The HL3 Series Infrared Tube Heater is a positive pressure, two-stage radiant heater system. This insert manual is a supplement to the Tube Heater General Manual and provides specific information related to the HL3 Series model. All persons involved with the installation, operation, and maintenance of the heater system must read and understand the information in this insert manual and the accompanying Tube Heater General Manual.

⚠️ WARNING ⚠️

Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury, or death. Read the installation, operation, and maintenance instructions thoroughly before installing or servicing this equipment.

This heater must be installed and serviced by trained gas installation and service personnel only. Failure to comply could result in personal injury, asphyxiation, death, fire, or property damage.

In locations used for the storage of combustible materials, signs must be posted to specify the maximum permissible stacking height to maintain the required clearances from the heater to the combustibles. Signs must either be posted adjacent to the heater thermostats or, in the absence of such thermostats, in a conspicuous location.

Not for residential use! Do not use this heater in the home, sleeping quarters, attached garages, etc. Installation of a commercial tube heater system in residential indoor spaces may result in property damage, serious injury, asphyxiation, or death.

For Your Safety

If you smell gas:

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

INSTALLER: Present this manual to the end user.
Keep these instructions in a clean and dry place for future reference.
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NOTE: See page 10 for a list of available models and specifications.
1.0 Safety

**WARNING**

Improper installation, adjustment, alteration, service, or maintenance can cause property damage, serious injury, or death. Read and understand the installation, operating, and maintenance instruction thoroughly before installing or servicing this equipment. Only trained, qualified gas installation and service personnel may install or service this equipment.

Safety Labels and Their Locations

Product safety signs or labels should be replaced by the product user when they no longer are legible. Contact either your local distributor or the product manufacturer for obtaining replacement signs or labels.

---

**F/N: LLV3EP1**

120V Input

**F/N: LLV3EP2**

24V Input

(Orange crescent - with relay option)

**F/N: LLV3EP4**

24V Input

(White crescent - no relay)

**F/N: LLV3EP14**

(Operational Indicator Lights)

**F/N: LLTB018 (Natural Gas)**

**F/N: LLTB019 (Prop. Gas)**

**F/N: LLTCL006L, LLTCL001C/R**

Clearance to Combustibles Labels

**F/N: LLLOGO32**

Logo Label

---
1.0 Safety • Safety Labels and Their Locations • Clearances to Combustibles

Clearances to Combustibles

**WARNING**

Placement of explosive objects, flammable objects, liquids, and vapors close to the heater may result in explosion, fire, property damage, serious injury, or death. Do not store or use explosive objects, liquids, or vapor in the vicinity of the heater.

Clearances to combustibles is defined as the minimum distance that must exist between the tube surface, or reflector, and any combustible items (see Figure 1.1). It also pertains to the distance that must be maintained from moving objects around the tube heater.
When installing the tube heater system, clearances to combustibles for the model tube heater and configuration must be maintained. Refer to Chart 1.1 below to determine the required distances for your model.

Chart 1.1 • Clearance to Combustibles in Inches (see Figure 1.1 for Mounting Angles)

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Mounting Angle*</th>
<th>Front</th>
<th>Behind</th>
<th>Top</th>
<th>Below</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL3 (20, 30, 40) - (65, 75) [N, P]</td>
<td>0°</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>45°</td>
<td>39</td>
<td>8</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>with 1 side shield</td>
<td>0°</td>
<td>29</td>
<td>8</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>with 2 side shields</td>
<td>0°</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>60</td>
</tr>
<tr>
<td>20 ft. from burner</td>
<td>0°</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>HL3 (30, 40) - 100 [N, P]</td>
<td>0°</td>
<td>14</td>
<td>14</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>45°</td>
<td>39</td>
<td>8</td>
<td>10</td>
<td>66</td>
</tr>
<tr>
<td>with 1 side shield</td>
<td>0°</td>
<td>29</td>
<td>8</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td>with 2 side shields</td>
<td>0°</td>
<td>16</td>
<td>16</td>
<td>6</td>
<td>66</td>
</tr>
<tr>
<td>20 ft. from burner</td>
<td>0°</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>HL3 (30, 40, 50) - 125 [N, P]</td>
<td>0°</td>
<td>20</td>
<td>20</td>
<td>6</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>45°</td>
<td>58</td>
<td>8</td>
<td>10</td>
<td>76</td>
</tr>
<tr>
<td>with 1 side shield</td>
<td>0°</td>
<td>42</td>
<td>8</td>
<td>6</td>
<td>76</td>
</tr>
<tr>
<td>with 2 side shields</td>
<td>0°</td>
<td>20</td>
<td>20</td>
<td>6</td>
<td>76</td>
</tr>
<tr>
<td>20 ft. from burner</td>
<td>0°</td>
<td>7</td>
<td>7</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>HL3 (40, 50, 60) - 150 [N, P]</td>
<td>0°</td>
<td>24</td>
<td>24</td>
<td>6</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>45°</td>
<td>58</td>
<td>8</td>
<td>10</td>
<td>81</td>
</tr>
<tr>
<td>with 1 side shield</td>
<td>0°</td>
<td>42</td>
<td>8</td>
<td>6</td>
<td>81</td>
</tr>
<tr>
<td>with 2 side shields</td>
<td>0°</td>
<td>23</td>
<td>23</td>
<td>6</td>
<td>81</td>
</tr>
<tr>
<td>20 ft. from burner</td>
<td>0°</td>
<td>11</td>
<td>11</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>HL3 (40, 50, 60, 70) - 175 [N, P]</td>
<td>0°</td>
<td>34</td>
<td>34</td>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>45°</td>
<td>63</td>
<td>8</td>
<td>10</td>
<td>92</td>
</tr>
<tr>
<td>with 1 side shield</td>
<td>0°</td>
<td>50</td>
<td>8</td>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>with 2 side shields</td>
<td>0°</td>
<td>30</td>
<td>30</td>
<td>6</td>
<td>92</td>
</tr>
<tr>
<td>20 ft. from burner</td>
<td>0°</td>
<td>11</td>
<td>11</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td>HL3 (50, 60, 70) - 200 [N, P]</td>
<td>0°</td>
<td>41</td>
<td>41</td>
<td>6</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>45°</td>
<td>63</td>
<td>8</td>
<td>10</td>
<td>94</td>
</tr>
<tr>
<td>with 1 side shield</td>
<td>0°</td>
<td>54</td>
<td>8</td>
<td>6</td>
<td>94</td>
</tr>
<tr>
<td>with 2 side shields</td>
<td>0°</td>
<td>30</td>
<td>30</td>
<td>6</td>
<td>94</td>
</tr>
<tr>
<td>20 ft. from burner</td>
<td>0°</td>
<td>11</td>
<td>11</td>
<td>6</td>
<td>44</td>
</tr>
</tbody>
</table>

*Heaters mounted on an angle between 0° and 45° must maintain clearances posted for 0° or 45°; whichever is greater.

The stated clearance to combustibles represents a surface temperature of 90°F (50°C) above room temperature. Building materials with a low heat tolerance (such as plastics, vinyl siding, canvas, tri-ply, etc.) may be subject to degradation at lower temperatures. It is the installer's responsibility to assure that adjacent materials are protected from degradation.

Figure 1.1 • Mounting Angles
2.0 Installation

⚠️ WARNING

Improper installation, adjustment, alteration, service, or maintenance can cause property damage, serious injury, or death. Read and understand the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment. Only trained, qualified gas installation and service personnel may install or service this equipment.

Not for residential use! Do not use this heater in the home, sleeping quarters, attached garages, etc. **Installation of a commercial tube heater system in residential indoor spaces may result in property damage, serious injury, or death.**

Instructions for the following are detailed in the Tube Heater General Manual:

- Design considerations
- Hanger suspension and placement
- Tube layout and assembly
- Burner control box suspension
- Reflectors (and accessories)
- Venting and combustion air intake
- Gas requirements
- Baffle assembly

**Note:** Electronic versions of all manuals are available at www.detroitradiant.com

### Gas Requirements

<table>
<thead>
<tr>
<th>Type of Gas</th>
<th>Required Manifold Pressure</th>
<th>Minimum Inlet Pressure</th>
<th>Maximum Inlet Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>3.5 Inches. W.C.</td>
<td>5.0 Inches. W.C.</td>
<td>14.0 Inches. W.C.</td>
</tr>
</tbody>
</table>

⚠️ **IMPORTANT:** Consult the Tube Heater General Manual for gas connection requirements.

### Electrical Requirements

- 120VAC - 60 Hz, GND, 3-wire
- 24VAC thermostat connection
- Starting current 4.8 amps
- Running current 1.1 amps

**NOTICE**

Connecting the thermostat with a voltage other than 24V may damage the heater. The HL3 Series requires a 24VAC connection to the thermostat. This is either supplied by the heater internally (standard) or by an external transformer (with optional isolation relays, P/N: HLRP). See Figure 2.1A-B.

**NOTE:** A yellow control cord replaces the external terminal plug on stainless steel models and models with water resistant upgrades.
**Wiring**

---

**WARNING**

**Electric Shock**

Field wiring to the tube heater must be connected and grounded in accordance with national, state, provincial, local codes, and to the guidelines in the Tube Heater General Manual and Series Insert Manual. In the United States refer to the most current revisions to the ANSI/NFPA 70 Standard and in Canada refer to the most current revisions to the CSA C22.1 Part I Standard.

---

**Figure 2.1 • Field Wiring Diagrams**

**A. Single Heater, No Relay (Single Thermostat)**

![Diagram A](image)

1. **1/4" spade terminals required (as supplied)**
2. **THERMOSTAT**
3. **N**
4. **24VAC**
5. **Low**
6. **High**

When using a thermostat that requires constant power a common wire must be run from the C terminal on the thermostat back to the transformer.

**NOTE:** If optional yellow control cord is installed then the following wire colors apply:
- **Neutral = green**
- **Low = white**
- **High = black**

---

**B. Multiple Heaters with Relay Option (Single Thermostat)**

![Diagram B](image)

1. **Three 1/4" spade terminals required (as supplied)**
2. **THERMOSTAT**
3. **N**
4. **24VAC**
5. **Low**
6. **High**

**EXTERNAL TRANSFORMER** (field supplied)

**NOTE:** If optional yellow control cord is installed then the following wire colors apply:
- **Neutral = green**
- **Low = white**
- **High = black**

---

**120VAC Power (observe polarity)**

---

Type: HL3 Series
Before field wiring this appliance - Check existing wiring; replace if necessary.

Note: If any of the original wire supplied with the appliance must be replaced, it must be replaced with wiring material having a temperature rating of at least 105° C.

Figure 2.2 - Internal Wiring Diagrams

A. 35-66 Ladder Diagram

B. 35-66 Block Diagram
Figure 2.3 • Alternative Wiring Diagrams

A. 35-66 Ladder Diagram - With HLRP Relay

B. 35-66 Block Diagram - With HLRP Relay
# Specifications

## Chart 2.1 • Specifications

<table>
<thead>
<tr>
<th>Model Number</th>
<th>Gas Type (select one)</th>
<th>BTU/hr (High Fire)</th>
<th>BTU/hr (Low Fire)</th>
<th>Straight Length</th>
<th>U-Tube Length</th>
<th>Standard Weight (lbs.)</th>
<th>Stainless Steel Weight (lbs.)</th>
<th>Recommended Mounting Height</th>
<th>Combustion Chamber (Black Coated)</th>
<th>Radiant Emitter Tube(s) (Black Coated)</th>
<th>36&quot; Baffle Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>HL3-20-65</td>
<td>Nat. or Prop.</td>
<td>65,000</td>
<td>50,000</td>
<td>21'-9&quot;</td>
<td>13'-1&quot;</td>
<td>120</td>
<td>N/A</td>
<td>9' to 14'</td>
<td>Alum</td>
<td>Alum</td>
<td>5</td>
</tr>
<tr>
<td>HL3-20-75</td>
<td>Nat. or Prop.</td>
<td>75,000</td>
<td>50,000</td>
<td>21'-9&quot;</td>
<td>13'-1&quot;</td>
<td>120</td>
<td>145</td>
<td>10' to 15'</td>
<td>Alum</td>
<td>Alum</td>
<td>5</td>
</tr>
<tr>
<td>HL3-30-65</td>
<td>Nat. or Prop.</td>
<td>65,000</td>
<td>50,000</td>
<td>31'-5&quot;</td>
<td>&quot;17'-9&quot;</td>
<td>160</td>
<td>N/A</td>
<td>10' to 15'</td>
<td>Alum</td>
<td>Alum</td>
<td>4</td>
</tr>
<tr>
<td>HL3-30-75</td>
<td>Nat. or Prop.</td>
<td>75,000</td>
<td>50,000</td>
<td>31'-5&quot;</td>
<td>&quot;17'-9&quot;</td>
<td>160</td>
<td>195</td>
<td>11' to 18'</td>
<td>Alum</td>
<td>Alum</td>
<td>5</td>
</tr>
<tr>
<td>HL3-30-100</td>
<td>Nat. or Prop.</td>
<td>100,000</td>
<td>65,000</td>
<td>31'-5&quot;</td>
<td>&quot;17'-9&quot;</td>
<td>160</td>
<td>195</td>
<td>12' to 20'</td>
<td>Alum</td>
<td>Alum</td>
<td>5</td>
</tr>
<tr>
<td>HL3-30-125</td>
<td>Nat. or Prop.</td>
<td>125,000</td>
<td>82,000</td>
<td>31'-5&quot;</td>
<td>&quot;17'-9&quot;</td>
<td>160</td>
<td>195</td>
<td>13' to 23'</td>
<td>Alum</td>
<td>Alum</td>
<td>6</td>
</tr>
<tr>
<td>HL3-40-65</td>
<td>Nat. or Prop.</td>
<td>65,000</td>
<td>50,000</td>
<td>41'-1&quot;</td>
<td>22'-9&quot;</td>
<td>190</td>
<td>N/A</td>
<td>11' to 18'</td>
<td>Alum</td>
<td>Alum</td>
<td>3</td>
</tr>
<tr>
<td>HL3-40-75</td>
<td>Nat. or Prop.</td>
<td>75,000</td>
<td>50,000</td>
<td>41'-1&quot;</td>
<td>22'-9&quot;</td>
<td>190</td>
<td>235</td>
<td>11' to 18'</td>
<td>Alum</td>
<td>Alum</td>
<td>4</td>
</tr>
<tr>
<td>HL3-40-100</td>
<td>Nat. or Prop.</td>
<td>100,000</td>
<td>65,000</td>
<td>41'-1&quot;</td>
<td>22'-9&quot;</td>
<td>190</td>
<td>235</td>
<td>12' to 20'</td>
<td>Alum</td>
<td>Alum</td>
<td>4</td>
</tr>
<tr>
<td>HL3-40-125</td>
<td>Nat. or Prop.</td>
<td>125,000</td>
<td>82,000</td>
<td>41'-1&quot;</td>
<td>22'-9&quot;</td>
<td>190</td>
<td>235</td>
<td>13' to 23'</td>
<td>Alum</td>
<td>Alum</td>
<td>5</td>
</tr>
<tr>
<td>HL3-40-150*</td>
<td>Nat. or Prop.</td>
<td>150,000</td>
<td>100,000</td>
<td>41'-1&quot;</td>
<td>22'-9&quot;</td>
<td>190</td>
<td>235</td>
<td>14' to 25'</td>
<td>Titan</td>
<td>Titan</td>
<td>5</td>
</tr>
<tr>
<td>HL3-40-175*</td>
<td>Nat. or Prop.</td>
<td>175,000</td>
<td>125,000</td>
<td>41'-1&quot;</td>
<td>22'-9&quot;</td>
<td>190</td>
<td>235</td>
<td>15' to 27'</td>
<td>Titan</td>
<td>Titan</td>
<td>5</td>
</tr>
<tr>
<td>HL3-50-125</td>
<td>Nat. or Prop.</td>
<td>125,000</td>
<td>82,000</td>
<td>50'-9&quot;</td>
<td>&quot;27'-5&quot;</td>
<td>235</td>
<td>290</td>
<td>15' to 27'</td>
<td>Alum</td>
<td>Alum</td>
<td>3</td>
</tr>
<tr>
<td>HL3-50-150*</td>
<td>Nat. or Prop.</td>
<td>150,000</td>
<td>100,000</td>
<td>50'-9&quot;</td>
<td>&quot;27'-5&quot;</td>
<td>235</td>
<td>290</td>
<td>15' to 27'</td>
<td>Titan</td>
<td>Titan</td>
<td>3</td>
</tr>
<tr>
<td>HL3-50-175*</td>
<td>Nat. or Prop.</td>
<td>175,000</td>
<td>125,000</td>
<td>50'-9&quot;</td>
<td>&quot;27'-5&quot;</td>
<td>235</td>
<td>N/A</td>
<td>16' to 30'</td>
<td>Titan</td>
<td>Titan</td>
<td>3</td>
</tr>
<tr>
<td>HL3-50-200*</td>
<td>Nat. or Prop.</td>
<td>200,000</td>
<td>145,000</td>
<td>50'-9&quot;</td>
<td>&quot;27'-5&quot;</td>
<td>235</td>
<td>N/A</td>
<td>17' to 35'</td>
<td>Titan</td>
<td>Titan</td>
<td>2</td>
</tr>
<tr>
<td>HL3-60-150*</td>
<td>Nat. or Prop.</td>
<td>150,000</td>
<td>100,000</td>
<td>60'-5&quot;</td>
<td>32'-5&quot;</td>
<td>265</td>
<td>330</td>
<td>16' to 30'</td>
<td>Titan</td>
<td>Titan</td>
<td>2</td>
</tr>
<tr>
<td>HL3-60-175*</td>
<td>Nat. or Prop.</td>
<td>175,000</td>
<td>125,000</td>
<td>60'-5&quot;</td>
<td>32'-5&quot;</td>
<td>265</td>
<td>N/A</td>
<td>16' to 30'</td>
<td>Titan</td>
<td>Titan</td>
<td>2</td>
</tr>
<tr>
<td>HL3-60-200*</td>
<td>Nat. or Prop.</td>
<td>200,000</td>
<td>145,000</td>
<td>60'-5&quot;</td>
<td>32'-5&quot;</td>
<td>265</td>
<td>N/A</td>
<td>17' to 35'</td>
<td>Titan</td>
<td>Titan</td>
<td>2</td>
</tr>
<tr>
<td>HL3-70-175*</td>
<td>Nat. or Prop.</td>
<td>175,000</td>
<td>125,000</td>
<td>70'-1&quot;</td>
<td>&quot;37'-3&quot;</td>
<td>300</td>
<td>N/A</td>
<td>19' to 42'</td>
<td>Titan</td>
<td>Titan</td>
<td>2</td>
</tr>
<tr>
<td>HL3-70-200*</td>
<td>Nat. or Prop.</td>
<td>200,000</td>
<td>145,000</td>
<td>70'-1&quot;</td>
<td>&quot;37'-3&quot;</td>
<td>300</td>
<td>N/A</td>
<td>19' to 42'</td>
<td>Titan</td>
<td>Titan</td>
<td>2</td>
</tr>
</tbody>
</table>

* Model requires stainless steel tube clamp (P/N: TP-220) to be located at the seam between the primary combustion chamber and the secondary combustion tube downstream of the burner control box.

** Model requires 5EA-SUB accessory package when installing in a ‘U’ configuration (P/N: TF1B).

^ Factory recommended mounting heights are listed as a guideline.

**IMPORTANT**: Reference box label to determine the number of required baffle sections for each model heater.

Alum = Black coated aluminized treated steel.

Titan = Black coated titanium stabilized aluminized steel.
Tube Installation Sequence

Figure 2.4 • Tube Installation Sequence

Important! The combustion chamber & radiant tube sections must be installed in the following order.

20 Foot

30 Foot

Stainless steel clamp location on 150 MBH models (P/N: TP-220)

40 Foot

Stainless steel clamp location on 150 - 200 MBH models (P/N: TP-220)

50 Foot

Stainless steel clamp location on 150-200 MBH models (P/N: TP-220)

60 Foot

Stainless steel clamp location on 150-200 MBH models (P/N: TP-220)

70 Foot

Key

Burner Control Box with 16-inch Burner Tube

Black Coated Combustion Chamber Tube*

Black Coated Aluminized Combustion Chamber/Radiant Emitter Tube

Standard Tube Clamp

Stainless Steel Tube Clamp (P/N: TP-220)

150-200 MBH models only - Located between 1st and 2nd 10 ft. tube sections.

Baffle Location

*Aluminized tubes (50,000 to 125,000 BTU/H models); Titan tubes (150,000 to 200,000 BTU/H models).

NOTE: Refer to the Tube Heater General Manual, Chart 3.6 (page 23) for secured reflector joints.
3.0 Operation

WARNING

This heater must be installed and serviced by trained gas installation and service personnel only.

Do not bypass any safety features or the heater’s built in safety mechanisms will be compromised.

Note: Reference the Tube Heater General Manual for installation requirements.

Sequence of Operation

Standby: The 35-66 control continually checks for internal faults, circuit integrity, and relay contact positioning.

Starting Circuit: Upon a call for heat, the control verifies that the differential switch is in the proper position (open). The control energizes the fan. Once operational static pressure is achieved, the differential switch will close initiating the ignition sequence. The glo-bar is powered and the gas valve opens after 45 seconds. If the flame is not sensed, the heater will attempt to re-ignite for a total of three (3) trials for ignition before proceeding to soft lockout.

Single Stage Running Circuit: After ignition, the flame rod monitors burner flame. If sense of flame is lost, the control closes the gas valve within one second and a new trial sequence (identical to the starting sequence) is initiated. If flame sense is not established within 8.5 seconds, the heater will attempt two (2) additional ignition sequences before proceeding to soft lockout. The control can be reset by briefly interrupting the power source.

Two Stage Running Circuit: The second stage on the gas valve is powered directly from the second stage of the thermostat. In order for two stage to flow to a higher output, single stage must be energized as well. The thermostat determines which stage to maintain for the desired temperature.

Shut Down: When the thermostat is satisfied, the fan will enter a two (2) minute post-purge cycle. Refer to Soft and Hard Lockout under Diagnostics on page 13.

Thermostat

HL3 Series heaters require a 24VAC, two-stage thermostat to operate. The burner control box is equipped with a round terminal strip that accepts three (3) 1/4” insulated female spade terminals. Do not supply 120V to the 24V connection.

The HL3 Series is equipped with or without relays (P/N: HLRP). The optional relays must be factory installed. NOTE: Units with a relay installed must have an external transformer (field supplied), see wiring diagram (Figure 2.2B).

Standard Configuration
Without relays (identified with white label around the terminal block):
• Single burner control box
• Single thermostat

Optional Configuration
With relays (identified with orange label around the terminal block):
• A single thermostat controls two or more burner control boxes.
• Heaters are common vented
• Must be factory installed

WARNING

This heater must be installed and serviced by trained gas installation and service personnel only.

Do not bypass any safety features or the heater’s built in safety mechanisms will be compromised.

Note: Reference the Tube Heater General Manual for installation requirements.
Diagnostics

Lockout:

The controls will automatically lockout the heater system when an external or system fault occurs. There are two types of lockout:

**Soft Lockout:** The heater will attempt to light three times. In the event of a failed attempt to light, (gas pressure, valve, no flame sense etc.), the heater will enter a soft lockout period for 15 minutes and then attempt to light three more times before entering Hard Lockout mode.

**Hard Lockout:** If proof of flame is not established, a component failure occurs or blockages are evident, the heater will enter hard lockout. If lockout occurs, the control can be reset by briefly interrupting the power source. Refer to Chart 3.1 and 3.2 below for a description of LED codes.

Figure 3.1 • Operational Indicator Lights

![Operational Indicator Lights Diagram]

Chart 3.1 • LED Diagnostic Codes - Fenwal Circuit Board

<table>
<thead>
<tr>
<th>LED Code</th>
<th>Fault Status</th>
<th>Fault Code Delay*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial flash on power up, then steady off</td>
<td>No fault, normal operation</td>
<td>No delay</td>
</tr>
<tr>
<td>Steady on</td>
<td>Module failure / Internal fault</td>
<td>No delay</td>
</tr>
<tr>
<td>1 flash</td>
<td>APS (Air Proving Switch) (Fan/Intake/Exhaust)</td>
<td>3 minutes</td>
</tr>
<tr>
<td>2 flashes</td>
<td>Lockout</td>
<td>17 minutes</td>
</tr>
<tr>
<td>3 flashes</td>
<td>Solenoid valve fault</td>
<td>1 minute</td>
</tr>
<tr>
<td>4 flashes</td>
<td>Leaky valve</td>
<td>12 seconds</td>
</tr>
<tr>
<td>Transformer fault</td>
<td>No delay</td>
<td></td>
</tr>
<tr>
<td>No flash on 117V startup</td>
<td>Transformer fault</td>
<td>No delay</td>
</tr>
</tbody>
</table>

*Some LED codes have a time delay before the LED will flash.

Chart 3.2 • LED Diagnostic Codes - Capable Controls Circuit Board

<table>
<thead>
<tr>
<th>LED Code</th>
<th>Fault Status</th>
<th>Fault Code Delay*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial flash (Red) on power up</td>
<td>Normal operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Steady flash (Green) during ignition</td>
<td>Normal operation</td>
<td>Immediate</td>
</tr>
<tr>
<td>Steady on (Green) after flame sense</td>
<td>Normal operation</td>
<td>1 minute</td>
</tr>
<tr>
<td>1 flash (Red)</td>
<td>Ignition failure</td>
<td>3 minutes</td>
</tr>
<tr>
<td>1 flash (Red)</td>
<td>Reverse Polarity</td>
<td>30 Seconds</td>
</tr>
<tr>
<td>2 flashes (Red)</td>
<td>Ignition error</td>
<td>12 seconds</td>
</tr>
<tr>
<td>3 flashes (Red)</td>
<td>Gas valve error</td>
<td></td>
</tr>
<tr>
<td>4 flashes (Red)</td>
<td>Line voltage frq. error</td>
<td></td>
</tr>
<tr>
<td>5 flashes (Red)</td>
<td>Internal control error</td>
<td></td>
</tr>
<tr>
<td>6 flashes (Red)</td>
<td>Pressure switch error</td>
<td></td>
</tr>
</tbody>
</table>
4.0 Troubleshooting Guide

Turn up thermostat.

Does the fan blower turn on?  
No  
Is the power at the heater 120V?  
Yes  
Does the heater have HLRP isolation relays? (identified with orange crescent around the terminal plug)?  
No  
Yes  

Find the source of the electrical problem between panel and heater.

Find the source of the electrical problem between panel and external transformer.

External transformer is faulty and must be replaced.

Is there 120V on the primary side of the external transformer?  
No  
Is there 24 Volts from the thermostat?  
Yes  

Is there 24 Volts on the secondary side of the external transformer?  
Yes  
No  

The thermostat or wiring is faulty and should be replaced or repaired.

Find source of electrical problem between the external transformer and thermostat.

Does the switch light energize?  
No  
Is the green light burnt out? If so, replace.  
No  
Is the inlet or the outlet of the unit plugged or obstructed?  
Yes  
No  

Repair the wiring between the transformer and the 24V terminal plug.

Does the igniter warm up and glow red?  
No  
Is the igniter physically damaged?  
Yes  
No  
Check voltage at igniter sequence (usually 5 to 15 seconds after power to heater). Is it 120V?  
Yes  
No  
Is the resistance through the igniter 50-400Ω?  
Yes  
No  

Repair the wiring between power in and transformer.

Is the inlet or the outlet of the unit plugged or obstructed?  
Yes  
No  

Replace transformer. 

Replace igniter.

Continued on page 16
**NOTICE**

Bypassing any switch is intended for testing purposes only. Do not leave switch bypassed during normal operation or the heater’s built-in safety mechanisms will be compromised.

---

**Key**

**Without HLRP Isolation Relays:**

<table>
<thead>
<tr>
<th>Start</th>
<th>Question</th>
<th>Process</th>
<th>Question</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Is the power across the 24V wire on the circuit board and ground 24V?**
  - Yes
  - **Is the power across the t-stat wire on the circuit board and ground 24V?**
    - Yes
    - **Is the circuit board sending 120V to the fan?**
      - Yes
      - **Is the fan obstructed?**
        - Yes
        - Remove obstruction.
    - No
    - **Is the relay board faulty and must be replaced.**
  - No
    - **Is there 120V on the primary side of the internal transformer?**
      - Yes
      - **The internal transformer is faulty and must be replaced.**
    - No
      - Repair wiring between power in and transformer.

- **Is there 120V on the primary side of the internal transformer?**
  - Yes
    - **The relay board is faulty and must be replaced.**
  - No
    - **Is there 120V on the primary side of the internal transformer?**
      - Yes
        - **The relay board is faulty and must be replaced.**
      - No
        - Repair wiring between power in and transformer.

---

**With HLRP Isolation Relays:**

<table>
<thead>
<tr>
<th>Process</th>
<th>Question</th>
<th>Corrective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Is there 24V across the TH and ground terminals on the circuit board?**
  - Yes
    - **Is the circuit board sending 120V to the fan?**
      - Yes
      - **Is the fan obstructed?**
        - Yes
        - Remove obstruction.
      - No
      - **Is the pressure switch stuck in the closed position?**
        - Yes
        - Replace switch.
        - No
      - **The circuit board is faulty and must be replaced.**
    - No
      - **The relay board is faulty and must be replaced.**
  - No
    - **Check for loose wiring or restrictions in hose connections to pressure switch. Are they OK?**
      - Yes
      - **Replace wiring or hose connections.**
      - No
      - **Repair thermostat or wiring from thermostat to heater.**
    - No
      - **Repair wiring or hose connections.**

---

* Replace the pressure switch after verifying:
  - Baffle(s) are in the radiant tube furthest from the burner.
  - Heater, fan blowers, squirrel cage, intake and exhaust are clean and free from dirt and obstructions.
  - The 4” air intake pipe does not exceed 20 ft. and/or 2 elbows.
  - There is not a negative pressure experienced at the area of air intake (e.g.; high winds, attic space, tightly sealed building).

---

* Refer to LED diagnostic Fault Code Chart; p.13.
4.0 Troubleshooting Guide

HL3 Series

Does the heater stay ON until a call for heat ends?

Yes → Troubleshooting ends.

No → The heater can shut down due to:
- Improper grounding.
- High winds.
- Taking combustion air from the attic.
- Dirty environment.
- Improperly positioned baffles.
- Fluctuating gas pressure.

Continued from page 14

After igniter is warmed up, does gas valve open?

Yes → Replace circuit board.

No → No

Does The burner light?

Yes → Yes

No → No

Check to make sure gas pressure is within minimum and maximum inputs, as indicated on the heater's rating plate. Is gas pressure OK?

Yes → Yes

No → No

Correct problem.

Turn on.

Correct problem.

Does the burner stay on? (approximately 8 seconds and then shut off)

Yes → Yes

No → No

Pressure switch may be faulty or there is a restriction in the exhaust.

Does the burner come on and turn off immediately (1 or 2 seconds)?

Yes → Yes

No → No

Check to make sure gas pressure is within minimum and maximum inputs, as indicated on the heater's rating plate. Is gas pressure OK?

Yes → Yes

No → No

Correct problem.

Test for 24V at valve opening period (usually 45 to 60 seconds after power to heater). Is there 24V to valve for 8 seconds?

Yes → Yes

No → No

Replace circuit board.

Is the ball valve/shut-off valve in the ON position?

Yes → Yes

No → No

Correct problem.

Check to make sure gas pressure is within minimum and maximum inputs, as indicated on the heater's rating plate. Is gas pressure OK?
Check to make sure gas pressure is within minimum and maximum inputs, as indicated on the heater's rating plate. Is gas pressure OK?
- Yes: Replace gas valve.
- No: Correct problem.

Were the gas lines purged of air?
- Yes: Correct problem.
- No: Purge gas line.

Is the heater properly grounded? Is the heater's polarity correct?
- Yes: With microampmeter, check DC amperage at flame rod. Is it greater than 1.0 microamps?
  - Yes: Check to make sure flame sensor wire is OK and then replace circuit.
  - No: Sensing rod is faulty or flame is weak. Check to make sure heater is operating at proper gas pressure as indicated on the heater's rating plate and then, if needed, replace sensing rod.
- No: Correct problem.

**If heater does not go into high fire mode:**

**NOTE:** To confirm that the heater is not in high fire mode, check manifold pressure.

If manifold pressure is 3.3” to 3.5” for natural gas or 9” to 10” for propane, the light is faulty and should be replaced.

When the heater is in low fire mode, manifold pressure is approximately 2.0” to 2.5” for natural gas or 5.0” to 6.5” for propane. If this is the case, the following troubleshooting steps should be followed:

Is there 24V across the GROUND and HIGH (HIGH to COM on heaters with optional isolation relays) on the terminal strip located on the outside of the control box?
- Yes: Measure voltage across the red wire on the VALVE and GROUND (red wire on RELAY to GROUND on heaters with isolation relays). Is it 24V?
  - Yes: Replace gas valve.
  - No: Replace relay.
- No: Repair or replace faulty wiring or thermostat.
## 5.0 Parts

### Chart 5.1 • Parts List

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
<th>Part #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP-5</td>
<td>Flange Gasket</td>
<td>TP-70</td>
<td>1/2 in. Control Box Gasket (10.3 inches)</td>
</tr>
<tr>
<td>TP-9</td>
<td>Conduit Coupling</td>
<td>TP-70A</td>
<td>1 in. Control Box Gasket (6 inches)</td>
</tr>
<tr>
<td>TP-10A</td>
<td>Conduit 4&quot; x 3/4&quot;</td>
<td>TP-76</td>
<td>Rubber Grommet</td>
</tr>
<tr>
<td>TP-14</td>
<td>Sight Glass Gasket</td>
<td>TP-82</td>
<td>Reflector Center Support (RCS)</td>
</tr>
<tr>
<td>TP-15</td>
<td>Sight Glass</td>
<td>TP-83</td>
<td>24 in. Stainless Steel Flexible Gas Connector</td>
</tr>
<tr>
<td>TP-16</td>
<td>Sight Glass Washer</td>
<td>TP-84</td>
<td>1/2 in. Female / Male Flare Fitting</td>
</tr>
<tr>
<td>TP-17</td>
<td>Sight Glass Kit</td>
<td>TP-85</td>
<td>1/2 in. Male / Male Flare Fitting</td>
</tr>
<tr>
<td>TP-19B</td>
<td>4 in. Wire Hanger with Tension Spring</td>
<td>TP-105</td>
<td>Aluminum Reflector End Cap</td>
</tr>
<tr>
<td>TP-20C</td>
<td>120 in. Aluminum Reflector</td>
<td>TP-106</td>
<td>Reflector End Cap Clips (8 pcs.)</td>
</tr>
<tr>
<td>TP-20D*</td>
<td>120 in. Stainless Steel Reflector</td>
<td>TP-113</td>
<td>Reflector Tension Spring</td>
</tr>
<tr>
<td>TP-21B</td>
<td>4 in. Standard Tube Clamp</td>
<td>TP-201B</td>
<td>V.3 Mid-High Burner (Color Code - TAN)</td>
</tr>
<tr>
<td>TP-25</td>
<td>1/4 in. Female Spade Terminal (Qty. 3)</td>
<td>TP-204</td>
<td>Gas Orifice (consult factory)</td>
</tr>
<tr>
<td>TP-26A</td>
<td>10 ft. Aluminized Radiant / Combustion Tube</td>
<td>TP-205</td>
<td>Glo-Bar™ Holder</td>
</tr>
<tr>
<td>TP-26B</td>
<td>10 ft. Titanium Coated Combustion Tube</td>
<td>TP-206</td>
<td>Glo-Bar™ Holder Spring Clip</td>
</tr>
<tr>
<td>TP-26D*</td>
<td>10 ft. 304 Stainless Steel Radiant Tube</td>
<td>TP-212</td>
<td>1/2” x 3” Pipe Nipple</td>
</tr>
<tr>
<td>TP-26E*</td>
<td>10 ft. 409 Stainless Steel Combustion Tube</td>
<td>TP-217</td>
<td>Brass Pressure Switch Barb Fitting</td>
</tr>
<tr>
<td>TP-31D</td>
<td>Interlocking Mounting Bracket (Qty. 2)</td>
<td>TP-219</td>
<td>Differential Vinyl Sensing Tube (burner)</td>
</tr>
<tr>
<td>TP-50A</td>
<td>Glo-Bar™ Igniter</td>
<td>TP-220</td>
<td>Stainless Steel Tube Clamp (150 &amp; 200 MBH)</td>
</tr>
<tr>
<td>TP-55A</td>
<td>1/20 hp Inducer Assembly (50-150 MBH)</td>
<td>TP-221</td>
<td>Glo-Bar™ Holder Gasket</td>
</tr>
<tr>
<td>TP-65I</td>
<td>36 in. Interlocking Turbulator Baffle</td>
<td>TP-222</td>
<td>Flame Rod</td>
</tr>
<tr>
<td>TP-68B</td>
<td>Large Strain Relief Bushing</td>
<td>TP-222A</td>
<td>Flame Rod Wire</td>
</tr>
</tbody>
</table>

* Optional upgrade or add-on item.
**Figure 5.2 • Tube and Reflector Components**

---

**Chart 5.2 • Parts List**

<table>
<thead>
<tr>
<th>Part #</th>
<th>Description</th>
<th>Part #</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP-245</td>
<td>3/16” X 1/8” Plastic Gas Valve 90° Vent</td>
<td>TP-3008A</td>
<td>Gas Valve Mounting Bracket</td>
</tr>
<tr>
<td>TP-264D</td>
<td>Differential Pressure Switch, 65 to 75 MBH</td>
<td>TP-3010</td>
<td>Service Panel Hinge</td>
</tr>
<tr>
<td>TP-264F</td>
<td>Differential Pressure Switch, 150 to 200 MBH</td>
<td>TP-3011</td>
<td>V.3 Igniter Box</td>
</tr>
<tr>
<td>TP-321</td>
<td>Ignition Plate Gasket</td>
<td>TP-3012</td>
<td>V.3 Igniter Box Cover</td>
</tr>
<tr>
<td>TP-331</td>
<td>Green Self-Tap Ground Screw (Qty. 2)</td>
<td>TP-3014</td>
<td>Plastic Air Orifice with Screen</td>
</tr>
<tr>
<td>TP-332</td>
<td>Divider Grommet</td>
<td>TP-3016</td>
<td></td>
</tr>
<tr>
<td>TP-333</td>
<td>60 in. Black 120V Power Cord with Ground</td>
<td>TP-3017</td>
<td></td>
</tr>
<tr>
<td>TP-383</td>
<td>Glo-Bar™ Igniter Plate</td>
<td>TP-3018</td>
<td></td>
</tr>
<tr>
<td>TP-579</td>
<td>4 in. Wire Hanger w/o Tension Spring</td>
<td>TP-3019</td>
<td></td>
</tr>
<tr>
<td>TP-826</td>
<td>40VA Transformer</td>
<td>TP-3020</td>
<td></td>
</tr>
<tr>
<td>TP-828</td>
<td>24V Yellow Operational Indicator Light (Qty. 2)</td>
<td>TP-3021</td>
<td></td>
</tr>
<tr>
<td>TP-832</td>
<td>Thermostat Terminal Strip</td>
<td>TP-3022</td>
<td></td>
</tr>
<tr>
<td>TP-851B</td>
<td>35-66 Diagnostic Circuit Board</td>
<td>TP-3023</td>
<td></td>
</tr>
<tr>
<td>TP-1018</td>
<td>Differential Switch Vinyl Sensing Tube (exhaust)</td>
<td>TP-3024</td>
<td></td>
</tr>
<tr>
<td>TP-1264A</td>
<td>Differential Pressure Switch, 100 to 125 MBH</td>
<td>TP-3025</td>
<td></td>
</tr>
<tr>
<td>TP-1325</td>
<td>Optional HLRP Isolation Relay* (Qty. 2)</td>
<td>TP-3026</td>
<td></td>
</tr>
<tr>
<td>TP-1428</td>
<td>24V Green Operational Indicator Light</td>
<td>TP-3027</td>
<td></td>
</tr>
<tr>
<td>TP-3001</td>
<td>Divider Panel</td>
<td>TP-3028</td>
<td></td>
</tr>
<tr>
<td>TP-3002A</td>
<td>Plastic End Panel, Control Compartment</td>
<td>TP-3029</td>
<td></td>
</tr>
<tr>
<td>TP-3003A</td>
<td>Plastic End Panel, Fan Compartment</td>
<td>TP-3030</td>
<td></td>
</tr>
<tr>
<td>TP-3004</td>
<td>V.3 Control Box</td>
<td>TP-3031</td>
<td></td>
</tr>
<tr>
<td>TP-3005A</td>
<td>Plastic Valve Chamber Lid</td>
<td>TP-3032</td>
<td></td>
</tr>
</tbody>
</table>

* Optional upgrade or add-on item.

---

**HL3 Series**

5.0 Parts • Tube and Reflector Components

V.3 Igniter Box Cover

Gas Valve Mounting Bracket

V.3 Igniter Box

Plastic Air Orifice with Screen

V.3 Pressure Switch Mounting Bracket

Low BTU Burner (Color Code - GREEN)

#8-23 Cage Nut (Qty. 4)

#8-32 x ½” Zinc Coated Steel Knurled Thumb Screw (Qty. 4)

Valve Compartment Bottom Panel

Valve Compartment Top Panel

Valve Compartment Side Panel

Controls Mounting Panel

36G54-224 Gas Valve - Natural Gas Assembly

36G54-226 Gas Valve - Prop. Gas Assembly

1/15 hp Inducer Assembly (175-200 MBH)

Reducer Plate (175-200 MBH)

4-Piece Wire Harness Set

V.3 16" HSI Burner Tube w/ Flange and Fittings

---

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## Kit Contents Check List

### Chart 5.3 * Kit Contents for HL3 Series - Reference the length column for your model.

### HL3 Series Kit Contents

<table>
<thead>
<tr>
<th>Part No.</th>
<th>Description</th>
<th>20 ft.</th>
<th>30 ft.</th>
<th>40 ft.</th>
<th>50 ft.</th>
<th>60 ft.</th>
<th>70 ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP-19B</td>
<td>4” Hanger with Reflector Tension Spring</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>TP-21B</td>
<td>4” Tube Clamp</td>
<td>2</td>
<td>3</td>
<td>4*</td>
<td>5*</td>
<td>6*</td>
<td>7*</td>
</tr>
<tr>
<td>TP-25</td>
<td>1/4” Female Spade Terminal</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>TP-82</td>
<td>4” Reflector Center Support (RCS)</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>TP-83</td>
<td>24” Stainless Steel Flexible Gas Connector</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
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<td>TP-105</td>
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* **NOTE:** One 4” stainless steel tube clamp (P/N: TP-220) is provided for each 150,000 - 200,000 BTU/h model. Place as shown on page 11.  
** Part number for models upgraded with stainless steel options.

### Approvals

- CSA
- Indoor Approval
- Outdoor Approval with OD-Kit
- Commercial Approval

### Limited Warranty

- 1 year - Burner box components
- 5 years - Combustion and radiant tubes
- 10 years - Stainless steel burner
- See page 36 of the General Tube Heater Manual for terms and conditions

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