

# 95M-200

## GAS-FIRED DIRECT VENT MODULATING HOT WATER BOILER



**⚠ WARNING**

Revise boiler control parameters only if you fully understand the purpose and result of the changes. Tampering without understanding the control settings in this manual will void the warranty and can result in unreliable operation, with possible severe personal injury, death, or substantial property damage.

**⚠ WARNING**

This document must only be used by a qualified heating installer or service technician. Read all instructions, including the Installation Manual (P/N# 240006103), the Parameter Guide (P/N# 240006105), the User's Information Manual (P/N# 240006106), and this Control Manual and Operating Instructions before attempting to program the control, and be sure to perform all steps in the order specified. Failure to comply could result in severe personal injury, death, or substantial property damage.

**IMPORTANT:** Installation must comply with local requirements and with the National Fuel Gas Code, ANSI Z223.1 for U.S. installations or CSA B149.1 or B149.2 for Canadian installations.

**DO NOT DESTROY THESE INSTRUCTIONS!!**

Please read carefully and keep in a safe place for future reference.



# 95-200M GAS FIRED DIRECT VENT MODULATING HOT WATER BOILER

CONTROL MANUAL AND OPERATING INSTRUCTIONS  
Printed in USA • Made In USA

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**Keep this manual near boiler  
and retain for future reference.**

## I - SAFETY SYMBOLS AND WARNINGS

The following defined symbols are used throughout this manual to notify the reader of potential hazards of varying risk levels.



**DANGER**

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



**WARNING**

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



**CAUTION**

Indicates a potential hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

**IMPORTANT:** Read the following instructions completely before installing!!

## II - OPERATING INFORMATION

This boiler is controlled by a microprocessor electronic control that senses outlet water temperature, return water temperature, and outdoor temperature (when a factory supplied, field installed outdoor sensor is installed). This information (plus input from external limit and operating controls) is used to regulate boiler on/off operation and will modulate boiler firing rate to more closely match output to demand.

### ELECTRICAL SPECIFICATIONS

Boilers require 120 vac/60 HZ power supply and are not polarity sensitive.

CONTROL SPECIFICATIONS	
Supply voltage	120 vac/60 hz
Electrical demand	10 va
Prepurge timing	10 seconds
Postpurge timing	15 seconds
Min. off time, space heating	10.2 seconds
Pump on after space htg.	0 minutes
Min. off time, DHW	10.2 seconds
Pump on after DHW	30.6 seconds
Line voltage fuse, F1	5 amp fast-blow
Low voltage fuse, F3	4 amp slow-blow

### BOILER CIRCULATOR

The circulator has sufficient head to handle the boiler pressure drop plus reasonable pressure drop in the connecting piping. See the separate Installation Manual (P/N# 240006103) for piping and flow rate information.

The boiler control's internal relay contact is suitable for handling only the boiler circulator provided. Do not wire additional pumps in parallel with the boiler circulator. To operate a system circulator when the boiler circulator is running, see the section on "Electrical Wiring" in the Installation Manual for wiring required.

### BOILER TEMPERATURE REGULATION

**OPERATING TEMPERATURE (TARGET):** The boiler control senses outlet water temperature and regulates the boiler firing rate to achieve a target temperature, set by installer with Parameter 4. Temperature can be set between 120°F and 194°F.

- **SPACE HEATING:** Target temperature is fixed (equal to Parameter 4) when outdoor reset is not installed or calculated as described under "Outdoor Reset Operation" when outdoor sensor is connected.
- **EXCEPTION:** See explanation of "Supply Temperature Boost."

- **DHW HEATING:** Target temperature is determined by adding Parameter 1 to Parameter 33 (default 150°F and 30°F). Do not change Parameter 1 from the factory default setting of 150°F unless the application is specially engineered for other temperature. DHW heating default setting is 180°F.

High limit operation: If outlet water temperature exceeds target temperature (or 180°F, whichever is lower), high limit action occurs. The control module shuts the burner off showing "b 9" followed by "26" on the display.

DHW operation (if used): The boiler is factory set to immediately change target outlet water temperature to 180°F on a call for heat from the DHW aquastat.

Additional Thermal Overrun Protection: High limit operation shuts down the burner when the outlet water temperature exceeds the target temperature. However, adverse conditions could cause the water temperature to rise too quickly and overshoot this temperature. The boiler control's advanced technology provides protection in the event of thermal overrun. Using its electronics, the control provides two additional levels of overrun protection:

- **LEVEL 1:** Indication would occur if supply water temperature reached 183°F. The control would display a soft lockout code ("b 9" followed by "18" if on the supply or "19" if on the return). The control would not operate the burner again until the water temperature dropped 9°F below target temperature.
- **LEVEL 2:** Lockout would occur if supply water temperature reached 200°F or if the return water reached 193°F. The control would enter hard lockout and display an error code ("E" followed by "18" if on the supply or "19" if on the return).

NOTE: Hard lockout requires manually pressing the display panel reset button to restart operation. Service technician must troubleshoot the cause of the problem and correct it before placing the boiler back in operation.

### LOW WATER PROTECTION

1. This boiler comes factory equipped with a manual reset low water cutoff. In addition, the boiler control uses temperatures sensed at both supply and return areas of the heat exchanger. If the flow rate is too low (temperature difference too high) or either temperature is too high, the control shuts the boiler down. This ensures boiler shut-down in the event of low water or low flow conditions.
2. Some codes and jurisdictions may accept these integral features of the control in lieu of requiring an additional limit control or low water cutoff. Consult your local jurisdiction for more information on low water cutoff requirements.

## II - OPERATING INFORMATION

### FREEZE PROTECTION

Do not install the boiler in a room likely to freeze.

NOTE: The following integral feature of the boiler control provides some protection for the boiler only, not for the system.

The control module provides freeze-up protection as follows when the boiler water temperature drops below 45° F:

- Below 45° F, the boiler circulator operates constantly.
- Below 37° F, the boiler turns on at low fire.
- Boiler and circulator turn off if boiler water temperature rises above 50° F.

### **CAUTION**

This feature of the boiler control does not eliminate the possibility of freezing. The installation must still use recognized design, installation and maintenance practice to prevent freeze potential for the boiler and system.

### SUPPLY TEMPERATURE BOOST

In outdoor reset operation (factory supplied, field installed outdoor sensor connected), the boiler control automatically increases the target outlet water temperature if a call for heat exceeds 10 minutes. At each 10 minutes of a continuous call for heat, the control module increases the target temperature by 18°F. The module will continue increasing target temperature until it reaches the value set in Parameter 4.

When the call for heat ends while target temperature is “boosted,” the target temperature drops about 2°F for each minute the thermostat is open.

**Purpose of “boosting”:** If the target temperature happens to be too low, the control “boosts” the target temperature until the supply water meets the system’s needs.

### OUTDOOR RESET OPERATION (IF USED)

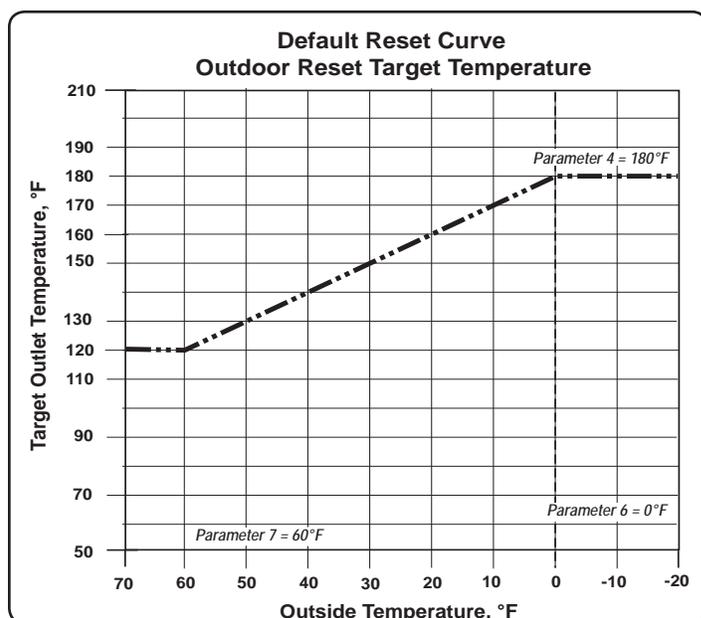
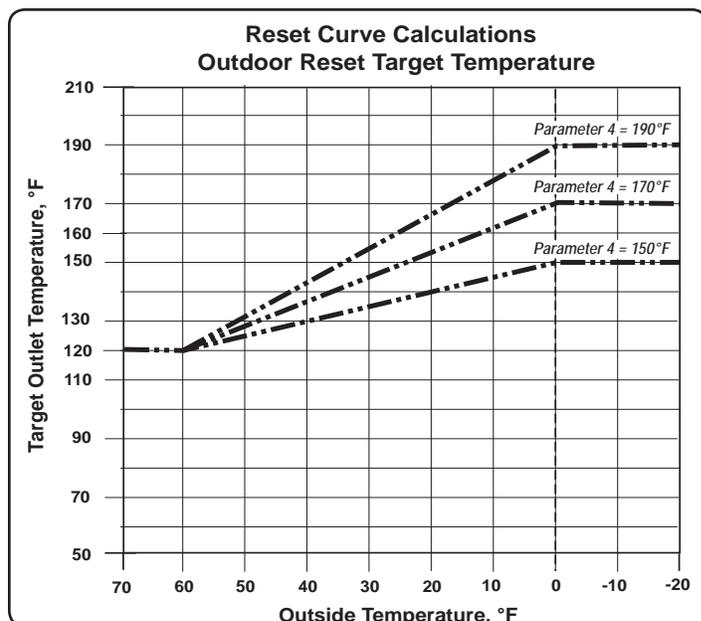
**Target temperature with outdoor reset:** All boilers are shipped with an outdoor temperature sensor. When this sensor is installed (low voltage terminal strip terminals A1 and A2), the boiler control regulates target outlet water temperature based on outside temperature. Set the temperature curve by setting Parameter 4 to:

- ODT (outdoor design temperature for the area).
- For ODT of 0°F or lower, set Parameter 4 to the desired supply temperature at the ODT.
- For ODT above 0°F, set Parameter 4 to the desired system temperature when outdoor temperature is 0°F.

**RESET CURVE:** The graph below shows how the boiler control calculates target temperature.

- For outdoor temperature at or below 0°F, the target temperature equals Parameter 4 and never higher.
- For outdoor temperature above 0°F, the target temperature is reduced on a curve that would result in 60°F supply temperature at 70°F outdoor temperature.

Summer/winter switch option: Install a summer/winter switch, if desired, to disable the boiler (space heating) circulator during non-heating months. Connect switch across the outdoor sensor terminals. When switch closes, the boiler circulator is disabled and the boiler operates only on call for DHW heating.



## II - OPERATING INFORMATION

### DHW OPERATION (IF USED)

The boiler control allows connection of a DHW aquastat to low voltage terminal strip terminals DHW T1 and DHW T2. When the DHW aquastat calls for heat, the module shuts down the boiler circulator activated the DHW circulator and

immediately sets target outlet water temperature to 180°F. This provides automatic priority heat allocation to the indirect water heater for maximum response and recovery. The DHW circulator continues for 30.6 seconds after the heating cycle to deliver the most possible heat.

## III - MODULATING CONTROL FEATURES

### BOILER CONTROL DESIGN

The integrated modulating boiler control is designed for central heating (CH) hot water boilers with modulating fan and gas-air control. Options for domestic hot water (DHW) and outdoor reset are available. Modulation is based upon data relayed to the control by specific temperature sensors. To ignite the burner, a direct spark igniter (DSI) is used.

The modulating boiler control is intended for use in combination with a display/user interface unit for both information and operation purposes. The control is designed for installation with a conventional on/off dry contact room thermostat. The control is able to provide hot water and outdoor reset functions.

### MAIN CONTROLLER FUNCTIONS

**Central Heat (CH):** The control uses sensors on the supply water, return water and outside air to determine the heat load of the heating system. This results in the boiler supplying just enough heat to satisfy the demand which results in fewer

overshoots and less short cycling than a conventional on/off boiler.

**Domestic Hot Water (DHW):** When used in conjunction with an indirect hot water heater this boiler has the capability to provide domestic hot water. An on/off dry contact aquastat is used to activate the call for domestic hot water.

**Outdoor Reset:** This control has the ability to sense outside air temperature using a factory supplied, field installed sensor. The controller detects the presence of the sensor and acts according to the parameters programmed into the controller.

### DISPLAY/USER INTERFACE

By means of the display/user interface, the installer and home owner can scroll through the control settings and customize the boiler to the heat delivery system used in the location of installation. See the "User Interface Quick Reference" in Section X of this manual for more information on using and programming the boiler control.

## IV - BOILER STARTUP

### STARTUP

NOTE: Instructions in this manual are based on factory default parameter settings.

1. Start the boiler only after completing all instructions in the Installation Manual.
2. To start the boiler, follow the "Operating Instructions" in this manual.
3. Once the boiler has started and is operating, continue the startup procedure by performing all of the following steps to set and verify operation of the controls.

### SET SPACE HEATING OPERATION

#### 1. VERIFY SPACE HEATING MODE

- A. Press the "Mode" button until the display shows [PARA]. This is the parameter mode.

- B. Press the "Step" button until the first digit of the display shows "3."
- C. The last digit must show a "1." If any other number displays, press the "+" button until a "1" shows in the right-hand digit, then press the "Store" button to save this setting.

#### 2. SET SPACE HEATING TARGET TEMPERATURE

- A. Press the "Step" button until the first digit of the display shows "4." The last three digits will show the outlet water temperature setting.
- B. Press the "+" or "-" buttons to change the setting to the desired outlet water temperature. The factory default setting is 180°F.
  - **OUTDOOR SENSOR INSTALLED:** Setting is the target temperature for outdoor temperature at or below the factory setting (32°F). At higher outside temperatures, the control module calculates the target temperature.

## IV - BOILER STARTUP

- When a summer/winter switch is used, closing the switch will disable the boiler (space heating) circulator during summer operation.
- **OUTDOOR SENSOR NOT INSTALLED:** Setting is the target temperature at all times.

C. Press the “Store” button to save the setting.

### CHECK DHW OPERATION SETUP

NOTE: If the control is already in parameter mode, skip step 1 (below) and proceed to step 2.

1. Press the “Mode” button until the display shows **[PARA]** (parameter mode).
2. Press the “Step” button until the first digit of the display shows a “2.”
3. The last digit must show a “1.” If any other number displays, press the “+” button until a “1” shows in the right-hand digit, then press the “Store” button to save this setting.
4. The control module turns on the DHW circulator when the indirect water heater operating control closes. The control module shuts off the boiler circulator (stops space heating) during calls for DHW heating.

### VERIFY OPERATION – SPACE HEATING

NOTE: Information below presented in brackets “[ ]” represents the actual display on the boiler control panel with the first digit indicating boiler status and the last three digits showing the measured boiler water temperature. (Ex.- [A180] indicates a status of “A” and a boiler water temperature of 180°F.)

1. Turn down DHW aquastat on DHW tank (if used). If necessary, turn off power and remove one of the DHW aquastat wires to ensure boiler will not receive a DHW heat call.
2. Turn off power to boiler at service switch.
3. Wait a few seconds, then turn on power to boiler.
  - **[180]** Self-check on power-up for a few seconds.
  - **[0180]** No call for heat.
4. Raise room thermostat to call for heat.
  - **[5180]** Blower/boiler circulator on. Blower and boiler circulator energize and control checks for air flow.
  - **[1180]** Prepurge. Blower speed will increase to ignition speed. The blower will run in prepurge for 10 seconds.

- **[2180]** Ignition. After prepurge, the control module opens the gas valve and starts ignition spark.
  - If burner flame proves within 4.5 seconds, burner continues to fire. Burner will fire at startup rate for about 10 seconds to allow flame to stabilize.
  - If burner flame does not prove within 4.5 seconds, control module attempts ignition sequence again. Flame must prove within 6 attempts or control will lockout (display will show **[E 02]**).
  - Verify flame failure operation by closing boiler manual gas cock to prevent gas flow. Open manual gas valve after testing.
  - **[3180]** Burner on, space heating. Once flame is proven and stable, the burner turns down to low fire for approximately 2 minutes.
  - After this low fire period, the burner is allowed to modulate. Firing rate depends on actual outlet water temperature versus target temperature.
5. Allow boiler to bring water temperature to target temperature.
    - **[6180]** Target temperature reached. The burner will shut down. The blower will run in postpurge (see below), then turn off. Boiler circulator continues to run as long as there is a call for heat.
  6. Lower room thermostat to stop call for heat.
    - **[1180]** Postpurge. When room thermostat is satisfied (call for heat ended), burner turns off. Blower will continue for 15-second postpurge, then turn off. If another call for heat occurs, boiler will remain off for ten seconds before starting again, and the display will show **[6180]**.
    - **[0180]** No call for heat. Boiler is now in standby mode (waiting for heat call).
  7. Repeat steps 1-6 several times to verify operation.
  8. Return the room thermostat to normal setting.

### VERIFY OPERATION – DHW

1. If necessary, reconnect DHW aquastat wiring to boiler.
2. Turn off power to boiler at service switch.
3. Wait a few seconds, then turn on power to boiler.
  - **[A150]** Self-check on power-up for a few seconds.
  - **[0150]** No call for heat.

## IV - BOILER STARTUP

4. Raise DHW aquastat above tank temperature to call for heat.
  - **[5150]** Blower/DHW circulator on. Blower and DHW circulator energize and control checks for air flow.
  - **[1150]** Prepurge. Blower speed will increase to ignition speed. The blower will run in prepurge for 10 seconds.
  - **[2150]** Ignition. After prepurge, the control module opens the gas valve and starts ignition spark.
  - If burner flame proves within 4.5 seconds, burner continues to fire. Burner will fire at startup rate for about 10 seconds to allow flame to stabilize.
  - If burner flame does not prove within 4.5 seconds, control module attempts ignition sequence again. Flame must prove within 5 attempts or control will lockout (display will show **[E 02]**).
  - Verify flame failure operation by closing boiler manual gas valve to prevent gas flow. Open gas valve after testing.
  - **[4150]** Burner on, DHW. Once flame is proven and stable, the burner is allowed to modulate. Firing rate depends on actual outlet water temperature versus target temperature.
5. Allow boiler to bring water temperature to target temperature.
  - **[6150]** Target temperature reached. The burner will shut down. The blower will run in postpurge (see below), then turn off. DHW circulator continues to run as long as there is a call for DHW heating.
6. Lower DHW aquastat to stop call for heat.
  - **[1150]** Postpurge. When room thermostat is satisfied (call for heat ended), burner turns off. Blower will continue for 15 second postpurge, then turn off. If another DHW heat call occurs, boiler will begin heating cycle after 10 second delay. If a CH call for heat occurs after a DHW demand, the heating cycle will begin after a 30 second delay.
  - **[8150]** DHW circulator run-on. The DHW circulator continues to run for 30 seconds.
  - **[0150]** No call for heat. Boiler is now in standby mode (waiting for heat call).
7. Repeat steps 1-6 several times to verify operation.
8. Return the DHW aquastat to normal setting.

### OPERATING INFORMATION

1. To check operating conditions (Ex.- actual or target temperature), see “*User Interface Quick Reference*” in Section X of this manual for an explanation of the boiler control’s “Information” mode.
2. During normal operation (no shutdown or lockout), the right 3 display digits show actual boiler outlet water temperature.

### PERFORM CHECK-OUT PROCEDURES

Complete the “Checkout Procedures and Adjustments” as indicated in Section VI of this manual.



**Replace boiler front jacket panel after performing any service to the boiler.**

## V - CHECKOUT PROCEDURES AND ADJUSTMENTS

### VERIFY SEQUENCE OF OPERATION

A detailed sequence of operation containing potential faults can be found in Sections VII, "Detailed Sequence of Operation." Refer to this section and Section XVIII, "Service Hints," for more information.

### INSPECT VENTING AND AIR INTAKE

Operate the boiler and verify that all vent/air intake connections are gastight and watertight. Repair any leaks immediately.

### INSPECT CONDENSATE DRAIN AND SYSTEM PIPING

Verify that condensate flows freely and all connections are watertight. Repair any leaks immediately.

### TEST IGNITION SYSTEM SAFETY SHUTOFF DEVICE

1. Remove front panel from appliance.
2. Turn off manual gas ball valve.
3. Set thermostat for a call for heat.
4. Boiler begins normal sequence of operation.
5. After approximately 30 seconds of pre-purge the appliance will attempt to light.
6. After 4 seconds the gas valve closes and the control retries 5 time, before entering lockout mode.
7. To reset the control, follow the instructions in Section IV of this manual, "Putting The Boiler In Operation."
8. Return thermostat to previous setting.

### TEST AND ADJUST HIGH LIMIT CONTROL

While burner is operating, adjust setting on high limit control below actual boiler water temperature. Burner should go off while circulator continues to operate. Raise limit setting above boiler water temperature and burner should reignite after pre purge and igniter warm-up period. Set the high limit control to at least 10°F above parameter 4 setting as described in the separate "Parameter Guide" (P/N# 240006105). Maximum high limit setting is 200°F. Minimum high limit setting is 100°F.

### TEST LOW WATER CUT OFF

1. Disconnect the wire from the LWCO sensor probe.
2. Set thermostat for call for heat.
3. Boiler should not begin normal sequence of operation.
4. Attach wire to the sensor probe.
5. Return thermostat to previous setting.

### TEST OTHER FIELD INSTALLED SAFETY CONTROLS (IF USED)

If the boiler is equipped with any additional safety controls, test for operation as outlined by the control manufacturer. Burner should be operating and should go off when controls are tested. When safety controls are restored, burner should reignite.

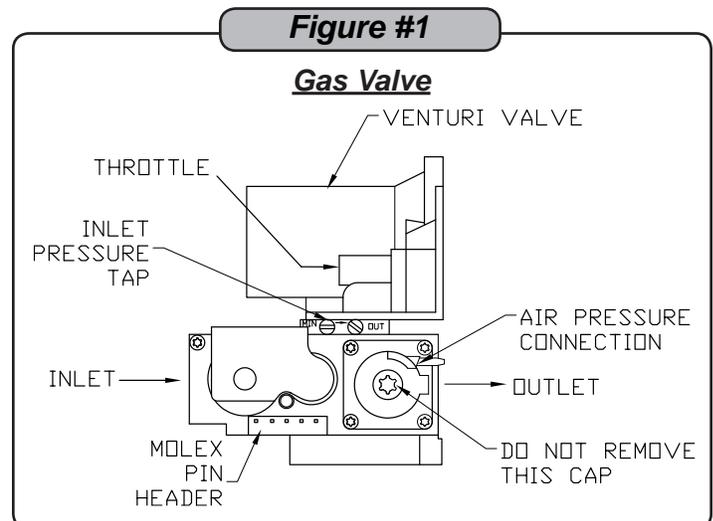
### SET FIELD INSTALLED THERMOSTAT HEAT ANTICIPATOR (IF USED)

For a single thermostat connected to the T-T screw terminals on the low voltage terminal strip on the control board of the boiler, the heat anticipator should be set at 0.1 amps. For other wiring configurations, refer to the instructions provided by the thermostat manufacturer regarding heat anticipator adjustment. Cycle boiler with thermostat. Raise the thermostat to the highest setting and verify boiler goes through normal start up cycle. Lower thermostat to lowest setting and verify boiler goes off.

### BOILER ADJUSTMENT

**NOTE:** It is important that this appliance operate as specified in the table below. The following steps can be used to verify that the appliance is operating in this range.

1. Check incoming gas pressure to the appliance using a pressure gauge with a resolution of 0.1" w.c. or better and a range from 0" to at least 14" w.c. Close the gas shutoff inside the boiler jacket. Locate the inlet pressure tap on the gas valve (see **Figure 1**) and open the inlet pressure tap screw ½ turn. Connect the positive side of the gauge to the inlet pressure tap, then open the gas shutoff. The gas pressure at high fire should read between 4" and 10" w.c. for natural gas and between 10" and 14" w.c. for LP gas.



## V - CHECKOUT PROCEDURES AND ADJUSTMENTS

2. Drill a ½" hole in the plastic CPVC vent pipe or exhaust tee, just large enough to allow access for the sample probe of your combustion analyzer.
3. Turn the thermostat to the closed position so the appliance is activated.
4. Set appliance to high fire mode as described in the "User Interface Quick Reference" section of this manual and allow it to run for approximately 5 minutes.
5. Insert the sample probe of your combustion analyzer into the hole you drilled in Step 2 about halfway into the exhaust gas stream. Take a flue gas reading and observe the % CO<sub>2</sub> and CO values. Adjust the throttle screw until the correct readings are reached. Turning the throttle screw clockwise decreases the rate and the CO<sub>2</sub> value. Turning the throttle screw counter clockwise increases the rate and the CO<sub>2</sub> value. Allow the appliance to stabilize for approximately one minute after adjusting the throttle screw before you take a reading with your combustion analyzer.
4. Operate boiler for 5 minutes.
5. Turn off all other gas appliances, extinguishing standing pilots where applicable.
6. At the gas meter, measure the time in seconds required to use one cubic foot of gas.

**NOTE:** Boiler must be in high fire mode for this operation. See the "User Interface Quick Reference" in this manual for more information on putting the boiler in high fire mode.

7. Calculate the BTUH Input Rate as follows:

$$\text{Btuh input rate} = \frac{3600 \times \text{heating value from Step 3}}{16 \pm 2 \text{ seconds}}$$

8. The measured input rate will vary with vent length, gas calorific content, altitude and ambient temperature. The boiler should be set up with the combustion specifications in the "Boiler Adjustment" section.

**IMPORTANT:** Under all conditions CO levels should not exceed 80 ppm.

6. Set appliance to low fire mode as described in the "User Interface Quick Reference" section of this manual and check CO<sub>2</sub> level as stated in Step 5. Low fire and high fire values should be approximately the same.
7. After adjustments are made stop the appliance, disconnect the pressure gauge, tighten the inlet pressure tap on the gas valve, remove the CO<sub>2</sub> meter from the CPVC pipe, and seal the hole with a ¼" NPT black iron plug. Use thread sealing compound or teflon tape to ensure a proper seal.
8. Return the thermostat switch to its original position.

**Installers:** Complete and sign the "Installation and Checkout Certificate" on the last page of this manual.

### MEASURE THE NATURAL GAS INPUT RATE

Correct input rate is essential for proper and efficient operation of the burner and boiler.

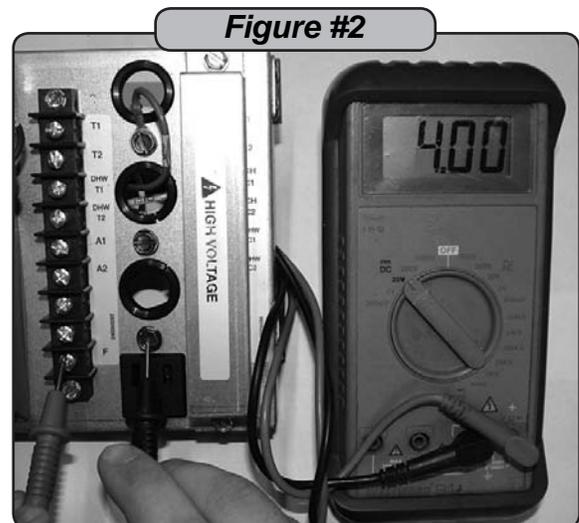
1. Determine the elevation at the installation site.
2. See Table 2 in Section IV of the separate "Installation Manual" (P/N# 240006103) to determine the correct approximate input rate for the local elevation.
3. Obtain the yearly average heating value of the local gas utility. At sea level elevation, it should be approximately 1000 BTU per standard cubic foot.

### DETERMINE LP GAS INPUT RATE

LP gas input rate is determined by measuring the CO<sub>2</sub> produced during combustion. This value should be set according to the guidelines table on the following page.

### MEASURE FLAME SENSE

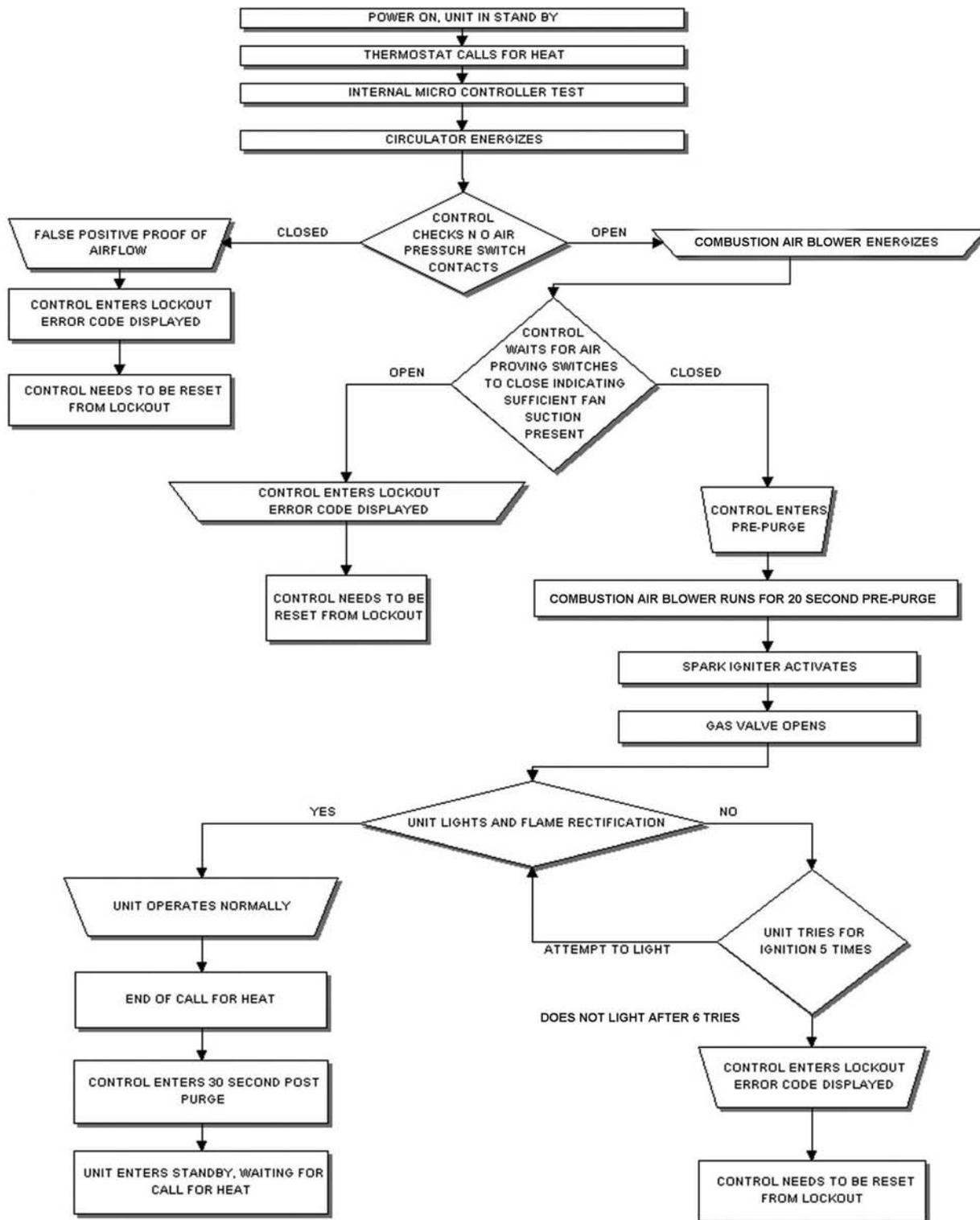
Flame sense can be an indicator of issues with air intake venting, exhaust venting, burner and ignitor condition and supply gas piping pressure. Using a multimeter capable of reading 0-20 VDC, attach one lead to the "F" terminal on the low voltage terminal block on the boiler control, and the other to any ground surface on the boiler. See Figure #2. The flame sense voltage must be in accordance with the values listed in the Flame Signal Guidelines chart later in this manual.



## V - CHECKOUT PROCEDURES AND ADJUSTMENTS

Pressure Guidelines						
Fan Speed	<b>Minimum RPM</b>			<b>Maximum RPM</b>		
Fuel	Natural Gas	LP	Natural Gas	LP		
Gas Line Inlet Pressure	N/A	N/A	At least 4" WC	At least 10" WC		
Differential Pressure	0.3" WC			2.0" WC		
<p><i>Note: Differential pressure values listed for comparison only. These values will change with vent length and altitude of installation.</i></p>						
Combustion Guidelines						
Outside	<b>Natural Gas</b>			<b>LP Gas</b>		
Temperature	<b>%CO<sub>2</sub></b>	<b>%O<sub>2</sub></b>	<b>CO</b>	<b>%CO<sub>2</sub></b>	<b>%O<sub>2</sub></b>	<b>CO</b>
70°F and up 21°C and up	9.6% to 10%	3.9% to 3.2%	Less than 80 PPM	11.1% to 11.5%	4.1% to 3.4%	Less than 80 PPM
30°F to 70°F -1°C to 21°C	9.3% to 9.6%	4.4% to 3.9%	Less than 80 PPM	10.8% to 11.1%	4.5% to 4.1%	Less than 80 PPM
30°F and below -1°C and below	9.0% to 9.3%	5.0% to 4.4%	Less than 80 PPM	10.5% to 10.8%	4.9% to 4.5%	Less than 80 PPM
Flame Signal Guidelines						
Fan Speed	<b>Minimum RPM</b>			<b>Maximum RPM</b>		
Flame Signal	Greater than 3.0 VDC			N/A		

## VI - DETAILED SEQUENCE OF OPERATION



## VII- SERVICE HINTS

### WARNING

**Do not attempt to modify the characteristics of this boiler in any way!! Fire, explosion, or risk of shock hazard may cause property damage, severe injury, or death.**

### IMPORTANT

1. If any component does not function properly, make sure it is correctly installed and wired before replacing it.
2. Static electricity discharge can damage the integrated modulating boiler control (IMBC). Touch metal surface to discharge static electricity before touching control.
3. The boiler control cannot be repaired. **If it malfunctions it must be replaced.**
4. Only trained, experienced service technicians should service the boiler control systems. After troubleshooting, follow the “*Detailed Sequence of Operation*” in this manual for a normal light off procedure.
5. All controls are factory tested in the assembly process and a defective control is generally the least likely cause. If you suspect you have a defective boiler control, read through the “*Troubleshooting*” section of this manual before you replace it.
6. It is extremely unlikely that the two consecutive controls are defective. If it seems to be happening, chances are that either there is nothing wrong with the control or it is being damaged by some other problem (for example, an electrical short burning out a transformer).

### TROUBLESHOOTING TOOLS

Have the following tools available prior to troubleshooting your boiler:

- Voltmeter that can check 120 VAC, 24 VAC, and 12 VDC
- Continuity Tester
- Contact Thermometer
- Inclined Manometer or Pressure Gauge with 0-6.0” range (0.01” scale) for measuring suction pressures at pressure switch
- U-Tube Manometer or Differential Pressure Gauge with 0-14” range (0.1” scale) for measuring inlet and manifold gas pressures

### INITIAL SERVICE CHECKS

Prior to troubleshooting:

1. Make sure that circuit breaker is on or fuse is okay at electrical panel.
2. Make sure that service switch is on.
3. Check for 120 VAC (minimum 102 VAC to maximum 132 VAC) to boiler.
4. Make sure thermostat is calling for heat and contacts (including appropriate zone controls) are closed. Check for 24 VAC between thermostat wire nuts and ground.
5. Make sure all external limit controls are either installed (and closed) or temporarily jumpered for testing.
6. Make sure that gas is on at the gas meter, at all appropriate manual shutoff valves, and at the gas control valve. Gas pressures should be a maximum of 10” w.c. (natural gas) or 14” w.c. (for LP gas) with no flow (lockup) or with boiler on and a minimum of 5” w.c. with gas flowing (verify during boiler startup with boiler at high fire).
7. Check that wire connectors at the boiler control and at the originating control are securely plugged in or connected.
8. Check that all hoses are securely connected and are not plugged in or damaged.

## VIII - TROUBLESHOOTING

### ⚠ WARNING

Electrical shock may cause serious injury or death. The following procedures may expose you to dangerous line voltage so use caution to avoid touching live electrical contacts. All service must be performed by a trained, experienced service technician.

### ⚠ WARNING

Should overheating occur or the gas supply fail to shut off, do **not** turn off or disconnect the electrical supply to the pump. Instead, shut off the gas at a location external to the appliance

Do not use the boiler if any part of the gas control system has been underwater. A qualified service technician should inspect the boiler and replace any part of the control system and any gas control which has been underwater.

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. Force or attempted repair may result in a fire or explosion.

### ⚠ CAUTION

#### WHAT TO DO IF YOU SMELL GAS

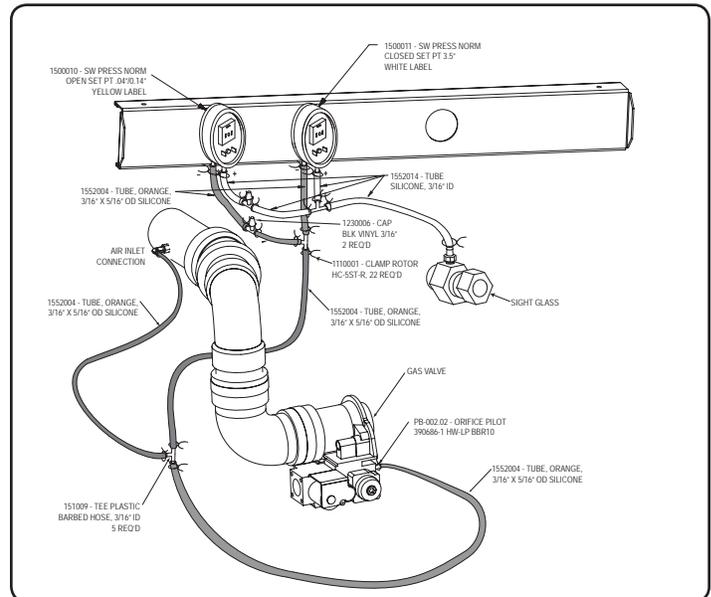
- Do not try to light any appliance.
- Do not use any electrical appliance.
- Do not touch any electrical switches; do not use any phones in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you cannot reach your gas supplier, call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

### DIFFERENTIAL AIR PRESSURE

The differential air pressure switch is a safety device which will prevent the boiler from firing if there is an air intake, boiler heat exchanger or vent blockage.

To check the differential air pressure:

1. Turn off service switch or lower thermostat setting.
2. Remove vinyl caps from tee.
3. Install testing lines as shown to inclined manometer or differential pressure gauge with the ability to read 0.01" increments to at least 6.0" w.c.
4. Turn on service switch and set thermostat to call for heat.



Boiler Status	Diff. Pressure	Switch Contacts	
Not Running	0"	3.5"	Closed
		0.14"	Open
Running with Blockage	Greater Than or Equal To Setpoints	3.5"	Open
		0.14"	Closed
Running w/out Blockage (approx.)	Min. Fire: 0.3" Max. Fire: 2"	3.5"	Closed
		0.14"	Closed

If manometer readings do not correspond to the chart above, check for possible causes:

- Blockage or moisture in suction lines to switch.
- Blockage in air intake or vent pipes.
- Undersized air intake or vent pipes.
- Loose blower wheel on motor shaft.
- Incorrect pressure switch or pressure switch setpoint

When pressure reading is proper and the pressure switch is operating properly, remove testing lines and reinstall vinyl caps to Tee and 3-way connector.

## VIII - TROUBLESHOOTING

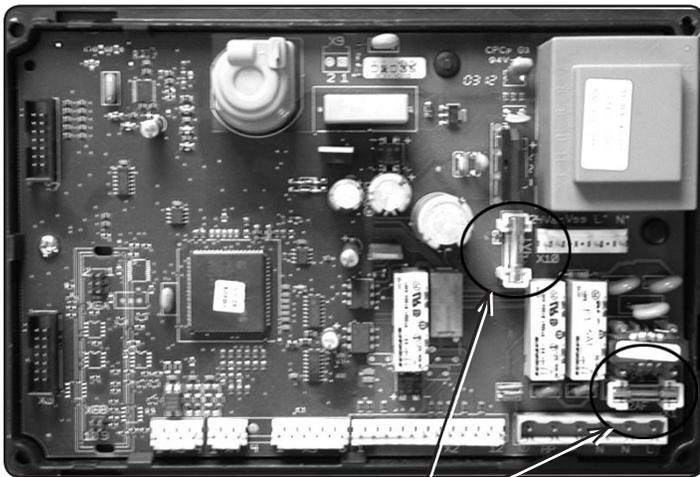
### ⚠ WARNING

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Always disconnect power to boiler before servicing. Failure to comply could result in severe personal injury, death or substantial property damage. Never jumper (bypass) any device except for momentary testing as outlined on the following pages of this manual. Severe personal injury, death or substantial property damage can result.

### CONTROL MODULE FUSES

**IMPORTANT:** Always check control module fuses before replacing control module or any major components (blower, etc.) If one of these fuses is blown, it can prevent control module or other components from operating.

1. Turn OFF power to boiler at external line switch.
2. Remove jacket front panel.
3. Remove control module cover.
4. Inspect fuses F1 and F3 (shown below).
5. The boiler is shipped with four spare fuses attached to



**F1 and F3 Fuses**

the control module cover.

6. If necessary, replace open fuse (F1 is 115V, 5-amp fast-blow; F3 is 24V, 4-amp slow-blow).

### ⚠ WARNING

Do not jumper fuse or replace with any fuse except as specified. Failure to comply could result in severe personal injury, death or substantial property damage.

7. Install control module cover and jacket top front cover after fuse inspection.
8. Restore power to boiler at external line switch and verify boiler operation after completing boiler service.

### CHECKING TEMPERATURE SENSORS

1. The boiler temperature sensors (outdoor, return water, and supply water) are all resistance-type devices.
2. The table below shows the correct resistance value for the sensor at various temperatures.

Temp °F	Sensor Ohms		Temp °F	Sensor Ohms	
	Min	Max		Min	Max
32	34,265	37,871	130	3,698	4,088
40	27,834	30,764	140	3,043	3,364
50	21,630	23,907	150	2,517	2,782
60	16,944	18,727	160	2,091	2,311
70	13,372	14,780	170	1,744	1,928
80	10,629	11,747	180	1,461	1,615
90	8,504	9,399	190	1,229	1,359
100	6,847	7,568	200	1,038	1,147
110	5,545	6,129	210	880	972
120	4,517	4,992	212	851	941

3. Use the resistance values at 32°F, 60°F, 70°F and 212°F to measure the sensor resistance at known temperatures (ice point, room temperature and sea level boiling point). For ice point and boiling point, insert the sensor in water at that temperature. Use an ohm meter to read resistance value.
4. To check whether the control module is correctly sensing temperature, you can use a resistance decade box. Connect the decade box temporarily in place of a sensor and use the control module "Information" mode to read the temperature.

## VIII - TROUBLESHOOTING

Boiler Not Firing And:	Check For:	Step	Corrective Actions:
Control display blank	120 vac at terminals L1 and L2 of line voltage strip?	1	NO - Check external line switch and fuse or breaker.
	120 vac on both sides of fuse F1? (Turn OFF external power to boiler before removing cover.	1	NO - Turn off power to boiler and replace fuse if necessary. Inspect boiler interior wiring to determine cause of fuse opening.
	Wiring correct, in good condition, and securely attached?	1	Correct if needed. Replace any damaged wiring or components. Replace control module if problem persists.
Display first digit shows 0; last digits show 2 or 3-digit number (boiler outlet water temp.)	Room thermostat and DHW aquastat satisfied?	1	YES - Boiler off, no call for heat. Turn up thermostat or aquastat. Boiler should start.
	Thermostat or aquastat calling for heat but boiler not firing.	1	Check voltage on both sides of low voltage fuse F3. (Turn OFF external power before removing cover.) If necessary, replace fuse. Determine reason for fuse failure if possible.
		2	Check/set boiler parameters 2 and 3. Make sure space heat or DHW is turned on. Turn on if necessary.
		3	Turn off power to boiler. Temporarily jumper low voltage terminal strip terminals T1 and T2 or DHW T1 and DHW T2. Retry. If boiler operates, check CH and DHW thermostat and wiring. Replace if necessary. Remove temporary jumper(s).
		4	Turn off power to boiler. Check wiring against wiring diagram; verify all wiring in good condition and secure.
		5	Replace wire harnesses and retry.
6	Replace control module.		
Display first digit shows a number from 1 to 8; last digits show 2 or 3-digit number (boiler outlet water temp.)		1	Boiler in normal operating mode.
Display flashes "9," then "b." Last two digits show code number.		1	See <i>User Interface Quick Reference</i> and <i>Soft Lockout Troubleshooting</i> in this manual for more information on the soft lockout code.

### SOFT LOCKOUT (Display flashes "9" and then "b" in first position; last two digits on steady (code))

Code	Reason For Soft Lockout	Corrective Actions (pressing RESET should restart boiler immediately):	
<b>WARNING:</b> Electrical shock hazard. Turn off power to boiler when working with wiring or replacing any boiler component.			
08	0.14" Pressure switch contacts open	1	Check pressure switch for proper operation. Replace pressure switch if moisture has entered switch. Check venting for blockage. Clear if present.
18	<b>High Limit Operation:</b> Burner off until outlet water temp. drops below 180 °F	1	This should only happen when the heat demand is lower than the lowest firing rate of the boiler, such as operation of a single, small zone. Check system for: <ul style="list-style-type: none"> <li>• Verify boiler and system are full of water.</li> <li>• Make sure system does not have trapped air.</li> <li>• Inspect and verify system piping and components.</li> <li>• Verify piping agrees with boiler manual recommendations.</li> </ul>
		2	Use contact thermometer to check outlet water temp. Compare to temp. shown with display in "INFO" mode ("1" in first digit). Replace return temp. sensor if results are not close. Replace control module if sensor replacement doesn't solve problem.
19	<b>High Limit Operation:</b> Burner off until return water temp. drops below 190 °F	1	Check system for: <ul style="list-style-type: none"> <li>• Verify boiler and system are full of water.</li> <li>• Make sure system does not have trapped air.</li> <li>• Inspect and verify system piping and components.</li> <li>• Make sure water flow is not reversed or pipes crossed.</li> </ul>
		2	Use contact thermometer to check return water temp. Compare to temp. shown with display in "INFO" mode ("2" in first digit). Replace return temp. sensor if results are not close. Replace control module if sensor replacement doesn't solve problem.

## VIII - TROUBLESHOOTING

### SOFT LOCKOUT (Display flashes "9" and then "b" in first position; last two digits on steady (code))

Code	Reason For Soft Lockout	Corrective Actions (pressing RESET should restart boiler immediately):	
<b>WARNING:</b> Electrical shock hazard. Turn off power to boiler when working with wiring or replacing any boiler component.			
<b>24</b>	<b>High Limit Operation:</b> Return temp. is higher than supply temp.	1	<ul style="list-style-type: none"> <li>• Verify boiler and system are full of water.</li> <li>• Make sure system does not have trapped air.</li> <li>• Inspect and verify system piping and components.</li> <li>• Make sure water flow is not reversed or pipes crossed.</li> </ul>
		2	Use contact thermometer to check return water temp. Compare to temp. shown with display in "INFO" mode ("2" in first digit). Replace return temp. sensor if results are not close. Replace control module if sensor replacement doesn't solve problem.
<b>25</b>	<b>High limit operation:</b> Outlet water temp. increased too quickly. Non-adjustable default setting 9.8°F/sec	1	This usually indicates flow rate too low. Check system for: <ul style="list-style-type: none"> <li>• Verify boiler and system are full of water.</li> <li>• Make sure system does not have trapped air.</li> <li>• Inspect and verify system piping and components.</li> <li>• Verify piping agrees with boiler manual recommendations.</li> </ul>
		2	Verify operation of boiler circulator: <ul style="list-style-type: none"> <li>• Check voltage at circulator junction box to ensure 120 vac when boiler operates. If no voltage, check wiring and wiring connections.</li> <li>• High voltage terminal strip terminals 5 and 6 should show 120 vac for space heating; terminals 3 and 4 should show 120 vac for DHW. Replace circulator if powered but not operating.</li> <li>• Replace line voltage wire harness if necessary. Replace control module if wire replacement doesn't resolve.</li> </ul>
<b>26</b>	Aquastat contacts open or LWCO contacts open or 3.5" Switch open	1	<ul style="list-style-type: none"> <li>• Verify proper setting of control.</li> <li>• Water temp too high, wait for temperature to drop below 180 degrees.</li> </ul>
		2	<ul style="list-style-type: none"> <li>• Check water level in boiler, fill if low.</li> <li>• Press LWCO reset switch on display panel</li> <li>• If problem still exists, check LWCO probe and board according to manufacturer's instructions. Replace if necessary.</li> </ul>
		3	Check pressure switch for proper operation. Replace if moisture has entered switch. Check venting for blockage. Clear if present.
<b>29</b>	Blower turning when it should be off.	1	Check boiler wiring against wiring diagram. Replace line voltage and low voltage wiring harnesses if necessary. Replace control module if wire replacement doesn't resolve.
<b>30</b>	<b>High limit operation:</b> Temp. rise across boiler too high.	1	This usually indicates flow rate too low. Check system for: <ul style="list-style-type: none"> <li>• Verify boiler and system are full of water.</li> <li>• Inspect and verify system piping and components.</li> <li>• Verify piping agrees with boiler manual recommendations.</li> <li>• Make sure system pressure drop is not too high.</li> </ul>
		2	Verify operation of boiler circulator. <ul style="list-style-type: none"> <li>• Check voltage at circulator junction box to ensure 120 vac when boiler operates. If no voltage, check wiring and wiring connections.</li> <li>• High voltage terminal strip terminals 5 and 6 should show 120 vac for space heating; terminals 3 and 4 should show 120 vac for DHW. Replace circulator if powered but not operating.</li> <li>• Replace line voltage wire harness if necessary. Replace control module if wire replacement doesn't resolve.</li> </ul>
<b>61</b>	Pressure switch contacts closed.	1	Check pressure switches for proper operation. Replace pressure switch if moisture has entered switch.
<b>65</b>	Blower not operating when turned on.	1	Turn off power to boiler. Remove line voltage connector at blower. Restart boiler and check voltage across blower plug terminals. If 120 vac is <b>NOT</b> present, inspect wiring and tightness of connections. Replace line voltage wire harness if necessary. Replace control module if wire harness replacement doesn't resolve.
		2	If 120 vac is present on blower wire harness, replace harness and retry. If problem persists, replace blower motor.

## VIII - TROUBLESHOOTING

### HARD LOCKOUT (Display flashes first digit "E" and last two digits (code))

Code	Reason For Hard Lockout	Corrective Actions (pressing RESET should restart boiler immediately):	
<b>WARNING:</b> Electrical shock hazard. Turn off power to boiler when working with wiring or replacing any boiler component.			
<b>00</b>	Flame detected on startup.	1	Burner may be operating too hot due to incorrect combustion. Inspect flame during operation following the procedure in this manual. If flame is acceptable at both high and low fire, go to step 2. If flame is not acceptable: <ul style="list-style-type: none"> <li>• For propane boilers, verify propane orifice is correct and properly installed. Obtain and install propane orifice if necessary.</li> <li>• For correctly orificed propane or natural gas boilers, replace gas valve if burner glows excessively.</li> </ul>
		2	Look into the burner inspection window after the boiler shuts down. If flame is still present, gas valve may be leaking. Replace gas valve. BEFORE replacing valve, check gas line pressure coming to boiler. Pressure must not exceed 13" w.c. or valve damage could occur.
<b>02</b>	Ignition failed through 5 attempts.	1	If no ignition spark occurs: <ul style="list-style-type: none"> <li>• Check ignition electrode cable, electrode connector, and connections.</li> <li>• Inspect ignition electrode cable and electrode for insulation damage.</li> <li>• Check ground lead from ground terminal strip to heat exchanger access cover.</li> </ul>
		2	If spark occurs, but no flame: <ul style="list-style-type: none"> <li>• Verify manual gas valve in boiler is open.</li> <li>• Verify plastic line from gas valve to air inlet elbow is connected to gas valve and elbow, and line is unobstructed with no kinks.</li> <li>• Check incoming gas pressure.</li> <li>• Verify gas lines are free of obstruction and purge gas lines of air if necessary.</li> <li>• Verify flue gas vent and air supply piping are correctly installed, in good condition, and free of obstructions.</li> <li>• Check voltage to gas valve (it should be approx. 19-21 vdc (24 vac) during ignition attempt).</li> <li>• Check gas meter to verify gas flows when gas valve is activated.</li> <li>• Remove and inspect/clean ignition electrode. Clean white oxides if necessary and replace ignition electrode if in poor condition or unable to be cleaned.</li> <li>• Disconnect gas valve from Venturi. Inspect Venturi gas line to verify there are no obstructions. Replace gas valve.</li> <li>• Check for possible flue gas recirculation at vent/air terminations or inside boiler housing.</li> <li>• If gas valve is powered, gas flows when activated, and above steps have been verified, replace gas valve and retry.</li> </ul>
		3	Flame occurs but flame signal too low (less than 3 vdc between X1-5 and ground): <ul style="list-style-type: none"> <li>• Inspect flame at both low and high fire rates. Inspect and clean burner if necessary. Replace burner if not in good condition.</li> <li>• Check gas flow rate at gas meter with boiler at high fire. If input is not within about 10% of boiler rating, replace gas valve. (Length of the vent/air piping will affect boiler firing rate, with longer piping causing lower inputs.)</li> <li>• Check ground wire and connections from ground terminal screw to X1-6 terminal on wiring harness. Use ground continuity meter to verify good ground path.</li> <li>• Follow procedure to inspect and clean ignition electrode. Replace ignition electrode if necessary.</li> <li>• If above does not correct problem, replace control module.</li> </ul>
<b>03</b>	Gas Valve Disconnected.	1	Verify gas valve connection.
<b>04</b>	Voltage lost after lockout occurred.	1	Control module will only restart with manual reset, even after power loss (but the error code information is lost).
<b>05</b>	Internal control failure.	1	Reset control and retry. If problem persists, replace control module.
<b>06</b>			
<b>07</b>			
<b>08</b>			

## VIII - TROUBLESHOOTING

### HARD LOCKOUT (Display flashes first digit "E" and last two digits (code))

Code	Reason For Hard Lockout	Corrective Actions (pressing RESET should restart boiler immediately):	
<b>WARNING:</b> Electrical shock hazard. Turn off power to boiler when working with wiring or replacing any boiler component.			
09	Internal control failure.	1	Reset control and retry. If problem persists, replace control module.
11			
12	Casting temperature switch opened.	1	Determine reason for limit action and correct. Check for air trapped at top of casting.
		2	If limits are closed, check wiring and connections. Apply a temporary jumper across terminals 6 and 8 and check operation. If problem persists, check boiler internal wiring. Replace low voltage harness if necessary. Replace control module if harness replacement doesn't resolve.
13 thru 17	Internal control failure.	1	Reset control and retry. If problem persists, replace control module.
18	<b>Thermal Overrun Condition:</b> Outlet water temp. above 200 °F	1	Check system for: <ul style="list-style-type: none"> <li>• Verify boiler and system are full of water.</li> <li>• Make sure system does not have trapped air.</li> <li>• Inspect and verify system piping and components.</li> <li>• Make sure water flow is not reversed or pipes crossed.</li> </ul>
		2	Use contact thermometer to check outlet water temp. Compare to temp. shown with display in "INFO" mode ("1" in first digit). Replace return temp. sensor if results are not close. Replace control module if sensor replacement doesn't solve problem.
19	<b>Thermal Overrun Condition:</b> Return water temp. above 190 °F	1	See Code 18, Corrective Action#1 (above).
		2	Use contact thermometer to check return water temp. Compare to temp. shown with display in "INFO" mode ("2" in first digit). Replace return temp. sensor if results are not close. Replace control module if sensor replacement doesn't solve problem.
28	Blower not running.	1	Turn off power to boiler. Remove line voltage connector at blower. Restart boiler and check voltage across blower plug terminals. If 120 vac is <b>NOT</b> present, inspect wiring and tightness of connections. Replace line voltage wire harness if necessary. Replace control module if wire harness replacement doesn't resolve.
		2	If 120 vac is present on blower wire harness, replace harness and retry. If problem persists, replace blower motor.
29	Blower signal not 0 when it should be.	1	Inspect wiring and connections. If wiring is correct, replace blower assembly. If blower assembly replacement is unsuccessful, replace control module.
30	Temp difference between supply & return, indicated by blocking code b30, was too large for 20 successive times. Non adjustable default Max Delta set to 100°F	1	Inspect supply & return water sensors for proper resistance.
		2	Inspect piping for proper configuration. For example, when used in a radiant heating application.
31	Outlet water temp. short circuit.	1	Inspect outlet water temp. sensor and wiring. Replace sensor if wiring correct and in good condition. Replace low voltage wiring harness if problem persists. Replace control module if harness replacement doesn't resolve.
32	Return water temp. short circuit.	1	Inspect return water temp. sensor and wiring. Replace sensor if wiring correct and in good condition. Replace low voltage wiring harness if problem persists. Replace control module if harness replacement doesn't resolve.
36	Supply water temp. sensor open circuit.	1	See Corrective Action# 1 under Code 31 (above)
37	Return water temp. sensor open circuit.	1	See Corrective Action# 1 under Code 32 (above)
44	Internal control failure.	1	Reset control and retry. If problem persists, replace control module.
60			
61			
65	Blower signal too low (not enough driving force).	1	Inspect wiring and connections. If wiring is correct, replace blower assembly. If blower assembly replacement is unsuccessful, replace control module.

## IX - USER INTERFACE QUICK REFERENCE

STANDBY MODE - KEY FUNCTIONS AND DISPLAY			
When boiler is powered on, the display will always show a single character (which represents the boiler's current operating sequence) followed by the measured outlet water temperature during self-test.			
When entering Standby Mode, user interface display briefly shows <b>Stby</b>	<b>Stby</b>	then displays <b>Sequence</b> and <b>Measured or Target Outlet Temperature</b> .	<b>0 180</b>
Press and Hold Key(s) in BLACK <sup>(1)</sup>	Duration	Result	Display
[MODE] [STEP] [STORE] <b>[+]</b> [-]	Tap	<b>Outlet water target temperature.</b> (Display shows "c" and outlet water target temp.) <sup>(2)</sup>	<b>c 190</b>
	Hold	<b>Turn space heating OFF/ON.</b> (Display shows "c" and outlet water temp. or OFF.)	
[MODE] [STEP] [STORE] <b>[+]</b> <b>[-]</b>	Tap	<b>Show factory setting for DHW.</b> (Make sure to adjust desired water temperature for DHW on the DHW tank aquastat.)	<b>d 140</b>
	Hold	<b>Turn DHW OFF/ON.</b> (Display shows "d" and DHW factory setting or OFF.)	
<b>[MODE]</b> [STEP] [STORE] <b>[+]</b> [-]	Hold	<b>Set burner to high fire.</b> (Display shows "H" and measured outlet water temp.)	<b>H 180</b>
<b>[MODE]</b> [STEP] [STORE] <b>[+]</b> <b>[-]</b>	Hold	<b>Set burner to low fire.</b> (Display shows "L" and measured outlet water temp.)	<b>L 180</b>
[MODE] [STEP] [STORE] <b>[+]</b> <b>[-]</b>	Hold	<b>Deactivate forced high/low firing.</b> (Display shows sequence and measured outlet water temp.)	<b>0 180</b>
<b>[MODE]</b> [STEP] [STORE] <b>[+]</b> [-]	Tap	<b>Change to next mode.</b> (Para)	<b>Para</b>

<sup>(1)</sup> Where two keys are shown pressed at the same time, you must press the keys together. A slight delay in pressing one of the keys may cause a different result.

<sup>(2)</sup> **Outlet water "target temperature" means:**

Outdoor sensor not connected - Target is fixed setpoint temp. Control attempts to maintain boiler outlet water temperature to setpoint.

Outdoor sensor connected - Target is temperature calculated by control module based on outside air temperature.

STANDBY MODE - BOILER SEQUENCE DISPLAY					
After display shows <b>Stby</b> for a brief period, the first character shows boiler status, followed by boiler outlet water temp. If the burner is being held off due to a soft lockout, the display alternates between showing "9" followed by boiler outlet water temp. and "b" followed by the two-digit codes below. Soft lockout means the boiler will start again automatically if the condition is corrected or timed out.					
Press <b>[RESET]</b> button to restart boiler without waiting for timeouts below.					
First Digit	Other Digits	Boiler Status	First Digit	Code #	Boiler is in soft lockout when "9" or "b" shown. Reason for boiler soft lockout is:
0	Actual (measured) outlet water temperature	Standby - no call for heat	"9" alternating with "b"	_18	Outlet temp. too high (over 203°F). Burner off until outlet water temp. drops 9°F below target temp.
1		Pre-purge (10 seconds) or Post-purge (15 seconds)		_19	Return temp. too high (over 203°F). Burner off until both outlet and return water temp. drops 9°F below target temp.
2		Ignition		_24	Return temp. higher than supply temp. Burner off waiting for correction.
3		Burner on for CH heating		_25	Outlet water temp. rose too quickly. Burner off 10 min. (burner recycles, increasing wait 1 min. each attempt to max. 15 min.)
4		Burner on for DHW heating		_26	External limit open, LWCO tripped or 3.5" press switch open on limit wired in soft lockout (auto reset) circuit. Burner off for 2½ minutes.
5		Checking airflow before prepurge		_29	Blower signal not 0 when it should be. Burner off until signal condition terminates.
6		Burner off because temperature setting has been reached		_30	Temp. rise across boiler more than 100°F. Burner off for 2½ minute wait (plus 1 minute for each failed attempt, up to max. of 22 minutes each time).
7		Pump on after CH heating cycle for run-on of 10 seconds		_61	Air pressure switch does not open.
8		Pump on after DHW heating cycle for run-on of 30 seconds		_65	Waiting for blower to start.
H		Burner on, running in high fire mode (manually set for test)			
L	Burner on, running in low fire mode (manually set for test)				

## IX - USER INTERFACE QUICK REFERENCE

PARAMETER MODE			
Press [MODE] button 1 time from Standby Mode.			
Display shows <b>Para</b> until a key is pressed	<b>Para</b>	then displays <b>Parameter</b> and <b>Current Status</b> .	1 180
Press and Hold Key(s) in BLACK <sup>(1)</sup>	Duration	Result	Display
[MODE] [STEP] [STORE] [+] [-]	Tap	Step to <b>next parameter</b> (continue tapping Step to change to 1, 2, 3, or 4)	1 140
[MODE] [STEP] [STORE] [+] [-]	Tap	Increase setting	2 01
	Hold	<b>FAST</b> increase setting	
[MODE] [STEP] [STORE] [+] [-]	Tap	Decrease setting	3 01
	Hold	<b>FAST</b> Decrease setting	
[MODE] [STEP] [STORE] [+] [-]	Tap	Store current setting (tap this key after setting the parameter as desired)	4 190
[MODE] [STEP] [STORE] [+] [-]	Tap	Next mode (info)	Info
<b>DHWSetting:</b> Left digit shows "1" and right digit shows "140." <b>DO NOT</b> change this setting. Performance could be unreliable. Set DHW tank temp. on DHW aquastat.	<b>DHW Setup:</b> Left digit shows "2" and right digit should show "01." <b>DO NOT</b> change this setting. DHW performance could be unreliable or unsafe.	<b>Space Heating (SH) Setup:</b> Left digit shows "3" and right digit should show "01." <b>DO NOT</b> change this setting as it might affect performance of your boiler.	<b>SH Temperature:</b> Left digit shows "4" and right three digits show target outlet water temp. (at 32°F outside if outdoor sensor is used). Adjust to desired settings with + and - keys.

<sup>(1)</sup> After the [STORE] button is pressed, the set value will flash twice to confirm the change. Change will take effect after you leave Parameter Mode.

INFORMATION MODE			
Press [MODE] button 2 times from Standby Mode.			
Display shows <b>Info</b> until a key is pressed	<b>Info</b>	then displays <b>Parameter</b> , <b>Flashing Dot</b> , and <b>Current Status</b> .	1. 190
Press and Hold Key(s) in BLACK <sup>(1)</sup>	Duration	Result	Display
[MODE] [STEP] [STORE] [+] [-]	Tap	Step to next parameter	1. 180
		Measured outlet water temperature (First digit shows 1 and dot flashes) <sup>(1)</sup>	2. 150
		Return water temperature (First digit shows 2 and dot flashes) <sup>(1)</sup>	3. - 18
		<b>This function not used</b> (First digit shows 3 and dot flashes) <sup>(2)</sup>	4. 42
		Outside temperature (First digit shows 4 and dot flashes) <sup>(3)</sup>	5. - 18
		<b>This function not used</b> (First digit shows 5 and dot flashes) <sup>(2)</sup>	6. 190
		Target outlet water temperature (First digit shows 6 and dot flashes) <sup>(4)</sup>	7. 1
		Outlet water temp. change over time (First digit shows 7 and dot flashes) <sup>(5)</sup>	8. 1
		Return water temp. change over time (First digit shows 8 and dot flashes) <sup>(5)</sup>	9. - 32
		<b>This function not used</b> (First digit shows 9 and dot flashes) <sup>(6)</sup>	

- <sup>(1)</sup> Digits after flashing dot show measured outlet temperature.
- <sup>(2)</sup> Digits after flashing dot show -18.
- <sup>(3)</sup> Digits after flashing dot show outside temperature.
- <sup>(4)</sup> Digits after flashing dot show target outlet temperature.
- <sup>(5)</sup> Digits after flashing dot show rate of change in °F per second.
- <sup>(6)</sup> Digits after flashing dot show -32.

**NOTE:** Display will show A-32 if [STEP] is pressed after "9" appears.

## IX - USER INTERFACE QUICK REFERENCE

HARD LOCKOUT MODE			
Boiler in hard lockout (requires manual RESET)			
Display flashes first digit <b>E</b>	<b>E</b>	and last two digits (lockout code) ( <i>see below</i> )	<b>xx</b>
Code	Reason for hard lockout	Code	Reason for hard lockout
<b>00</b>	Flame detected on start-up	<b>18</b>	Supply water temperature higher than 200°F
<b>02</b>	Ignition failed after 5 retries	<b>19</b>	Return water temperature higher than 190°F
<b>03</b>	Gas valve disconnected	<b>25</b>	Outlet temperature increased too fast
<b>04</b>	Power lost after lockout	<b>28</b>	No signal from blower; blower not running or defective blower motor
<b>05</b>	Internal control failure	<b>29</b>	Blower signal not "0" when it should be
<b>06</b>	Internal control failure	<b>30</b>	Max difference (b30) was too large for 20 successive times. Non adjustable default max delta set to 100°F.
<b>07</b>	Internal control failure	<b>31</b>	Outlet temperature sensor short circuit
<b>11</b>	Internal control error	<b>32</b>	Return temperature sensor short circuit
<b>12</b>	Casting temperature switch open	<b>36</b>	Outlet temperature sensor open circuit
<b>13</b>	Internal control failure	<b>37</b>	Return temperature sensor open circuit
<b>14</b>	Internal control failure	<b>44</b>	Internal control failure
<b>15</b>	Internal control failure	<b>60</b>	Internal error reading parameters
<b>16</b>	Internal control failure	<b>61</b>	Air flow circuit failure
<b>17</b>	Internal control failure	<b>65</b>	Not enough blower driving force

## XI - INSTALLATION AND CHECKOUT CERTIFICATE

<b>Boiler Model:</b>	<b>Boiler Serial Number:</b>	<b>Date of Installation:</b>
<b>Measured BTUH Input:</b>	<b>Boiler Location:</b>	<b>Altitude of Location:</b>
<b>Honeywell AM Kit Installed? (Yes/No):</b>	<b>Service Dates:</b>	
<b>System Type (Give Brief Description):</b>		

- Installation Instructions Have Been Followed
- Checkout Procedure/Adjustments Performed
- Maintenance/Service Issues Reviewed With Owner or Maintenance Person
- Installation Manual Affixed Adjacent To or On Boiler

<b>Installer/Technician's Company:</b>  <b>Installer's Name:</b>  <b>Company Address:</b>  <b>Company Phone Number:</b>  <b>Installer's Signature:</b>
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For technical assistance with this product, in the United States call toll free 1-800-325-5479,  
and in Canada call toll free 1-888-270-8324.

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