CEI Jacketed Firebox Heater
Operation, Service & Parts Manual
Heater models 1200 ~ 6300

CEI Enterprises
Albuquerque, New Mexico, U.S.A.
Contents

Section 1: Introduction .......................................................... 1
SAFETY ..................................................................................... 3
  IF YOU SMELL GAS ................................................................. 3
  WARNING! ............................................................................. 3
  IMPORTANT PRECAUTIONS .................................................. 3
  Identification of safety symbols used in this document .......... 4
Overview ................................................................................ 5
Main Components ................................................................... 6
  Burner .................................................................................... 6
  Jacketed Firebox ................................................................. 6
  Heat Exchanger .................................................................... 6
  Expansion Tank ..................................................................... 7
Other Components .................................................................... 7
How it Operates ...................................................................... 8

Section 2: Installation .......................................................... 11
  Inspection ............................................................................ 13
  Position ................................................................................ 13
  Connect Electrical ................................................................ 13
  Add Heat Transfer Fluid ...................................................... 15
    Natural Gas / Propane ...................................................... 18
    Fuel Oil ............................................................................. 19
Initial Startup ........................................................................ 20

Section 3: Operation .......................................................... 21
  Daily Start Up ...................................................................... 23
    Preparation for Start Up - All Fuels .................................. 23
    Gas Burner Start Up ......................................................... 23
    Fuel Oil Burner Start Up ................................................... 23
  Daily Shut Down .................................................................. 24
  Change Over (Gas/Fuel Oil) ................................................... 24
    From Gas to Fuel Oil ......................................................... 24
    From Fuel Oil to Gas ......................................................... 25
  Extended Shut Down ........................................................... 26

Section 4: Maintenance ...................................................... 27
  Maintenance – General ......................................................... 29
  Periodic Maintenance Schedule .......................................... 29
  Preventive Maintenance Schedule ....................................... 31
  Troubleshooting .................................................................. 36
Section 1: Introduction
Introduction
SAFETY

Safety is of prime concern whenever using an electrically operated, high temperature device. Please use proper safety precautions and follow all company, local, state and federal regulations for operating potentially dangerous equipment. Lock-out/tag-out equipment before performing maintenance.

IF YOU SMELL GAS

1. Open windows.
2. Do not touch electrical switches.
3. Extinguish any open flame.
4. Call your gas supplier immediately.

Do not store or use gasoline or other flammable liquids and vapors in the vicinity of this or any other appliance.

WARNING!

Improper installation, adjustment, alteration, service or maintenance can cause injury or property damage. For assistance or additional information consult CEI, a qualified installer, service agency or the gas supplier.

IMPORTANT PRECAUTIONS

1. Never attempt to light burner with paper or other materials.
2. Never experiment with the burner.
3. Never change the fuel or air adjustments without consulting with CEI or a qualified burner technician.
4. Never attempt to light the burner if combustion chamber contains any unburned fuel or gases.
5. Never throw waste paper, rags, garbage, or other waste materials into the combustion chamber.
6. Never wash out heating equipment room without first covering the burner with waterproof material.
This manual gives basic instructions which must be observed during installation, operation and maintenance of your CEI Firebox Heater. It is imperative that this manual be read by the responsible personnel/operator(s) prior to assembly and commissioning of any heat transfer fluid system. It must always be kept available at the site of Heater installation. It is not only the general safety instructions contained in this *Safety* section which must be observed, but also the specific information provided in the following sections and other applicable manuals.

### Identification of safety symbols used in this document

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Explosion prevention" /></td>
<td>Explosion prevention</td>
</tr>
<tr>
<td><img src="image" alt="Spray prevention" /></td>
<td>Spray prevention</td>
</tr>
<tr>
<td><img src="image" alt="Fire prevention" /></td>
<td>Fire prevention</td>
</tr>
<tr>
<td><img src="image" alt="Lock-Out / Tag-Out" /></td>
<td>Lock-Out / Tag-Out</td>
</tr>
<tr>
<td><img src="image" alt="Burn prevention" /></td>
<td>Burn prevention</td>
</tr>
<tr>
<td><img src="image" alt="Hot surfaces" /></td>
<td>Hot surfaces</td>
</tr>
<tr>
<td><img src="image" alt="Electrocution prevention" /></td>
<td>Electrocution prevention</td>
</tr>
<tr>
<td><img src="image" alt="Environmental protection" /></td>
<td>Environmental protection</td>
</tr>
<tr>
<td><img src="image" alt="Important" /></td>
<td>Important</td>
</tr>
<tr>
<td><img src="image" alt="High pressure" /></td>
<td>High pressure</td>
</tr>
</tbody>
</table>
Overview

The CEI Jacketed Firebox heater is an efficient, simple method to conduct heat to a heat transfer fluid for use in industries requiring a stable adjustable form of heat supplied to multiple locations. The standard heater consists of the burner, firebox, skid, heat exchanger, expansion tank, circulating pump and modulating controls.

This manual is intended to be used by owners, operators, and maintenance personnel to keep your CEI Heater in prime operating condition and to answer common questions regarding operating characteristics and capacities.

The heater serial and model numbers are located in two places; 1) an engraved tag located on the lower right hand corner of the control panel and 2) a stamp on the top of the skid.

Note: Please supply the serial number when requesting service support or making reference to the heater for spare parts or operational questions.

The heater assembly consists only of the basic heater without options. Various options are available and include:

- Lo-NOx environmental system
- Stack Pack efficiency equipment
- 50 cycle power
- 240/380/460 V power options
- Heavy fuel oil
- Methane fuel
- Manifold and side pump additions
- High temperature operation (550°F)
- Enlarged expansion tank
- Removable expansion tank
- Bolt-on exhaust stack extensions
- Heat Transfer Fluid strainers and filters
- Service contracts
- Start-up service
Main Components

CEI Jacketed Firebox Heaters for Heat Transfer Fluid (HTF) consist of four primary components:

1. Burner
2. Heat Exchanger
3. Jacketed Firebox
4. Expansion Tank

Burner

The Burner, located at the top end of the Fire Box above the Heat Exchanger, is capable of burning various fuels, most commonly natural gas, #2 fuel oil or propane.

Jacketed Firebox

The Firebox is the chamber where the fuel is burned. It is surrounded by an fluid filled jacket where heat is conducted to the Heat Transfer Fluid.

Heat Exchanger

The heat exchanger uses conduction and convection to transfer heat to the Heat Transfer Fluid. The hot gases generated by the burner are directed through boiler tubing to the exhaust stack. Turbulators are installed inside the boiler tubing to conduct heat to the tube inner wall. The turbulators also slightly stir the gases, increasing the efficiency of the heat exchanger.
Expansion Tank

The expansion tank mounted on the top of the CEI Heater is designed as a reservoir for Heat Transfer Fluid. As the heater is heated the heat transfer fluid expands and is held at a cooler temperature within the expansion tank. The expansion tank also serves as a way of purging the heater of trapped air and water.

The expansion tank includes an overflow pipe, fill pipe, level gage, liquid level control, and thermometer. The tank is connected to the top of the firebox where bubbles of air and water can migrate and be expelled via the overflow/vent.

Other Components

Exhaust Stack

The Exhaust Stack is a vertical tube located at the end of the Heat Exchanger. In some installations the Exhaust Stack includes a Flue Gas Recovery pipe for Low-NOx applications and/or a Stack-Pack to increase the efficiency of the heater.

Circulating Pump

A Centrifugal Circulating Pump is located before the Supply Pipe Plug Valve. Because the Pump is not a positive displacement type and is located after the Firebox, the CEI Heater is not considered a pressure vessel and does not require expensive certifications.

UV Scanner

The UV scanner is a quartz tube filled with a gas that ionizes when struck by UV radiation from the flame. In the absence of UV radiation, the gas acts as an insulator between two electrodes mounted inside the tube. The electrodes are continuously energized by a high voltage.

During combustion UV radiation ionizes the gas causing current pulses to flow between the electrodes. These current pulses result in a flame signal which is transmitted to an amplifier where it is processed to energize or hold in the flame relay.

Fuel Oil Filter (only on Heaters utilizing Fuel Oil)

The CEI supplied fuel oil filter is a step design felt filter with high depth loading capacity. Substitute filters should not be used without CEI approval. The CEI Heater is designed with specific requirements for pressure drop, flow rate and fuel oil cleanliness. Changing the filter to an unrecognized alternative could adversely affect the operation of your Heater.
Control Panel

The Control Panel indicates the current condition of the Heater and is a valuable troubleshooting tool.

How it Operates

Heat is introduced into the firebox from a positive pressure burner consuming natural gas, fuel oil, propane or other fuels. The flame uses both radiant and direct conduction to raise the temperature of the smooth interior of the firebox shell transferring heat to the surrounding fluid jacket. The high temperature gases are directed from the burner blast tube toward the back wall of the firebox. These hot gases escape the firebox by flowing back through the heat exchanger where additional heat is transferred to the heat transfer fluid. The spent gases are then exhausted through the exhaust stack. Several options can be included on the exhaust stack to further improve the efficiency and reduce the emissions of the standard heater. 85% efficiency is achievable with a standard CEI Heater and an additional 2-3% efficiency increase is possible with the addition of a Stack Pack to the exhaust stack.
The Heat Transfer Fluid (HTF) flow is in the opposite direction from that of the high temperature gases. The HTF enters the heater from the return pipe into the heat exchanger and then to the fire box jacket. A series of horizontal and vertical baffles directs the flow of HTF through the heat exchanger optimizing the transfer of heat by internal flow turbulence. Blade style turbulators stir the gases and absorb additional heat flowing through the heat exchanger to optimize heat transfer.

Helical guide rings in the firebox jacket direct the HTF around the full perimeter of the firebox. This full contact design provides maximum surface area for heat transfer. A centrifugal pump pulls HTF from the firebox jacket discharging it out of the heater supply pipe. A bypass line between the supply and return pipes ensures a constant flow of HTF through the heater, eliminating any potential for flow disruption from plant piping.
Introduction
Section 2: Installation
### Inspection

CEI takes great care in the preparation for and shipping of any CEI Jacketed Firebox Heater so that it will arrive ready for installation and operation. However, sometimes the unforeseen happens and damage to the heater occurs during loading, shipment and/or delivery.

We recommend a full inspection of the heater for any signs of damage and/or missing parts before installing the heater.

In the unlikely event that damage has occurred or a part (or parts) is missing, please contact your CEI representative before continuing with the heater installation.

### Position

When selecting a location for the CEI Jacketed Firebox Heater keep in mind that the heater produces significant heat and exhaust. Make certain that the selected site is level and capable of supporting its fully operational weight. See *Heater Specifications* on page 117.

Position the heater so that it is supported a minimum of 12" above grade to facilitate maintenance and cleaning.

*Note:* Always move the heater with the end opposite the burner section leading the way. Moving the heater any other way may cause damage.

### Connect Electrical

Verify that there is sufficient electrical power for the CEI Jacketed Firebox Heater before proceeding. See *Heater Specifications* on page 117 for the heater’s requirements.
Connect the external electrical power while adhering to any applicable codes.

Note: Power is supplied into the control box and requires a power cable access point (hole) in that box. CEI suggests that the access point be on the bottom of the control box.

Once connected, and before any fuel is supplied to the heater, bump (momentarily apply power just long enough to verify direction of rotation) both the blower fan and heat transfer fluid circulating pump motors to verify they rotate in the direction indicated on their respective housings.

Note: If the motors DO NOT turn in the indicated direction, turn the power off AT THE SOURCE then swap two of the three power connections at the main breaker. Repeat motor bumping.

When the power is connected and correct motor rotation has been verified, turn all heater switches and the power at the source OFF.
Add Heat Transfer Fluid

1. Connect the Heater’s heat transfer fluid supply and return lines to the corresponding external heat transfer fluid lines. Verify that both supply and return line valves on the heater lines are closed.

2. Open the expansion tank’s sight gauge valves and begin adding Heat Transfer Fluid (HTF) to the heater through the fill cap on top of the expansion tank.

3. When HTF is just visible in the expansion tank sight gauge apply external power. With power ON observe that the Low Level Sensor’s indicator in the control box is illuminated.
4. Turn the power back OFF after verifying the sensor’s indicator works.

Note: If the Low Level Switch LED indicator does not light, stop adding Heat Transfer Fluid and correct the problem before proceeding.

5. Open the Heat Transfer Fluid bypass valve, both supply and return line valves and the isolation valve between the firebox and pump. It is important that the bypass valve remains open whenever the heater is operating to help prevent overheating in the case of a clog in the external loop.

6. Continue adding HTF until the sight gauge indicates an approximately half-full expansion tank. While adding periodically check for leaks and correct as necessary including any connections not part of the heater.

7. Leaving all control switches OFF, re-apply power to the system.
8. After verifying that all HTF valves are open, remove the Circulating Pump's vent screw. With the screw removed **bump** (briefly apply power) the Circulating Pump motor. Continue bumping the Circulating Pump motor until HTF is coming out of the vent screw hole without any air bubbles. Replace the vent screw.

9. Turn on the Circulating Pump motor while leaving the Burner switch OFF.

10. Use the bleed valve on the pipe exiting the circulating pump to bleed air out of the heater (most air in the system is bled out in the expansion tank).
11. Watch the heat transfer fluid level in the expansion tank as air is bled from the system. Add heat transfer fluid as necessary to keep the tank level approximately ¼ full. Stop adding heat transfer fluid when all air has been bled from the system.

12. Turn all heater switches and the power at the source OFF. Replace the fill cap on the expansion tank.

**Natural Gas / Propane**

*Note:* If the CEI Jacketed Firebox Heater is Fuel Oil only, skip to Fuel Oil on page 19.

1. Verify that there is a sufficient supply of Natural Gas (or Propane) for the CEI Jacketed Firebox Heater before proceeding. See Heater Specifications on page 117 for the heater’s requirements.

2. Make sure the heater’s gas inlet supply valve is closed then connect the Gas supply to the inlet on the Heater. Open the source gas supply valve and check for leaks. Correct as necessary.

3. If the heater is a combination Gas/Fuel Oil heater AND fuel oil is not being used at this time, remove and store the coupling between the blower motor and the fuel oil pump.
   To remove the coupling:
   a. Remove all six flange nuts w/washers holding the blower motor/fan assembly to the burner and take the assembly far enough out of the housing to access the rubber coupling.
CAUTION! - The blower motor/fan assembly is heavy. Use care in handling it.

*Note:* When removing the assembly be careful not to damage the rubber coupling between the fan and the fuel oil pump.

b. Remove the coupling and store it for later use.
c. Reinstall the blower motor/fan assembly.

4. When the motor/pump coupling has been removed go to Initial Startup on page 20. If fuel oil is to be connected at this time continue below.

**Fuel Oil**

*Note:* If the CEI Jacketed Firebox Heater is Gas only, or a combo heater that is not being set up for fuel oil at this time, skip to Initial Startup on page 20.

1. Make sure the valve on the fuel oil supply is closed then connect the fuel oil supply line using a flared connection to the fuel oil inlet on the heater.
2. Once connected, open the valve on the fuel oil supply and check for leaks. Correct as necessary.

3. If the heater is a combo unit that has been operating on gas and the motor/pump coupling was removed for the gas operation, reinstall the coupling and coupling cover. Reverse step 3 under Natural Gas / Propane above to install the coupling.

---

**Initial Startup**

**CAUTION!** - Raise the heat transfer fluid temperature slowly. Rapidly raising the heat transfer fluid temperature will cause an overflow and potential fire.

1. Turn the Heater Switch ON then set the UDC1200 Modulating Temperature Controller to 200°F.

2. Once the temperature stabilizes at 200°F let it remain at that temperature for 2 hours.

3. Set the UDC1200 Modulating Temperature Controller to 220°F.

4. Once the temperature stabilizes at 220°F let it remain at that temperature for 2 hours.

5. Repeat steps 3 and 4 increasing the temperature in 20°F increments until the desired temperature is reached (normally 300°F).

6. Recheck for leaks and heat transfer fluid level. Turn the power off and let the heater and heat transfer fluid cool before correcting leaks and/or adding additional heat transfer fluid.
Section 3: Operation
Daily Start Up

Note: Daily Start Up is only necessary when the heater was shut down for a short period (i.e. overnight or maintenance)

Preparation for Start Up - All Fuels

1. Ensure that the heater is in working order.
   Note: Fuel Oil burner – Make sure that the fuel oil tank has an adequate fuel level and that the fuel is the proper grade.
2. Set the burner control panel switch to the OFF position.
   Note: Combination Gas/Fuel Oil burner – Set the fuel selector switch to the fuel to be burned.
3. Turn the thermostat or operating control down to its lowest setting.
4. Check fuses and replace as necessary.
5. Depress the flame safeguard programming control reset button.

Gas Burner Start Up

1. Manually open and close the main gas shut off cock, leak test cock and pilot cock to determine that they operate freely. Open all three cocks. (Reset low gas pressure switch if supplied.)
2. Set the main power switch and burner panel control switch to the ON position. Wait 30 seconds and turn up thermostat or operating control to the desired setting.
3. The burner blower motor will start and after a suitable pre-purge period (this will vary with the type of flame safeguard control supplied - but will usually be a minimum of 30 seconds to a maximum of 90 seconds) the burner pilot will light, after which the main flame will be established.

If the heater does not respond properly contact CEI or a qualified burner service company.

Note: For combination Gas/Fuel Oil heaters open all fuel oil line valves (fuel oil must circulate through the fuel oil pump, even when burning gas).

Fuel Oil Burner Start Up

1. Open all valves in fuel oil lines.
2. Set the main power switch and burner panel control switch to the ON position. Wait 30 seconds and turn up thermostat or operating control to the desired setting.
3. The burner blower motor will start. Depending upon the type of flame safeguard control supplied, the fuel ignition system may energize within 1 or 2 seconds after the blower motor starts or could be as long as 90 seconds.

If the heater does not respond properly contact CEI or a qualified burner service company.

Daily Shut Down

Note: Daily Shut Down is only necessary if the heater will be shut down for a short period (i.e. overnight or for routine maintenance)

1. Turn the Burner control panel switch OFF. However, be sure to leave the Circulating Pump switch ON for at least 10 additional minutes to allow the heat transfer fluid to evenly cool.
2. Close all valves in gas and fuel oil lines.

Change Over (Gas/Fuel Oil)

Note: Change Over is for those dual energy burner installations where the heater normally runs on one energy source and is switching to an alternate energy source.

From Gas to Fuel Oil

1. Turn the heater’s main circuit breaker OFF.
2. Close both the heater’s gas inlet valve and the source gas valve.
3. Disconnect the gas line from the heater at the gas inlet connection.

Note: If the heater will only be operating on fuel oil for a short period the gas line may be left connected. However, be sure to close both the inlet and source gas valves.

4. If necessary install the coupling between the blower motor and fuel oil pump (installations that primarily run on gas usually have the coupling between the blower motor and fuel oil pump removed).
   To install the coupling:
   a. Remove all six flange nuts w/washers holding the blower motor/fan assembly to the burner and take the assembly far enough out of the housing to access the rubber coupling location.
**CAUTION!** - The blower motor/fan assembly is heavy. Use care in removing it.

b. Install the coupling into the flange on the fuel oil pump.

c. Reinstall the blower motor/fan assembly making sure the flange on the end of the shaft properly lines up with the coupling.

5. Connect the source fuel line to the fuel inlet on the heater.

6. Change the GAS /OIL switch on the Control Box to OIL.

7. Open the source fuel valve and check for leaks. Correct as necessary.


---

**From Fuel Oil to Gas**

1. Turn the heater’s main circuit breaker OFF.

2. Close the source fuel valve and all fuel valves on the heater.

3. Disconnect the source fuel line from the fuel inlet on the heater.

4. Remove the coupling between the blower motor and fuel oil pump if the switch from fuel to gas is anticipated to be long term. See step 3 under Natural Gas / Propane in Installation for directions.

   **Note:** *When the switch from fuel to gas is expected to be short term it’s acceptable to leave the coupling in place as long as you ensure that the pump has a good fuel oil supply so that it will not run dry when the burner is operating on the gas cycle.*

   *Be certain that the pump is adequately primed to prevent against mechanical seizure caused by lack of fuel oil.*

5. Connect the source gas line to the gas inlet on the heater.
6. Change the GAS /OIL switch on the Control Box to GAS.
7. Open the source gas valve and check for leaks. Correct as necessary.
8. Go to Gas Burner Start Up on page 23.

Extended Shut Down

1. Place main power switch and burner control panel switch to the OFF position.
2. Close all valves in gas and fuel oil lines.
3. Cover burner to protect it from dust and dampness.
Section 4: Maintenance
Maintenance – General

Only qualified service technicians should make mechanical or electrical adjustments to the burner and/or associated control equipment.

Maintenance personnel can perform preventive most maintenance procedures.

Observe and follow the safety information covered in SAFETY on page 3 and Daily Start Up on page 23 (when appropriate).

Turn the burner power supply OFF and close manual fuel valves as appropriate for routine maintenance.

Make sure that combustion and ventilation fresh air sources to the burner room remain clean and open.

Periodically check all electrical connections and make sure the flame safeguard control chassis is firmly connected to its wiring base.

Refer to manufacturer’s product bulletins supplied with the burner for maintenance on the flame safeguard control and other components.

<table>
<thead>
<tr>
<th>Item</th>
<th>Frequency</th>
<th>Checked By</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gages, monitors and</td>
<td>Daily</td>
<td>Operator</td>
<td>Make visual inspection and record readings in log</td>
</tr>
<tr>
<td>indicators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrument and</td>
<td>Daily</td>
<td>Operator</td>
<td>Make visual checks of the heater settings compared to CEI’s recommended specifications</td>
</tr>
<tr>
<td>equipment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firing rate control</td>
<td>Weekly</td>
<td>Operator</td>
<td>Verify heater meets CEI’s recommended settings</td>
</tr>
<tr>
<td></td>
<td>Semiannually</td>
<td>Service Technician</td>
<td>Verify heater meets CEI’s recommended settings</td>
</tr>
<tr>
<td></td>
<td>Annually</td>
<td>Service Technician</td>
<td>Check with combustion test</td>
</tr>
<tr>
<td>Flue, vent, stack, or</td>
<td>Monthly</td>
<td>Operator</td>
<td>Make visual inspection of linkage, check for proper operation</td>
</tr>
<tr>
<td>outlet damper</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combustion air</td>
<td>Monthly</td>
<td>Operator</td>
<td>All sources remain clean and open</td>
</tr>
<tr>
<td>Ignition System</td>
<td>Weekly</td>
<td>Operator</td>
<td>Make visual inspection Check the Fireye flame signal strength readout, should be greater than 25 (see Combustion safety controls below)</td>
</tr>
</tbody>
</table>
### Fuel Valves

<table>
<thead>
<tr>
<th>Operation</th>
<th>Frequency</th>
<th>Responsible Party</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot and main</td>
<td>Weekly</td>
<td>Operator</td>
<td>Open limit switch-make aural and visual check. Check valve position indicators and check fuel meters if so fitted</td>
</tr>
<tr>
<td>Pilot and main gas or main fuel oil</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Perform leakage tests-refer to valve manufacturer’s instructions</td>
</tr>
</tbody>
</table>

### Combustion safety controls

<table>
<thead>
<tr>
<th>Operation</th>
<th>Frequency</th>
<th>Responsible Party</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame failure</td>
<td>Weekly</td>
<td>Operator</td>
<td>Close manual fuel supply for (1) pilot, (2) main fuel cock, and/or valve(s); check safety shutdown timing; log</td>
</tr>
<tr>
<td>Flame signal strength</td>
<td>Weekly</td>
<td>Operator</td>
<td>If flame signal meter installed, read and log; for both pilot and main flames, notify service organization if readings are very high, very low, or fluctuating; refer to flame safeguard manufacturer’s instructions</td>
</tr>
<tr>
<td>Pilot turndown test</td>
<td>As required annually</td>
<td>Service Technician</td>
<td>Required after any adjustments to flame scanner mount or pilot burner; verify annually-refer to flame safeguard manufacturer’s instructions. See Gas Pilot Adjustment on page 44.</td>
</tr>
<tr>
<td>Refractory hold in</td>
<td>As required annually</td>
<td>Service Technician</td>
<td>Refer to Gas Pilot Adjustment on page 44.</td>
</tr>
<tr>
<td>High limit safety control</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Refer to burner manufacturer’s instructions</td>
</tr>
<tr>
<td>Operating control</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Refer to burner manufacturer’s instructions</td>
</tr>
<tr>
<td>Low draft, fan, air pressure and damper</td>
<td>Monthly</td>
<td>Operator</td>
<td>Refer to this manual and control manufacturer’s instructions</td>
</tr>
<tr>
<td>High and low gas pressure interlocks</td>
<td>Monthly</td>
<td>Operator</td>
<td>Refer to instructions in this manual</td>
</tr>
<tr>
<td>Low fuel oil pressure interlocks</td>
<td>Monthly</td>
<td>Operator</td>
<td>Refer to instructions in this manual</td>
</tr>
<tr>
<td>Fuel valve interlock switch</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Refer to valve manufacturer’s instructions</td>
</tr>
<tr>
<td>Purge switch</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Refer to fuel/air control motor manufacturer’s instructions</td>
</tr>
<tr>
<td>Low fire start interlock</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Refer to fuel/air control motor manufacturer’s instructions</td>
</tr>
<tr>
<td>Automatic changeover control (dual fuel)</td>
<td>At least annually</td>
<td>Service Technician</td>
<td>Under supervision of gas utility</td>
</tr>
<tr>
<td>Inspect burner components</td>
<td>At least annually</td>
<td>Service Technician</td>
<td>Refer to this manual and control component manufacturer’s instructions</td>
</tr>
<tr>
<td>Remove fuel oil drawer assembly</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Remove and clean</td>
</tr>
<tr>
<td>Check blower motor and blower</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Remove and clean wheel for cleanliness. Remove and clean as necessary</td>
</tr>
<tr>
<td>Remove, inspect and clean gas pilot assembly</td>
<td>Annually</td>
<td>Service Technician</td>
<td>Remove and clean</td>
</tr>
</tbody>
</table>
# Preventive Maintenance Schedule

<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Start-up</th>
<th>Daily (visual check)</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Yearly</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record base point numbers</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Having base point numbers will help troubleshooting if problem occur</td>
</tr>
<tr>
<td>Prime Circulating Oil Pump seal area</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CRITICAL – May cause pump damage if not done at start-up</td>
</tr>
<tr>
<td>Check motors rotation</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fan has indicating label Circulating pump has indicating arrow cast into its frame.</td>
</tr>
<tr>
<td>Check fuel pressure gauges</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gas Inlet &amp; Manifold Pressure Gauges Fuel Oil Main &amp; Bypass Pressure Gauges</td>
</tr>
</tbody>
</table>

---

![Image of a gas boiler system with labels for various pressure gauges and connections.]

- **Main Fuel Oil Pressure Gauge**
- **Manifold Gas Pressure Gauge**
- **Gas Inlet Gauge**
- **Bypass Fuel Oil Pressure Gauge**
- **Gas Inlet Connection**
<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Start-up</th>
<th>Daily (visual check)</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Yearly</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check for clear exhaust</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Adjust burner fuel pressure and damper openings as required</td>
</tr>
<tr>
<td>Check for leaks</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visually check the burner for debris and/or blockage at blower</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual check of Heat Transfer Fluid pressure</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>Log pressure readings</td>
</tr>
<tr>
<td>Set temperature limits and alarms</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>See Heater Console on page 13.</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Start-up</td>
<td>Weekly</td>
<td>Monthly</td>
<td>Yearly</td>
<td>Notes</td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------</td>
<td>--------</td>
<td>---------</td>
<td>--------</td>
<td>-------</td>
<td></td>
</tr>
<tr>
<td>Grease Plug Valves</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>Grease fitting on Plug Valve (under dust cap in photo)</td>
<td></td>
</tr>
<tr>
<td>Heat Transfer Fluid level</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>Check level daily, analyze fluid annually</td>
<td></td>
</tr>
<tr>
<td>Heat Transfer Fluid filter/strainer</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>If present (optional, supplied by customer), check filter or strainer daily during first full week of operation and after heater maintenance; monthly thereafter. Replace or clean as required.</td>
<td></td>
</tr>
</tbody>
</table>
### Grease circulating pump

The circulating pump bearings consist of one outboard grease lubricated ball bearing and one internal liquid flushed carbon sleeve bearing. The ball bearing should be lubricated at the following intervals:

<table>
<thead>
<tr>
<th>Pump speed</th>
<th>Lubrication interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>1450 rpm</td>
<td>3200 hours of operation</td>
</tr>
<tr>
<td>1750 rpm</td>
<td>2800 hours of operation</td>
</tr>
<tr>
<td>2900 rpm</td>
<td>2000 hours of operation</td>
</tr>
<tr>
<td>3500 rpm</td>
<td>1700 hours of operation</td>
</tr>
</tbody>
</table>

Use the following quantities of grease:

<table>
<thead>
<tr>
<th>Bearing bracket</th>
<th>Grease (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>35</td>
<td>15</td>
</tr>
</tbody>
</table>

Use a lithium-soap grease lubricant free from resins and acids, protects against rust, and is suitable for high temperature.

### Fuel oil filter(s)

The quality of fuel oil will dictate the frequency of cleaning.

### Clean components external

Environmental conditions will dictate schedule.
<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Start-up</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Yearly</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remove to examine and clean UV Scanner</td>
<td>Daily (visual check)</td>
<td>X</td>
<td></td>
<td></td>
<td>Check for soot build-up – clean as needed</td>
</tr>
<tr>
<td>Check Flame Safeguard System</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Check flame signal strength for degradation. Close main and pilot fuel valves to verify shut-down sequence and timing. Log all events and timing.</td>
</tr>
<tr>
<td>Clean burner blower</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>Remove blower motor and clean blower wheel and blower housing.</td>
</tr>
</tbody>
</table>
Troubleshooting

Gas, Fuel Oil or Gas/Fuel Oil Burner – General Operations

Burner Fails to Start

1. Defective ON/OFF or Fuel Transfer switch. Replace.
2. Control circuit has an open control contact. Check limits, low heat transfer fluid cutoff, proof of closure switch and others as applicable.
3. Bad fuse or switch open on in-coming power source. Correct as required.
5. Flame safeguard control safety switch tripped. Reset and determine cause for apparent flame failure.
7. Frozen fuel oil pump shaft preventing blower motor operation. Replace fuel oil pump.
8. Flame safeguard control starting circuit blocked due to flame relay being energized (display shows False Flame):
   • Possible defective scanner – replace.
   • Possible defective amplifier – replace.
   • Scanner actually sighting flame due to leaking fuel valve – correct unwanted flame cause.
   • Defective flame safeguard control – replace.
   • External light source reaching sensor through firebox sight glass - correct.

Occasional Lockouts for No Apparent Reason

1. Gas pilot ignition failure. Readjust to make certain that ignition is instant and that flame signal readings are stable and above minimum values. Make certain the pressure is correct at the pilot test tee.
2. Gas pilot ignition and direct spark fuel oil ignition. Verify that there are no cracks in the porcelain. Check that both transformer and electrode end plugs connections are tight.
3. Loose or broken wires. Check all wire nut connections and tighten all terminal screw connections in panel and elsewhere as appropriate.
4. Occasional low voltage supply. Have local utility correct.
5. Occasional low gas supply pressure. Have local utility correct.
6. Air leak in fuel oil suction line or check valve not holding. Correct as required.
Gas Operation

Burner Motor Runs but Pilot Does Not Light

1. Gas supply to burner shut off – make sure all manual gas supply valves are open. Automatic high pressure valve at meter such as Sentry type tripped shut due to high gas pressure – reset valve and correct cause for valve tripping.

2. Pilot solenoid valve not opening – listen and feel for valve actuation. Solenoid valve not being powered – check electrical circuitry. Replace coil or entire valve if coil is burned out.


4. Gas pressure too high or too low at pilot orifice. Readjust gas pilot as required.

5. Defective ignition transformer – replace.


7. Air flow switch not making circuit – check out electrically and correct pressure adjustment on switch if required. Defective air flow switch. Replace. Air switch negative pressure sensing tube out of position – reposition as necessary.

Burner Motor Runs & Pilot Lights but Main Gas Flame is NOT Established

1. Main shut off or test cock closed. Check to make certain fully open.

2. Pilot flame signal reading too low to pull in flame safeguard relay. Readjust gas pilot as required.

3. Defective automatic main or auxiliary gas shut off valves. Replace valve(s) as required.

4. Defective flame safeguard control or plug in amplifier. Check and replace as required.

5. Butterfly valve incorrect. Readjust as required.


Carbon Monoxide Readings on Gas Firing

1. Flame impingement on cold heat transfer surfaces caused by excessive firing rate. Reduce firing rate to correct input volume.

2. Incorrect gas/air ratios. Readjust burner to correct CO₂/O₂ levels to reduce CO formation to appropriate level.

Gas High Fire Input Cannot Be Achieved

1. Gas company pressure regulator or meter operating incorrectly not allowing required gas pressure at burner train inlet. Have gas company correct.

2. Gas cock upstream of train inlet not fully open. Check and correct.
4. Gas train main and/or leak test cocks not fully open. Check and correct.
5. Automatic gas valve not opening fully due to defective operation. Replace.
8. Main gas pressure regulator vent line obstructed. Check and correct.
9. Normally open vent valve (if supplied) not closing when automatic gas valves open. Check to see if valve is fully closed when automatic valves are open. Replace vent valve if not closing fully.

Fuel Oil Operation

Burner Motor Runs but Direct Spark Ignited Fuel Oil Flame is NOT Established
1. Defective fuel oil nozzle. Remove and clean or replace.
2. Low fuel oil pressure. Check with gauge for correct light-off pressure.
3. Defective fuel oil pump. Replace.
5. Fuel oil pump coupling loose or defective. Replace or tighten as required.
6. Low fuel oil pressure switch (if supplied) defective or incorrectly set. Adjust or replace switch.
8. Ignition electrodes cracked and grounding out spark. Replace electrodes.
9. Ignition lead wire defective and grounding spark out. Replace.
10. Ignition plug in connections at transformer or electrodes loose. Tighten.
11. Air flow switch not making. Reset pressure or replace.
12. Defective flame safeguard control or plug in purge timer card. Replace.
13. Air dampers held in high fire position due to mechanical binding of linkage. Readjust linkage.
14. Loose wiring connections. Check and tighten all connections.

Fuel Oil Flame Ignites but then Flame Safeguard Control Locks Out on Safety
1. Flame scanner lens dirty. Remove and clean.
2. Scanner sight tube blocked or dirty. Check and clean.
3. Flame scanner defective. Replace.
5. Fuel/air ratios incorrect resulting in unstable or smoky flame causing scanner
6. Defective flame safeguard amplifier or control. Replace as appropriate.

**Fuel Oil Flame Extremely Smoky at Light Off or in Low Fire Position**
1. Defective fuel oil nozzle. Replace.
3. Normally closed fuel oil solenoid valve in fuel oil nozzle return line not opening. Check electrical circuitry and replace valve if defective.
4. Normally open pump mounted solenoid valve malfunctioning. Replace valve or pump.

**Light Off Fuel Oil Flame Is Established and Proven but Burner Will Not Attempt to Go to the High Fire Position**
1. Burner high fire temperature or pressure control could be defective or not set to call for high fire. Readjust or replace control.
2. Loose wires. Verify wiring and tighten all connections.
3. Flame safeguard control or high fire panel switching relay (if supplied) defective. Verify and correct as required.

**Low Fuel Oil Flame Is Established and Proven but Flame Out Occurs in Transition from Low Fire to High Fire**
1. Defective fuel oil nozzle. Replace.
2. High fire fuel oil pressure too low. Readjust.
3. Air dampers set too far open at low fire causing flame to blow out in starting to high fire. Readjust dampers.
4. Fuel oil pump coupling loose or defective. Tighten or replace.
5. Defective fuel oil pump. Replace.
7. Fuel/air ratios incorrect causing flame to blow out when going to high fire. Readjust linkage.

**White Smoke Formation on Fuel Oil Firing**
Fuel Oil/Air ratios incorrect due to excess air or fuel oil flow is too low. Readjust for proper fuel input, CO₂ and smoke reading.
Gray or Black Smoke Formation on Fuel Oil Firing

1. Impingement on cold combustion chamber surfaces due to incorrect fuel oil nozzle spray angle for application. This could also result in carbon formation on chamber surfaces. Change nozzle spray angle in order to shorten or narrow the flame as required.

2. Defective or dirty fuel oil nozzle. Replace or clean nozzle.

3. Incorrect fuel oil/air ratios. Readjust burner to correct CO₂ and smoke levels.


Fuel Oil High Fire Input Rate Cannot Be Achieved


2. Fuel oil supply pressure to nozzle too low. Readjust.


4. Fuel oil pump coupling loose (slipping) or defective. Replace.

5. Linkage mechanically binding. Readjust.

6. Fuel oil nozzle return line metering valve setting incorrect. Readjust to attain required nozzle bypass pressure.

7. Blocked or dirty suction line fuel oil filter. Replace or clean.


10. Vent system on fuel oil tank blocked creating vacuum on tank, with high vacuum and lowered fuel oil flow to burner. Check and correct.

Adjustments

Gas Pilot Adjustment

Excessive gas pressure and insufficient air are the most common causes of pilot ignition failure. Nominal pilot gas pressures are as follows:

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Nominal Pilot Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEI-1200</td>
<td>2&quot; - 4&quot; W.C.</td>
</tr>
<tr>
<td>CEI-1800 / 2400</td>
<td>1½&quot; - 3&quot; W.C.</td>
</tr>
<tr>
<td>CEI-3600 / 4900 / 6300</td>
<td>1¾&quot; - 2&quot; W.C.</td>
</tr>
</tbody>
</table>

Note: Do not increase pressure beyond that required for a stable flame signal.
Read the gas pressure at the test tee on the pilot gas supply pipe with a manometer or 0 to 10" W.C. gauge. Look for stability of gas pressure at all times. For dependable pilot ignition, always use air damper setting to provide MOST air and LOW-EST pilot gas pressure setting allowable for good pilot signal at all times.

**Note:** There is a tendency to set the air dampers in a closed, barely open position. This action may produce insufficient air for dependable pilot ignition. Air damper openings should be at least ¼" on each damper (or ½" on one, with the other nearly closed). Some job conditions may require larger air damper openings than those shown above.

1. Remove the pilot assembly and check for proper spark gap. The spark gap between the electrode and the outside radius of the gas pilot assembly should be 1/16" - 3/32". DO NOT set the spark to arc against the pilot head nozzle.

2. Close the checking cock (test cock). Start up burner and stop flame safeguard control timer with check switch during pilot ignition.

3. Observe the pilot signal with a DC voltmeter or microammeter. Reduce the pilot gas pressure to a point where the signal is erratic or reduced substantially from the initial reading.

4. Raise the pilot gas pressure to a point where the pilot signal is again stable. Remove the scanner and use a mirror to view the pilot flame through the scanner pipe. Be sure to get full coverage of scanner pipe by pilot flame.

**Note:** A live flame from cigarette lighter or butane torch may be needed to keep scanner actuated while viewing the pilot flame.
Release the check switch and observe the meter as the main gas valve opens and moves the air damper. If there is a drop in signal as this happens, increase pilot pressure slightly until signal is steady at all times.

5. Perform the Gas Pilot Flood Test below.

Gas Pilot Flood Test

Many pilot problems are caused by a poor mixture of gas and air at the point of ignition (ignition spark gap). The cause of this poor mixture condition is usually excessive gas flow or insufficient air (air dampers are closed too far).

1. Turn the burner off and shut the manual leak test cock in the main gas train.

   **Note:** The manual leak test cock valve should always be closed when making pilot adjustments.

2. Take steps to keep the fuel air linkage in the pilot light off position. Place the flame safeguard timer check switch in the test position.

3. Install a manometer or 0 to 10" W.C. gas pressure gauge in the pilot test tee fitting. Plug an appropriate flame signal meter into the flame safeguard control.

   **CAUTION!** the ignition transformer generates 6000 volts.

4. Disconnect the high tension ignition lead wire at the ignition transformer secondary terminal. Either hold onto the insulated portion or let the free ignition wire hang loose making sure it cannot come into contact with the bare ignition terminal on the transformer.

5. Start the burner and let it go through the prepurge period. When the pilot ignition circuit energizes (listen for the sound of the solenoid valve opening or watch the pilot gas pressure gauge) wait about 3 to 4 seconds then CAREFULLY touch the ignition lead wire to the transformer terminal secondary.

   If the pilot fuel/air mixture and ignition electrode are adjusted correctly, the pilot will light instantly and the flame signal reading will be steady and of the correct value. Continue to step 6.

   **If the pilot does not light instantly readjust the pilot gas pressure and/or the air dampers and/or the ignition electrode setting.**

6. Turn the burner off. Reconnect the ignition lead wire to the ignition transformer secondary terminal. Set the check switch in the flame safeguard control for automatic operation. Open the checking gas cock, turn the burner on and verify that the pilot lights and proves instantly providing good, smooth ignition of the main gas flame.

   **A successful Gas Pilot Flood Test does not always a guarantee correct pilot air/fuel mixture. However, a failure almost always indicate an excessively rich mixture.**
Fuel Oil Nozzle Servicing

*Note:* When removing or replacing the fuel oil nozzle and electrode assembly, take care to prevent damage to the ignition wire.

1. Remove the entire Fuel Oil Ignitor Gun Assembly for ease of service.
2. Disassemble (do not force disassembly) and thoroughly clean the nozzle with a liquid solvent (preferably non-flammable) and a brush. If the nozzle is damaged or burned, replace it.
3. Check the strainer. Clean or replace as necessary.

*Note:* Do not use a screwdriver, wire brush or similar metallic objects to clean nozzles. Damage to orifices or spray slots result in off-center or sparky fires.

4. Remove and clean the ignitor assembly including the porcelain insulators. Replaced the porcelain insulators if cracked.
5. Check the electrode tips and diffuser as indicated below and adjust as necessary:

5/16” from the tip of the Nozzle to the arc point

5/16” from the center of the Nozzle out (up in photo) to the Electrodes
6. Check that the diffuser is uniformly flat with approximately 1/4" to 5/16" between the blades.

7. Check the high tension wires and clips between the transformer and ignitor electrodes for deterioration.

8. Re-seat the nozzle firmly in the nozzle adapter to prevent leaks.
Section 5: Parts Replacement
Gas Train Components

Because components in the Gas Train should only be replaced and/or adjusted by qualified personnel CEI has not included replacement instructions for these components in this manual.

Firebox Sight Glass

Let the Heater cool before removing or replacing the Sight Glass.

1. Unscrew the cap holding the Sight Glass and remove it from the firebox.
2. Remove the three screws holding the sight glass in the cap and remove the sight glass.
3. Reverse the procedure to install the replacement sight glass.

Burner Back Plate Sight Glass

Let the Heater cool before removing or replacing the Sight Glass.

1. Remove the two screws holding the burner back plate in place then slide the plate down and off.
2. From the inside of the plate pop the sight glass ring out of the plate.
3. Reverse the procedure to install the replacement sight glass.
Expansion Tank Sight Gauge (glass)

Let the Heater and Heat Transfer Fluid cool before removing or replacing the Expansion Tank Sight Gauge.

1. Close both expansion tank sight gauge valves.
2. Loosen the two compression fittings on either end of the sight gauge - remove the gauge.
3. Using new rubber gaskets, install the new sight gauge and tighten the compression fittings.
4. Open both expansion tank sight gauge valves and check for leaks - correct as necessary.

Thermometer (any)

Let the Heater and Heat Transfer Fluid cool before removing or replacing a Thermometer.

CAUTION! - Make sure to unscrew the thermometer and NOT the thermowell.

1. Unscrew the thermometer from the thermowell and remove the thermometer.
2. Screw the new thermometer into the thermowell using gas/oil resistant pipe thread compound on the threads. Pay attention to the readability of the thermometer.
Thermocouple

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Thermocouple.

Let the Heater cool before removing or replacing the Thermocouple.

1. Remove the cover over the electrical connections, label the wiring (white is positive, red is negative) then disconnect the wiring. Disconnect the electrical conduit from the thermocouple and move it and its cable out of the way.
2. Unscrew the thermocouple assembly from the firebox and remove the unit.
3. Reverse the procedure to install the replacement thermocouple using gas/oil resistant pipe thread compound on the threads.
4. Remove the lockout and restore power.

Heat Transfer Fluid Circulating Pressure Switch

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Heat Transfer Fluid Circulating Pressure Switch.

Let the Heater cool before removing or replacing the Heat Transfer Fluid Circulating Pressure Switch.

1. Close the Heat Transfer Fluid Isolation, Supply and By-pass valves.
2. Place a drip pan under the switch location - a significant amount of Heat Transfer Fluid may leak out of the pipe where the switch is installed.
3. Remove the cover over the electrical connections, label the wiring then disconnect the wiring. Disconnect the electrical conduit from the switch and move it and its cable out of the way.
4. Unscrew and remove the switch.
5. Reverse the procedure to install the replacement switch using gas/oil resistant pipe thread compound on the threads.
6. Remove the lockout and restore power.
Heat Transfer Fluid Circulating Pressure Gauge

Let the Heater cool before removing or replacing the Heat Transfer Fluid Circulating Pressure Gauge.

1. Close the Heat Transfer Fluid Isolation, Supply and By-pass valves.
2. Place a drip pan under the gauge location - a significant amount of Heat Transfer Fluid may leak out of the pipe where the gauge is installed.
3. Unscrew and remove the gauge.
4. Reverse the procedure to install the replacement gauge using gas/oil resistant pipe thread compound on the threads.

*Note: Wait at least 10 minutes for the pipe thread compound to set before continuing.*

Fuel Filter

Let the Heater and cool before removing or replacing the Fuel Filter.

*Note: Fuel oil between the filter and the first fuel solenoid, and fuel oil between the filter and fuel oil supply valve, will leak out when the filter housing is removed.*

1. Place a drip pan under the fuel filter to catch leaking fuel oil.
2. Close the fuel oil supply valve (at the fuel oil supply).
3. Unscrew the filter housing and remove the old filter.
4. Place the new filter into the filter housing and inspect the filter housing O-ring making sure it is seated properly. Replace the O-ring if necessary.
5. Screw the filter housing back into place then remove the drip pan.
6. Open the fuel oil supply valve and check for leaks. Correct as necessary. If necessary go to Fuel Oil System Bleeding on page 57.

Fuel Oil Pressure Gauge (any)

Let the Heater cool before removing or replacing a Fuel Oil Pressure Gauge.

1. Place a drip pan *(or drip rag)* under the defective pressure gauge then remove the gauge.
2. Put gas/oil resistant pipe thread compound on the threads of the replacement gauge then install the gauge. Remove the drip pan.

*Note:* Wait at least 10 minutes for the pipe thread compound to set before continuing.

3. Start the heater on fuel oil to confirm proper operation. If fuel oil pressure is incorrect go to Fuel Oil System Bleeding on page 57.

---

**Fuel Oil Solenoid**

**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the Fuel Oil Solenoid.

Let the Heater cool before removing or replacing a Fuel Oil Solenoid.

1. Place a drip pan (*or drip rag*) under the defective solenoid then disconnect the fuel oil line flare connections.
2. Open the PowerFlame terminal box and locate where the leads from both solenoids are connected together.

3. Remove the cable ties then disconnect the solenoid wires from one another.

4. Remove the conduit nut holding the defective solenoid in place and remove the solenoid.

5. Install the replacement solenoid using the nut from above.

6. Connect the solenoid wires together and add cable ties.

7. Reconnect the fuel oil lines and remove the drip pan.

8. Remove the lockout and restore power.

9. Start the heater on fuel oil to confirm proper operation. If fuel oil pressure is incorrect go to Fuel Oil System Bleeding on page 57.

---

**Fuel Oil Pump**

**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the Fuel Oil Pump.

Let the Heater cool before removing or replacing the Fuel Oil Pump.

1. Close the fuel oil supply valve (at the fuel oil supply).
2. Place a drip pan (or drip rag) under the fuel oil pump then disconnect the flare connections for the fuel oil supply and return lines, the coupling for the fuel oil solenoids, and the coupling for the fuel oil check valve (indicated below).

3. Remove the two bolts holding the fuel oil pump then remove the pump and the attached plumbing.

   **Note:** When removing the assembly be careful not to damage the rubber coupling between the fuel oil pump and fan.

4. Mark the position of the coupling's flange on the motor shaft then loosen its set screws and remove the flange. Measure the distance from the motor shaft end to the mark just made.

5. Remove the fuel oil supply pipe, T fitting and coupling fitting from the pump.

6. Install the blower/fuel oil pump coupling flange on the replacement pump's shaft at the distance measured in step 4.

7. Put gas/oil resistant pipe thread compound on the threads of the items just removed then install then on the replacement pump making sure to align the parts as they were on the old pump.

   **Note:** Wait at least 10 minutes for the pipe thread compound to set before continuing.

8. Install the new pump reversing the steps above.

   **Note:** Be sure to properly align the fuel oil pump with the rubber coupling and the fan shaft.

9. Align the damper to the linkage where it was marked in step 4 and tighten the linkage.

10. Reconnect the fuel lines disconnected in step 2.

11. Remove the drip pan and open the fuel oil supply valve.

12. Remove the lockout and restore power.
13. Start the heater on fuel oil to confirm proper operation. If fuel oil pressure is incorrect go to Fuel Oil System Bleeding on page 57.

Modulating Fuel Oil Valve

1. Shut the fuel oil supply OFF then start the heater and let it run through pre-purge.
   • As the modulation motor repositions the modulating fuel oil valve’s pointer to low fire, record the position of the pointer.

   • As the modulation motor repositions the modulating fuel oil valve’s pointer to high fire, record the position of the pointer.

   **Note:** The pointer at low fire is at a higher number (as in the image above) than when at high fire (pointer is near 0).

2. Disconnect and lock out the power.

   **CAUTION!** - Make sure power is disconnected and locked out before removing the Modulating Fuel Oil Valve.

   Let the Heater cool before removing or replacing the Modulating Fuel Oil Valve.
3. Loosen the indicated actuator arm screws.

4. Place a drip pan (or rag) under the valve.

5. Disconnect the flare connections just above the gauge and the check valve (indicated below).

6. Unscrew the gauge Tee from the pipe leading to the valve.
7. Support the valve, loosen the setscrew and remove the nuts from the U-bolt.

8. While supporting the valve, slide the actuator arm away and lower it with the check valve and gauge pipe it from the burner.

9. Remove the pipe for the gauge and the elbow for the check valve.

10. Screw the pipe for the gauge and the elbow for the check valve into the replacement valve using gas/oil resistant pipe thread compound on the threads. Pay attention to the orientation of the check valve elbow.

11. Slide the replacement valve into the actuator arm and hold it in position with the U-bolt with nuts/washers removed above.

12. Reinstall the tee with the gauge using gas/oil resistant pipe thread compound on the threads. Pay attention to the orientation of the gauge.

**Note:** Wait at least 10 minutes for the pipe thread compound to set before continuing.

13. Reconnect the fuel lines, tighten the U-bolt nuts and the set screw. Remove the drip pan.

14. Position the pointer to the position recorded for low fire then snug the actuator arm screws.

15. Remove the lockout and restore power.

16. Start the heater and let it run through pre-purge. Check that the valve pointer points to both the low and high fire positions recorded earlier. If fuel oil pressure is incorrect go to Fuel Oil System Bleeding on page 57.

17. Go to step 3 under Air Damper, Gas and/or Fuel Linkage on page 91 to complete the Modulating Fuel Oil Valve replacement.
Fuel Oil System Bleeding

1. Make sure all fuel oil system connections are tight.
2. Place a drip pan (or drip rag) under the fuel oil return line next to the fuel oil filter.
3. Start the heater on fuel oil then slightly loosen the fuel oil return line connection at the fuel filter letting any air escape.
4. When no air is escaping and fuel oil is leaking out of the connection, tighten the connection.
5. Remove the drip pan and clean up any spilled fuel oil.

Burner Fuel Oil Ignition Transformer

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Burner Fuel Oil Ignition Transformer.

Let the Heater cool before removing or replacing the Burner Fuel Oil Ignition Transformer.

1. Remove the cover over the electrical connections, label then disconnect the wiring. Disconnect the electrical conduit from the box and move it and its cable out of the way.
2. Remove the heater back plate to access the transformer mounting nuts.

3. Unplug the two spark ignition wires then remove the transformer mounting nuts w/washers. Remove the transformer.

4. Install the replacement transformer using the nuts w/washers removed above.

5. Plug in the fuel oil spark ignition wires.

6. Reinstall the heater back plate
7. Feed the wiring through the side of the transformer cover, reattach the conduit then connect the wires to the transformer terminals. Reinstall the electrical cover.

8. Remove the lockout and restore power.

9. Start the heater on fuel oil to confirm proper operation.

---

**Fuel Oil Ignition Gun**

**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the Fuel Oil Ignition Gun.

Let the Heater and cool before removing or replacing the Fuel Oil Ignition Gun.

**Note:** This procedure can also be used for servicing.

**Gun Assembly**

1. Shut the fuel oil supply OFF and place a drip pan (or rag) under the fuel oil gun connections.

2. Remove the heater back plate and unplug the two ignition cables from the transformer.
3. Disconnect the fuel lines flare connections where they enter the burner and remove the indicated bolt.

4. Remove the fuel oil gun assembly.
   
   **Note:** If individual components are being replaced see their respective instructions that follow. (See Ignition Electrodes on page 60) (See Ignition Cables on page 62)

5. Check the replacement gun for proper spacing of the electrode tips and spacing to the fuel oil nozzle. See Ignition Electrodes below for measurements.

6. Install the replacement fuel oil gun assembly, center the diffuser within the tunnel then bolt into place using the bolt removed above.

7. Reconnect the fuel lines and remove the drip pan.

8. Remove the lockout and restore power.

9. Start the heater on fuel oil to confirm proper operation.

**Ignition Electrodes**

10. With the fuel oil gun assembly out, disconnect the cables from the ends of the electrodes.

11. Remove the diffuser. Loosen the clamp holding the electrodes to the fuel line and remove the electrodes.

12. Install the replacement electrodes and reinstall the diffuser. Tighten screws just enough to hold the diffuser and electrodes while allowing movement.
13. Adjust the electrode tips and diffuser as indicated:

14. Tighten the clamp and recheck the electrode adjustments.
15. Plug the cables into the electrodes.
16. Check that the diffuser is uniformly flat with approximately 1/4” to 5/16” between the blades.
17. Repeat from step 6.
Ignition Cables

18. With the fuel oil gun assembly out, disconnect the cables from the ends of the electrodes.
19. Remove the cable strain reliefs from the spacer bracket.

20. Remove the strain reliefs from the removed cables.
21. Plug the replacement cables into the ignition electrodes then feed through the spacer bracket.
22. Install the strain reliefs onto the cables at the spacer bracket.
23. Check that the diffuser is uniformly flat with approximately 1/4” to 5/16” between the blades.

Burner Blower Motor

**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the Burner Blower Motor.

**Let the Heater cool before removing or replacing the Burner Blower Motor.**

1. On the blower motor, remove the cover over the electrical junction box, label the motor wiring then disconnect the wiring. Release the wiring strain relief then remove the wiring cable from the junction box.

**CAUTION!** - The blower motor/fan assembly is heavy. Use care in removing it.
2. Remove all six flange nuts w/washers holding the motor/fan assembly to the burner and remove the assembly.

*Note: When removing the assembly be careful not to damage the rubber coupling between the fan and the fuel oil pump (when equipped).*

3. Mark the position of the fan on the motor shaft then remove the fan from the motor shaft. Measure the distance from the motor shaft end to the mark just made and write it down.

4. Remove the motor from the burner mounting flange.

5. Attach the replacement motor to the burner mounting plate.

6. Measure from the end of the new motor’s shaft the distance written down above and make a mark on the shaft. Position the fan at the mark on the motor shaft and tighten the fan mounting screws.

7. Place the assembly back onto the burner and reinstall the flange nuts w/washers.

*Note: Be sure to properly align the fan shaft with the rubber coupling to the fuel oil pump (when equipped).*

8. Reinstall the cable, reconnect the wiring then tighten the strain relief. Reinstall the junction box cover.

9. Remove the lockout and restore power.

10. Start the heater and verify the motor is rotating in the direction indicated on the housing. Correct if necessary.

11. Check for unwanted vibrations when the blower turns on - correct as necessary.
Burner Air Flow Switch

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Burner Air Flow Switch.

Let the Heater cool before removing or replacing the Burner Air Flow Switch.

1. Loosen the air line nut and disconnect the air line from the switch.

2. Remove the cover over the electrical junction box, label the switch wiring then disconnect the wiring. Disconnect the electrical conduit from the box and move it and its cable out of the way.

3. Remove the screws holding the air flow switch in place and remove the switch.

4. Position and install the replacement switch using the screws removed above then reconnect the air line.

5. Feed the wiring through the side of the electrical junction box and reattach the conduit.

CAUTION! For steps 6 through 11 the exposed terminals below the pressure adjustment screw may have 110VAC present.

6. Clip the switch wires together making sure that they cannot ground against anything, since they will be powered with 110 volts during the adjustment.

7. Put a continuity meter across the common and normally open terminals on the air switch.

8. Close the gas train checking cock. Remove the lockout and restore power.
9. Start the blower motor. The meter should read electrical continuity as soon as the blower starts.

10. Disconnect the blower motor (blower lead wire or the wire which energizes coil of motor starter. Within 4 to 5 seconds after the blower motor is de-energized, the meter should indicate an open air flow switch circuit (no continuity).

11. If the switch does not open in 4 to 5 seconds, readjust accordingly. Turn the air flow switch adjustment screw clockwise to shorten cut-off response time, and counter-clock-wise to lengthen cut-off response time.

12. Turn the burner power off. Remove the shorting clip from the two disconnected wires and let them hang loose. (They will be powered with 110 volts, so don’t let them ground out.)

13. Open the gas train checking cock. Turn the burner on. With the wires disconnected, the burner should go into a purge cycle, although neither the ignition nor the main fuel valve circuits will be energized.

   **Note:** If they do energize, there is a wiring problem. Correct as required.

14. Turn power off. Reconnect the air flow switch wires to the air flow switch terminals. Restore power and place burner back into normal operation.

15. Verify the burner started as expected then install the switch cover.
Burner Gas Ignition Transformer

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Burner Gas Ignition Transformer.

Let the Heater cool before removing or replacing the Burner Gas Ignition Transformer.

1. Remove the cover over the electrical connections, label the wiring then disconnect the wiring. Disconnect the electrical conduit from the box and move it and its cable out of the way.

2. Disconnect the gas spark ignition wire from the top of the transformer.

3. Remove the heater back plate to access the transformer mounting nuts.
4. Remove the transformer mounting nuts w/washers and remove the transformer.

5. Install the replacement transformer using the nuts w/washers removed above.

6. Reinstall the heater back plate.

7. Reconnect the gas spark ignition wire to the top of the transformer.

8. Feed the wiring through the side of the transformer cover, reattach the conduit then connect the wires to the transformer terminals. Reinstall the electrical cover.

9. Remove the lockout and restore power.

10. Start the heater on gas to confirm proper operation.
Gas Pilot Assembly

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Gas Pilot Assembly.

CAUTION! Turn the gas supply OFF with the Main Gas Cock valve on the gas train.

**Note:** Before removing the pilot housing from the blast tube mount make sure that alignment marks are present.

1. Disconnect the ignition wire from the gas pilot transformer and disconnect the tubing connection from the gas pilot assembly.
2. Mark the position of the Pilot Mounting Plate against the blast tube then remove the indicated mounting screws.
3. Loosen both the indicated screw and setscrew then remove the assembly from the blast tube (the assembly is shown already removed from the blast tube for clarity).
4. Reverse the procedure making sure the *clip* on goes on the inside of the blast tube to hold the front end of the assembly in place. Make sure to line up the alignment marks before tightening the screws and setscrew.

   ![Clip - goes on inside of blast tube]
   
   ![Pilot Mounting Plate - goes on outside of blast tube]

5. Remove the lockout and restore power.
6. Start the heater on gas to confirm proper operation.

**Ignition Electrode**

1. Remove the clamp screw and clamp then remove the electrode.

   ![Clamp screw]

2. Install the replacement electrode and adjust the electrode distance from the open end and the spark gap then tighten the clamp screw. The spark gap between the electrode and the outside radius of the gas pilot...
assembly should be 1/16” - 3/32”. DO NOT set the spark to arc against the pilot head nozzle.

3. Reinstall the assembly following the steps under Gas Pilot Assembly above.

**Ignition Cable**

1. Unplug the cable from the back of the electrode and pull out through the strain relief.

2. Reinstall the assembly following the steps under Gas Pilot Assembly above.
**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the UV Scanner.

Let the Heater cool before removing or replacing the UV Scanner.

1. Note the route of the UV Sensor's cable then remove the cable ties holding the cable (be sure to note how the excess cable is coiled).
2. Open the PowerFlame terminal box and locate terminals S1 and S2.
3. Note which color of wire is connected the which terminal then disconnect the UV Scanner wires and pull the cable out the conduit connector.
4. Remove the UV Scanner from the burner.

5. Install the replacement UV Scanner and feed its cable through the conduit connector.

6. Connect the wires to terminals S1 and S2 in the PowerFlame terminal box.

   **Note:** Newer scanners also include a ground wire - be sure to connect it to the ground connection in the terminal box.

7. Route and cable tie the cable as noted in step 1 and coil the excess cable so it doesn’t get caught/damaged in moving parts.

8. Remove the lockout and restore power.

9. Start the heater on gas to confirm proper operation.
Level Control

**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the Level Control.

Let the Heater cool before removing or replacing the Level Control.

Place a drip pan under the Level Control to catch up to 5 gallons of heat transfer fluid from the control's plumbing.

1. Drain all the heat transfer fluid out of the expansion tank.
2. Remove the upper cover from the Level Control.
3. Locate, label and disconnect the electrical connections going into the conduit. Remove the conduit nut and pull the conduit with wiring away from the level control.
4. Make sure to have a drip pan positioned then unscrew the Level Control from the expansion tank.

5. Reverse the procedure to install the replacement Level Control using gas/oil resistant pipe thread compound on the threads. Be careful to not to damage the float.
6. Remove the lockout and restore power.
7. Start the heater and monitor the level control signal.
Level Control Switch

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Level Control Switch.

Let the Heater cool before removing or replacing the Level Control.

1. Remove the upper cover from the Level Control.
2. Disconnect the switch electrical connections and spring.
3. Remove the switch mounting screw and remove the switch.

4. Reverse the procedure to install the new switch. Note that the switch wires left to right in the image go to terminals 4, 5 & 6 respectively.
5. Remove the lockout and restore power.
6. Start the heater and monitor the level control signal.
Circulating Motor/Pump Coupling

**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the Motor Pump Coupling.

1. Remove the cover from the coupling cover between the motor and pump.
2. If the entire coupling is being replaced, mark the position of the coupling on both the motor and pump shafts.

**Note:** Normally only the sleeve is replaced unless a flange is damaged.

3. Loosen the set screws on one flange and slide it away from the other enough to remove the sleeve. Remove the sleeve.
   **Note:** If only the sleeve is being replaced, skip to step 8.
4. Slide the flange from above off of its shaft. As the flange key is exposed, remove and set it aside.
5. Loosen the set screws on the other flange and remove it. Remove its key and set it aside as it is exposed.
6. Place one of the replacement flanges onto a shaft, position its key then slide it over the key. Align it with the mark made above then snug its set screws.
7. Slide the remaining flange onto the other shaft, position its key and slide it over the key far enough to place the sleeve between the two flanges.
8. Position the sleeve between the flanges then slide the free flange barely against the sleeve and aligned with the mark from above. Snug its set screws.
9. Continue to the Circulating Motor/Pump Coupling Alignment on page 76.
Circulating Motor/Pump Coupling Alignment

CAUTION! - Make sure power is disconnected and locked out before aligning the Motor/Pump Coupling.

Note: Inspect the existing sleeve to ensure there are no obvious equipment issues that could lead to a premature failure of a replacement sleeve. For example, if the serrations are worn off the old sleeve, there could be issues with misalignment. If the old sleeve is torn, particularly a diagonal tear in the sleeve, this could indicate the coupling is being subjected to an over torque condition. These issues need to be corrected prior to placing the equipment back in service.

1. Measure the coupling width at the outside of the flanges (see figure below) at several places around the coupling. All measurements should be the equal.

Note: Measurements that are not equal may indicate that the motor and pump shafts are not parallel to one another (tilted). Check the shafts to be parallel to the frame then correct the item that is not parallel using shims.
2. Lay a straight edge across the top of the flanges and note the space between the straight edge and the second flange. This parallel misalignment should be minimal.

![Note space]

*Note:* If the parallel misalignment is too great shim the lower item (motor or pump) to correct.

**CAUTION!** If the surfaces are not parallel excessive vibration may result. Contact CEI for assistance.

3. Tighten the coupling set screws and repeat from step 1.
4. Reinstall the coupling cover and remove the drip pan (if placed).
5. Remove the lockout and restore power.
6. Start the circulating pump (motor) and check for unwanted vibrations - correct as necessary.

If the circulating pump motor was replaced verify the motor is rotating in the direction indicated on the housing. Correct if necessary.

---

**Circulating Pump Motor**

**CAUTION!** - Make sure power is disconnected and locked out before removing or replacing the Circulating Pump Motor.

1. Remove the cover from the coupling cover between the motor and pump.
2. Remove the cover over the electrical junction box, label the motor wiring then disconnect the wiring. Release the wiring strain relief then remove the wiring cable from the junction box.
CAUTION! - Motors are heavy and may require a mechanical lift to remove and place on the heater assembly.

3. Mark the position of the motor then loosen and remove the mounting bolts holding the motor in place. Remove the motor making sure to note the position of any shims. Set the shims aside.

4. Mark the position of the coupling on the motor shaft then loosen its set screws and remove the coupling and coupling key. Measure the distance from the motor shaft end to the mark just made.

5. On the replacement motor\(^1\), place a mark the distance from the end of the motor shaft measured above. Slide the coupling onto the shaft making sure to properly position the key and align it with the mark on the shaft. Snug but do not torque the coupling set screws.

6. Position the replacement motor and any removed shims on the heater and loosely bolt into place.

7. Reinstall the cable, reconnect the wiring then tighten the strain relief. Reinstall the junction box cover.

8. Go the Circulating Motor/Pump Coupling Alignment on page 76.

---

Circulating Pump

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Circulating Pump.

Let the Heater and Heat Transfer Fluid cool before removing or replacing the Circulating Pump.

1. Close the Heat Transfer Fluid Isolation, Supply and By-pass valves.

2. Place a drip pan under the circulating pump - a significant amount of Heat Transfer Fluid will leak out of the pump and surrounding plumbing when the pump is removed.

3. Remove the cover from the coupling cover between the motor and pump.

CAUTION! - Pumps are heavy and may require a mechanical lift to remove and place on the heater assembly.

4. Mark the position of the pump then loosen and remove the mounting bolts holding the pump in place. Remove the pump making sure to note the position of any shims. Set the shims aside.

---

1. If the replacement motor IS NOT an exact replacement, align the end of the flange (serration side) with the end of the motor shaft.
5. Mark the position of the coupling on the pump shaft then loosen its set screws and remove the coupling and coupling key. Measure the distance from the pump shaft end to the mark just made.

**Note:** Before installing the replacement pump be sure to remove all dust plugs from the pump. Check all possible locations.

6. On the replacement pump, place a mark the distance from the end of the pump shaft measured above. Slide the coupling onto the shaft making sure to properly position the key and align it with the mark on the shaft. Snug but do not torque the set screws.

7. Position the replacement pump with new flange gaskets and any removed shims on the heater and loosely bolt into place.

8. Go the Circulating Motor/Pump Coupling Alignment on page 76.

---

**Electrical Components (Control Box)**

CAUTION! - Make sure power is disconnected and locked out before removing or replacing any Electrical Component.

**Note:** Certain electrical components contain settings and/or programming that must be set before using the component. When a replacement is ordered from CEI the settings and/or programming are pre-set for your system with the exception of some site specific settings. Ordering these components from another vendor may require additional resources to set or program the component.

1. When a component to be replaced has wiring connected to it, label the wiring as to its corresponding connection then disconnect the wiring.

2. Remove the component.

**Note:** Depending on the specific component, the component may be plugged in, screwed in, etc. Use the correct tool(s) to remove it.

3. Reverse the above to install the replacement component. For site specific settings see the indicated components listed below:
   - Honeywell UDC1200 Modulating Temperature Controller on page 80
   - Honeywell UDC120L High Temperature Limit Controller on page 83

4. Remove the lockout and restore power.

---

2. If the replacement pump IS NOT an exact replacement, align the end of the flange (serration side) with the end of the pump shaft.
Honeywell UDC1200 Modulating Temperature Controller

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Honeywell UDC1200 Modulating Temperature Controller.

Note: The Honeywell UDC1200 Modulating Temperature Controller is pre-programmed to the values listed in the tables below when ordered from CEI.

There are two distinct UDC1200 areas to program; Configuration and Setup. Configuration is programmed first.

Note: The controller automatically returns to the Operator mode after 2 minutes if no buttons are pressed.

Configuration

Note: It is important to know this procedure in case of loss of program due to power surges.

1. Remove the lockout and restore power.

2. With power applied to the unit, press and hold \( \text{SETUP} \) then press \( \text{SEL} \) to enter the Select mode (SLCt on the lower display).

3. Use \( \text{SEL} \) or \( \text{SEL} \) to scroll the upper display until it shows Conf then press \( \text{SETUP} \).

4. Use \( \text{SEL} \) or \( \text{SEL} \) to adjust the upper display for a value of 20 (the default unlock code for configuration) then press \( \text{SETUP} \).

5. Press \( \text{SETUP} \) to display the desired Configuration Parameter on the lower
display then use \( \uparrow \) or \( \downarrow \) to set the upper display value. Press \( \text{Man} \text{ Auto} \) to accept and enter the parameter value.

**Note:** If the Man/Auto button is not pressed the value returns to the original value.

6. Repeat step 5 until all Configuration Parameter values match the values in the following table:

<table>
<thead>
<tr>
<th>Lower Display</th>
<th>Function</th>
<th>Upper Display Value</th>
<th>Lower Display</th>
<th>Function</th>
<th>Upper Display Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>InPt</td>
<td>Input Type</td>
<td>JF</td>
<td>AHY2</td>
<td>Alarm 2 Hysteresis</td>
<td>1.0</td>
</tr>
<tr>
<td>ruL</td>
<td>Scale Range Upper Limit</td>
<td>450.0</td>
<td>LAEn</td>
<td>Loop Alarm</td>
<td>dISA</td>
</tr>
<tr>
<td>rLL</td>
<td>Scale Range Lower Limit</td>
<td>20.0</td>
<td>Inhi</td>
<td>Alarm Inhibit</td>
<td>nonE</td>
</tr>
<tr>
<td>CtYP</td>
<td>Control Type</td>
<td>SnGL</td>
<td>USE1</td>
<td>Output 1 Usage</td>
<td>Pri</td>
</tr>
<tr>
<td>Ctrl</td>
<td>Primary Outut Control Action</td>
<td>rEu</td>
<td>tyP1</td>
<td>Linear Output 1 Range</td>
<td>4_20</td>
</tr>
<tr>
<td>ALA1</td>
<td>Alarm 1 Type</td>
<td>dE</td>
<td>USE2</td>
<td>Output 2 Usage</td>
<td>A2_d</td>
</tr>
<tr>
<td>dAL1</td>
<td>Derivative Alarm 1 Value</td>
<td>25.0</td>
<td>USE3</td>
<td>Ouptup 3 Usage</td>
<td>A1_r</td>
</tr>
<tr>
<td>AHY1</td>
<td>Alarm 1 Hysersis</td>
<td>35.0</td>
<td>diSP</td>
<td>Display Strategy</td>
<td>2</td>
</tr>
<tr>
<td>ALA2</td>
<td>Alarm 2 Type</td>
<td>dE</td>
<td>CLoc</td>
<td>Configuration Lock Code</td>
<td>20</td>
</tr>
<tr>
<td>dAL2</td>
<td>Derivative Alarm 2 Value</td>
<td>15.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Press \( \text{Man} \text{ Auto} \) two times to exit Configuration.

**Setup**

**Note:** It is important to know this procedure in case of loss of program due to power surges.

Configuration must be completed before starting Setup.

1. With power applied to the unit, press and hold \( \text{SETUP} \) then press \( \uparrow \) to enter the Select mode (SLCt on the lower display).

2. Use \( \uparrow \) or \( \downarrow \) to scroll the upper display until it shows SetP then press \( \text{SETUP} \).

**Note:** While the UDC1200 is in Setup the Man indicator is lit.
3. Use  or  to adjust the upper display for a value of 10 (the default unlock code for setup) then press  

4. Press  to display the desired Setup Parameter on the lower display then use  or  to set the upper display value.

**Note:** Unlike configuration, pressing Setup after changing a value enters that value and displays the next parameter.

5. Repeat step 4 until all Setup Parameter values match the values in the following table:

<table>
<thead>
<tr>
<th>Lower Display</th>
<th>Function</th>
<th>Value</th>
<th>Lower Display</th>
<th>Function</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FiLt</td>
<td>Input Filter Time</td>
<td>0.0</td>
<td>dAL 1</td>
<td>Derivative Alarm 1</td>
<td>25.0</td>
</tr>
<tr>
<td></td>
<td>Constant</td>
<td></td>
<td></td>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>OFFS</td>
<td>Process Variable</td>
<td>0.0</td>
<td>AhY 1</td>
<td>Alarm 1 Hysteresis</td>
<td>35.0</td>
</tr>
<tr>
<td></td>
<td>Offset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPLj</td>
<td>Current Power Levels</td>
<td>0</td>
<td>dAL 2</td>
<td>Derivative Alarm 2</td>
<td>15.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>Pb_P</td>
<td>Primary Proportional</td>
<td>10.0</td>
<td>AhY 2</td>
<td>Alarm 2 Hysteresis</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Band</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ArSt</td>
<td>Integral Time</td>
<td>5.00</td>
<td>ApT</td>
<td>Auto Pre-Tune</td>
<td>diSA</td>
</tr>
<tr>
<td>rAtE</td>
<td>Derivative Time</td>
<td>1.00</td>
<td>PoEn</td>
<td>Auto/Manual Control</td>
<td>EnAb</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Selection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>biAS</td>
<td>Manual Reset</td>
<td>0</td>
<td>SpR</td>
<td>Show Set Point Ramp</td>
<td>diSA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Adjust</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPuL</td>
<td>Set Point Upper</td>
<td>450.0a</td>
<td>rP</td>
<td>Set Point Ramp Value</td>
<td>(leave blank)</td>
</tr>
<tr>
<td></td>
<td>Limit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPLL</td>
<td>Set Point Lower</td>
<td>20.0a</td>
<td>SP</td>
<td>Set Point Value</td>
<td>350.0</td>
</tr>
<tr>
<td></td>
<td>Limit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPuL</td>
<td>Primary Output</td>
<td>100</td>
<td>SLoc</td>
<td>Setup Lock Code</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Power Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a. These values are automatically populated from the corresponding values in configuration*

6. Press and hold  then press  to return to the Select mode.
Honeywell UDC120L High Temperature Limit Controller

CAUTION! - Make sure power is disconnected and locked out before removing or replacing the Honeywell UDC120L High Temperature Limit Controller.

Note: The Honeywell UDC120L High Temperature Limit Controller is pre-programmed to the values listed in the tables below when ordered from CEI.

There are two distinct UDC120L areas to program; Configuration and Setup. Configuration is programmed first.

Note: The controller automatically returns to the Operator mode after 2 minutes if no buttons are pressed.

**Configuration**

Note: It is important to know this procedure in case of loss of program due to power surges.

1. Remove the lockout and restore power.
2. With power applied to the unit, press and hold **SETUP** then press **UP** to enter the Select mode (SLCt on the lower display).
3. Use **UP** or **DOWN** to scroll the upper display until it shows **ConF** then press **SETUP**.
4. Use **UP** or **DOWN** to adjust the upper display for a value of 20 (the default unlock code for configuration) then press **SETUP**.
5. Press **SETUP** to display the desired Configuration Parameter on the lower
display then use \( \uparrow \) or \( \downarrow \) to set the upper display value. Press \( \text{RESET} \) to accept and enter the parameter value.

**Note:** If a changed parameter value is blinking the Reset button must be pressed or the value will return to the original value.

6. Repeat step 5 until all Configuration Parameters match the values in the following table:

<table>
<thead>
<tr>
<th>Lower Display</th>
<th>Function</th>
<th>Upper Display Value</th>
<th>Lower Display</th>
<th>Function</th>
<th>Upper Display Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>InPt</td>
<td>Input Type</td>
<td>JF</td>
<td>AHY1</td>
<td>Alarm 1 Hysteresis</td>
<td>1</td>
</tr>
<tr>
<td>ruL</td>
<td>Scale Range Upper Limit</td>
<td>450.0</td>
<td>ALA2</td>
<td>Alarm 2 Type</td>
<td>P_Lo</td>
</tr>
<tr>
<td>rLL</td>
<td>Scale Range Lower Limit</td>
<td>20.0</td>
<td>PLA2</td>
<td>Low Alarm 2 Value</td>
<td>20</td>
</tr>
<tr>
<td>OFFS</td>
<td>Process Variable Offset</td>
<td>0</td>
<td>AHY2</td>
<td>Alarm 2 Hysteresis</td>
<td>1</td>
</tr>
<tr>
<td>Ctrl</td>
<td>Limit Action</td>
<td>Hi</td>
<td>USE2</td>
<td>Output 2 Usage</td>
<td>A1_d</td>
</tr>
<tr>
<td>SPuL</td>
<td>Setpoint Upper Limit</td>
<td>450.0</td>
<td>diSP</td>
<td>Display Strategy</td>
<td>EnAb</td>
</tr>
<tr>
<td>ALA1</td>
<td>Alarm 1 Type</td>
<td>P_Hi</td>
<td>Cloc</td>
<td>Configuration Lock Code</td>
<td>20</td>
</tr>
<tr>
<td>PhA1</td>
<td>High Alarm 1 Value</td>
<td>450.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7. Press and hold \( \text{SETUP} \) then press \( \uparrow \) to return to the Select mode.

**Setup**

**Note:** It is important to know this procedure in case of loss of program due to power surges.

**Configuration must be completed before starting Setup.**

1. If necessary, press and hold \( \text{SETUP} \) then press \( \uparrow \) to enter the Select mode (SLC\text{t} on the lower display).

2. Use \( \uparrow \) or \( \downarrow \) to scroll the upper display until it shows \( \text{SEtp} \) then press \( \text{SETUP} \).

**Note:** While the UDC120L is in Setup the Setup LED indicator is lit.

3. Use \( \uparrow \) or \( \downarrow \) to adjust the upper display for a value of 10 (the unlock code for setup) then press \( \text{SETUP} \).
4. Press \textbf{SETUP} to display the desired Setup Parameter on the lower display then
use \textbf{ or \textbf{}} to set the upper display value.

5. Press \textbf{SETUP} to accept the parameter and display the next parameter.

6. Repeat from step 4 until all Setup Parameters match the values in the following table:

\begin{center}
\begin{tabular}{|c|c|c|c|c|}
\hline
Lower & Function & Value & Lower & Function & Value \\
Display & & & Display & & \\
\hline
SP & Setpoint Value & 450.0 & AHY1 & Alarm 1 Hysteresis & 1.0 \\
hySt & Limit Hysteresis & 1.0 & PLA2 & Low Alarm 2 Value & 20.0 \\
fLt & Input Filter time Constant & 2.0 & AHY2 & Alarm 2 Hysteresis & 0.1 \\
PhA1 & High Alarm 1 Value & 450.0 & SLoc & Setup Lock Code & 10 \\
\hline
\end{tabular}
\end{center}

7. Press and hold \textbf{SETUP} then press \textbf{ to return to the Select mode.

\section*{Modulating Motor}

\textbf{Let the Heater cool before removing or replacing the Modulating Motor.}

\textbf{CEI suggests that the Modulation Motor and its internal Resistor Board be replaced together.}

1. If not already present, mark both the low and high fire positions for the air
damper openings, both right and left linkages and the modulating fuel oil valve
pointer.

\textbf{CAUTION!} - Make sure power is disconnected and locked out
before removing or replacing the Modulating Motor.
2. Remove the electrical connection cover, label all the wiring then disconnect the wiring. Remove the conduit nuts then remove the wiring cable from the motor enclosure.

3. DO NOT loosen any linkage bolts or screws. Loosen the 4 square head bolts (2 on each side) on the modulating motor shaft extensions just enough to allow the extensions to slide then slide each shaft extension off the motor shafts.

4. Remove the 4 mounting bolts/nuts/washers holding the modulating motor then remove the motor.

If possible, replace the resistor board and adjust the cams on a workbench.

- See Workbench on page 87 for workbench instructions.
- See On Heater on page 89 for on heater instructions.
Workbench

1. When installing a new resistor board, set its DIP switches to match those of the removed motor’s resistor board.

Note: To verify the DIP switches are correctly set measure the resistance from $W^+$ to R and $R^+$ and B. Resistance should be $66.5\,\Omega$ and $237\,\Omega$ respectively.

2. Remove the new modulating motor cover and install the resistor board.

3. When the resistor board is installed, connect the brown wires from the transformer to T1 & T2 on the resistor board then set the board switches the same as those on the removed motor.

   If the resistor board is not installed at this time connect the brown wires from the transformer to the T1 & T2 lugs.

CAUTION! Possibility of electrical shock - all connections may and all transformer leads will be live. Use proper precautions for steps 4 through 8.
4. Connect 110VAC to the motor’s transformer input leads then apply power. When power is applied the motor will drive to the low fire position (if not already there).

5. With the motor at the Low Fire position, adjust the outer cam so that the indicated high point of the cam is actuating the low fire switch.

6. Remove power, place a jumper between R– and B. Reapply power to drive the motor to the High Fire position.

7. With the motor at the High Fire position, adjust the inner cam so that the indicated high point of the cam is actuating the high fire switch.

8. Remove power and remove the jumper.

9. Repeat steps 4 through 8 to verify the cams actuate their switches at the proper positions. Disconnect the external power.
10. Using the bolts/nuts/washers removed earlier, install the new modulating motor.

11. See Air Damper, Gas and/or Fuel Linkage on page 91 to complete the modulating motor replacement.

On Heater

1. Note the removed motor's resistor board switch settings and wire connections:
   • When installing a new resistor board, set its DIP switches to match those of the removed motor's resistor board.
     
     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
     |---|---|---|---|---|---|---|---|---|----|
     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

     Old Style Dip Switches      New Style Dip Switches
     Switch positions are the same - numbering differs

   *Note: To verify the DIP switches are correctly set, measure the resistance from $W^+$ to $R$ and $R^+$ and $B$. Resistance should be 66.3Ω and 237Ω respectively.*

   • If the existing resistor board is being reused, disconnect the wiring and remove it from the defective motor.

2. Install the resistor board in the new motor and connect all the wires except the wire to the $W^+$ terminal.

3. Using the bolts/nuts/washers removed earlier, install the new modulating motor.
**CAUTION!** Possibility of electrical shock - all terminal connections may and all transformer leads will be live. Use proper precautions for steps 4 through 11.

4. Route the wiring cable into the new motor and secure the conduit with the conduit nuts removed earlier.

5. Verify that the main fuel valves are closed then apply power to the burner – the burner will go through a prepurge cycle and stop (locked out) in a low fire position.

6. With the motor at the Low Fire position, adjust the outer cam so that the indicated high point of the cam is actuating the low fire switch.

7. Remove power, place a jumper between R– and B. Reapply power to drive the motor to the High Fire position.

8. With the motor at the High Fire position, adjust the inner cam so that the indicated high point of the cam is actuating the high fire switch.

9. Remove power and remove the jumper.

10. Repeat steps 5 through 9 to verify the cams actuate their switches at the proper positions.

11. Connect the W+ wire to the W+ terminal then install the motor cover.

12. Continue to Air Damper, Gas and/or Fuel Linkage.
Air Damper, Gas and/or Fuel Linkage

1. With the burner locked out and the modulating motor at the low fire position
slide the motor shaft extensions onto the motor shafts paying attention to the
linkage marks made earlier. Because the motor shafts are square the shaft
extensions will properly align onto the motor shafts (when the shaft extension
bolts were only loosened). Tighten the shaft extension bolts.

2. Turn the burner on and let it advance to the main flame light off position.

**Note:** Perform steps 3 through 5 using the fuel source normally used to operate the heater. On combination
systems, when no changes have been made to the control linkage, the linkage for the other
fuel should not need adjustment.

3. With the burner in the low fire position, check for a fuel/air ratio low fire
settings of:
   - 7 - 9% CO₂ and little or no³ CO on Gas.
   - 8 - 10% CO₂ and #0 - #2 Smoke Reading on Fuel.

   **Note:** If an adjustment is necessary, make the adjustment and mark the linkage at the new
settings.

4. Increase the firing rate to the midway point. Again check for a fuel/air ratio of:
   - 7 - 9% CO₂ and little or no³ CO.
   - 9 - 11% CO₂ and #0 - #2 Smoke Reading on Fuel.

   **Note:** If an adjustment is necessary, make the adjustment and mark the linkage at the new
settings.

5. Increase the firing rate to high fire position and repeat the test done for the
mid point adjustment. Check for fuel/air ratio of:
   - 8½ - 10% CO₂ and little or no³ CO on Gas
   - Approximately 12½% CO₂ and no more than #2 Smoke Reading on Fuel.

   **Note:** If an adjustment is necessary, make the adjustment and mark the linkage at the new
settings.

Gas/Air or Fuel/Air Mixture Adjustments

**CAUTION!** The following procedures should only be performed by individuals
qualified and trained to perform the adjustments.

The adjustments that follow are condensed. For complete instructions consult the
manufacturer’s manual.
Gas Burner Instructions

1. Check all linkages
2. Close the main, checking and pilot gas cocks.
3. Install required system measuring devices:
   - Appropriate flame signal meter to the flame safeguard control.
   - U-Tube Manometer or 0-10" W.C. gauge in the pilot test tee port.
   - Stack thermometer and CO₂ or O₂ analyzer sample line to the breaching.
   - Draft gauge or inclined manometer to the combustion chamber test point.
   - 0-35" W.C. gauge main gas pressure regulator inlet.
4. Slowly open the main gas cock in order to determine that the incoming gas pressure is within the specified limits of the main and pilot gas pressure regulators, automatic fuel valves and gas pressure switches.
5. Disconnect the pilot line at the inlet to the pilot gas pressure regulator and purge air from the pilot gas line. After the air is purged from the gas supply system, close the pilot cock and reconnect the pilot line. Leave the pilot cock closed.

   Note: It is strongly recommended that an automatic gas valve bubble leak test be performed in accordance with the gas valve manufacturer's instructions periodically in order to ensure that the valve is functioning according to the manufacturer's specifications. It is also suggested that the test be conducted during a normal prepurge burner operation.

6. If necessary, set the air dampers approximately ¼" open. With both pilot and leak test gas cocks closed, open the main gas cock to allow the low gas pressure switch to make its circuit. With the control switch in the OFF position, apply power to the burner through the main burner disconnect switch. Switch the burner panel ON/OFF switch to the ON position momentarily to determine that the blower rotation is correct.
7. Restart the burner. With the pilot gas cock closed, the burner goes through a blower prepurge period. After the prepurge the gas pilot ignition transformer is energized although no pilot will be established. At no time should there be any flame signal reading nor should the main gas valve attempt to open. At the end of the pilot trial for ignition and blower purge period the flame safeguard control should shut the system down in a safety lock-out mode. The safety lock-out mode requires a manual reset to the flame safeguard control to restart the burner.
8. Wait three minutes, reset the flame safeguard control safety switch and open the pilot gas cock. When the blower prepurge period ends and the burner is energized, set the flame safeguard timer Stop/Run switch to Stop. While the pilot is on make adjustments as required. Recycle the burner several times to make certain pilot operation is reliable.
9. **Initial Spark Pickup Test.** With the pilot gas cock closed, the burner goes through a blower prepurge period. After the prepurge the gas pilot ignition transformer will be energized although no pilot will be established. At no time should there be any flame signal reading nor should the main gas valve attempt to open. At the end of the pilot trial for ignition and blower purge period the flame safeguard control should shut the system down in a safety lock-out mode. The safety lock-out mode requires a manual reset to the flame safeguard control to restart the burner.

10. Once the pilot adjustments are complete set the timer switch to the Run position to allow the start-up sequence to proceed to the automatic gas valve energizing position.

11. When the main automatic gas valve begins to open, slowly open the checking gas cock to light off the main flame. The main flame should light immediately.

12. Adjust the burner as necessary to provide smooth ignition of the main flame. If the flame signal drops significantly when the main automatic gas valve opens, slightly increase the pilot gas pressure to attain a stable flame signal value.

13. Verify that the butterfly valve is in the low fire position. To verify observe the end of the metering valve shaft, the slot in the end of the shaft indicates the position of the valve. If low fire the valve should be nearly closed.

14. Turn the burner on and let it advance to the main flame light off position. Take action as necessary to hold the linkage at the low fire position by electrically disconnecting the modulating motor.

**Note:** It is suggested that the factory settings be noted and marked on the linkage prior to proceeding with final adjustment.

15. With the burner in the factory set low fire position, adjust air and fuel linkage to good fuel/air ratio low fire settings (7 - 9% CO₂, little or no CO). If the linkage position is different from the factory settings, mark the linkage at the new settings.

16. Increase the firing rate to the midway point. Set the fuel/air ratios to achieve good combustion values (7-9% CO₂, little or no CO). Again, if the linkage position is different from the factory settings, mark the linkage at the new mid fire position.

17. Increase the rate to high fire position and repeat the test done for the mid point adjustment. Results should range in the area of 8½ to 10% CO₂ with little or no CO. The metering device setting and air damper openings should be marked and noted to obtain high fire reference points if different from the factory settings.

3. Although Underwriters Laboratories permits higher readings of CO (Carbon Monoxide), it is desirable to obtain readings between 0 and 100 PPM, depending on local codes and burner manufacturer’s recommendations.
18. Operate the modulating lever arm on the modulating motor through the three previously referenced points. Minor setting modifications may be required to ensure that the reference points are acquired.

19. Tighten (finger tight) the hex bolt to the linkage rod at the swivel on the modulating motor driver arms and run the motor through its full travel to ensure that the linkage is free and that limits on the metering device and air dampers are not exceeded.

20. Determine that the required gas input rate is being achieved by clocking the gas flow at the gas meter.

21. Intermittently operate the burner until the heat transfer fluid indicates an increase in temperature.

22. Tighten all linkages and permanently mark the settings.

23. Check the limit control as follows:
   a. Run the burner until the limit control settings have been reached.
   b. Set the controls so that the burner goes to the low fire position before the operating limit control turns the burner off (the burner should turn off when the set temperature is reached).
   c. After a temperature drop the burner should restart automatically.

24. Set and check operation of:
   - Low and high gas pressure switches.
   - All burner and heat exchanger controls and operating devices.
   - Blower Combustion Air Flow Switch.

**Fuel Oil Burner Instructions**

1. Check all linkages
2. Install oil pressure and vacuum gauges. Check the fuel oil suction line to be sure the manual valve is open. Check the fuel oil filter for tightness.
3. Install required systems measuring devices:
   - Appropriate flame signal meter to the flame safeguard control
   - Stack thermometer, CO₂ and Smoke Tester sample line in the breaching
   - Draft gauge to the combustion chamber test point
4. With the burner panel control switch in the OFF position, apply power to the burner through the main burner disconnect switch. Switch the burner panel ON/OFF switch to the ON position momentarily to determine that the blower motor is running in the right rotation.
5. If necessary, set the air damper approximately ¼” open and start the burner. When first started the ignition circuit energizes after the blower prepurge period finishes and all limit and other interlock circuits are closed. Set the flame safeguard timer Stop/Run test switch in the Stop position thus causing the ignition timing sequence to stop. There should be no evidence of a flame signal reading nor should the main fuel oil solenoid valve attempt to open.
6. The ignition spark and main fuel oil solenoid valve are energized at the same time. As soon as the fuel oil flame is detected by the flame scanner, the ignition spark is de-energized.

7. Either remove the flame scanner from its sight pipe or electrically disconnect the main fuel oil solenoid valve and start the burner. The flame safeguard control will not detect any flame and goes into a safety lockout mode requiring manual reset of the flame safeguard safety lockout switch. (should a pressure reading occur before the main fuel oil valve is programmed to open it is indicating that the main fuel oil valve is leaking.)

**Note:** The modulating motor is connected by linkage to the air inlet dampers and the modulating fuel oil valve located in the oil nozzle return line. The fuel metering valve controls the fuel input quantity from low to high fire.

8. Verify that the modulating fuel oil valve is at the low fire position. To verify observe the pointer on the metering valve shaft. The pointer must be pointing near the #6 or #7 position on the dial. As the burner runs from low to high fire the pointer moves from the low fire setting towards the 0 position on the dial.

9. Turn the burner on and let it advance to the main flame light off position. Take action as necessary to hold the linkage at the low fire position by electrically disconnecting the modulating motor.

**Note:** It is suggested that the factory settings be noted and marked on the linkage prior to proceeding with final adjustment.

10. With the burner in the factory set low fire position, adjust air and fuel linkage to good fuel/air ratio low fire settings (8 - 10% CO$_2$ and #0 - #2 smoke reading). If the linkage position is different from the factory settings, mark the linkage at the new settings.

11. Increase the firing rate to the midway point. Set the fuel/air ratios to achieve good combustion values (9 - 11% CO$_2$ and #0 to #2 smoke reading). Again, if the linkage position is different from the factory settings, mark the linkage at the new mid fire position.

12. Increase the rate to the high fire position and repeat the tests done for the mid-point adjustment. Results should be in the area of 12½% CO$_2$ and no more than #2 smoke. The metering device setting and air damper openings should be marked and noted to obtain high fire reference points if different from the factory settings.

13. Operate the modulating lever arm on the modulating motor through the three previously determined reference points. Minor setting modifications may be required to ensure that the reference points are acquired.
14. Tighten (finger tight) the hex bolt to the linkage rod at the swivel on the modulating motor driver arms and run the motor through its full travel to ensure that linkage is free and that the limits on the metering device and air dampers are not exceeded.

15. Intermittently operate the burner until the heat transfer fluid indicates an increase in temperature.

16. Tighten all linkages and permanently mark settings.

32. Check the limit control as follows:
   a. Run the burner until the limit control settings have been reached.
   b. Set the controls so that the burner goes to the low fire position before the operating limit control turns the burner off (the burner should turn off when the set temperature is reached).
   c. After a temperature drop the burner should restart automatically.

17. Set and check operation of:
   • Low Fuel Oil Pressure Switch.
   • All burner and heat exchanger controls and operating devices.
   • Blower Combustion Air Flow Switch.
Section 6: Parts
Item part numbers can differ depending on heater size - refer to the illustration on the indicated page.

<table>
<thead>
<tr>
<th>#</th>
<th>Description - page #</th>
<th>#</th>
<th>Description - page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Control Box - page 100</td>
<td>11</td>
<td>Burner, starting on page 106</td>
</tr>
<tr>
<td>2</td>
<td>Drain Pipe Assembly on page 102</td>
<td>12-14</td>
<td>Miscellaneous Parts on page 114</td>
</tr>
<tr>
<td>3</td>
<td>Fuel Filter Assembly on page 103</td>
<td>15-16</td>
<td>Heat Transfer Fluid Plumbing on page 104</td>
</tr>
<tr>
<td>4-7</td>
<td>Heat Transfer Fluid Plumbing on page 104</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Circulating Pump Assembly on page 103</td>
<td>21</td>
<td>Expansion Tank - Contact CEI</td>
</tr>
<tr>
<td>9-10</td>
<td>Sight Gauge on page 105</td>
<td>22</td>
<td>Jacketed Fire Box - Contact CEI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>23</td>
<td>Heat Exchanger - Contact CEI</td>
</tr>
</tbody>
</table>
Front Panel

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description (qnty if more than 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0103328</td>
<td>UDC 1200 Temperature Controller</td>
</tr>
<tr>
<td>0103330</td>
<td>UDC 120L Limit Controller</td>
</tr>
<tr>
<td>0106260</td>
<td>Fireye BLL-510 Display</td>
</tr>
<tr>
<td>0108352</td>
<td>110-130VAC LED Pilot Lamp</td>
</tr>
<tr>
<td>0108347</td>
<td>Pilot Light Base - White</td>
</tr>
<tr>
<td>0108363</td>
<td>2 Position Maintained Switch (4)</td>
</tr>
<tr>
<td>0108371</td>
<td>Flush Black Push Button</td>
</tr>
<tr>
<td>0108434*a</td>
<td>Through the Door Operator</td>
</tr>
<tr>
<td>0108678</td>
<td>2 Position Maintained Switch (Red, Illuminated)</td>
</tr>
</tbody>
</table>

*a. This item activates the system main circuit breaker listed by system size under Main Circuit Breakers on page 102.
Internal Control Box Components

With minor exceptions, all CEI Jacketed Firebox Heaters utilize one of two control boxes: UL or CSA. Heaters sold in Canada use the CSA control box while heaters sold elsewhere, including the U.S., use the UL control box.

Most UL and CSA control boxes parts are identical and are listed below:

- Fireye Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Part #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0106261</td>
<td>Fireye YP-138 Programmer</td>
</tr>
<tr>
<td>2</td>
<td>0106259</td>
<td>Fireye YB-110UVSC w/Amplifier</td>
</tr>
<tr>
<td>Not Shown</td>
<td>0106262</td>
<td>Wiring Base for Amplifier/Chassis</td>
</tr>
<tr>
<td>3</td>
<td>0106263</td>
<td>Annunciator Kit (includes chassis, base and connecting cable)</td>
</tr>
<tr>
<td>Not Shown</td>
<td>0106264</td>
<td>Fireye 129-178-4 Remote Mounting Kit</td>
</tr>
<tr>
<td></td>
<td>60.2874.1</td>
<td>Annunciator Base* (Connects chassis)</td>
</tr>
<tr>
<td></td>
<td>ED 580</td>
<td>Interconnect Cable* (Connects chassis)</td>
</tr>
</tbody>
</table>

*a. Available separately, this item is also part of Annunciator Kit (0106263).

- Other components:

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0108275</td>
<td>Relay, DIN Rail 2 C-Form Contacts</td>
</tr>
<tr>
<td>0215007</td>
<td>Control Transformer</td>
</tr>
<tr>
<td>0215038</td>
<td>Cover for Control Transformer</td>
</tr>
</tbody>
</table>

CEI Jacketed Firebox Heater with a UL control box have some parts not included in a CSA control box, these include:

<table>
<thead>
<tr>
<th>UL (only) Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0101022</td>
<td>4A 1P Breaker</td>
</tr>
<tr>
<td>0101170</td>
<td>3A fuse (2)</td>
</tr>
<tr>
<td>0104054</td>
<td>Modular Double Fuse Holder</td>
</tr>
</tbody>
</table>
Components not previously listed vary from one CEI Jacketed Firebox Heater to the next.

**Note:** Items for specialty systems (i.e. non-standard voltage, etc.) are not listed. Contact CEI for help with these items.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Part Number</th>
<th>System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Circuit Breakers&lt;sup&gt;a&lt;/sup&gt;</td>
<td>30A Panel Mounted Breaker</td>
<td>0108439</td>
<td>1200, 2400, 1800</td>
</tr>
<tr>
<td></td>
<td>40A Panel Mounted Breaker</td>
<td>0108433</td>
<td>3600</td>
</tr>
<tr>
<td></td>
<td>50A Panel Mounted Breaker</td>
<td>0108456</td>
<td>4900</td>
</tr>
<tr>
<td></td>
<td>60A Panel Mounted Breaker</td>
<td>0108469</td>
<td>6300</td>
</tr>
<tr>
<td>Combo (motor) Starters</td>
<td>6.3–10A Panel Mount</td>
<td>0108418</td>
<td>1200, 4900, 6300</td>
</tr>
<tr>
<td></td>
<td>2.5–4.0A Panel Mount</td>
<td>0108444</td>
<td>1800, 2400, 3600</td>
</tr>
<tr>
<td></td>
<td>10–16A Panel Mount</td>
<td>0108449</td>
<td>1800, 2400</td>
</tr>
<tr>
<td></td>
<td>18–25A Panel Mount</td>
<td>0108451</td>
<td>3600</td>
</tr>
<tr>
<td></td>
<td>1.6–2.5A Panel Mount</td>
<td>0108468</td>
<td>1200</td>
</tr>
<tr>
<td></td>
<td>23–32A Panel Mount</td>
<td>0108642</td>
<td>4900, 6300</td>
</tr>
</tbody>
</table>

<sup>a</sup> These circuit breakers are externally controlled by the Thru The Door Operator (P/N 0108434) listed on page 100.

**Drain Pipe Assembly**

The CEI Part Number for this item is the same regardless of heater size.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>¾&quot; Brass Gate Valve</td>
<td>1301006</td>
</tr>
</tbody>
</table>
**Fuel Filter Assembly**

The CEI Part Numbers for these items are the same regardless of heater size.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3/8” Check Valve</td>
<td>1301031</td>
</tr>
<tr>
<td>2</td>
<td>Fuel Filter</td>
<td>1507001</td>
</tr>
<tr>
<td>3</td>
<td>Fuel Meter (optional)</td>
<td>4513267</td>
</tr>
</tbody>
</table>

**Circulating Pump Assembly**

The CEI Part Numbers for these items may vary depending on heater size.

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>Part Number (HP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Motor</td>
<td>0302004A (5) 0302005A (7½)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0302007A (15) 0302030A (20)</td>
</tr>
<tr>
<td>2</td>
<td>Coupling</td>
<td>1801002-SIHI 1801003-SIHI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1801004-SIHI</td>
</tr>
<tr>
<td>3</td>
<td>Circulating Pump</td>
<td>1506000 1506001</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1506002 1506004</td>
</tr>
<tr>
<td>4</td>
<td>Coupling Cover</td>
<td>6614000-2010 6622000-2010</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6640000-9010 6663000-6010</td>
</tr>
</tbody>
</table>
### Heat Transfer Fluid Plumbing

The CEI Part Numbers for these items may vary depending on heater size.

<table>
<thead>
<tr>
<th>#</th>
<th>Description</th>
<th>Part Number - Size</th>
<th>High Temperature Heaters use Gate Valves instead of Plug Valves where indicated</th>
<th>All other items match same size heater</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1200</td>
<td>1800</td>
<td>2400–4900</td>
</tr>
<tr>
<td>1</td>
<td>Return Plug Valve</td>
<td>1303013 - 2&quot;</td>
<td>1303015 - 3&quot;</td>
<td>1303016 - 4&quot;</td>
</tr>
<tr>
<td>2</td>
<td>H.O. Heater Pipe Thermometer</td>
<td></td>
<td>0402007</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bypass Gate Valve</td>
<td>1303085 - 1&quot;</td>
<td>1303094 - 1½&quot;</td>
<td>1303082 - 2&quot;</td>
</tr>
<tr>
<td>4</td>
<td>Supply Plug Valve</td>
<td>1303013 - 2&quot;</td>
<td>1303015 - 3&quot;</td>
<td>1303016 - 4&quot;</td>
</tr>
<tr>
<td>5</td>
<td>Bleeder Valve</td>
<td></td>
<td>1503026</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Isolation Plug Valve</td>
<td>1303014 - 2½&quot;</td>
<td>1303015 - 3&quot;</td>
<td>1303016 - 4&quot;</td>
</tr>
</tbody>
</table>

See Circulating Pump Assembly on page 103
The CEI Part Number for the sight gauge is the same for the 1200 through 4900 series CEI Jacketed Firebox Heaters, the 6300 heater uses a different sight gauge.

<table>
<thead>
<tr>
<th># Description</th>
<th>1200–4900</th>
<th>6300</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Sight Gauge (glass)</td>
<td>0401016</td>
<td>0401018</td>
</tr>
<tr>
<td>2 - Sight Gauge Cock (pair)</td>
<td>0401010</td>
<td></td>
</tr>
<tr>
<td>3 - Temperature Gauge</td>
<td>0402005</td>
<td></td>
</tr>
<tr>
<td>Sight Glass Rubber Gasket (not shown) - 2 required</td>
<td>0401011</td>
<td></td>
</tr>
</tbody>
</table>
Burner (blower side)

The CEI Part Number for the Blower Motor (item 1) varies depending on the size of the heater:

<table>
<thead>
<tr>
<th>Heater</th>
<th>Part Number - Horsepower</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200</td>
<td>03010030 - ¾HP</td>
</tr>
<tr>
<td>1800~2400</td>
<td>03010005 - 1½HP</td>
</tr>
<tr>
<td>3600~6300</td>
<td>Call for Part Number &amp; HP</td>
</tr>
</tbody>
</table>

The CEI Part Numbers for these items are the same regardless of heater size.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Air Flow Switch</td>
<td>0102018-PF</td>
</tr>
<tr>
<td>3</td>
<td>Gas Pilot Cutoff Solenoid Valve</td>
<td>1305008-PF</td>
</tr>
<tr>
<td>4</td>
<td>Fuel Oil Transformer</td>
<td>0214002-PF</td>
</tr>
<tr>
<td>5</td>
<td>Gas Transformer</td>
<td>0214004-PF</td>
</tr>
<tr>
<td>6</td>
<td>Gas Pilot Assembly (access)</td>
<td>See page 108</td>
</tr>
<tr>
<td>7</td>
<td>Fireye UV1A6 Scanner</td>
<td>0106130</td>
</tr>
</tbody>
</table>
The CEI Part Numbers for these items are the same regardless of heater size.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fuel Solenoid (2)</td>
<td>1503011</td>
</tr>
<tr>
<td>2</td>
<td>0–600 Oil Pressure Gauge</td>
<td>0401020-PF</td>
</tr>
<tr>
<td>3</td>
<td>0–200 Oil Pressure Gauge</td>
<td>0401020</td>
</tr>
<tr>
<td>4</td>
<td>Fuel Pump</td>
<td>1503011</td>
</tr>
</tbody>
</table>

The CEI Part Number for the Oil Check Valve (item 5) and the Modulating Oil Valve (item 6) varies depending on the size of the heater:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>1200–2400</th>
<th>3600</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Modulating Oil Valve&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1301003-PF</td>
<td>1301005_PF</td>
</tr>
<tr>
<td>6</td>
<td>Fuel Oil Check Valve</td>
<td>1301030-C10</td>
<td>1301029</td>
</tr>
</tbody>
</table>

<sup>a</sup> Call CEI for 4900–6300 part number

Note: See pages 109 thru 112 for Gas Train Components
## Burner - Internal

### Gas Pilot Assembly

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gas Pilot Assy</td>
<td>0614013-PF</td>
</tr>
<tr>
<td>1</td>
<td>Electrode</td>
<td>0208008-PF</td>
</tr>
<tr>
<td>2</td>
<td>Cable</td>
<td>0205004</td>
</tr>
</tbody>
</table>

### Fuel Oil Nozzle and Ignitor Electrodes

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fuel Oil Ignitor Gun Assy</td>
<td>060439-PF</td>
</tr>
<tr>
<td>1</td>
<td>Electrodes (pair)</td>
<td>0208008-PF</td>
</tr>
<tr>
<td>2</td>
<td>Diffuser</td>
<td>009901-125</td>
</tr>
<tr>
<td>3</td>
<td>Fuel Oil Nozzle</td>
<td>See below</td>
</tr>
<tr>
<td></td>
<td>Cables (pair - not shown)</td>
<td>0205004</td>
</tr>
<tr>
<td></td>
<td>Oil Screen (not shown)</td>
<td>2515031-L/C</td>
</tr>
</tbody>
</table>

### Heater Size and Nozzle Part Number

<table>
<thead>
<tr>
<th>Heater Size</th>
<th>Nozzle Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1200 (6 gph)</td>
<td>0612012</td>
</tr>
<tr>
<td>1800 (9.5 gph)</td>
<td>0612013-PF</td>
</tr>
<tr>
<td>2400 (12 gph)</td>
<td>0612014-PF</td>
</tr>
<tr>
<td>3600 (19.5 gph)</td>
<td>0612016</td>
</tr>
<tr>
<td>4900/6300</td>
<td>Call CEI</td>
</tr>
</tbody>
</table>
Gas Train

1200~1800 Heaters

The CEI Part Numbers for these items may vary depending on heater size.

<table>
<thead>
<tr>
<th># - Description (Qnty if &lt; 1)</th>
<th>Part Number - Size</th>
<th># - Description (Qnty if &lt; 1)</th>
<th>Part Number - Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Gas Cock Valve (2)</td>
<td>1302043 - 2&quot;</td>
<td>6 - Gas Orifice Spring</td>
<td>0102114 - 2&quot;</td>
</tr>
<tr>
<td>2 - Main Gas Regulator</td>
<td>0102012 - 2&quot;</td>
<td>7 - Gas Pilot Ball Valve</td>
<td>0901021 - ¼&quot;</td>
</tr>
<tr>
<td>3 - Gas Actuator Valve</td>
<td>1304032</td>
<td>8 - Gas Pilot Regulator</td>
<td>0102007 - 3/8&quot;</td>
</tr>
<tr>
<td>4 - Gas Valve Body</td>
<td>1304031 - 2&quot;</td>
<td>9 - Gas Pressure Gauge (2)</td>
<td>0401008 - 0~15 H2O</td>
</tr>
<tr>
<td>5 - Butterfly Valve</td>
<td>1304016 - 1¼&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1304014 - 2&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Orifice for Propane (Optional)

<table>
<thead>
<tr>
<th>Part # - Size</th>
<th>Heater</th>
</tr>
</thead>
<tbody>
<tr>
<td>0102040 - 17/32&quot;</td>
<td>1200</td>
</tr>
<tr>
<td>0102041 - 31/32&quot;</td>
<td>1800</td>
</tr>
</tbody>
</table>
2400~3600 Heaters

The CEI Part Numbers for these items may vary depending on heater size.

<table>
<thead>
<tr>
<th># - Description (Qnty if &lt; 1)</th>
<th>Part Number - Size</th>
<th># - Description (Qnty if &lt; 1)</th>
<th>Part Number - Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Gas Cock Valve (2)</td>
<td>1302043 - 2&quot;</td>
<td>7 - Gas Pilot Ball Valve (2)</td>
<td>0901021 - ¼&quot;</td>
</tr>
<tr>
<td>2 - Main Gas Regulator</td>
<td>0102012 - 2&quot;</td>
<td>8 - Gas Pilot Regulator</td>
<td>0102007 - ⅛&quot;</td>
</tr>
<tr>
<td>3 - Gas Actuator Valve</td>
<td>1304032</td>
<td>9 - Gas Pressure Gauge (2)</td>
<td>0401008 - 0~15 H₂O</td>
</tr>
<tr>
<td>4 - Gas Valve Body</td>
<td>1304031 - 2&quot;</td>
<td>10 - High Pressure Switch</td>
<td>0113057</td>
</tr>
<tr>
<td>5 - Butterfly Valve</td>
<td>1304014 - 2&quot;</td>
<td>11 - Low Pressure Switch</td>
<td>0113058</td>
</tr>
<tr>
<td>6 - Gas Orifice Spring</td>
<td>0102114 - 2&quot;</td>
<td>Propane Orifice (optional)</td>
<td>0102042 - 25/32&quot;</td>
</tr>
</tbody>
</table>
## 4900 Heater

<table>
<thead>
<tr>
<th># - Description (Qnty if &lt; 1)</th>
<th>Part Number - Size</th>
<th># - Description (Qnty if &lt; 1)</th>
<th>Part Number - Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - Gas Cock Valve (2)</td>
<td>*980400 - 2½&quot;</td>
<td>8 - Gas Pilot Regulator</td>
<td>0102007 - 3/8&quot;</td>
</tr>
<tr>
<td>2 - Main Gas Regulator</td>
<td>*300900 - 2½&quot;</td>
<td>9 - Butterfly Valve</td>
<td>*M90030 - 2&quot;</td>
</tr>
<tr>
<td>3 - 17.5W ASCO G.C. Valve</td>
<td>*281200 - 2½&quot;</td>
<td>10 - Gas Orifice Spring</td>
<td>0102046 - 2½&quot;</td>
</tr>
<tr>
<td>4 - 13 Second ON/OFF Proof of Closure</td>
<td>*190900</td>
<td>11 - Low Pressure Switch</td>
<td>*161000</td>
</tr>
<tr>
<td>5 - Proof of Closure Valve Body</td>
<td>*194300 - 2½&quot;</td>
<td>12 - High Pressure Switch</td>
<td>*161100</td>
</tr>
<tr>
<td>6 - Gas Pressure Gauge (3)</td>
<td>0401008 - 0-15&quot; H2O</td>
<td>Propane Orifice (optional)</td>
<td>0102047 - 1-7/8&quot;</td>
</tr>
<tr>
<td>7 - Gas Pilot Ball Valve</td>
<td>*980030 - ¼&quot;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Indicates manufacturer part number
## 6300 Heater

<table>
<thead>
<tr>
<th>#</th>
<th>Description (Qty if &lt; 1)</th>
<th>Part Number - Size</th>
<th>#</th>
<th>Description (Qty if &lt; 1)</th>
<th>Part Number - Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gas Cock Valve (2)</td>
<td>*980450 - 3”</td>
<td>8</td>
<td>Gas Pilot Ball Valve</td>
<td>0901021 - ¼”</td>
</tr>
<tr>
<td>2</td>
<td>Main Gas Regulator</td>
<td>*301100 - 3”</td>
<td>9</td>
<td>Gas Pilot Regulator</td>
<td>0102007 - ⅜”</td>
</tr>
<tr>
<td>3</td>
<td>Fast Opening Acuator</td>
<td>*199000</td>
<td>10</td>
<td>Butterfly Valve</td>
<td>*273740 - 3”</td>
</tr>
<tr>
<td>4</td>
<td>Valve Body for 199000</td>
<td>*196500 - 3”</td>
<td>11</td>
<td>Gas Orifice Spring</td>
<td>0102114-3 - 3”</td>
</tr>
<tr>
<td>5</td>
<td>Proof of Closure Fast Opening Acuator</td>
<td>*199010</td>
<td>12</td>
<td>Low Pressure Switch</td>
<td>*161000</td>
</tr>
<tr>
<td>6</td>
<td>Valve Body for 199010</td>
<td>*1997460 - 3”</td>
<td>13</td>
<td>High Pressure Switch</td>
<td>*161100</td>
</tr>
<tr>
<td>7</td>
<td>Gas Pressure Gauge (3)</td>
<td>0401074 - 0-15psi</td>
<td></td>
<td>Propane Orifice (optional)</td>
<td>0102078 - 1-⅛”</td>
</tr>
</tbody>
</table>

* Indicates manufacturer part number
Modulating Motor

The Modulating Motor controls valve and air damper positions through linkage for both Gas and Fuel. The CEI Part Numbers for the Modulating Motor, and the internal Resistor Board (not visible) are the same regardless of heater size.

<table>
<thead>
<tr>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulating Motor</td>
<td>0304006</td>
</tr>
<tr>
<td>Resistor Board</td>
<td>0304007</td>
</tr>
<tr>
<td>The resistor board is mounted inside the modulating motor housing and must be ordered separately</td>
<td></td>
</tr>
</tbody>
</table>
The CEI Part Numbers for these items are the same regardless of heater size.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>CEI Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Strobe Light</td>
<td>2001312</td>
</tr>
<tr>
<td>2</td>
<td>Heat Transfer Fluid Circulating Pressure Switcha</td>
<td>0102086</td>
</tr>
<tr>
<td>3</td>
<td>Heat Transfer Fluid Circulating Pressure Gaugeb</td>
<td>0401020</td>
</tr>
<tr>
<td>4</td>
<td>Level Control</td>
<td>0105001</td>
</tr>
<tr>
<td></td>
<td>Level Control Switch (internal to Level Control)b</td>
<td>0105002</td>
</tr>
<tr>
<td>5</td>
<td>Fire Box Thermometer</td>
<td>0402005</td>
</tr>
<tr>
<td>6</td>
<td>Type J Thermocouple</td>
<td>0103128</td>
</tr>
<tr>
<td>7</td>
<td>Fire Box Sight Glass</td>
<td>0401017</td>
</tr>
</tbody>
</table>

a. The location of the Pressure Switch and Pressure Gauge vary slightly between different sized heaters.

b. This item replaces the mercury switch (which is no longer available) on some older Level Controls.
Section 7: Reference
### Jacketed Heater Specifications

**Firebox Heaters**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>CEI 1200</th>
<th>CEI 1800</th>
<th>CEI 2400</th>
<th>CEI 3600</th>
<th>CEI 4900</th>
<th>CEI 6300</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTU Input</td>
<td>1,120,000</td>
<td>1,277,000</td>
<td>1,400,000</td>
<td>1,640,000</td>
<td>2,030,000</td>
<td>2,430,000</td>
</tr>
<tr>
<td>BTU Output</td>
<td>1,410,000</td>
<td>2,115,000</td>
<td>2,820,000</td>
<td>4,230,000</td>
<td>5,640,000</td>
<td>7,300,000</td>
</tr>
<tr>
<td>Fuel Usage Cold Fuel Oil</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Fuel Usage Natural Gas</td>
<td>100</td>
<td>150</td>
<td>200</td>
<td>300</td>
<td>400</td>
<td>600</td>
</tr>
<tr>
<td>Burner Model</td>
<td>CR4-GO-20A</td>
<td>CR4-GO-25B</td>
<td>CR4-GO-30C</td>
<td>CR5-GO-35D</td>
<td>CR6-GO-40E</td>
<td>CR6-GO-50F</td>
</tr>
<tr>
<td>Fuel Usage Natural Gas Pressure (in W.C.)</td>
<td>12-14</td>
<td>12-14</td>
<td>14-16</td>
<td>16-18</td>
<td>16-18</td>
<td>18-20</td>
</tr>
<tr>
<td>Burner Blower HP</td>
<td>3/4</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
<td>1/2</td>
</tr>
<tr>
<td>Blower Capacity (CFM)</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>250</td>
<td>250</td>
<td>250</td>
</tr>
<tr>
<td>Pump HP</td>
<td>5</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Pump Flow (GPM)</td>
<td>632</td>
<td>632</td>
<td>632</td>
<td>632</td>
<td>632</td>
<td>632</td>
</tr>
<tr>
<td>Pump Pressure (Ft Hd / psi)</td>
<td>115/50</td>
<td>115/50</td>
<td>115/50</td>
<td>115/50</td>
<td>115/50</td>
<td>115/50</td>
</tr>
<tr>
<td>Heat Transfer Fluid Capacity (Gal)</td>
<td>95</td>
<td>145</td>
<td>165</td>
<td>240</td>
<td>270</td>
<td>275</td>
</tr>
<tr>
<td>Electric Load (kW)</td>
<td>5.2</td>
<td>7.6</td>
<td>7.8</td>
<td>13.6</td>
<td>18.1</td>
<td>21.8</td>
</tr>
<tr>
<td>Heat Transfer Fluid Capacity (Gal)</td>
<td>95</td>
<td>145</td>
<td>165</td>
<td>240</td>
<td>270</td>
<td>275</td>
</tr>
<tr>
<td>Expansion Tank Capacity (Gal)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Pipe Size (in)</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Approx Wt (lb) less Heat Transfer Fluid</td>
<td>3900</td>
<td>4600</td>
<td>4910</td>
<td>4910</td>
<td>4910</td>
<td>4910</td>
</tr>
</tbody>
</table>
### Alarm Codes

<table>
<thead>
<tr>
<th>Terminals</th>
<th>Message</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recycle L1-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1-40:</td>
<td>TIME CLOCK INTERLOCK TERM L1-40</td>
<td></td>
</tr>
<tr>
<td>40-41:</td>
<td>HEATER CONTROL SWITCH OFF TERMINAL 40-41</td>
<td></td>
</tr>
<tr>
<td>41-42:</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>42-3:</td>
<td>BC1 RELAY NOT ENERGIZED (HEAT DEMAND)</td>
<td></td>
</tr>
<tr>
<td>Oil Limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44-46:</td>
<td>REMOTE FUEL PUMP AUS CONTACT TERM 44-46</td>
<td></td>
</tr>
<tr>
<td>46-47:</td>
<td>LOW FUEL OIL PRESSURE SWITCH TERM 46-47</td>
<td></td>
</tr>
<tr>
<td>47-48:</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>48-50:</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>Gas Limits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-51:</td>
<td>LOW GAS PRESSURE SWITCH TERM 49-51</td>
<td></td>
</tr>
<tr>
<td>51-52:</td>
<td>HIGH GAS PRESSURE SWITCH TERM 51-52</td>
<td></td>
</tr>
<tr>
<td>52-54:</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>Non-Recycle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-43:</td>
<td>EXPANSION TANK LOW OIL LEVEL (SWITCH)</td>
<td></td>
</tr>
<tr>
<td>43-44:</td>
<td>NOT USED</td>
<td></td>
</tr>
<tr>
<td>54-55:</td>
<td>HIGH MEDIA TEMP CONTROLLER OR HMT RELAY</td>
<td></td>
</tr>
<tr>
<td>55-56:</td>
<td>HIGH FLUE GAS STACK TEMP TERM 55-56</td>
<td></td>
</tr>
<tr>
<td>56-57:</td>
<td>CIRCULATING PUMP AUX CONTACT TERM 56-57</td>
<td></td>
</tr>
<tr>
<td>57-58:</td>
<td>LOW MEDIA(OIL) PRESSURE SW TERM 57-58</td>
<td></td>
</tr>
<tr>
<td>58-59:</td>
<td>HIGH MEDIA(OIL) PRESSURE TERM 58-59</td>
<td></td>
</tr>
<tr>
<td>59-60:</td>
<td>COMB BLOWER AUS CONTACT TERM 59-60</td>
<td></td>
</tr>
<tr>
<td>60-P:</td>
<td>LOW COM AIR PRESSURE SWITCH TERM 60-P</td>
<td></td>
</tr>
</tbody>
</table>
### Safety Lockout Codes

<table>
<thead>
<tr>
<th>Lockout Message</th>
<th>FAN</th>
<th>OPEN DAMPER</th>
<th>CLOSE DAMPER</th>
<th>AUTO</th>
<th>IGN</th>
<th>FLAME</th>
</tr>
</thead>
<tbody>
<tr>
<td>T13 FUEL VALVE END SWITCH OPEN</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>M-D LOW FIRE START OPEN</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-D LOW FIRE START OPEN - PTFI</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-D LOW FIRE START OPEN - MTFI</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-D CLOSED</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-8 CLOSED</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M-8 HIGH PURGE CIRCUIT OPEN</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FALSE FLAME-STANDBY</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>FLAME FAIL PTFI</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>FLAME FAIL - MTFI</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>FLAME FAIL AUTO</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3-P RUN INTLK OPEN - PREPURGE</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-P RUN INTLK OPEN - PURGE</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-P RUN INTLK OPEN-PTFI</td>
<td>X</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-P RUN INTLK OPEN-MTFI</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-P RUN INTLK CLOSED-STANDBY</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-P RUN INTLK OPEN-AUTO</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FUEL VALVE STATE CHANGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>CHECK FUSE</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Lockout Message</td>
<td>FAN</td>
<td>OPEN DAMPER</td>
<td>CLOSE DAMPER</td>
<td>AUTO</td>
<td>IGN</td>
<td>FLAME</td>
</tr>
<tr>
<td>-------------------</td>
<td>-----</td>
<td>-------------</td>
<td>--------------</td>
<td>------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>CHECK WIRING</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>CHECK SCANNER</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>CHECK PROGRAMMER</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHECK CHASSIS</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHECK EXPANSION MODULE</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
CONTACT INFORMATION

CEI ENTERPRISES, INC.
An Astec Company
P.O. Box 9156
Albuquerque, New Mexico, U.S.A. 87119

CEI Service (General Contact):
Phone: (800) 545-4034 or (505) 842-5556
Fax: (505) 243-1422
www.ceienterprises.com

Department Contact Information

Service/Parts Manager
Cell: (505) 264-5259

Engineering Manager
Cell: (505) 288-0323

Director of Controls
Cell: (505) 263-6466

Parts Representative
Cell: (505) 235-2789