

VII: MAINTENANCE AND SERVICE INSTRUCTIONS

A. MAINTENANCE OF LOW WATER CUT-OFF DEVICES

WARNING

Probe and float type low water cut-off devices require annual inspection and maintenance.

1. Although these devices are solid state in their operation, the probe is exposed to possible contamination in the boiler water and subject to fouling.
2. It is important to physically remove the probe from the boiler tapping annually and inspect that probe for accumulation of scale or sediment.
3. Follow these steps to inspect, clean and/or replace the probe:
 - a. Turn off electric service to the boiler.
 - b. Drain boiler water to a level below the tapping for the probe.

DANGER

Assure that the boiler is at zero pressure before removing the LWCO probe. DO NOT rely on the pressure gauge to indicate that the boiler is at zero pressure. Open the safety valve to relieve all internal pressure prior to proceeding. Safety valve discharge piping must be piped such that the potential for burns is eliminated.

- c. Disconnect wiring connections between the low water cut-off control and the probe.
- d. Remove the low water cut-off control from the probe.
- e. Unscrew the probe from the boiler tapping.
- f. Inspect that portion of the probe that is exposed to the boiler water for a scale or sediment buildup.
- g. Light deposits may be removed by wiping the probe with a damp cloth. Wiping the probe with a cloth soaked in vinegar will remove more tenacious lime deposits. The most stubborn deposits may be removed from the probe by using a diluted amount, 3 parts of water to 1 part of phosphoric acid (H_2PO_4).

CAUTION

Exercise caution when handling phosphoric acid and follow the instruction label on its container.

- h. Clean the pipe threads of the probe to remove old, hardened pipe dope and other foreign matter.
- i. Apply a moderate amount of good quality pipe dope to the pipe threads on the probe, leaving the two end threads bare. **DO NOT** use PTFE (Teflon) tape.
- j. Screw the probe into the boiler tapping.
- k. Mount the low water cut-off control on the probe.
- l. Reconnect the control to probe wiring.
- m. Fill the boiler to its normal waterline.
- n. Add boiler water treatment compound as needed (refer to Paragraph B.).
- o. Restore electric service to the boiler.
- p. Fire burner to bring the water in the boiler to a boil to drive off free oxygen.
- q. **WARNING — BEFORE RETURNING BOILER TO SERVICE:** Follow the low water cut-off check out procedure in Section V "System Start-Up", Paragraph I, Step 5.

B. BOILER AND SYSTEM CLEANING INSTRUCTIONS FOR TROUBLE FREE OPERATION.

1. STEAM BOILERS:

- a. Oil, greases & sediments which accumulate in a new boiler and piping must be removed from the system in order to prevent an unsteady water line and carry over of the water into the supply main above boiler.

Operate the boiler with steam in the entire system for a few days allowing the condensate to return to the boiler. If the condensate can temporarily be wasted, operate boiler only for the length of time it takes for condensate to run clear. If the latter cannot be achieved or if the condensate is returned to the boiler, boil out the boiler using the SURFACE BLOW-OFF connection.

- i. Drain boiler until 1" of water is visible in gauge glass. Run temporary 1/2" NPT pipe line from the surface blow-off connection to an open drain or some other location where hot water may be discharged safely. **DO NOT** install valve in this line.
- ii. Drain about 5 gallons of hot water from boiler into a container and dissolve into it an appropriate amount of recommended boil out compound. Remove safety valve & add solution to boiler water thru exposed tapping using a funnel.

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2. WATER BOILERS:

a. Filling of boiler and system.

GENERAL — In a hot water heating system, the boiler and entire system (other than the expansion tank) must be full of water for satisfactory operation. Water should be added to the system until the boiler pressure gauge registers 12 psi. To insure that the system is full, water should come out of all air vents when opened.

b. BOILING OUT OF BOILER AND SYSTEM.

The oil and grease which accumulate in a new hot water boiler can be washed out in the following manner:

- i. Remove relief valve using extreme care to avoid damaging it.
- ii. Add an appropriate amount of recommended boil out compound.
- iii. Replace relief valve.
- iv. Fill the entire system with water.
- v. Start firing the boiler.
- vi. Circulate the water through the entire system.
- vii. Vent the system, including the radiation.
- viii. Allow boiler water to reach operating temperature, if possible.
- ix. Continue to circulate the water for a few hours.
- x. Stop firing the boiler.
- xi. Drain the system in a manner and to a location that hot water can be discharged with safety.
- xii. Remove plugs from all available returns and wash the water side of the boiler as thoroughly as possible, using a high-pressure water stream.
- xiii. Refill the system with fresh water.

c. Add appropriate boiler water treatment compounds as recommended by your qualified water treatment company.

d. Make pH or Alkalinity Test.

After boiler and system have been cleaned and refilled as previously described, test the pH of the water in the system. This can easily be done by drawing a small sample of boiler water and testing with hydrion paper which is used in the same manner as litmus paper, except it gives specific readings. A color chart on the side of the small hydrion dispenser gives the reading pH.

Hydrion paper is inexpensive and obtainable from any chemical supply house or through your local druggist. The pH should be higher than 7 but lower than 11. Add some of the washout chemical (caustic soda), if necessary, to bring the PH within the specified range.

e. Boiler is now ready to be put into service.

3. EXCESSIVE MAKE-UP WATER

A leaky system will increase the volume of make-up water supplied to the boiler, which can significantly shorten the life of the boiler. Entrained in make-up water are dissolved minerals, salts and oxygen. When the fresh, cool make-up water is heated in the boiler, the minerals fall out as sediment, the salts coat the inside of the boiler, and the oxygen escapes as a gas. The accumulation of sediment eventually isolates the water from contacting the cast iron. When this happens the cast iron in that area gets extremely hot and eventually cracks. The presence of free oxygen or chloride salts in the boiler corrodes the cast iron from the inside. More make-up water and higher concentrations of contaminants damage the boiler sooner. **Our warranty does not cover corrosion and sediment-related damage.** Clearly it is in everyone's best interest to prevent this type of failure. You can do your part by ensuring that your system is leak-free, keeping leakage to less than 2 percent of the boiler water volume each month.

IMPORTANT

IF, DURING NORMAL OPERATION, IT IS NECESSARY TO ADD MORE WATER THAN INDICATED BELOW, CONSULT A QUALIFIED SERVICE TECHNICIAN TO CHECK YOUR SYSTEM FOR LEAKS.

Model No.	Gallons Per Month	Gallons Per Year
CL3	0.3	4
CL4	0.4	5
CL5	0.5	6

C. ATTENTION TO BOILER WHILE NOT IN OPERATION

1. IMPORTANT

IF BOILER IS NOT USED DURING WINTER TIME, IT MUST BE FULLY DRAINED TO PREVENT FREEZE DAMAGE.

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2. Spray inside surfaces with light lubricating or crankcase oil using gun with extended stem so as to reach all corners.
3. With steam boilers, at end of season add sufficient water to fill boiler to top of water column and leave it that way until fall when water should be drained again to proper level. If, at this time, boiler water is dirty, drain water, flush out boiler, and refill with clean water to prescribed water level.
4. Always keep the manual fuel supply valve shut off if the burner is shut down for an extended period of time.
5. To recondition the heating system in the fall season after a prolonged shut down, follow the instructions outlined in Section V, Paragraphs A through K.

WARNING

This boiler contains controls which may cause the boiler to shut down and not restart without service. If damage due to frozen pipes is a possibility, the heating system should not be left unattended in cold weather; or appropriate safeguards and alarms should be installed on the heating system to prevent damage if the boiler is inoperative.

VIII: BOILER CLEANING

WARNING

All boiler cleaning must be completed with burner service switch turned off.

- A. CLEAN THE FLUEWAYS** (See Figure 31).
1. Disconnect oil line(s) and remove burner and burner mounting plate. See Figures 1A thru 1D.
 2. Lay protective cloth or plastic over combustion chamber blanket.
 3. Remove the smokepipe as necessary to gain access to the boiler canopy.
 4. Remove the jacket top panels.
 5. Remove the canopy being careful not to damage the cerafelt gasket.
 6. Using a 1¼" diameter wire or fibre bristle brush (30" handle) clean the flueways. Brush from the top using diagonal strokes for best results. **DO NOT** allow brush to strike the target wall or liner in the chamber.
- B. CLEAN TOP OF BOILER SECTIONS.**
1. Brush and vacuum the tops of the boiler sections.
- C. CLEAN THE FIREBOX.**
1. Using wire or fibre bristle brush, clean crown of boiler and inside of water legs. **DO NOT** allow brush to strike target wall or blanket in the combustion chamber.
- D. AFTER CLEANING,** remove protective cloth with debris and vacuum as necessary, but be careful not to damage blanket. Inspect target wall, combustion chamber blanket and burner mounting plate insulation for signs of damage. If damaged, replace as needed.

E. REASSEMBLE BOILER.

- CAUTION: DO NOT** start the burner unless canopy, smokepipe and burner swing door are secured in place.
1. Install the canopy taking care to align the gaskets without blocking the flueways. If gasket is damaged, replace as needed.
 2. Close and secure burner swing door to front section with fasteners.
 3. Reconnect oil line(s).
 4. Reinstall Top Panels and secure with sheet metal screws.
 5. Reinstall smokepipe on canopy and secure to collar with sheet metal screws.

WARNING

The boiler must be connected to an approved chimney in good condition. Serious property damage could result if the boiler is connected to a dirty or inadequate chimney. The interior of the chimney flue must be inspected and cleaned before the start of the heating season and should be inspected periodically throughout the heating season for any obstructions. A clean and unobstructed chimney flue is necessary to allow noxious fumes that could cause injury or loss of life to vent safely and will contribute toward maintaining the boiler's efficiency.

VIII: BOILER CLEANING (continued)

NOTES:

1. PRIOR TO CLEANING BOILER, LAY A PROTECTIVE CLOTH OR PLASTIC OVER THE BLANKET TO COLLECT DEBRIS FALLING FROM FLUEWAYS.
2. AFTER CLEANING, INSPECT TARGET WALL, COMBUSTION CHAMBER BLANKET AND BURNER SWING DOOR INSULATION FOR SIGNS OF DAMAGE. IF DAMAGED, REPLACE AS NEEDED.
3. REPLACE CANOPY GASKET STRIPS AS NEEDED IF DAMAGED.

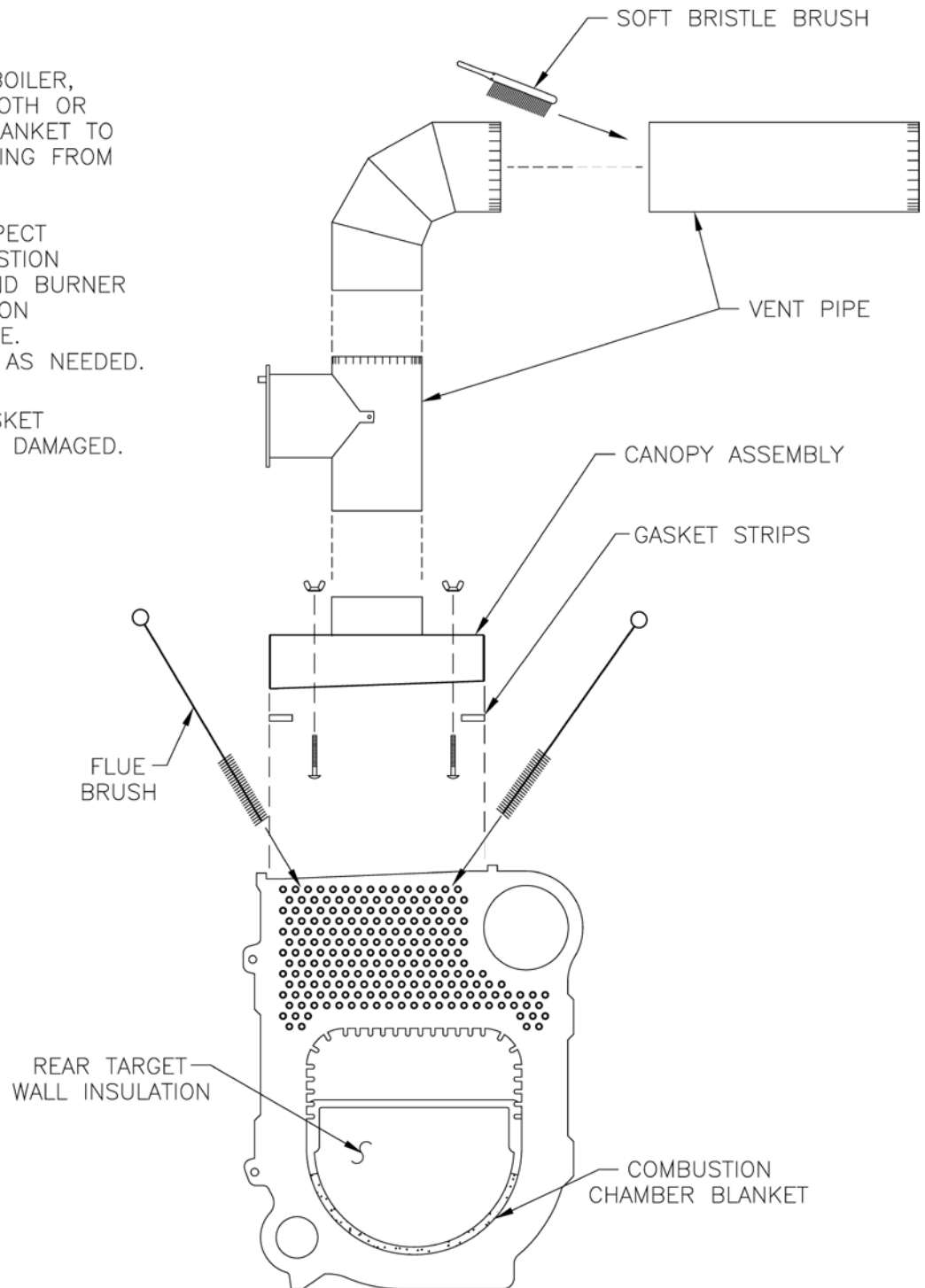


Figure 31: Cleaning of Boiler Flueways

Important Product Safety Information **Refractory Ceramic Fiber Product**

Warning:

The Repair Parts list designates parts that contain refractory ceramic fibers (RCF). RCF has been classified as a possible human carcinogen. When exposed to temperatures about 1805°F, such as during direct flame contact, RCF changes into crystalline silica, a known carcinogen. When disturbed as a result of servicing or repair, these substances become airborne and, if inhaled, may be hazardous to your health.

AVOID Breathing Fiber Particulates and Dust

Precautionary Measures:

Do not remove or replace RCF parts or attempt any service or repair work involving RCF without wearing the following protective gear:

1. A National Institute for Occupational Safety and Health (NIOSH) approved respirator
 2. Long sleeved, loose fitting clothing
 3. Gloves
 4. Eye Protection
- Take steps to assure adequate ventilation.
 - Wash all exposed body areas gently with soap and water after contact.
 - Wash work clothes separately from other laundry and rinse washing machine after use to avoid contaminating other clothes.
 - Discard used RCF components by sealing in an airtight plastic bag. RCF and crystalline silica are not classified as hazardous wastes in the United States and Canada.

First Aid Procedures:

- If contact with eyes: Flush with water for at least 15 minutes. Seek immediate medical attention if irritation persists.
- If contact with skin: Wash affected area gently with soap and water. Seek immediate medical attention if irritation persists.
- If breathing difficulty develops: Leave the area and move to a location with clean fresh air. Seek immediate medical attention if breathing difficulties persist.
- Ingestion: Do not induce vomiting. Drink plenty of water. Seek immediate medical attention.

IX: TROUBLESHOOTING

A. COMBUSTION

1. **NOZZLES** — Although the nozzle is a relatively inexpensive device, its function is critical to the successful operation of the oil burner. The selection of the nozzle supplied with the CL boiler is the result of extensive testing to obtain the best flame shape and efficient combustion. Other brands of the same spray angle and spray pattern may be used but may not perform at the expected level of CO₂ and smoke. Nozzles are delicate and should be protected from dirt and abuse. Nozzles are mass-produced and can vary from sample to sample. For all of those reasons a spare nozzle is a desirable item for a serviceman to have.
2. **FUEL LEAKS** — Any fuel leak between the pump and the nozzle will be detrimental to good combustion results. Look for wet surfaces in the air tube, under the ignitor, and around the air inlet. Any such leaks should be repaired as they may cause erratic burning of the fuel and in the extreme case may become a fire hazard.
3. **SUCTION LINE LEAKS** — Any such leaks should be repaired, as they may cause erratic burning of the fuel and in extreme cases may become a fire hazard. Whatever it takes, **The Oil Must Be Free of Air**. This can be a tough problem, but it must be resolved. Try bleeding the pump through a clear tube. There must be no froth visible. There are various test kits available to enable you to look at the oil through clear tubing adapted to the supply line at the pump fitting. Air eliminators are on the market that have potential. Also, electronic sight glasses are being used with good success. At times, new tubing must be run to the tank or new fittings put on. Just make sure you get the air out before you leave.

Any air leaks in the fuel line will cause an unstable flame and may cause delayed ignition noises. Use only flare fittings in the fuel lines.

4. **GASKET LEAKS** — If 11.5 to 12.5% CO₂ with a #1 smoke cannot be obtained in the breeching, look for air leaks around the burner mounting gasket, observation door, and canopy gasket. Such air leaks will cause a lower CO₂ reading in the breeching. The smaller the firing rate the greater effect an air leak can have on CO₂ readings.
5. **DIRT** — A fuel filter is a good investment. Accidental accumulation of dirt in the fuel system can clog the nozzle or nozzle strainer and produce a poor spray pattern from the nozzle. The smaller the firing rate, the smaller the slots become in the nozzle and the more prone to plugging it becomes with the same amount of dirt.
6. **WATER** — Water in the fuel in large amounts will stall the fuel pump. Water in the fuel in smaller amounts will cause excessive wear on the pump, but more importantly water doesn't burn. It chills the flame and causes smoke and unburned fuel to pass out of the combustion chamber and clog the flueways of the boiler.
7. **COLD OIL** — If the oil temperature approaching the fuel pump is 40°F or lower, poor combustion or delayed ignition may result. Cold oil is harder to atomize at the nozzle. Thus, the spray droplets get larger and the flame shape gets longer. An outside fuel tank that is above grade or has fuel lines in a shallow bury is a good candidate for cold oil. The best solution is to locate the tank near the boiler in the basement utility room or bury the tank and lines deep enough to keep the oil above 40°F. Check environmental issues with local authorities having jurisdiction.
8. **FLAME SHAPE** — Looking into the combustion chamber through the observation port, the flame should appear straight with no sparklers rolling up toward the crown of the chamber. If the flame drags to the right or left, sends sparklers upward or makes wet spots on the target wall, the nozzle should be replaced. If the condition persists look for fuel leaks, air leaks, water or dirt in the fuel as described above.
9. **HIGH ALTITUDE INSTALLATIONS** — Air openings must be increased at higher altitudes. Use instruments and set for 11.5 to 12.5% CO₂.
10. **START-UP NOISE** — Late ignition is the cause of start-up noises. If it occurs recheck for electrode settings, flame shape, air or water in the fuel lines.
11. **SHUT DOWN NOISE** — If the flame runs out of air before it runs out of fuel, an after burn with noise may occur. That may be the result of a faulty cut-off valve in the fuel pump, or it may be air trapped in the nozzle line. It may take several firing cycles for that air to be fully vented through the nozzle. Water in the fuel or poor flame shape can also cause shut down noises.

NOTICE

CHECK TEST PROCEDURE. A very good test for isolating fuel side problems is to disconnect the fuel system and with a 24" length of tubing, fire out of an auxiliary five gallon pail of clean, fresh, warm #2 oil from another source. If the burner runs successfully when drawing out of the auxiliary pail then the problem is isolated to the fuel or fuel lines being used on the jobsite.

IX: TROUBLESHOOTING (continued)

B. OIL PRIMARY CONTROL (Oil Primary)

1. Burner (Oil Primary) will not come on.
 - a. No power to Oil Primary.
 - b. Oil Primary is in lockout or restricted mode. Press reset button for one (1) second to exit lockout. If control has recycled three times within the same call for heat, it will enter into restricted mode. To reset from restricted mode, refer to Section V, Paragraph I, Step 2 for details.
 - c. CAD cell seeing light.
 - d. CAD assembly defective.
 - e. Control motor relay is stuck closed (see note below).
2. Burner (control) will light, then shut down after a short time, then restart after one (1) minute.
 - a. CAD cell is defective.
 - b. Air leaking into oil line causing flame out.
 - c. Defective nozzle causing flame to be erratic.
 - d. Excessive airflow or draft causing flame to leave burner head.
 - e. Excessive back pressure causing flame to be erratic.
3. Control locks out after Trial For Ignition (TFI).
 - a. No oil to burner.
 - b. Shorted electrodes.
 - c. Nozzle clogged.
 - d. Airflow too high.
 - e. Ignitor module defective.
 - f. CAD cell defective.

g. Oil valve stuck open or closed.

Note: The Safety Monitoring Circuit (SMC) is designed to provide lockout in the event of a stuck or welded motor relay.

NOTICE

If flame is not established within 15 seconds of oil valve actuation (known as Trial For Ignition [TFI]) lockout will occur. Lockout is indicated by a red LED solid-on located on the oil primary control.

Hard Lockout will occur if the Oil Primary Control locks-out three (3) times during a call for heat. This is indicated by red light reset button solid-on.

C. INTELLIGENT OIL BOILER CONTROL

- **Cold Start Boiler Control** is used on Boilers without Tankless Heaters.
 - **Warm Start Boiler Control** is used on Boilers with Tankless Heaters
1. When a problem occurs with the boiler operation, the Boiler Control easily provides specific, valuable information to help resolve the issue quickly. The display on the Boiler Control should be the first place to check.
 - a. If an Error Code "Err" **IS NOT** displayed on the Boiler Control: In this circumstance, Table 12 can be used to determine the problem and possible causes.

TABLE 12: TROUBLESHOOTING GUIDE

System Condition	Diagnostic Condition	Check	Action
Boiler is cold, house is cold.	Display is OFF.	120 Vac System power.	Turn system power on.
	Display is ON.	24 Vac T-T	No 24 V; replace control.
		24 V present; disconnect thermostat, short T-T.	Boiler starts, check wiring and thermostat.
		120 Vac at B1-B2	<ul style="list-style-type: none"> • If no, replace control. • If yes, check burner and wiring.
	Refer to Err on display.	-----	
Boiler is hot, house is cold.	Display is ON.	120 Vac at C1-C2	<ul style="list-style-type: none"> • 120 Vac at C1-C2, check wiring to pump. • Wiring OK, is pump running? • If not, replace the pump. • If pump is running, check for trapped air or closed zone valves
		Boiler below the Low Limit temperature, wait for boiler to go above Low Limit temperature.	-----
		Boiler above LL? If yes, check for 120 Vac between ZC and L2.	<ul style="list-style-type: none"> • If no 120 Vac, replace control. • If yes, check zone relays, circulators and wiring.

IX: TROUBLESHOOTING (continued)

- b. If the Boiler Control detects an error it will flash "Err" (boiler control error) followed by a number. Use this text and number to identify the boiler problem and corrective action in Table 13 below.

TABLE 13: BOILER CONTROL ERROR NUMBERS

Display	Status	Recommended Corrective Actions
Err 1	Temperature Sensor Fault	Temperature sensor failure, wire harness loose or shorted connection or control hardware failure: <ul style="list-style-type: none"> - Check sensor is securely attached to boiler control - Check that sensor wire is not damaged - If secure and in good condition, replace sensor - If problem persists, replace control
Err 2	Communication Fault	EnviraCom terminal is shorted to ground or line voltage. <ul style="list-style-type: none"> - Check wiring to EnviraCOM terminals 1,2 and 3. Wiring to external EnviraCom device is incorrect.
Err 3	Internal Hardware Fault	Error detected with AC power supply frequency or boiler control failure. Cycle power to the control. Replace control if problem persists.
Err 4	Burner Output (B1) Fault	B1 output sensed powered during safety output relay check sequence or un-powered during running, or powered in idle in combination with water temperature above 264°F limit. Cycle power to the control. Replace control if problem persists.
Err 5	Line Voltage Fault (< 80 Vac)	AC voltage out of specification high or low; check L1, L2, 110 VAC.
Err 6	Fuse missing	Internal fuse is blown or missing. The fuse protects the Aquastat from miswiring the L1 and L2 on Oil Primary. When the Oil Primary is correctly wired the fuse is useless and not detected. If Primary is wired incorrectly the fuse is blown out and Aquastat report error 6. EnviraCOM message is sent when the wiring is fixed and the error disappears to indicate the end of the error state. Check wiring and replace fuse.
Err 7	User settings lost, (reset to factory defaults)	Warning: Generated if user adjustments are lost and the device uses factory default values. Error is cleared by entering and exiting the Adjustment mode. Replace control if problem persists.
Err 8	Manual Reset Lockout (resettable)	Set if Err 4 was invoked four times in a row. Check wiring and clear Lockout by pressing all three user keys for 30 seconds.