GAS IGNITION CONTROLS TRAINING
Using The Source Suitcase Lab Trainer
Hands-on Lab Exercises for use with The Source “Suitcase” Trainer

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Standing Pilot

NOTE: Purchased suitcases contain the Standing Pilot lab controls, demo suitcases may not.

Operation

In a standing pilot ignition system a pilot burner remains lighted all the time to light the main burner on every call for heat. The thermostat energizes the gas valve to send gas to the main burner.

Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitcase Lab Trainer</td>
<td>VR8200 Standing Pilot Combination Gas Control</td>
</tr>
<tr>
<td>Burner with pilot burner and pilot gas hose</td>
<td>Burner bracket</td>
</tr>
<tr>
<td>Q340 Thermocouple</td>
<td>Propane bottle connector, regulator, hose &amp; quick connect</td>
</tr>
</tbody>
</table>

Procedure

1. Check: POWER OFF, VALVE OFF.
2. Locate the components needed for this lab and mount them on the trainer.
3. Refer to the wiring diagram and pictures on the next page. Use jumper wires to connect the components.
4. Instructor approves setup and wiring.
5. Turn valve knob to PILOT and light pilot.
6. Set thermostat to call for heat. Caution – the main burner will light.
7. With the burner on, carefully unscrew the thermocouple from the valve and observe what happens. This simulates a failed thermocouple. How long does it take for the pilot and main burner to go out? _______ seconds. (The same thing would happen if the pilot flame went out.)
8. With the thermocouple disconnected, attempt to relight the pilot. What happens?

Using a Multimeter

1. With pilot operating, connect a multimeter set for DC Millivolts to the thermocouple and record reading _____________. (Typical reading of 25 to 30Mv)
2. Using a multimeter set for AC voltage and when burner is firing, measure the voltage at the valve terminals and record reading _____________.
3. Using a multimeter set for AC amperage and when the burner is firing, check the amperage draw of the gas valve and record reading _____________.
   ~Compare to amperage listed on valve.

Review Questions

1. What is the symptom of a failed thermocouple? ____________________________

2. How long does it take for the system to detect a failed pilot? ____________________________

3. Will a standing pilot go out during a power failure? ____________________________

4. Can the main burner operate during a power failure? ____________________________
Intermittent Pilot

Operation
In an intermittent pilot ignition system a pilot burner is lighted on every call for heat to light the main burner. After the thermostat is satisfied, both the main burner and the pilot are turned off.

Components

<table>
<thead>
<tr>
<th>Suitcase Lab Trainer</th>
<th>Intermittent Pilot Igniter Assembly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination Gas Control:</td>
<td>S8610U Intermittent Pilot Ignition Module</td>
</tr>
<tr>
<td>• VR8345 Universal Electronic Ignition CGC, or</td>
<td></td>
</tr>
<tr>
<td>• VR8204 Intermittent Pilot CGC</td>
<td></td>
</tr>
<tr>
<td>Burner with pilot burner and pilot gas hose attached</td>
<td>Burner Bracket</td>
</tr>
<tr>
<td>Propane bottle connector, regulator, hose &amp; quick connect</td>
<td></td>
</tr>
</tbody>
</table>

Procedure

1. □ Check: POWER OFF, VALVE OFF.
2. □ Locate the components needed for this lab and mount them on the trainer.
3. □ Refer to the wiring diagram and pictures on the next page. Use jumper wires to connect the components.
4. □ Instructor approves setup and wiring.
5. □ Observe normal sequence of operation:
   a. Set thermostat to call for heat. What happens?
6. □ Observe operation when there is a problem (Refer to “Error Code” tables at the end of this book):
   a. With the burner on, carefully unplug the ground wire from the burner bracket. This interrupts the flame sensing circuit. Record what happens:
   b. With the burner running carefully unplug the wire going to the pilot valve terminal PV on the gas valve. Record what happens:
   c. With the burner OFF, turn the gas control to OFF. Initiate a call for heat and record what happens:

Using a Multimeter

1. □ Using a multimeter set for Microamps record the Microamp Flame Current reading with just the pilot operating ______, then with the main burner firing ______. Why is there a difference?
2. □ Using a multimeter set for AC voltage and thermostat not calling for heat, measure the voltage on the TH-W and 24 V GND terminals ______.
3. □ Turn thermostat up for heat and measure the voltage on the TH-W and 24 V GND terminals ______.
4. □ Using a multimeter set for AC amperage and when the burner is firing record the valve amperage draw of the pilot valve ______, main valve ______, and both valves together ______. Compare to amperage listed on the valve.
5. □ Using a multimeter set for AC voltage and when burner is firing, measure the voltage at the valve terminals and record reading.
Review Question
1. What is the symptom of a failure to sense flame on a call for heat? ______________________
2. How long does it take for the system to detect a failed pilot? ______________________
3. What is the symptom of failure to detect the pilot flame? ______________________

Intermittent Pilot
**SmartValve™**

**Operation**
The Honeywell SmartValve™ burner control is a variation of the intermittent pilot system. The main burner is still lit by a pilot burner, but instead of using a spark to light the pilot it uses a 24 volt hot surface ignitor. The **pilot burner** is lighted on every call for heat. After the thermostat is satisfied, both the main burner and the pilot are turned off.

**Components**

<table>
<thead>
<tr>
<th>Suitcase lab trainer</th>
<th>Burner bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td>SV9501 SmartValve™ Combination Gas Control</td>
<td>Burner with SmartValve™ pilot burner and pilot gas hose attached</td>
</tr>
<tr>
<td>Propane bottle connector, regulator, hose &amp; quick connect.</td>
<td></td>
</tr>
</tbody>
</table>

**Procedure**

1. **Check**: POWER OFF, VALVE OFF.
2. **Locate** the components needed for this lab and mount them on the trainer.
3. **Refer** to the wiring diagram and pictures on the next page. Use jumper wires to connect the components.
4. **Instructor approves** setup and wiring.
5. **Observe** normal sequence of operation:
   a. Set thermostat to call for heat. What happens?
6. **Observe operation when there is a problem**:
   a. With the burner on, carefully blow out the pilot and main burner flame. Record what happens:
   b. With the burner OFF, disconnect the gas supply to the valve. Initiate a call for heat and record what happens:

**Using a Multimeter**

1. **Using** Instructor supplied Flame Current Kit #395466 measure Microamp reading ________ (Typical reading of 2 to 4 Microamps)
2. **Using** Instructor supplied Input Voltage Harness #396085, check the voltages to valve ________.
3. **Using** a multimeter set for Ohms check the resistance of the Hot Surface Igniter ________ (Typical reading 3 to 4 ohms if > 10 replace.)

**Review Question**

1. How long does it take for the system to detect a failed pilot? ________
2. What is the symptom of failure to detect the pilot flame? ________
Direct Burner Ignition (HSI)

Operation
In a Hot Surface Direct Burner Ignition system there is no pilot; the main burner is lighted directly by a silicon carbide ignitor. The ignitor is powered by a 120 volt electrical source and becomes hot enough to ignite the gas coming out of the burner.

Components

<table>
<thead>
<tr>
<th>Suitcase lab trainer</th>
<th>Burner and burner bracket</th>
</tr>
</thead>
<tbody>
<tr>
<td>S8910U HSI Control Module</td>
<td>Hot Surface Igniter</td>
</tr>
<tr>
<td>• VR8345 Universal Electronic Ignition CGC, or</td>
<td>Propane bottle connector, regulator, hose &amp; quick connect.</td>
</tr>
<tr>
<td>• VR8205 Direct ignition CGC</td>
<td></td>
</tr>
</tbody>
</table>

Procedure
1. Check: POWER OFF, VALVE OFF.
2. Locate the components needed for this lab and mount them on the trainer.
3. Refer to the wiring diagram and pictures on the next page. Use jumper wires to connect the components.
4. Instructor approves setup and wiring.
5. Observe normal sequence of operation:
   a. Set thermostat to call for heat – look for:
      - 32 seconds of prepurge (no action – in a real system the inducer would be running)
      - 34 seconds of igniter warm up
      - 4 or 7 seconds trial for burner ignition
      - Ignitor OFF
      - Burner ON
6. Observe operation when there is a problem:
   a. With the burner on, carefully blow out the main burner flame. Record what happens:
   b. With the burner OFF, disconnect the gas supply to the valve. Initiate a call for heat and record what happens:

Using a Multimeter:
1. Using a multimeter set AC volts and the thermostat not calling for heat, measure the voltage on the 24 V and 24 V GRN terminals .
2. Turn the thermostat up to call for heat and re-measure the voltage.
3. Using a Multimeter set for AC amps and when the burner is firing measure the amperage draw of the valve . Compare to the amperage listed on the valve.
4. Using a multimeter set for AC voltage and when the burner is firing, measure the voltage at the valve terminals and record reading .

Review Question
1. How long does it take for the system to detect a flameout?
2. What is the symptom of failure to detect the main burner flame?
Direct Burner Ignition (HSI)
Direct Burner Ignition (DSI)

Operation
In a Spark Direct Burner Ignition system there is no pilot; the main burner is lighted directly by a high voltage spark placed where it will light the gas flowing from the main burner.

Components

<table>
<thead>
<tr>
<th>Suitcase Lab Trainer</th>
<th>Burner</th>
</tr>
</thead>
<tbody>
<tr>
<td>S87D DSI Control Module</td>
<td>Burner Bracket</td>
</tr>
<tr>
<td>• VR8345 Universal Electronic Ignition CGC, or</td>
<td>Propane bottle connector, regulator, hose &amp; quick connect</td>
</tr>
<tr>
<td>• VR8205 Direct ignition CGC</td>
<td></td>
</tr>
<tr>
<td>Q347 Spark Ignitor &amp; Ignition Cable</td>
<td>Q354 Flame Sensor</td>
</tr>
</tbody>
</table>

Procedure
1. Check: POWER OFF, VALVE OFF.
2. Locate the components needed for this lab and mount them on the trainer.
3. Refer to the wiring diagram and pictures on the next page. Use jumper wires to connect the components.
4. Instructor approves setup and wiring.
5. Observe normal sequence of operation:
   a. Set thermostat to call for heat – look for:
      – Immediate spark ON and Valve OPEN
      – Burner lights
      – Ignitor OFF
      – Burner remains ON
6. Observe operation when there is a problem:
   a. With the burner on, carefully blow out the main burner flame. Record what happens:
   b. With the burner OFF, disconnect the gas supply to the valve. Initiate a call for heat and record what happens

Using a Multimeter
1. Using a multimeter set for AC volts and the thermostat not calling for heat, measure the voltage at 25V and 25 V GND ________
2. Turn the thermostat up to call for heat and re-measure the voltage ________.
3. Using a multimeter set for AC amperage and when the burner is firing, measure the amperage draw of the valve ________. Compare to the amperage listed on the valve.
4. Using a multimeter set for AC voltage and when burner is firing, measure the voltage at the valve terminals and record reading ________.
5. Using a multimeter set for Microamps and when the burner is firing, measure the flame current on the flame rod ground wire ________. (The meter must be wired in series with the ground wire.)
Review Question
1. How long does it take for the system to detect a flameout?

2. What is the symptom of failure to detect the main burner flame?

Direct Burner Ignition (DSI)
## S8610U LED Status Codes

<table>
<thead>
<tr>
<th>Green LED Flash Code*</th>
<th>Indicates</th>
<th>Next System Action</th>
<th>Recommended Service Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>No “Call for Heat”</td>
<td>Not applicable</td>
<td>None</td>
</tr>
<tr>
<td>Flash Fast</td>
<td>Power up - internal check</td>
<td>Not applicable</td>
<td>None</td>
</tr>
<tr>
<td>Heartbeat</td>
<td>Normal startup - ignition sequence started (including pre purge)</td>
<td>Not applicable</td>
<td>None</td>
</tr>
<tr>
<td>4 Seconds ON then “x” flashes</td>
<td>Device in run mode. “x” = flame current to the nearest µA</td>
<td>Not applicable</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>5 minute Retry Delay – Pilot flame not detected during trial for ignition</td>
<td>Initiate new trial for ignition after retry delay completed.</td>
<td>If system fails to light on next trial for ignition check gas supply, pilot burner, spark and flame sense wiring, flame rod contaminated or out of position, burner ground connection.</td>
</tr>
<tr>
<td>3</td>
<td>Recycle – Flame failed during run</td>
<td>Initiate new trial for ignition. Flash code will remain through the ignition trial until flame is proved.</td>
<td>If system fails to light on next trial for ignition, check gas supply, pilot burner, flame sense wiring, contamination of flame rod, burner ground connection.</td>
</tr>
<tr>
<td>4</td>
<td>Flame sensed out of sequence</td>
<td>If situation self corrects within 10 seconds, control module returns to normal sequence. If flame out of sequence remains longer than 10 seconds, control will resume normal operation 1 hour after error is corrected.</td>
<td>Check for pilot flame. Replace gas valve if pilot flame present. If no pilot flame, cycle “Call for Heat.” If error repeats, replace control.</td>
</tr>
<tr>
<td>5</td>
<td>Damper Error – Damper required but not present – Damper failed to open within 60 seconds – Damper failed to close within 60 seconds</td>
<td>If damper error corrects, ignition control resumes normal operation.</td>
<td>Check damper connection, damper wiring, and 24V connection on control. Replace damper if necessary.</td>
</tr>
<tr>
<td>6</td>
<td>Control Internal Error</td>
<td>Control module remains in wait mode. When the fault corrects, control module resumes normal operation.</td>
<td>Cycle “Call for Heat.” If error repeats, replace control.</td>
</tr>
<tr>
<td>7</td>
<td>Flame rod shorted to ground</td>
<td>Control module remains in wait mode. When the fault corrects, control module resumes normal operation.</td>
<td>Check flame sense lead wire for damage or shorting. Check that flame rod is in proper position. Check flame rod ceramic for cracks, damage or tracking.</td>
</tr>
<tr>
<td>8</td>
<td>Low secondary voltage supply</td>
<td>Control module remains in wait mode. When the fault corrects, control module resumes normal operation.</td>
<td>Check transformer and AC line for proper input voltage to the control. Check with full system load on the transformer.</td>
</tr>
</tbody>
</table>

* Flash Code Descriptions:
  - Flash Fast: rapid blinking.
  - Heartbeat: Constant ½-second bright, ½-second dim cycles.
  - 4-second solid on pulse followed by “x” 1-second flashes indicates flame current to the nearest µA. This is only available in run mode.
  - A single flash code number signifies that the LED flashes X times at 2 Hz, remains off for two seconds, and then repeats the sequence.