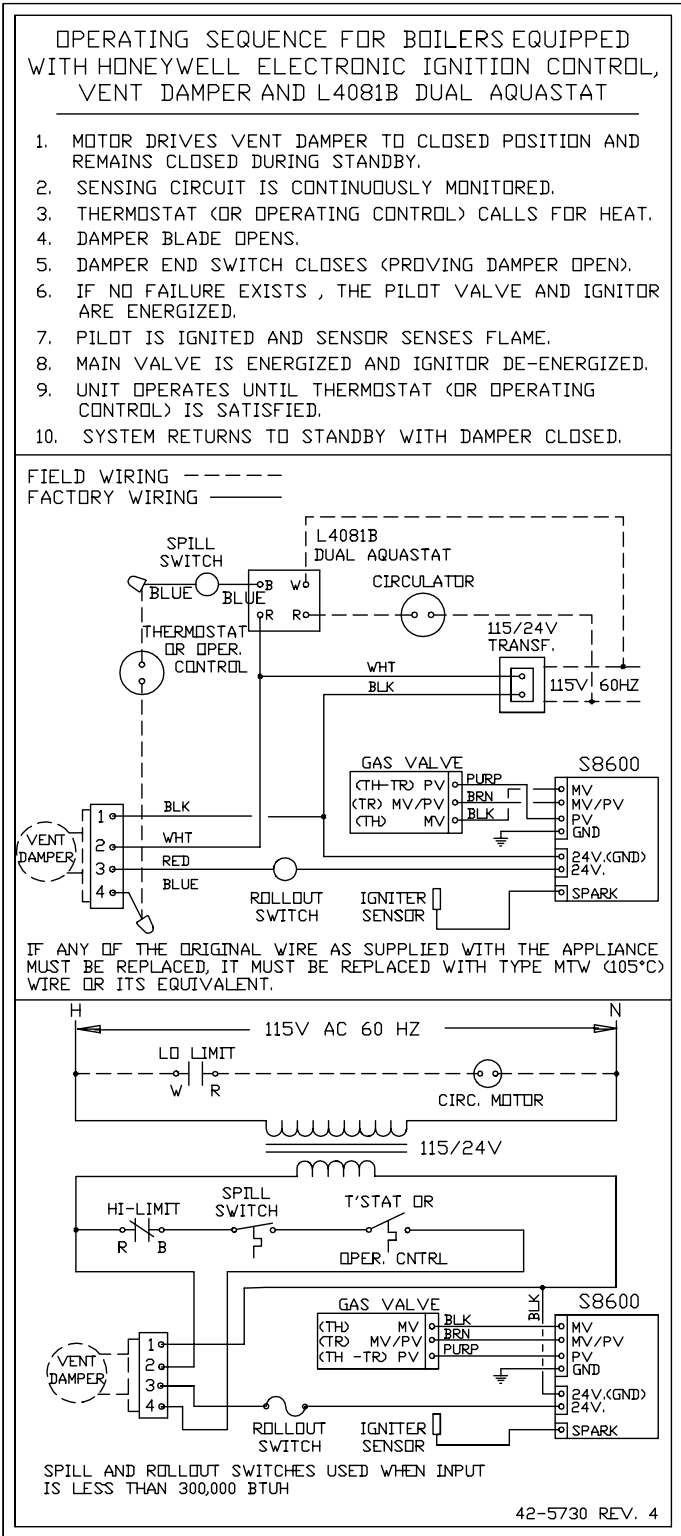
IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, USE A SIMILAR WIRE OF 105° C RATING.



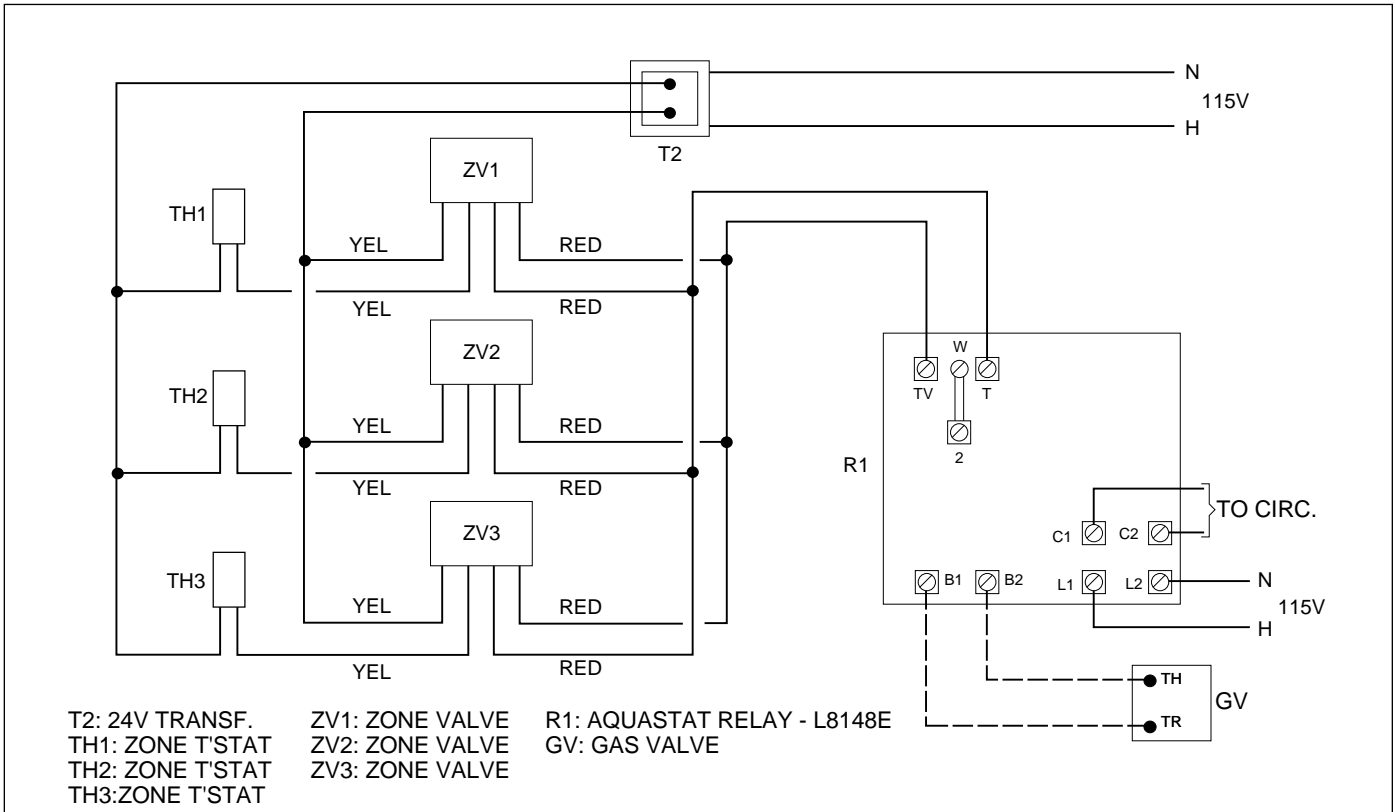
SPILL AND ROLLOUT SWITCHES USED WHEN INPUT IS LESS THAN 300,000 BTUH.

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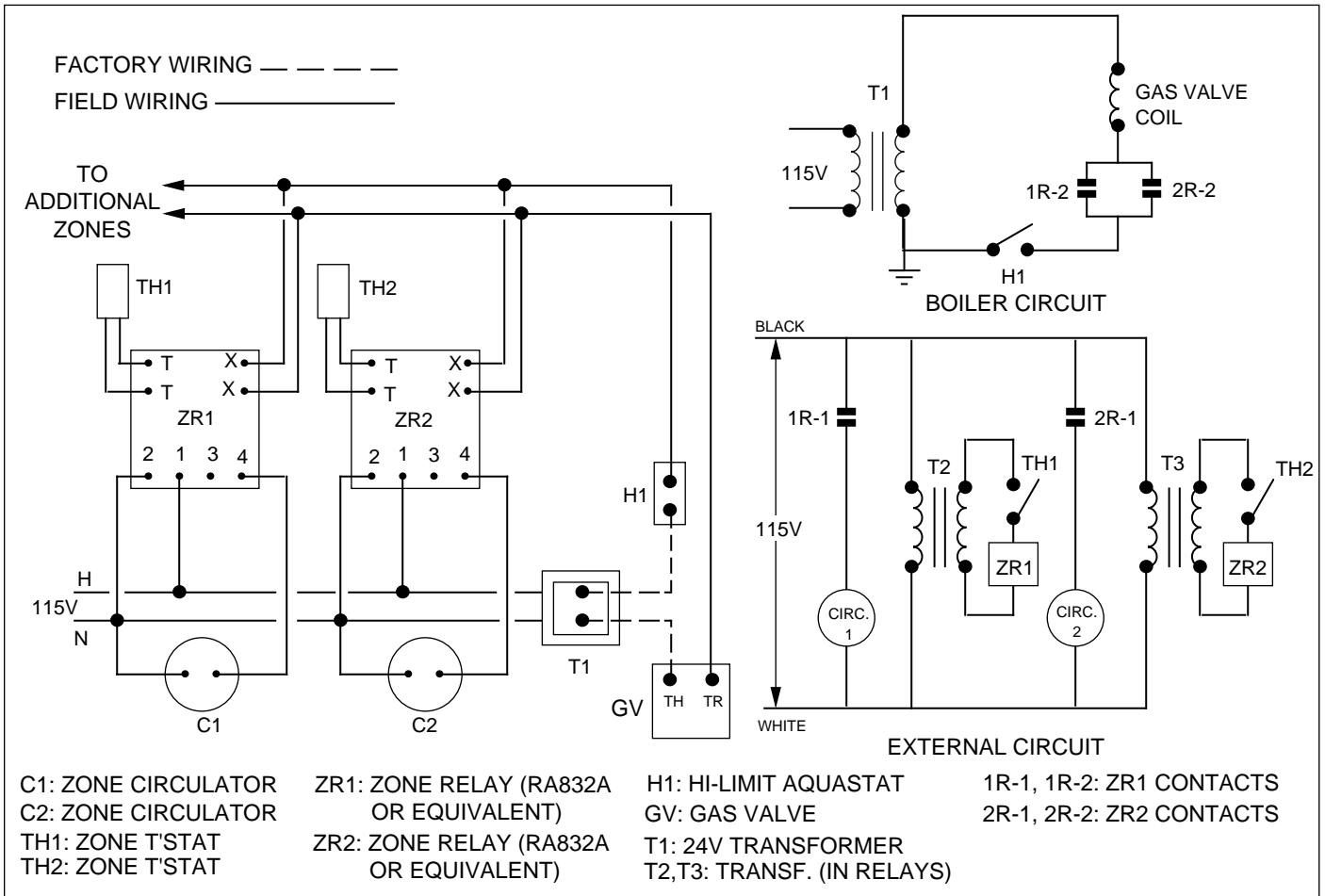
**FIGURE 1.21: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS WITH IID, VENT DAMPER, R8285 CONTROL CENTER & DUAL AQUASTAT L4081A**



**FIGURE 1.22: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS WITH IID, VENT DAMPER, & DUAL AQUASTAT L4081B**



**FIGURE 1.23: WIRING DIAGRAM FOR ZONING WITH ZONE VALVES**

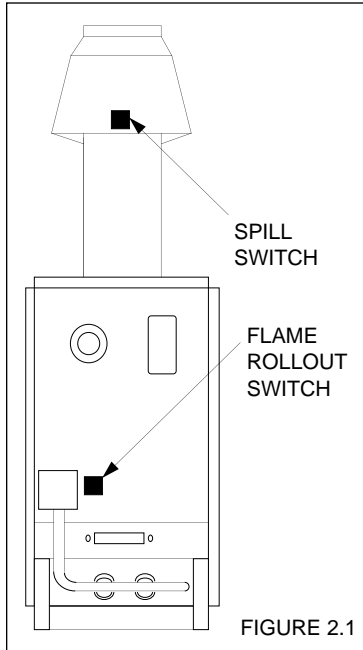


**FIGURE 1.24: WIRING DIAGRAM FOR ZONING WITH CIRCULATORS**

## SECTION 2: START-UP & OPERATION

### Safety Controls

Spill switch (see Figure 2.1) detects the escape of combustion products through the draft hood 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 by inadequate chimney draft. **This is a manual reset-type device and can be reactivated by depressing the spill switch reset button.**



Flame rollout switch (see Figure 2.1) 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 either a single use device, which must be replaced if it is tripped, or a manual reset-type device that can be reset by depressing the reset button. Flue passages must be inspected by a qualified installer if problem occurs, prior to switch being replaced or reset.

**DANGER:** If flame rollout switch or spill switch trips repeatedly during start-up or operation, it indicates a hazardous condition to be corrected immediately.

**WARNING:** If boiler cannot be restored to normal operation after resetting 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.

### 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 Z21.13-1991.

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

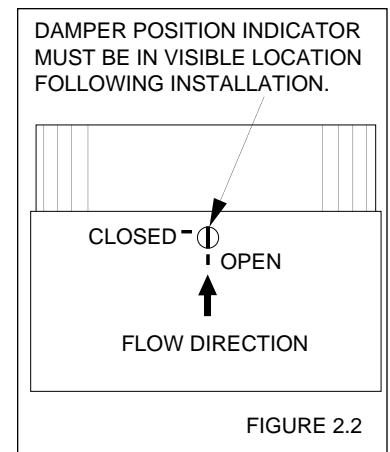
1. Bleed all heating system air vents, starting on lowest floor. Open vents one at a time until water squirts out. Close vent and repeat procedure with remaining vents.

2. Make sure boiler combination gas valve is in OFF position. Then, open main gas shutoff valve, allowing gas to flow to boiler.

3. Set thermostat heat anticipator at .8 amp when thermostat is controlling boiler directly. When zone controlled, set heat anticipator to amp draw of zone valve or circulator pump relay.

4. Set thermostat to call for heat and turn on electrical power to boiler. Observe that vent damper position indicator has rotated to open position (see Figure 2.2).

**Damper must be in open position when boiler main burner is operating. In case of a damper malfunction, the damper blade may be manually placed in the full open position to permit burner operation. To accomplish this, first disconnect electrical power and then separate the vent connector from the damper. Manually (using hand tools if required) rotate the blade until the end switch closes. Reposition and reconnect the vent connector to the boiler before turning on the electrical power.**

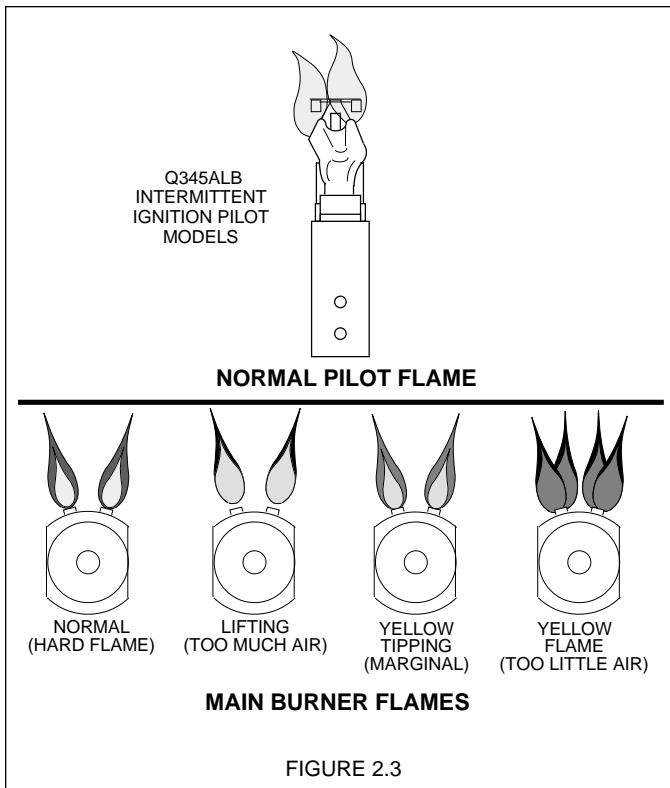


5. Allow circulator to run 15 to 30 minutes, which should purge any leftover air from system. Check automatic air vent for the proper operation and entire system for any leaks. Make sure all air is purged from system before lighting boiler.

6. Set thermostat to no longer call for heat. Observe that damper position indicator rotated to closed position.

7. Set thermostat to lowest setting and light boiler following lighting instructions in Figure 2.4. Boiler is equipped with flame rollout switch to shut down boiler in case of sustained flame roll-out or excessive heat behind front panel. If switch opens, see the information on "Safety Controls" on this page.

8. Observe pilot and main burner flame (see Figure 2.3). All burner ports should be ignited and burn with a steady blue flame.



**WARNING: Never leave the job with yellow burning flames. This condition indicates 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. Failure to comply with this warning can result in severe personal injury or death!**

9. 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 position 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.

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

- a. Make sure that all appliances served by meter are turned off during timing of gas input rate to the boiler.
- b. Measure the time in seconds 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: An HC-120D boiler takes 5 minutes, 6 seconds to use 10 cubic feet of natural gas. Local utility indicated heating value of the natural gas being supplied is 1020 Btu/cu ft. Therefore:

$$6 + (5 \times 60) = 306 \text{ seconds}$$

$$\frac{36,000}{306} \times 1020 = 120,000 \text{ Btu/hr}$$

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.**

11. If boiler input needs to be corrected, adjust the combination gas valve pressure regulator. (Regulator is factory set at 3.5" W.C. for natural gas or 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 .2" W.C. from factory-set pressures. If rated input cannot be obtained with regulator adjustment, gas supply pressure or orifice size may be the cause. Consult your local utility and Hydrotherm.

12. The gas burner orifices supplied with the boiler have been carefully designed to provide the correct gas input rate for most gas conditions typically found in the U.S. Occasionally, however, the local gas characteristics may not allow the unit to be properly adjusted for input. If this is the case, the local utility or Hydrotherm may recommend the orifices be changed. When changing orifices, follow the procedures in Section 3 of this manual.

13. Start and stop boiler several times by raising and lowering the thermostat setting.

14. After the boiler has been firing long enough to raise the boiler water temperature to above the minimum setting of the high limit, check the high limit by turning its setting from maximum to minimum setting. This should turn the boiler off. Return high limit to desired setting.

15. With the boiler firing, disconnect the wire connected to the "PV" terminal on Honeywell S8600 control. Gas valve should close.



## 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.** This appliance is equipped with an ignition device which automatically lights the pilot. Do **NOT** try to light the pilot by hand.

**B. 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.

**C.** Use only your hand to turn the gas control knob. Never use tools. If the knob will not 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.

**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 the control system and any gas control which has been underwater.

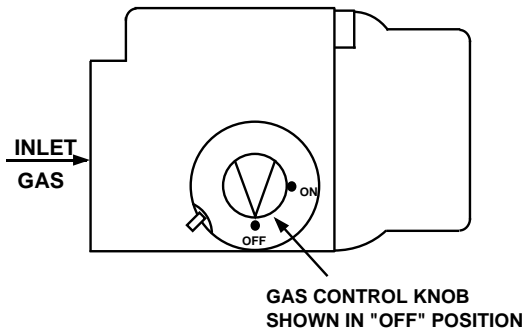
## OPERATING INSTRUCTIONS

### Intermittent Pilot - Honeywell VR8204 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. This appliance is equipped with an ignition device which automatically lights the pilot. Do **NOT** try to light the pilot by hand.
5. Turn gas control knob clockwise ↻ to "OFF". Do not force.
6. Wait five (5) minutes to clear out any gas. Then smell for gas, including near the floor. If you then smell gas, **STOP!** Follow "B" in the safety information above. If you don't smell gas, go to next step.
7. Turn gas control knob counterclockwise ↺ to "ON".
8. Turn on all electric power to the appliance.

9. Set thermostat to desired setting.

10. If the appliance will not operate, follow the instructions "TO Turn Off Gas To Appliance" and call your service technician or gas supplier.



## TO TURN OFF GAS TO 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 clockwise ↻ to "OFF". Do not force.

## SECTION 3: MAINTENANCE

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 boiler or allow dirt/debris to accumulate in area immediately surrounding boiler. Keep boiler area clear and free from combustible materials, gasoline and other flammable vapors and liquids. Do not allow lint, paper or rags to accumulate near burners. Do not place clothing on boiler to dry. Do not obstruct the flow of combustion and ventilation air.**

**NOTE: Boiler is not for use in systems where water is replenished. Do not draw water from system for cleaning. Minerals in water can build up on heat transfer surfaces and cause overheating and subsequent failure of cast iron sections.**

**NOTE: If boiler is equipped with a low water cutoff, follow manufacturer's maintenance instructions.**

### 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.

### FREEZE PROTECTION

Where absolutely necessary, system antifreeze can be utilized. It must be compatible with hydronic heating systems. System must be designed to accommodate necessary changes in heat transfer, pump head, flow rate & expansion. For more information, consult The Hydronics Institute Technical Topics Number 2A publication.

**NOTE: Never use an RV-type antifreeze protection solution nor an automotive-type antifreeze as damage to the boiler and other system components may result.**

### BEFORE EACH HEATING SEASON

1. Remove and inspect draft hood and vent piping (connecting draft hood 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 hood, jacket top and cast iron dome. Using a flash light,

examine all flue passageways.

- a. If passageways are free of soot and obstructions, replace dome and seal with furnace cement or high temperature silicone adhesive/sealant.
  - b. If passageways need cleaning, remove 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 dome and seal with furnace cement or high temperature silicone adhesive/sealant.
  - c. Reinstall jacket top panel and draft hood.
3. Check and clean burner assembly. Remove burner access panel. To remove burners, lift up and to rear until burners are disengaged from orifices. Brush top of burners with soft bristle brush; 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 BURNER WITH 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, test electronic control operation at least once a year. Float type controls should be flushed twice a year.
6. Lubricate circulator motor according to manufacturer's instructions. This information may be contained in labeling on the pump frame.
7. Follow "System Start-Up & Adjustments" procedures in Section 2 of this manual.

## HOW TO CHANGE ORIFICES

1. Shut off power supply and gas supply to the boiler.
2. Remove burner access panel. To remove burners, lift up & 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. The size can also be checked by using a pin gauge (see Figure 3.1). All orifices are screwed into the manifold and may be removed by using a 5/8" wrench or socket.

MODEL	NAT. GAS DRILL SIZE	L.P. GAS DRILL SIZE
HC-65	2.60MM	52
HC-85	32	49
HC-100	37	1.65MM
HC-120	40	1.55MM
HC-145	35	51
HC-165	32	1.85MM

FIGURE 3.1

4. Reverse above procedures to install orifices & burners. BE SURE TO INSTALL BURNERS WITH BURNER PORTS ON TOP SURFACE (UPRIGHT).

## EQUIVALENT ORIFICE SIZES AT HIGH ALTITUDES (INCLUDES 4% INPUT REDUCTION FOR EACH 1,000 FEET)

Model #	Fuel Type	Orifice Qty.	Orifice Size									
			Sea Level	2000 ft.	3000 ft.	4000 ft.	5000 ft.	6000 ft.	7000 ft.	8000 ft.	9000 ft.	10000 ft.
HC-65D,E	NG	2	2.60mm	39	40	41	41	42	42	43	43	44
HC-65D,E	LP	2	52	52	53	53	53	53	53	54	54	54
HC-85D,E	NG	2	32	33	34	35	35	36	36	37	38	40
HC-85D,E	LP	2	49	50	50	50	51	51	51	52	52	52
HC-100D,E	NG	3	37	38	39	39	40	41	42	42	43	43
HC-100D,E	LP	3	1.65mm	52	53	53	53	53	53	54	54	54
HC-120D	NG	4	40	41	42	42	42	43	43	44	44	46
HC-120D	LP	4	1.55mm	54	54	54	54	54	54	55	55	55
HC-125E	NG	4	39	40	41	41	42	42	43	43	44	44
HC-125E	LP	4	1.60mm	1.60mm	53	53	53	53	53	54	54	54
HC-145D,E	NG	4	35	36	36	37	37	38	39	40	41	42
HC-145D,E	LP	4	51	51	52	52	52	52	53	53	53	54
HC-165D,E	NG	4	32	33	34	35	35	36	36	37	38	40
HC-165D,E	LP	4	1.85mm	50	50	50	51	51	51	52	52	52

**NOTE:** For orifice part numbers, see "Orifice Part Numbers" chart on page 24.

## TROUBLESHOOTING

### NO HEAT

1. Blown fuse or circuit breaker.
2. Power switch turned off.
3. IID system malfunction.
4. Vent damper not open.
5. Circulator not running.
6. Air in lines and radiation.
7. Tripped rollout switch.
8. Tripped spill switch.

### INSUFFICIENT HEAT

1. Incorrect t'stat anticipator setting.
2. Hi-limit control setting too low.
3. Boiler undersized or underfired.
4. Insufficient radiation.

### CAUTION:

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

**Verify proper operation after servicing.**

5. Air traps in lines or radiation.

### OVERHEATING

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

### ODOR, EXCESSIVE MOISTURE IN BUILDING

1. Leak in piping.
2. Carbon build-up in flueways.
3. Blocked chimney.
4. Downdrafts- incorrect termination

### YELLOW FLAME, CARBON BUILD-UP

1. Unit overfired.
2. Air shutter misadjustment
3. Wrong orifices.
4. Burning in burner mixing tube.
5. Inadequate combustion air.
6. Inadequate draft (flue blockage).

### NOISE

1. Ignition-incorrect air shutter adjustment
2. Whistle due to burr on orifices.
3. Burner "fluteing" -air shutter opening too wide.

# APPENDIX A

MÉTHODE D' INSTALLATION B: pour le volet motorisé de ventilation.

**DANGER: Le volet de ventilation doit servir seulement à la chaudière. Ne pas l'utiliser pour ventiler d'autres appareils; sinon cela pourrait provoquer un incendie ou causer un empoisonnement par le monoxyde de carbone.**

## 1. Monter le volet de ventilation sur la partie supérieure du coupe-tirage.

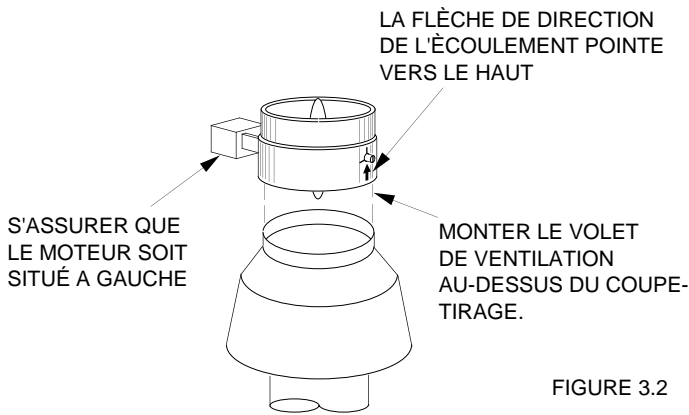


FIGURE 3.2

## 2. Fixer le volet de ventilation au coupe-tirage.

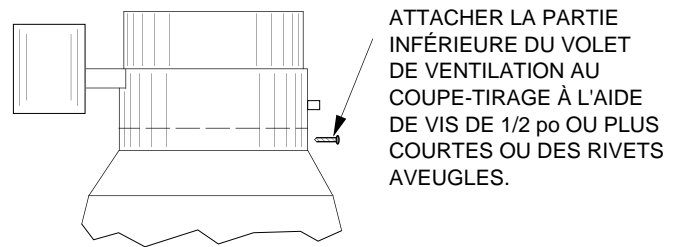


FIGURE 3.3

## 3. Brancher le faisceau de fils.

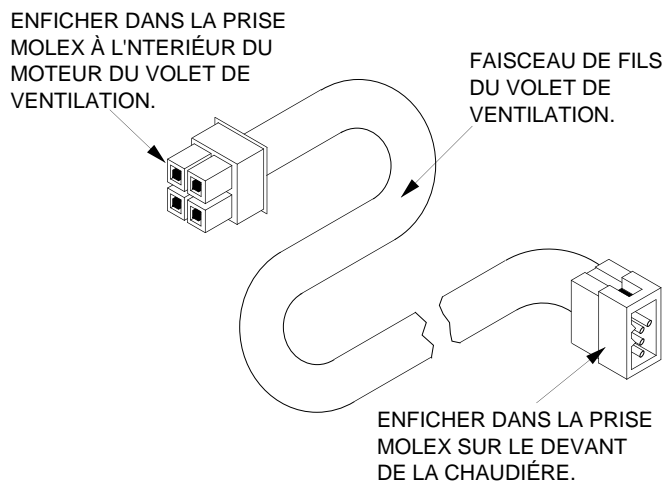


FIGURE 3.4

LE REGISTRE DOIT ÊTRE EN POSITION OUVERTE LORSQUE LE BRÛLEUR PRINCIPAL EST EN MARCHE.

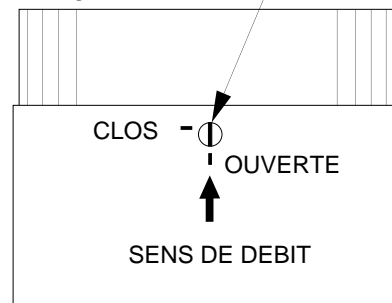


FIGURE 3.5

# HydroTherm®

## MODEL HC-D REPLACEMENT PARTS LIST

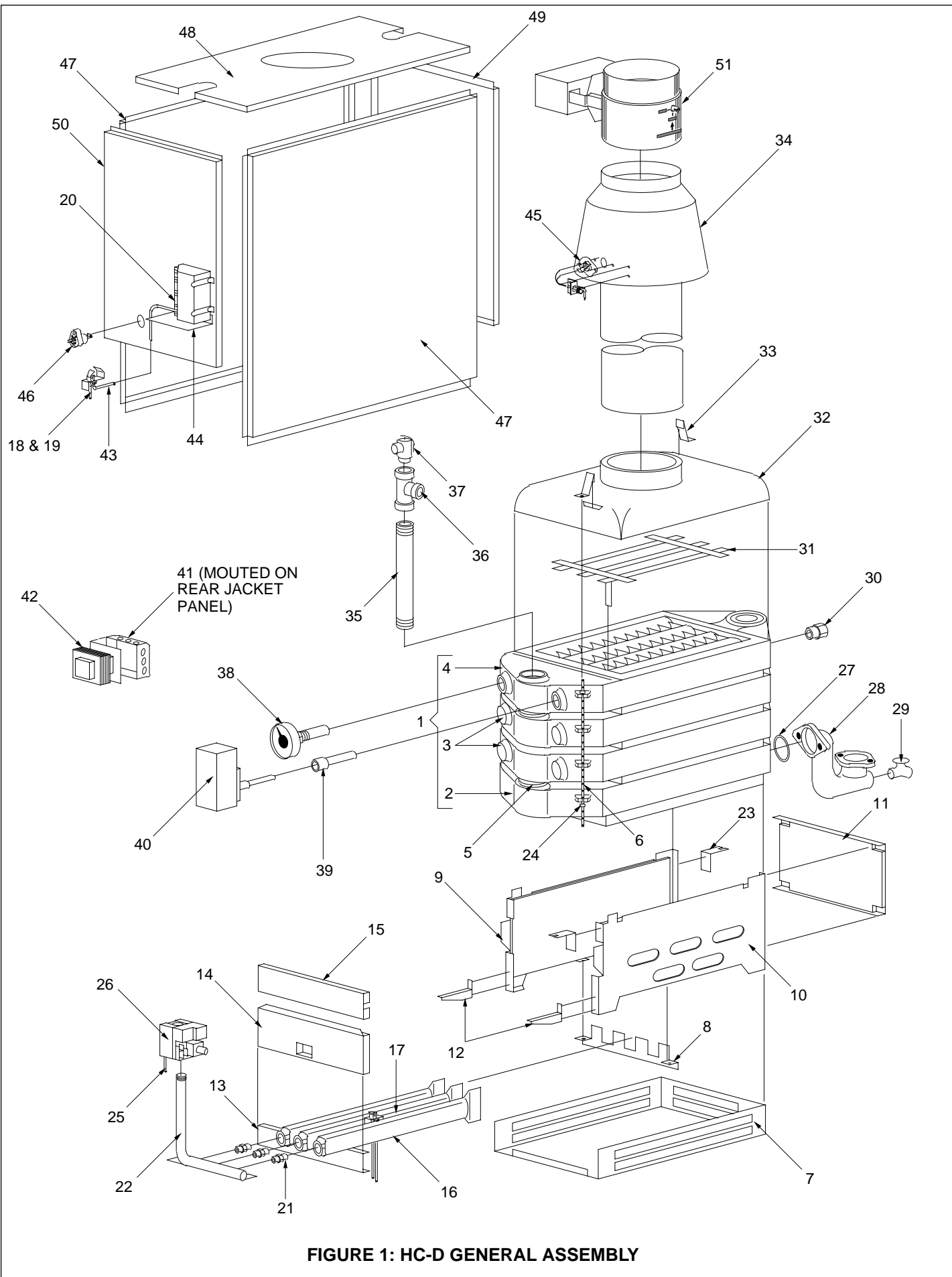
### ORDERING INFORMATION

When ordering replacement parts, provide the model and serial number shown on the unit rating plate as well as the part number and name as shown in the parts list. Parts may be obtained from your local Hydro-therm heating contractor.



REF NO.	NAME OF PART	PART NO.	HC-65D	HC-85D	HC-100D	HC-120D	HC-145D	HC-165D
1	Absorption Unit	BM-3169	1					
	Absorption Unit	BM-3170		1	1	1		
	Absorption Unit	BM-3171					1	
	Absorption Unit	BM-3103						1
2	Section, Bottom	BM-9682						1
	Section, Bottom	BM-9683	1					
	Section, Bottom	BM-9680					1	
	Section, Bottom	BM-9681		1	1	1		
3	Section, Middle	BM-9684		1	1	1	2	2
4	Section, Top	BM-9685	1	1	1	1	1	1
5	Push Nipple - 1 -1/2"	53-1310	1	2	2	2	3	3
6	Tie Rod - 5/16-18X 8 1/2"	44-1108	2					
	Tie Rod - 5/16-18 X 12"	44-1109		2	2	2		
	Tie Rod - 5/16-18 X 15 1/2"	44-1110					2	
	Tie Rod - 5/16-18 X 14"	44-1103						2
7	Base Pan	03-4315	1	1	1	1	1	
	Base Pan	03-4330						1
8	Bracket - Burner	03-7132	1	1		1	1	
	Bracket - Burner	03-7133			1			
	Bracket - Burner	03-7134						1
9	Side Plate, Insulated - L.H.	BM-3320	1					
	Side Plate, Insulated - L.H.	BM-3325		1	1	1	1	
	Side Plate, Insulated - L.H.	BM-3329						1
10	Side Plate, Insulated - R.H.	BM-3321	1					
	Side Plate, Insulated - R.H.	BM-3326		1	1	1	1	
	Side Plate, Insulated - R.H.	BM-3330						1

REF NO.	NAME OF PART	PART NO.	HC-65D	HC-85D	HC-100D	HC-120D	HC-145D	HC-165D
11	Rear Tie Plate, Insulated Rear Tie Plate, Insulated Rear Tie Plate, Insulated	BM-3322 BM-3327 BM-3331	1	1	1	1	1	1
12	Bracket, Manifold - L.H. Bracket, Manifold - R.H.	03-7153 03-7154	1 1	1 1	1 1	1 1	1 1	1 1
13	Front Tie Bar Front Tie Bar	03-7873 03-7874	1 1	1 1	1 1	1 1	1 1	1 1
14	Base Door, Insulated Base Door, Insulated	BM-3324 BM-3332	1 1	1 1	1 1	1 1	1 1	1 1
15	Front Tie Plate, Insulated Front Tie Plate, Insulated	BM-3323 BM-3328	1 1	1 1	1 1	1 1	1 1	1 1
16	Burner	03-7114	1	1	2	3	3	3
17	Burner with Pilot Bracket	03-7118	1	1	1	1	1	1
18	Pilot Igniter Ass'y-NG Q345IB-1103 Pilot Igniter Ass'y-LP Q345ALB	62-3668 BM9613	1 1	1 1	1 1	1 1	1 1	1 1
19	Pilot Orifice-NG (BCR 18) Pilot Orifice-LP (BBR10)	62-3326 62-3327	1 1	1 1	1 1	1 1	1 1	1 1
20	Pilot Control-S8600F, NG Pilot Control-S8600M, LP	BM-8142 BM-8143	1 1	1 1	1 1	1 1	1 1	1 1
21	Burner Orifice 2.60MM (Nat.) Burner Orifice #32 (Nat.) Burner Orifice #35 (Nat.) Burner Orifice #37 (Nat.) Burner Orifice #40 (Nat.) Burner Orifice #49 (Prop.) Burner Orifice #51 (Prop.) Burner Orifice #52 (Prop.) Burner Orifice 1.55MM (Prop.) Burner Orifice 1.65MM (Prop.) Burner Orifice 1.85MM (Prop.)	25-1141 25-1132 25-1126 25-1121 25-1136 25-1127 25-1124 25-1129 25-1138 25-1139 25-1140	2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2	3 3 3 3 3 3 3 3 3 3 3	4 4 4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4 4 4	4 4 4 4 4 4 4 4 4 4 4
22	Manifold Manifold Manifold Manifold	24-1105 24-1106 24-1107 24-1108	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1	1 1 1 1
23	Tie Bracket	55-2603	2	2	2	2	2	2
24	5/16 - 18 Hex. Nut	57-2602	10	10	10	10	10	6
25	Pilot Line with Fittings	BM-3395	1	1	1	1	1	1
26	Gas Valve-24v NG VR8204H1006 Gas Valve-24v LP VR8204H1014	02-1543 02-1546	1 1	1 1	1 1	1 1	1 1	1 1
27	Gasket - Circulator Fitting	59-1000	1	1	1	1	1	1
28	Universal Circulator Fitting	01-3331	1	1	1	1	1	1
29	Drain Valve	51-1201	1	1	1	1	1	1
30	Pipe Plug - 1/2	56-4601	1	1	1	1	1	2
31	Grid Grid Assembly Grid Assembly Grid Assembly Grid Assembly	03-2201 BM-9609 BM-9610 BM-9611 BM-9612	1 1 1 1 1	1 1 1 1 1	1 1 1 1 1	1 1 1 1 1	1 1 1 1 1	1 1 1 1 1
32	Dome - 5" Dome - 7"	01-2100 01-2103	1 1	1 1	1 1	1 1	1 1	1 1
33	Bracket - Dome	55-1404	2	2	2	2	2	2
34	Draft Hood for Spill Switch - 5" Draft Hood for Spill Switch - 7" X 6"	03-8140 03-8142	1 1	1 1	1 1	1 1	1 1	1 1



**FIGURE 1: HC-D GENERAL ASSEMBLY**

REF NO.	NAME OF PART	PART NO.	HC-65D	HC-85D	HC-100D	HC-120D	HC-145D	HC-165D
34	Draft Hood for Spill Switch - 7"	03-8145						1
35	Nipple - 3/4 X 9"	53-1133	1	1	1	1	1	1
36	Vent Fitting	56-5430	1	1	1	1	1	1
37	Pressure Relief Valve	22-1203	1	1	1	1	1	1
38	Temp. - Pressure Indicator	20-1014	1	1	1	1	1	1
39	Well - 1/2"	02-3413	1	1	1	1	1	1
40	Aquastat Relay L8148E	02-2406	1	1	1	1	1	1
	Hi-Limit Aquastat L4080B	02-2700	1	1	1	1	1	1
41	Junction Box - 4" x 4" (24V)	58-1800	1	1	1	1	1	1
42	Transformer - 40VA	26-3001	1	1	1	1	1	1
--	Cope Seal - (5 Ft. needed)	10-6625	2	3	3	3	4	4
44	Heat Shield	03-3129	1					
	Heat Shield	03-3137		1	1	1	1	1
45	Spill Switch (Manual Reset)	58-2526	1		1	1	1	1
	Spill Switch (Manual Reset)	58-2524		1				
46	Rollout Switch (Manual Reset)	58-2527	1	1		1	1	1
	Rollout Switch (Manual Reset)	58-2526			1			
47	Side Panel - Jacket	03-1000.1	2					
	Side Panel - Jacket	03-1007.1		2	2	2		
	Side Panel - Jacket	03-1013.1					2	
	Side Panel - Jacket	03-1017.1						2
48	Top Panel - Jacket	03-1000.2	1	1	1			
	Top Panel - Jacket	03-1004.1				1	1	
	Top Panel - Jacket	03-1018.1						1
49	Rear Panel - Jacket	03-1000.3	1					
	Rear Panel - Jacket	03-1012.2		1	1	1		
	Rear Panel - Jacket	03-1013.3					1	
	Rear Panel - Jacket	03-1017.3						1
50	Front Panel - Jacket	03-1000.4	1					
	Front Panel - Jacket	03-1012.3		1	1	1		
	Front Panel - Jacket	03-1013.4					1	
	Front Panel - Jacket	03-1017.2						1
-	Jacket - Complete	03-1000	1					
	Jacket - Complete	03-1007		1	1			
	Jacket - Complete	BM-9617				1		
	Jacket - Complete	03-1004					1	
	Jacket - Complete	03-1017						1
51	Vent Damper w/ Harness Ass'y.	02-5865	1	1	1			
	Vent Damper w/ Harness Ass'y.	02-5867				1	1	
	Vent Damper w/ Harness Ass'y.	02-5854						1

## ORIFICE PART NUMBERS

ORIFICE SIZE	HYDROTHERM PART NO.	ORIFICE SIZE	HYDROTHERM PART NO.	ORIFICE SIZE	HYDROTHERM PART NO.
32	25-1132	40	25-1136	51	25-1124
33	25-1130	41	25-1135	52	25-1129
34	25-1119	42	25-1111	53	25-1128
35	25-1126	43	25-1112	1.55mm	25-1138
36	25-1120	44	25-1113	1.60mm	25-1142
37	25-1121	46	25-1114	1.65mm	25-1139
38	25-1137	49	25-1127	1.85mm	25-1140
39	25-1125	50	25-1123	2.60mm	25-1141