7. Startup and Operation

Once setup properly, EnergyLogic furnaces are designed to operate reliably over a wide range of conditions with minimal adjustment. This section is provided to make sure that the furnace is set up properly, and to provide instructions on the initial start up.

7.1 Do's and Don'ts/Tech Tips

1. Read each procedure completely before performing the steps.
2. Do not burn gasoline or kerosene in your furnace.
3. Do not place chlorinated solvents into the tank.
4. Do not burn antifreeze coolant (ethylene glycol) in your furnace.
5. Regularly check for water and/or coolant in the tank at the tank drain.
6. Do not allow your fuel tank to run out of fuel (avoid the hassles of small particle contamination and re-priming of the fuel system).
7. Document the pressure and vacuum readings of the furnace after it has been operated several hours. This will assist with future diagnostics, if necessary.
8. Do not place fuel suspected of having debris, such as an oil dry product, into the tank.
9. Store this manual in an accessible location.
10. Only use EnergyLogic fuel filters. Do not use paper element filters.
11. PERFORM THE RECOMMENDED PERIODIC MAINTENANCE.
12. Unplug the burner during the off season (summer) to prevent coking of the preheater and nozzle.

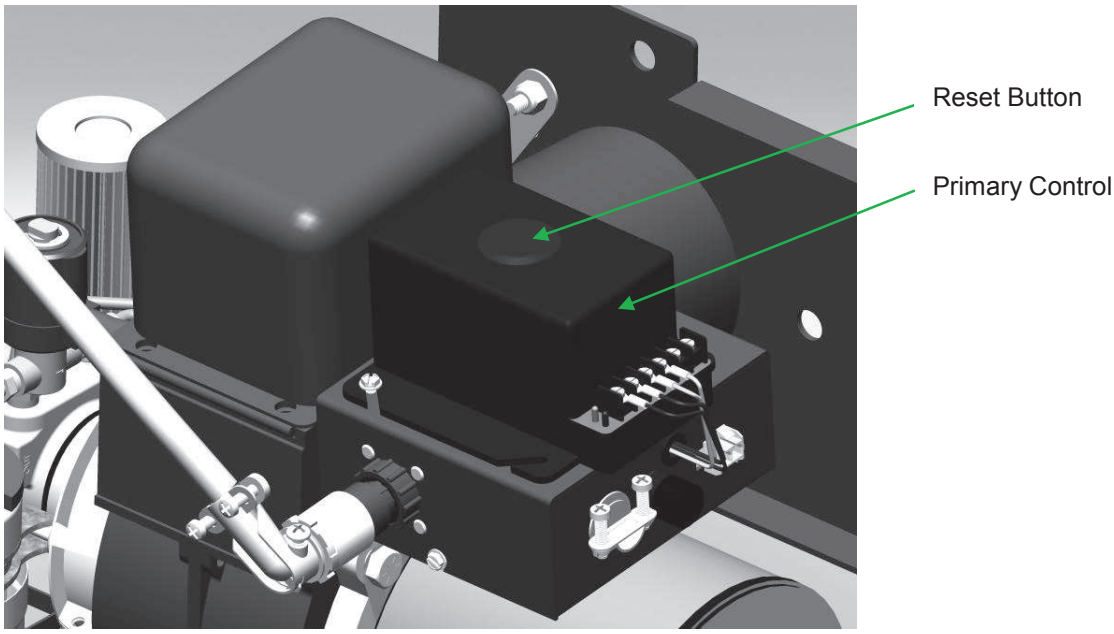
7.2 Burner Primary Control Operation

The burner operation is governed by the Primary Control (shown in figure). This device is pre-programmed and is not adjustable. The important interface points are as follows:

- The two T-Terminals are for the thermostat signal. To simulate a closed thermostat, you can jumper across the two T terminals with an alligator clip.
- The two F-Terminals are for the cad cell signal. The cad cell is a light sensor inside the burner that senses the flame. To simulate a flame, you can jumper across the two F terminals with an alligator clip.

⚠ WARNING *Do not leave the T and F terminals jumped during normal furnace operation, as this bypasses several safety checks and may cause excessive oil to be deposited in the combustion chamber, creating a fire or explosion hazard. For the same reason, do not leave the T and F terminals jumped for more than 30 seconds if oil is being sprayed but not being burned.*

- The reset button is used to reset the controller, in case of multiple failed start attempts or flameouts.
- The LED(s) (on some models) are used to indicate proper furnace operation or errors.



Burner Primary Control (models vary)

During normal operation, the furnace operates as follows:

1. The wall thermostat closes.
2. If the preheater is hot enough to close the internal thermostat (120°F), then the controller is released to start the burner.
3. The burner motor comes on, which starts the combustion air blower and compressor.
4. The ignition transformer is powered to spark the igniter.
5. The fuel pump turns on to deliver fuel.
6. Within 30 seconds the flame lights, and is recognized by the cad cell.
7. The heat exchanger gets warm.
8. The Fan & Limit Control turns on the circulation blower to deliver warm air to the room.
9. The burner continues to operate until the room is warm and the thermostat opens.

7.3 Safety Systems and Warnings

Several systems built into the burner controls ensure that the burner operates safely and will shutdown if something is wrong:

Preheater Thermostat: This device prevents the primary control from attempting to start the burner with fuel that is too cold (below 120°F). In addition, if the oil temperature drops below the limit while the burner is firing, the burner will shut down.

Cad Cell: The Cad Cell detects the light emitted by the flame to determine that the flame is on. If the burner does not light within 30 seconds, or if the flame goes out for any reason, the controller will shut down the burner. This prevents the accumulation of unburned fuel in the

combustion chamber, potentially generating smoke, rumbling and/or misfiring once the burner lights.

Primary Control – Recycle Mode: If the burner loses flame for any reason, the Primary Control will enter Recycle Mode (LED codes). After approximately 60 seconds, the Primary Control will attempt to restart the system. If no flame is seen by cad cell, the Primary Control will lock out (LED codes). To reset, press/release reset button. If the cad cell sees a flame, the Primary Control will continue running the burner. **⚠WARNING** Multiple resets may allow oil to accumulate in the heat exchanger, therefore do not reset more than one or two times. Call for service from an authorized professional if controller continues to trip. **⚠WARNING** DO NOT ATTEMPT TO START THE BURNER WHEN EXCESS OIL HAS ACCUMULATED IN THE CHAMBER, WHEN THE FURNACE IS FULL OF VAPOR, OR WHEN THE COMBUSTION CHAMBER IS VERY HOT.

Primary Control - Limited Reset/Restricted Mode: If several attempts to restart are not successful, the controller may go into a restricted mode (*refer to controller instructions). **⚠WARNING** *If Restricted Mode occurs, do not continue to try to operate the burner until the problem has been resolved. Call for service.*
**The controller models vary.*

7.4 Furnace Startup

Prior to the initial startup of the furnace, it is important to make sure the fuel system is properly primed to remove air bubbles that will cause nuisance flameouts. Once the burner is operating, the system is checked and necessary adjustments are made.

CAUTION *Fuel vacuum side leaks that cause air to get into the fuel system are a major cause of nuisance burner shut-downs. It is critical to eliminate all vacuum side leaks from the fuel lines!*

⚠WARNING DO NOT ATTEMPT TO START THE BURNER WHEN EXCESS OIL HAS ACCUMULATED IN THE CHAMBER, WHEN THE FURNACE IS FULL OF VAPOR, OR WHEN THE COMBUSTION CHAMBER IS VERY HOT. Refer to section 8.5.1 (heat exchanger cleaning) for instructions on removal of excess oil.

⚠WARNING DO NOT START THE BURNER UNLESS ALL CLEANOUT PANELS ARE SECURE IN PLACE.

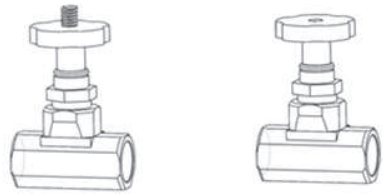
7.4.1 Fuel System Priming

This section explains how to prime the metering pump. **CAUTION** *Use a backup wrench when removing or installing the flare fittings, plugs or caps to ensure that you do not loosen threaded fittings and create a leak.*

1. Make sure the used oil storage tank has adequate oil, with oil level above the low fuel cut off float switch (if installed). You may pre-fill the Fuel Filter with non-synthetic ATF to

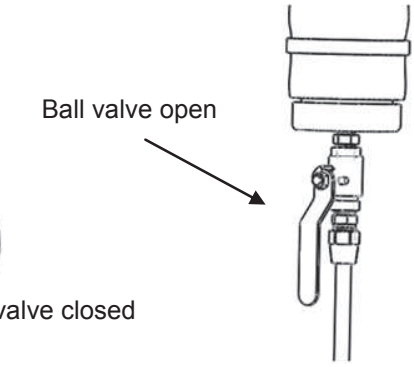
speed the priming process and to reduce amount of air in system. Do not pre-fill with new motor oil as new motor oil will not burn! Hand-tighten the filter (apply thin film of oil to gasket). Make sure all hand valves are open.

2. Unplug the thermostat cable connector at the burner, and set the thermostat to the lowest temperature setting.
3. Ensure the fire-stop valve and that ball valves are open.
4. Switch on the main power circuit to the furnace, and make sure that the burner and preheater are plugged in.
5. Have oil absorbing rags handy to catch oil.

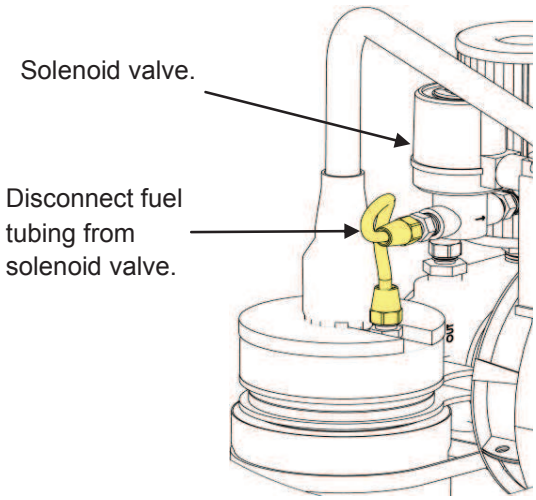


Fire stop valve open

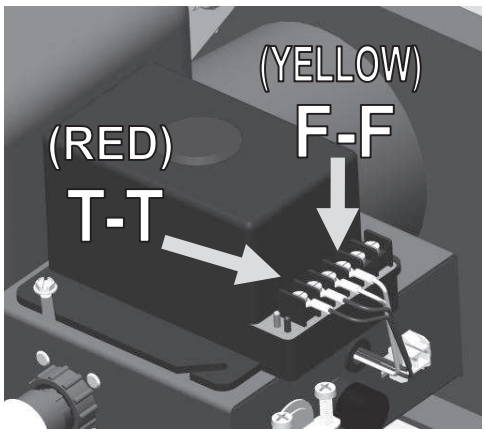
Fire stop valve closed



6. Using a 7/16” wrench, disconnect the small fuel tubing from the inlet of the solenoid valve (refer to figure).
7. Loosen the small tube fitting at the preheater outlet and pivot the fuel tubing so that it is pointed away from the burner. Then, re-tighten the fitting at the preheater outlet to seal during priming.
8. Place a container under the open end of the fuel tubing.
9. Jump one set of alligator clips across the T-T terminals (red wires) on the primary control to simulate the thermostat requesting heat. The primary control delays the start for 3 seconds.



10. Once the burner motor starts, immediately jumper across the F-F terminals (yellow wires) on the primary control with another alligator clip to simulate the cad cell seeing a flame.
11. It will take some time (10 – 30 minutes, depending on the unit size and length of tubing between the pump and preheater) for the fuel to reach and fill the preheater.
12. Once fuel is flowing steadily from the tube at the top of the preheater into the container with ***no air bubbles visible***, the system is primed. **⚠CAUTION** *The preheater and fuel coming out of the preheater are hot.*
13. Remove the alligator clips from the terminals. **⚠WARNING** *Do not leave the T-T and/or F-F*



Jumping the T-T and F-F Terminals

terminals jumped during normal furnace operation, as this bypasses several safety checks.

14. Reconnect the fuel tubing to the solenoid valve and preheater outlet. **⚠CAUTION** *The preheater and fuel coming out of the preheater are hot.*
15. Plug the thermostat cable connector back into the burner.
16. Make sure that the preheater valve is open.

7.4.3 Starting the Furnace

Prior to starting the furnace, allow the preheater to heat the fuel for 30 minutes. The preheater thermostat circuit will close once fuel temperature reaches approximately 120°F. Once the fuel is hot, start the furnace as follows:

⚠WARNING DO NOT ATTEMPT TO START THE BURNER WHEN EXCESS OIL HAS ACCUMULATED, WHEN THE FURNACE IS FULL OF VAPOR, OR WHEN THE COMBUSTION CHAMBER IS VERY HOT. Refer to section 8.5.1 (heat exchanger cleaning) for instructions on removal of excess oil.

⚠WARNING DO NOT START THE BURNER UNLESS ALL CLEANOUT PANELS ARE SECURE IN PLACE.

1. Verify the LEDs (on certain models) on the primary control are not flashing. You may need to reset the controller by pressing the reset button.
2. Set the wall thermostat to a high temperature to send a call for heat and start the furnace.
3. It may take a few attempts for the furnace to light on the initial start, as the nozzle block will not be filled with fuel yet.
4. If the furnace will not light, proceed to the troubleshooting section of the manual or call EnergyLogic for technical support.
5. **⚠WARNING** Continue to the next section for important checks and adjustments.

7.4.4 Burner System Checkout

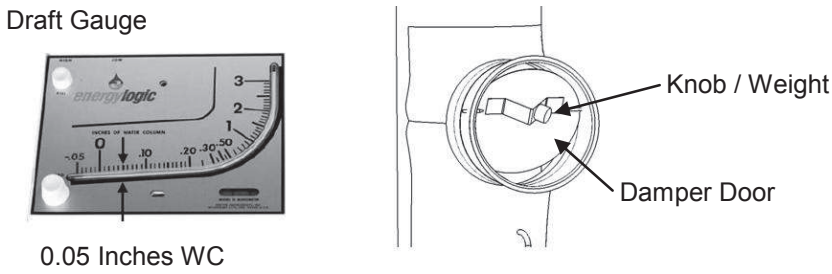
Once the furnace starts operating, make the following checks and adjustments:

⚠ WARNING *If you are unable to obtain the proper adjustments, do not run the furnace. If you cannot resolve the issue, call EnergyLogic Technical Services for assistance.*

Blower Operation: Within the first two or three minutes after the furnace starts, make sure that the blower turns on and directs warm air into the room. If not, this may indicate a problem with the Fan & Limit Control or the fan wiring. Shut down the furnace and diagnose the issue, or call EnergyLogic Technical Service for assistance.

Exhaust System: Check that the flue exhaust is flowing properly, and there are no exhaust leaks inside the building. Check the outside flue pipe to ensure that no black smoke is present. If smoke is present and the draft below is correct (see adjustment procedure below), call EnergyLogic Technical Service for assistance.

Draft Adjustment: After operating the furnace for about 15 minutes, verify the draft gauge is reading 0.05 inches of water column, WC (refer to figure).



Draft reading and adjustment

- If the draft gauge reading is less than 0.05 inches of WC: Loosen the adjustment weight on the barometric damper door, then slide it to the right or closer to the damper door pivot axis, and retighten it.
- If the draft gauge reading is more than 0.05 in. WC: Slide the weight to the left or away from the damper door pivot axis, and retighten it.
- Verify that the reading remains at 0.05 inches of WC with exhaust fans and vented appliances on in your building and all doors and windows closed. **⚠ WARNING** *A negative pressure inside the building may impede intake of combustion air to the burner, which may result in a hazard from smoke inhalation and/or fire. Use of exhaust fans in your shop without adequate make-up air may create a negative pressure. There are other possible causes as well. Corrective measures must be taken if the correct draft setting cannot be achieved.*

⚠ WARNING *If you are unable to adjust the damper door to obtain 0.05 inches WC, there is not enough draft for proper exhaust. Do not run the furnace under this condition. If you cannot resolve the issue, call EnergyLogic Technical Services for assistance.*

Note: The draft gauge should read 0.0 inches of WC when the draft gauge probe is removed from the stack (If not, make sure the gauge is level, and readjust the zero knob). If the furnace

is not running, the draft gauge with the probe installed into the stack will read near zero, but depending on ambient conditions may fluctuate between 0 and 0.03 inches of WC.
⚠CAUTION *The probe may be hot*.

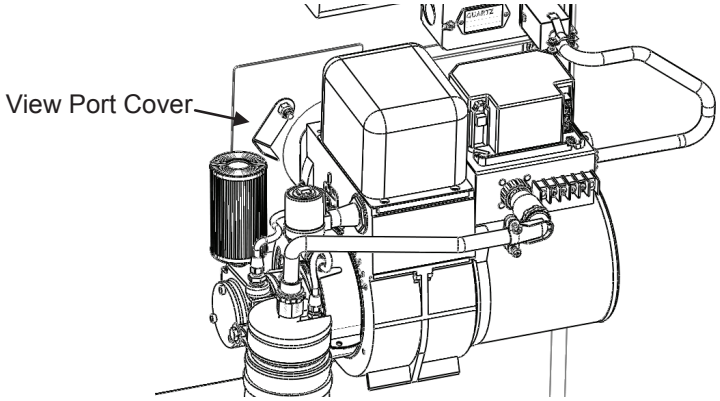
Fuel Pressure Gauge: The fuel pressure gauge on the pump outlet should read approximately 3-20 psi, with the higher pressures for longer runs or colder fuel.

- If the fuel pressure reading is high, inspect the fuel tubing between the pump and burner. Look for crimped tubing or obstructions in the preheater or nozzle block assembly. Repair as necessary.

Vacuum Gauge: The vacuum gauge on the inlet of the pump should read between 0 and 5 inches of mercury (Hg) for a Side Suction system. For Top Suction systems, the vacuum reading should be between 1 and 6 inches of Hg.

- If the vacuum reading is reading above normal, check the following:
  - Inlet to the suction line is clear of obstructions and all valves are open.
  - Fuel filter must be clean (was it clogged with sludge from the tank?).
  - Oil must be above 50°F (10°C).
  - Review how the pump is mounted compared to the instructions.

Burn Quality – Visual Check: When the burner is operating properly, the flame is bright yellow. To verify the flame color, rotate the viewport cover on the burner door clockwise, as shown in figure. View from a distance of at least 18 inches (46 cm). Close the viewport after checking the flame. If the flame is other than bright yellow, this indicates improper combustion. Contact EnergyLogic Technical Service for help. **⚠CAUTION** *The burner door and view port cover are hot. Wear gloves and safety glasses when inspecting the flame. View from a distance of at least 18 inches (46 cm).*



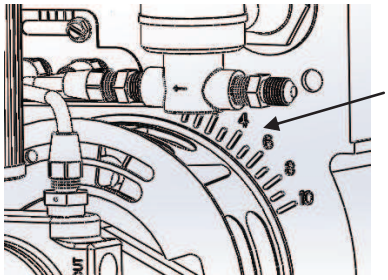
Visual Flame Inspection

Burn Quality – CO2 Exhaust Measurement: A qualified service technician with an exhaust combustion analyzer can make adjustments to the air shutter if required. Measurements are

taken through the draft gauge probe port. Exhaust gas carbon dioxide readings should be as follows for a clean furnace:

- EL-140H / EL-200H = 10 – 11%
- EL-340H / EL-350H = 11 – 12%

A qualified service technician may adjust the air shutter settings if necessary. Some burners have an adjustable inner slotted air band, along with the outer adjustment shutter plate. To adjust the plate, loosen the locking screws, then rotate the shutter and retighten the locking screws. The slotted air band should not require adjustment. A higher number allows more air into the burner. A lower number setting allows less air. The factory settings shown below normally work well, but higher altitude locations may require adjustments:



Shutter Adjustment

- EL-140H: 5 for Plate – Closed Air Band
- EL-200H: 7 for Plate – Closed Air Band
- EL-340H: 4 for Plate – Closed Air Band
- EL-350H: 4 for Plate – 4 for Air Band

Burn Quality – Smoke Measurement: A qualified service technician may measure smoke content, following procedures of his smoke pump.

- Acceptable results per smoke pump comparison chart = zero or #1 smoke spot.
- A yellow- brown smoke spot color is normal when burning used oil due to the presence of non-combustibles.
- The absence of black or dark grey soot indicates complete combustion.

Flame Monitoring Cad Cell: A qualified service technician may check the cad cell [Flame on]

- Disconnect the cad cell leads from the FF terminals on the controller.
- Using TT and FF jumpers, run the furnace.
- Measure the resistance (ohms) of the cad cell by probing across the cad cell lead wires.
- An acceptable resistance is greater than 0 – 500 ohms for a new burner and heat exchanger with the flame on.
- Remove the TT jumper to lose the flame. The resistance reading with no flame should be greater than 5000 ohms. Your meter may register “OL” if out of limit.
- Make sure all jumpers have been removed when testing is complete.

7.5 Everyday Operation of Your EnergyLogic Used Oil Furnace

Once installed and checked, operate your EnergyLogic Furnace as follows:

Daily Operation.

- Set the room thermostat to the desired temperature.
- You should not let the temperature of the room get below 50°F (10°C), or the oil will become thick and may present fuel delivery issues.
- To shut down the furnace in an emergency, turn off the power at the user-installed, switched junction box or main breaker.

Manage the Used Oil.

- Do not put unapproved substances into your used oil storage tank. See section 1.5.1 for a list of approved fuels.
- Monitor the bottom of your tank for water and drain it off on a regular basis.
- Don't let your oil tank run dry. Don't risk introduction of air into the fuel delivery system. You will save yourself much time and trouble by keeping your tank filled with oil. If you don't have one, consider installing an optional EnergyLogic Low-Fuel Cut-Off Switch to turn off the furnace at low fuel levels.
- When filling the tank be careful not to agitate the oil so that air/sludge are not introduced into the fuel pump.
- Pre-screen the oil prior to putting it into the tank. Occasionally have your tank drained and cleaned.

Monitor the System.

- After your initial set up, monitor the system gauge readings on a regular schedule to assure that the system is stable. Record the readings and any maintenance performed in the maintenance log (refer to section 8) to track your system performance over time.
- Maintain your furnace. Regular maintenance will help to keep the furnace running reliable and efficient for many years.

Summer Blower Operation and Shutdown

- Perform seasonal maintenance.
- In summer months, the blower may be used to circulate room air. To run the blower fan manually, the white button on the fan & high temperature limit controller may be pushed in. To set the controller back to automatic mode, the button may be pulled out. Make sure that the preheater is unplugged from the burner wire box if using the furnace blower in the summer.
- Refer to shutdown procedure in Section 8.6.