MODEL R SERIES INSTALLATION, OPERATION & MAINTENANCE MANUAL & REPLACEMENT PARTS LIST

Gas-Fired Water Cast Iron Boilers
180,000 to 300,000 Btuh Input
Standing Pilot, Intermittent Pilot & Vent Damper

SECTION 1: BOILER INSTALLATION
Introduction .......................................................... 2
Step 1: Locating & Setting Boiler ................................ 3
Step 2: Installing/Purging Water Piping ...................... 5
Step 3: Venting Boiler .............................................. 8
Step 4: Installing/Testing Gas Piping ......................... 10
Step 5: Wiring Boiler ............................................... 11

SECTION 2: START-UP & OPERATION
Safety Controls ...................................................... 17
Start-Up & Adjustments ............................................ 17

SECTION 3: MAINTENANCE
Water Treatment ..................................................... 20
Freeze Protection ................................................... 20
Before Each Heating Season .................................... 20
How To Change Orifices .......................................... 21
Troubleshooting .................................................... 21

Appendix A (French Vent Damper Translation) ............ 22
Replacement Parts List ............................................. 23

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 (for model R-300 vent damper is optional).

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.

NOTE: SPILL & ROLLOUT SWITCHES USED ON R-180 THRU R-250.

<table>
<thead>
<tr>
<th>BOILER MODEL</th>
<th>DIMENSIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>R-180C</td>
<td>28-1/4&quot;</td>
</tr>
<tr>
<td>R-210C</td>
<td>28-1/4&quot;</td>
</tr>
<tr>
<td>R-250C</td>
<td>32-1/4&quot;</td>
</tr>
<tr>
<td>R-300B</td>
<td>32-1/4&quot;</td>
</tr>
</tbody>
</table>

*LOCATED IN FRONT ON MODELS R-180C AND R-210C

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:** Adequate fresh air must be provided for combustion. Otherwise, improper boiler operation and inadequate venting of deadly flue gases may result.

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 install-ed 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.).

**WARNING:** Never install boiler on combustible flooring or 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. Install boiler on non-combustible flooring only, unless local codes permit use and fabrication of a recommended fireproof base (see Figure 1.2A).
3. Check that burners and controls are in the proper position.
4. Check proper seating of baffle grid inside of dome opening (see Figure 1.2B).

**PROCEDURE D: Install jacket.**

1. Unpack jacket parts from carton and check that quantity is correct: two side panels, one rear panel, one left top panel and one right top panel (see Figure 1.3).
2. Stand left and right side panels in place and fasten to front panel with screws provided. Fasten side panels to rear panel in same manner.
3. Lock left and right halves of top panel together and fasten to side panels with screws provided.

---

**FIGURE 1.2A**

- 22 GAUGE SHEETMETAL
- 6" OVERHANG OF BLOCK AND SHEETMETAL ALL AROUND
- 4" HOLLOW CLAY TILE (TWO COURSES) OPENINGS THRU BLOCKS IN TOP COURSE TO BE AT 90° ANGLE TO OPENINGS THRU BOTTOM COURSE

**FIGURE 1.2B**

- DOME
- BAFFLE GRID

**FIGURE 1.3**

- LEFT TOP PANEL
- RIGHT TOP PANEL
- REMOVED KNOCK-OUT
- ASSEMBLY SCREW
- REAR PANEL
- LEFT SIDE PANEL
- FRONT PANEL (BOILER MOUNTED)
- RIGHT SIDE PANEL
STEP 2: INSTALLING & PURGING WATER PIPING

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

PROCEDURE A: Install pressure relief valve and relief valve discharge piping. For Model R-300B supply outlet is at rear and relief valve piping 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.

PROCEDURE B: Install supply and return water piping. For Models R-180C & 210C supply outlet is at front of boiler and relief valve piping is at rear 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 ACCESSORIES.
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 1.6). 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 1.7). 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 1.8). 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 1.9).

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.

**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 1.10). 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 means to prevent gravity circulation of the boiler water during the cooling cycle.

**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.


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”.

**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.

NOTE: For boilers equipped with intermittent pilot install plug supplied in damper package into damper vane hole. For standing pilot boilers discard plug. Additional venting and chimney requirements are provided on page 9.

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. R-C boilers are equipped with factory-mounted spill switch harness/mounting bracket as-sembly; 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.

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 1.13](image)

2. Secure damper to draft hood.

![Figure 1.14](image)

3. Check damper operation.

![Figure 1.15](image)

4. Connect wire harness.

![Figure 1.16](image)
**PROCEDURE C: Install flue pipe between vent damper and chimney (6" minimum clearance required between flue pipe and combustibles).**

USE VENT SUPPORT(S) AS REQUIRED TO PREVENT SAGGING

**FIGURE 1.17**

1. Seal all unused openings in common venting system.

2. Visually inspect the venting system for proper size and horizontal pitch and determine if 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 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 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:

**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.

**DANGEROUS:** 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 R-180C 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:

180,000 Btu per hour = 176.4 cu.ft. per hour

1020 Btu per cu.ft.

- Find 20 ft. in upper portion of the table for natural gas under “Length of Pipe, Feet” heading.
- Moving down the column, match required capacity. Higher capacity acceptable. In our case it is 190 cu.ft.
- 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)

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

### 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)

<table>
<thead>
<tr>
<th>Nominal Iron Pipe Size, Inches</th>
<th>Length of Pipe, Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot;</td>
<td>275  189  152  129  114  103  96  89  83  78  69  63</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>567  393  315  267  237  217  196  185  173  162  146  132</td>
</tr>
<tr>
<td>1&quot;</td>
<td>1071 732  590  504  448  409  378  346  322  307  275  252</td>
</tr>
<tr>
<td>1-1/4&quot;</td>
<td>2205 1496 1212 1039  937  834  771  724  677  630  567  511</td>
</tr>
<tr>
<td>1-1/2&quot;</td>
<td>3307 2299 1858 1559 1417 1275 1180 1086 1023  967  866  787</td>
</tr>
<tr>
<td>2&quot;</td>
<td>6221 4331 3465 2992 2646 2394 2205 2047 1921 1811 1606 1498</td>
</tr>
</tbody>
</table>

**FIGURE 1.18**
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.

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 1.20 through 1.28.
OPERATING SEQUENCE
WITH VENT DAMPER, 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 CLOSES (PROVING DAMPER OPEN).
IF NO FAILURE EXISTS, THE PILOT VALVE AND IGNITER
ARE ENERGIZED.
PILOT IS I G N I T E D 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.

FIELD WIRING ------
FACTORY WIRING -------

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

FIGURE 1.20: WIRING DIAGRAM & OPERATION
SEQUENCE FOR BOILERS EQUIPPED WITH
INTERMITTENT PILOT, VENT DAMPER & L8148E
AQUASTAT RELAY
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 closes (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.

FIELD WIRING - FACTORY WIRING

FIGURE 1.21: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS EQUIPPED WITH INTERMITTENT PILOT & VENT DAMPER & HIGH LIMIT AQUASTAT

OPERATING SEQUENCE
FOR PV BOILERS WITH IID, VENT DAMPER AND L4081B DUAL AQUASTAT

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 ignitor are energized.
7. Pilot is ignited and sensor senses flame.
8. Main valve is energized and ignitor de-energized.
9. Unit operates until thermostat (or operating control) is satisfied.
10. System returns to standby with damper closed.

FIELD WIRING - FACTORY WIRING

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

THIS BOILER IS EQUIPPED WITH 24 VOLT CONTROLS. DO NOT CONNECT GAS VALVE TO LINE VOLTAGE.

IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THE BOILER MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE MTW(105°C) WIRE OR ITS EQUIVALENT.

FIGURE 1.23: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS EQUIPPED WITH STANDING PILOT

FIGURE 1.24: WIRING DIAGRAM & OPERATION SEQUENCE FOR BOILERS EQUIPPED WITH STANDING PILOT & L8148E AQUASTAT RELAY
OPERATING SEQUENCE
FOR BoILERS EQUIPPED WITH
HONEYWELL ELECTRONIC PILOT CONTROL

SENSING CIRCUIT IS CONTINUOUSLY MONITORED.
THERMOSTAT (OR OPERATING CONTROL) CALLS FOR HEAT.
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 CONTINUES TO OPERATE UNTIL THERMOSTAT
(OR OPERATING CONTROL) IS SATISFIED.

SPIll AND ROLLouT SWITCHES USED WHEN INPUT IS
LESS THAN 300,000 BTUH

FIGuRE 1.25: WiRRING DIAgram & oPERRATION
SEQUEnCE FOR BoILOERS EQUIPPED
WITh INTERRMITTENT PIoLIT

FIGuRE 1.26: WiRRING DIAgram & oPERRATION
SEQUEnCE FOR BoILOERS EQUIPPED WITH
INTERRMITTENT PIoLIT & L8148E AQUASTAT RELAY

42-5704 REV. 4

42-5705 REV. 3
**FIGURE 1.27: WIRING DIAGRAM FOR ZONING WITH ZONE VALVES**

- **T2**: 24V TRANSF.
- **TH1**: 24V T'STAT.
- **TH2**: 24V T'STAT.
- **TH3**: 24V T'STAT.
- **ZV1**: ZONE VALVE
- **ZV2**: ZONE VALVE
- **ZV3**: ZONE VALVE
- **R1**: AQUASTAT RELAY - L8148E
- **GV**: GAS VALVE

**FACTORY WIRING**

- **TO ADDITIONAL ZONES**

**FIELD WIRING**

- **C1**: ZONE CIRCULATOR
- **C2**: ZONE CIRCULATOR
- **TH1**: ZONE T'STAT
- **TH2**: ZONE T'STAT
- **TH3**: ZONE T'STAT
- **ZR1**: ZONE RELAY (RA832A OR EQUIVALENT)
- **ZR2**: ZONE RELAY (RA832A OR EQUIVALENT)

**FIGURE 1.28: WIRING DIAGRAM FOR ZONING WITH CIRCULATORS**

- **T1**: 24V TRANSFORMER
- **T2, T3**: TRANSF. (IN RELAYS)
- **1R-1, 1R-2**: ZR1 CONTACTS
- **2R-1, 2R-2**: ZR2 CONTACTS
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 a single use device and must be replaced if it is tripped. Flue passages must be inspected by a qualified installer if problem occurs, prior to switch replacement.

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 Figures 2.4, 2.5, 2.6 & 2.7. 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.
used per hour). Multiply this figure by the heating value of the gas to obtain Btu input per hour.

Example: An R-300B boiler takes 2 minutes to use 10 cubic feet of natural gas. Local utility indicated heating value of the natural gas being supplied is 1020 Btu/ft. Therefore:

\[
(2\times60) = 120 \text{ seconds} \\
36,000 \times \frac{1020}{120} = 306,000 \text{ Btu/hr}
\]

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" 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 burners 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. 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.

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, 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.

LIGHTING CONTINUOUS PILOT INSTRUCTIONS

Standing Pilot Honeywell VR8300
Natural or Propane Gas

This appliance has a pilot which must be lit by hand. When lighting the pilot, follow these instructions exactly:

1. STOP! Read the safety information above on this page.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. Remove control access panel (If applicable).
5. Turn 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 then smell gas, STOP! Follow “A” in the safety information above. If you don’t smell gas, go to the next step.
7. Remove the base door covering the top of the burners and enclosing the pilot.
8. Find pilot – Follow metal tube from gas control. The pilot is between the central burner tubes behind the base door.
9. Turn knob on gas control clockwise 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 immediately and 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 the base door.
12. Turn gas control knob counterclockwise to “ON”.
13. Turn on all electric power to the appliance.
14. Set thermostat to desired setting.

OPERATING INSTRUCTIONS

Honeywell VR8300

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. 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” in the safety information above. If you don’t smell gas, go to next step.
8. Turn gas control knob counterclockwise to “ON”.
9. Replace control access panel.
10. Turn on all electric power to the appliance.
11. Set the thermostat to the desired setting.
12. If the appliance will not operate, follow the instructions “To Turn Off Appliance” and call your service technician or gas supplier.
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 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.

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: Do not obstruct the flow of combustion and ventilation air.

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.
4. Reverse above procedures to install orifices & burn-ers. 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

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ORIFICE PART NUMBERS

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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.
5. Air traps in lines or radiation.
6. Overheating
1. Wrong thermostat anticipator setting.
2. Bad thermostat location.
4. Downdrafts- incorrect termination

ODOR, EXCESSIVE MOISTURE IN BUILDING
1. Leak in piping.
2. Carbon build-up in flueways.
4. Downdrafts- incorrect termination

YELLOW FLAME, CARBON BUILD-UP
1. Unit overfired.
2. Air shutter misadjustment
3. Wrong orifices.
5. Inadequate combustion air.
6. Inadequate draft (flue blockage).

NOISE
1. Ignition-incorrect air shutter adjustment.
2. Whistle due to burr on orifices.

CAUTION:
Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and danger-ous operation. Verify proper operation after servicing.
APPENDIX A

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

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.

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

3. Vérifier le fonctionnement du volet de ventilation.

4. Brancher le faisceau de fils.

FIGURE 1.9
FIGURE 1.10
FIGURE 1.11
FIGURE 1.12
FIGURE 2.2
**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 Hydrotherm heating contractor.

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<td>02-1553</td>
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<td>Hi-Limit Aquastat - L4006A</td>
<td>BM-4897</td>
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<td>Hi-Limit Aquastat - L4080B</td>
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<td>Aquastat Relay - R8148E</td>
<td>02-2406</td>
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<td>26</td>
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<td>02-3413</td>
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<td>27</td>
<td>Temp./Press. Indicator (For 50 # R.V.)</td>
<td>20-1014</td>
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<td>Temp./Press. Indicator (For 75/100 # R.V.)</td>
<td>20-1003</td>
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<td>Temp./Press. Indicator (For 100 # R.V.)</td>
<td>20-1011</td>
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<td>Grid Ass'y.</td>
<td>BM-9614</td>
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<td>Grid Ass'y.</td>
<td>BM-9615</td>
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<td>Grid Ass'y.</td>
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<td>30</td>
<td>Dome - 7&quot;</td>
<td>01-2104</td>
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<td>Dome - 7&quot;</td>
<td>01-2106</td>
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<td>Dome - 8&quot;</td>
<td>01-2105</td>
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<td>31</td>
<td>Bracket, Dome</td>
<td>55-3800</td>
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<td>32</td>
<td>Draft Hood for Spill Switch - 7&quot; (R Only)</td>
<td>03-8144</td>
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<td>Draft Hood for Spill Switch - 7&quot; (R Only)</td>
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<td>Draft Hood - 8&quot; (R-300)</td>
<td>03-7609</td>
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<td>33</td>
<td>Nipple - 3/4&quot; X 9&quot;</td>
<td>53-1133</td>
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<td>Nipple - 3/4&quot; X 11&quot;</td>
<td>53-1135</td>
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<td>34</td>
<td>Coupling - 3/4&quot;</td>
<td>56-5001</td>
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<td>35</td>
<td>Press. Relief Valve - 30 PSI</td>
<td>22-1203</td>
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<tr>
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<td>Press. Relief Valve - 50 PSI</td>
<td>22-1200</td>
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<td>Press. Relief Valve - 75 PSI</td>
<td>22-1803</td>
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<td>Press. Relief Valve - 100 PSI</td>
<td>22-1201</td>
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<td>36</td>
<td>Transformer - 115/24V, 20VA</td>
<td>26-3005</td>
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<td>37</td>
<td>Junction Box - 24V</td>
<td>58-1800</td>
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<tr>
<td>38</td>
<td>Side Panel - Jacket</td>
<td>03-1060.1</td>
<td>2</td>
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<tr>
<td>39</td>
<td>Front Panel - Jacket</td>
<td>03-1033</td>
<td>1</td>
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<tr>
<td>40</td>
<td>Rear Panel - Jacket</td>
<td>03-1034</td>
<td>1</td>
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<td>41</td>
<td>Top Panel - L.H. - Jacket</td>
<td>03-1060.4</td>
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<td>Top Panel - R.H. - Jacket</td>
<td>03-1060.6</td>
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<td>- Jacket Assy (Less Front Panel)</td>
<td>03-1032</td>
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<tr>
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<td>- Cope Seal - 5 Ft. Increments</td>
<td>10-6625</td>
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</table>
* THESE ITEMS ARE USED WITH INTERMITTENT PILOT SYSTEMS

FIGURE 1: R GENERAL ASSEMBLY
<table>
<thead>
<tr>
<th>REF NO.</th>
<th>NAME OF PART</th>
<th>PART NO.</th>
<th>&quot;A&quot; BATTERY (2 MODULES)</th>
<th>&quot;B&quot; BATTERY (3 MODULES)</th>
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<tbody>
<tr>
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<td>PART NO.</td>
<td>NO. REQ'D</td>
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<tr>
<td>43</td>
<td>Spill Switch (Manual Reset) (R Only)</td>
<td>58-2526</td>
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<td>44</td>
<td>Rollout Switch (Thermal Fuse) (R Only)</td>
<td>58-2525</td>
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<td>Rollout Switch (Thermal Fuse) (R Only)</td>
<td>58-2538</td>
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**MULTI-TEMP JACKET PARTS LIST**

<table>
<thead>
<tr>
<th>NAME OF PART</th>
<th>&quot;A&quot; BATTERY (2 MODULES)</th>
<th>&quot;B&quot; BATTERY (3 MODULES)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PART NO.</td>
<td>NO. REQ'D</td>
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<tr>
<td>Jacket - Complete</td>
<td>BM-9112</td>
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<tr>
<td>Side Panel</td>
<td>03-1060.1</td>
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<td>Front Panel</td>
<td>03-1060.2</td>
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<td>Rear Panel</td>
<td>03-1060.3</td>
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<td>Top Panel L.H.</td>
<td>03-1060.4</td>
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<tr>
<td>Top Panel - Center</td>
<td>03-1060.5</td>
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<tr>
<td>Top Panel - R.H.</td>
<td>03-1060.6</td>
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<tr>
<td>Stiffening Channel</td>
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**ADDITIONAL COMPONENTS FOR VENT DAMPER**

(For use with intermittent Pilot Only)

<table>
<thead>
<tr>
<th>REF NO.</th>
<th>NAME OF PART</th>
<th>PART NO.</th>
<th>NUMBER REQUIRED PER BOILER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>R-180C</td>
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<tr>
<td>-</td>
<td>Vent Damper 7&quot;</td>
<td>02-5854</td>
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<tr>
<td>-</td>
<td>Vent Damper 8&quot;</td>
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<td>-</td>
<td>Cable Bracket</td>
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</table>

**PARTS FOR HONEYWELL INTERMITTENT PILOT SYSTEM (SEE FIGURE 1)**

<table>
<thead>
<tr>
<th>REF NO.</th>
<th>NUMBER REQUIRED PER BOILER NAME OF PART</th>
<th>PART NO.</th>
<th>NUMBER REQUIRED PER BOILER</th>
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<tbody>
<tr>
<td></td>
<td>R-180C</td>
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<td>R-250C</td>
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<td>46</td>
<td>Transformer - 40VA</td>
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<td>47</td>
<td>Gas Valve-24V Nat. VR8304P 4332</td>
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<td>Gas Valve-24V Prop. VR8304P 4330</td>
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<td>48</td>
<td>Pilot Control - S8600F (Nat.)</td>
<td>BM-8142</td>
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<td>Pilot Control - S86600M (Prop.)</td>
<td>BM-8143</td>
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<td>50</td>
<td>Igniter Sensor - Q3451B-1103</td>
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