TriangleTube
Hot Water Specialists

The **Delta performance**

PG-25/30/35/40 & 45

SERVICE TECHNICIAN'S

TROUBLE SHOOTING GUIDE

2002-50 TSG-PG-9/02

WARNING

Indicates a potentially hazardous situation, if ignored, can result in death, serious injury or substantial property damage.

NOTICE

Indicates special instructions on installation, operation or maintenance, which are important to the equipment/product, but not related to personal injury hazards.

WARNING

This guide is to be used in conjunction with the PERFORMANCE Installation and Maintenance manual. Procedures and servicing listed in this manual must be performed by a qualified service technician, installer, service agency or gas supplier. Any procedures or service performed by an unqualified individual or service agency can result in severe personal injury, death or substantial property damage.

This guide is to be used in conjunction with the Triangle Tube PERFORMANCE Combination Water Heater Installation and Maintenance Guide.

Good Troubleshooting Practices

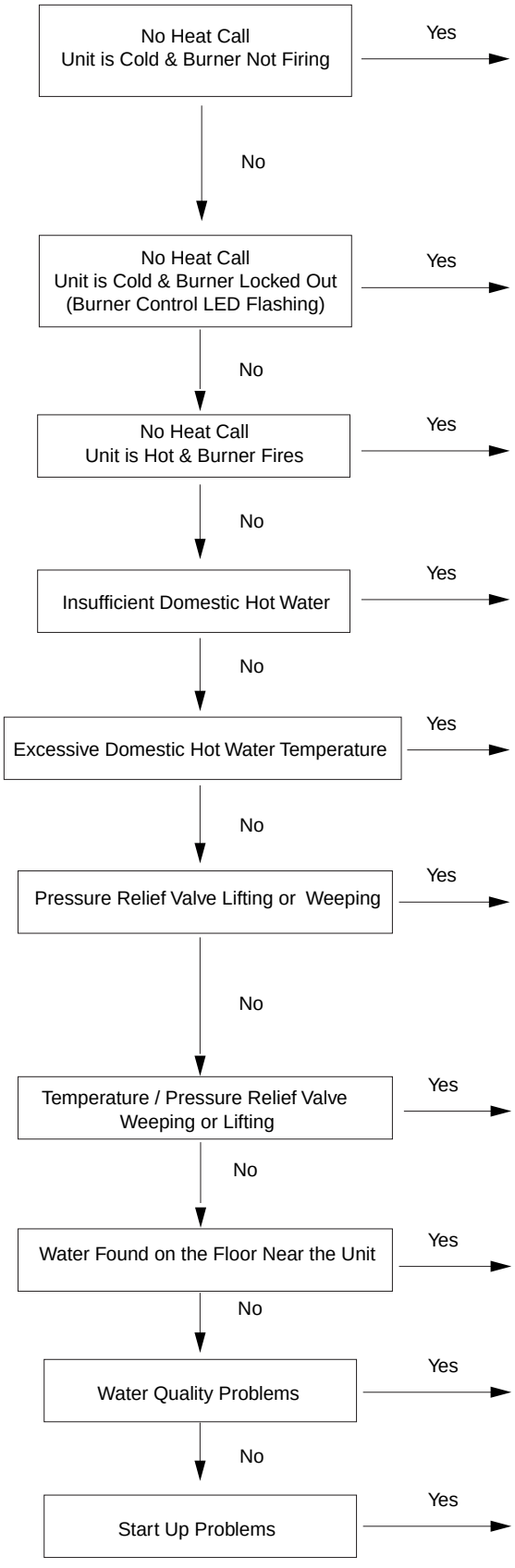
Before leaving for the job site:

- Check your parts and tools.
  - Test equipment and tools that you will need:
    Electrical meter that can measure voltage and continuity.
    Pressure gauge, Watts #276H300 Test Gauge or similar.
    Temperature Gauge or metering device.
    Manometer.
    Combustion analyzer.
    Bucket, 1 gallon or larger with volume markings.
    Stopwatch.
    Standards tools of the trade (wrenches, screwdrivers...).
  - Parts to solve most problems:
    120V to 24V, 40 VA Transformer.
    DPDT Relay, 24V coil with 120V rated contacts.
    Thermostat Kit PGRKIT121.
- Know the PERFORMANCE model number.
- Review all appropriate manuals before leaving for the job site.

At the job site:

- Clarify the problem
- Have the PERFORMANCE manual and any other wiring, zone control or piping diagrams or installation guides readily available.
- Turn to page 2 - read carefully and follow instructions step by step.

REMEMBER
Follow the Troubleshooting Guide step be step, always double checking your results. Skipping steps or not completing steps can lead to wrong conclusions, repeated visits to the job site, unhappy customers and unnecessary warranty claims.



No Heat Call - Unit Cold & Burner Not Firing - Page 5-7

- Check Manual Reset Limit
- Check the LED Code on Burner Control
- Check the Incoming Power Supply
- Check the Transformer / 24V Circuit
- Check the Safety Limits
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- Burner Components
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- High Altitude
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Service Instruction 1 - Accessing the Electrical Control Panel

1. Disconnect power supply to the PERFORMANCE prior to proceeding with the instructions.

WARNING

Failure to disconnect the power supply prior to proceeding with the instructions could lead to possible electrical shock hazard and cause severe personal injury or death.

2. Remove the top jacket panel by disengaging the lock pins by applying an upward force along the front edge of the panel.

3. Remove the front jacket panel by disengaging the lock pins using a flat head screwdriver.
   a. Insert the screwdriver between the front jacket panel and the side jacket panel along the upper corner.
   b. Use a twist motion to disengage the front panel from the side panel.
   c. Repeat this process along the other side of the front jacket panel.
   d. Once the upper corners are disengaged, lean the front panel forward and lift the panel up to disengage the lower tabs.

NOTICE

Use extreme care not to damage the jacket panels when using a screwdriver to disengage the front jacket panel.

4. Remove the (4) locking pins located on the top and lower corners of the black control panel. Once the locking pins are removed, the front control panel will lay forward exposing the control / electrical panel components

5. If needed the power supply may be reconnected to allow further troubleshooting procedures.

WARNING

Exercise extreme care when working with the electrical panel components exposed and the unit's electrical power reconnected. A potential electrical hazard exists when working in this condition. Failure to exercise extreme caution could lead to severe personal injury or death.

6. Disconnect the electrical supply prior to any replacement of electrical components or prior to reassembling the control panel to the unit.

7. To reassemble the front control panel, align the panel corners to the proper position on the side panel and tighten the lock down pins.

8. To reassemble the front jacket panel, insert the lower tabs into the side panels. Lift the panel up to align the locking pins with the retaining clips and snap the panel into place.

9. Align the top jacket panel with the locking pins and snap downward into place.

Service Instruction 2 - Removing Front or Top Jacket Panel and Burner Hood

1. Insert the screwdriver between the jacket panel or burner hood and the side jacket panel near the panel corner.

2. Use a twist motion to disengage the panel from the side panel.

3. Repeat this process along the corners of the jacket panel.

4. To remove the Front jacket once the upper corners are disengaged, lean the panel forward and lift the panel up to disengage the lower tabs.

NOTICE

Use extreme care not to damage the jacket panels when using a screwdriver to disengage the jacket panel.

Service Tip 1

All 120V wiring on the PERFORMANCE control panel is separate from the 24V wiring. The 120V wiring is located on the terminal strip in front of the transformer. The 24V wiring is located on the terminal strip to the left of the transformer. Both terminal strips are numbered from right to left; the 120V strip begins with #1 and the 24V begins with #5. For control panel and burner module wiring, see pages 25 through 27.

Service Tip 2

The control panel consists of (2) DPDT relays. The relays are designated as Relay 1, which controls the burner function and is located near the transformer. The second relay, Relay 2, controls the circulator function and is located on the left side of the control panel.

Service Tip 3

During initial startup the PERFORMANCE may emit an odor. This odor is due to the initial burning of ceramic fibers in the combustion insulation and the oils on the interior tank surfaces. These odors will dissipate as the unit continues to operate.

Check the Manual Reset Safety Limit.

- The Manual Reset Safety Limit reset button is located on the center of the front control panel.
- If the Manual Reset Limit had tripped then check the following items:
    - The function of the Manual Reset Limit.
    - The setting of the Manual Reset Limit should be 205ºF.
    - The function of the Primary Thermostat.
    - Check the Primary return system temperature. The recommended supply/return temperature differential is 20ºF to 30ºF.

Check the LED Display on the Burner Control.

- Remove the Burner Hood panel per Service Instruction 2.
- Is the Burner Control LED flashing? The control module is located at the lower right side of the burner mounting plate and the LED is located left side of wire connections on the burner control.

If the LED is flashing:

Steady On - Indicates the control is functioning properly
1 Flash with Pause - Indicates the control is in lockout due to ignition failure. See page 8.
2 Flashes with Pause -Indicates main flame was lost after the flame was established. See page 8.
3 Flashes with Pause - Indicates internal fault within the control module. Replace the control module.
5 Flashes with Pause- Indicates an open pressure switch. See page 10.

If the LED is not steady on or flashing:

Check the Incoming Power Supply.

- Access the control panel components per Service Instruction 1.
- Check for voltage across terminals 1 and 2 for 120V. See Service Tip 1.
    - If voltage is not present check incoming electrical supply.
- Check for 120V, polarity, across terminals 1 and G. See Service Tip 1.
    - If voltage is present across terminals 1 and G, then polarity is correct.
    - If voltage is not present check incoming electrical supply wire connections and electrical supply source.
- Proceed to **Check the Transformer and 24V Circuit.**

Check the Transformer and 24V Circuit.

- Complete the procedure for checking Incoming Power Supply.
- Check for voltage across terminals 5 and 6 for 24 volts. See Service Tip 1.

- If voltage is not present, and 120V is supplied to the unit replace the Transformer.

- Proceed to **Check the Safety Limits.**

Check the Safety Limits.

- Complete the procedures for checking **Incoming Power Supply** and for checking the **Transformer and 24V Circuit**.
- Check for voltage across terminals 6 and 7 for 24 volts. See Service Tip 1.
  - If voltage is not present, check the following items related to the LWCO device:
    - Is the system pressure above 10 psig? The system pressure must be above 10 psig for the LWCO device to activate.
    - If the system pressure is above 10 psig, check for continuity across the LWCO device terminals. Replace the LWCO device if switch is proven open.
- Check for voltage across terminals 6 and 8 for 24 volts. See Service Tip 1
  - If voltage is not present, check the following items related to the Manual Reset Limit:
    - Push the reset button located on the Control Panel. Does it reset?
    - If the manual reset limit does reset check to ensure limit is set to 205ºF and ensure primary supply/return differential is 20º to 30ºF.
    - Is the Manual Reset Limit functioning properly? Is the manual reset limit tripping at a temperature setting of 205ºF? Replace the Manual Reset Limit as needed.
- Check the function of the Automatic Reset Limit by:

1. Turn the Secondary thermostat to the highest possible setting. The installer may need to run domestic hot water with the unit shut down in order to cool the inner tank and to initiate a “call for heat” on the Secondary thermostat.
2. Check for voltage across terminals 6 and 11 for 24 volts. See Service Tip 1. If voltage is not present check the following:
   - Check for voltage across terminals 12 and 6 for 24 volts. If voltage is present continue to run domestic hot water to cool the unit down.
   - Turn the Secondary thermostat to the lowest possible setting and check for voltage across terminals 12 and 6 for 24 volts. If voltage is not present, replace the Secondary thermostat.
3. If 24 volts is present at terminals 11 and 6, check for 24 volt across terminals 14 and 6. If voltage is not present check the following:
   - Is the system temperature below 160ºF?
   - If the temperature is below 160ºF, then replace the Automatic Reset Limit.

- If the system temperature is above 160ºF, initiate a “call for heat” within the system and attempt to cool the unit down. If the unit cools down and the Automatic Reset limit does not reset, replace the limit.

NOTICE

The reason for either the Manual Reset or the Automatic Reset Limit to activate in a lockout mode may be due to a low return temperature from the system. It is recommended to maintain a 20ºF to 30ºF differential between the primary supply temperature and the primary return temperature. In radiant systems using a mixing valve or other means of providing tempered water to the system it is recommend to use a bypass loop between the primary supply and return piping. This by-pass loop should contain a valve that can be used to divert primary water from the supply to the return. The valve should be adjusted to increase the return temperature and a supply /return differential of 20º to 30ºF. Once the differential is achieved, no further adjustments are required on the valve.

Check the function of “Relay 1”. See Service Tip 2.

- If 24 volts is present at terminals 14 and 6, then check for 120 volts at terminals 4 and 2. See Service Tip 1.
  - If 120 volts is not present at terminals 4 and 2, replace the “Relay 1”.

Check the LED Display on the Burner Control.

- Remove the Burner Hood per Service Instruction 2.
- Is the Burner Control LED flashing? (The control module is located at the lower right side of the burner mounting plate and the LED is located left side of wire connections on the burner control.)

What is the LED Flashing Code?

Steady On - Indicates the control is functioning properly
1 Flash with Pause - Indicates the control is in lockout due to ignition failure.
2 Flashes with Pause -Indicates main flame was lost after the flame was established.
3 Flashes with Pause - Indicates internal fault within the control module.
5 Flashes with Pause - Indicates an open pressure switch.

NOTICE

The burner control module can be reset by turning the PERFORMANCE "OFF" for 30 seconds before initiating any "calls for heat".

If the Flashing Code is 1 or 2, was the fuel supply interrupted?

- Check and ensure all shut off valves on the gas supply line(s) are open.
- For propane applications, ensure the propane tank is not empty.
- Check the function of gas supply line components such as meters and regulators.

If the Flashing Code is 1 or 2, check the flame signal and burner module.

- Check the Grounding.

  A common ground is required for the blower, ignition system and burner control. The common ground should be traced to the control panel and the incoming power supply.

  If the ground is poor or erratic, safety shutdown may occur occasionally even though operation is normal at the time of the checkout. If the ground circuit is incomplete the burner control will allow (3) trials for ignition before going into safety lockout.

  Electrical ground connections must be clean and tight. If any lead wire is damaged or deteriorated, replace as needed with No. 14 or 18 gauge, moisture-resistant, thermoplastic insulated wire with a 90ºC minimum rating.

  Excessive temperature at the ceramic flame rod insulator can also permit electrical leakage to ground. Examine the flame rod and mounting bracket, and replace if bent, or damaged.

- Check Spark Ignition Circuit.

  1. Turn off the manual gas supply valve to prevent the flow of gas to the burner.

2. Disconnect the ignition cable at the burner control stud terminal to isolate the circuit from the ignition sensor and prepare a short jumper lead using heavily insulated wire such as ignition cable.
3. Energize the burner control. Connect one end of the jumper to the burner control terminal COM. Do not disconnect the existing wire lead. Move the free end slowly towards the stud terminal to establish a spark and then pull the lead wire slowly away from the stud. Note the length of the gap at which arcing stops.

WARNING

Do not touch either the bare end of the jumper or the stud terminal. Very high voltage circuit (22 Kv) is present and electrical shock hazard can result. Perform the test immediately upon energizing the burner module before the unit goes into safety lockout and interrupts the spark circuit.

4. An arc length of 1/8 inches (3.2 mm) or more indicates satisfactory voltage output. Replace the burner control if no arc can be established or the maximum gap is less than 1/8 inches.

- Control Module Flame Sensor Circuit

If the flame signal back to the burner control is less than 0.6µ A the burner control will lock out. To check the flame signal back to the burner control:

1. Disconnect the ignition lead from the spark terminal on the burner control.
2. Connect a shunt-switch between the ignition lead and the burner control module spark terminal.
3. Connect a voltmeter (dc micrometer scale) in parallel with the shunt-switch. Connect the red (positive) lead of the meter to the ignition lead free end. Connect the black (negative) meter lead to the spark terminal of the burner control.
4. Close the shunt-switch, restart and energize the burner module. Once the main flame is established open the shunt switch and read the voltmeter. The flame sensor circuit must be at least 0.6 µA and the reading must be steady. If the reading is less than 0.6 µA or the reading is unsteady, check all electrical connections and/or replace the flame sensor if the ceramic insulator is cracked.

NOTICE

Do not attempt to ignite the PERFORMANCE burner with the shunt-switch open. The voltage supplied for the spark ignition will destroy the voltmeter.

If the Flashing Code is 1 or 2, check the Gas Valve.

- Check the function of the Gas Valve.

1. Energize the burner control module by initiating a “call for heat”.
2. After the initial 6 second prepurge cycle, listen carefully for the gas valve solenoid to energize. A distinct “klunk” can be heard.

3. If the gas valve solenoid does not energize, disconnect power to the PERFORMANCE and remove the the wire leads from the burner control module terminals MV and COM.
4. Reconnect power and initiate a call for heat.
5. With a voltmeter, measure for 24 volts at the burner control module terminals MV and COM.
   - If no voltage is present, replace the burner control module.
   - If voltage is present, replace the rectifier plug harness. If the initial problem continues, replace the gas valve.

If the Flashing Code is 1 or 2, check the Blower Assembly.

- Check the function of the Blower Assembly.

1. Energize the burner control module by initiating a “call for heat”.
2. The blower should initiate the prepurge cycle immediately.

- If the blower does not initiate the prepurge cycle check the following:

1. Remove the Molex plug connection at the base of the blower assembly.
2. Energize the burner control module by initiating a “call for heat”.
3. With a voltmeter, check voltage across the end pins of the Molex plug (black and white wire) for 120 volts.
   - If no voltage is present, replace the burner control module.
   - If voltage is present, replace the blower assembly.

If the Flashing Code is 3, replace the Burner Control Module.

If the Flashing Code is 5, check the Pressure Switch.

- Check continuity across the Pressure Switch terminal.
  - With the unit not running remove the wire leads at the Pressure Switch and check continuity across the switch terminals.
    - If the continuity check shows the switch is open, then replace the switch.
    - If the switch is proven closed, proceed to the next item.
- Check the air inlet pressure.
  - Remove the air inlet sensing tube from the pressure switch.
  - Attached the air inlet sensing tube to a manometer that has a minimum scale of 0 to 6 inches of water column.

NOTICE

The pressure at the air switch is a negative pressure. Ensure manometer is set for vacuum readings.

- Initiate a call for heat. Note the manometer reading during the prepurge cycle. Once the reading is recorded, shut the unit down.
- Compare the manometer reading to Table 1, on Page 11 with identification on the pressure switch.

Table 1 - Pressure Switch Settings

PG Model	Natural Gas Inches w.c.	Propane Inches w.c.	High Altitude Natural Gas Inches w.c.	High Altitude Propane Inches w.c.
PG-25	1.84	3.35	N/A	N/A
PG-30	1.84	3.35	2.7	3.35
PG-35	1.84	3.35	3.35	3.35
PG-40	2.7	3.35	2.7	3.35
PG-45	2.7	3.35	2.7	3.35

Identifying the Pressure Switch

Yellow Label Pressure Switch - 1.84 inches w.c.

Red Label Pressure Switch - 2.7 inches w.c.

Blue Label Pressure Switch - 3.35 inches w.c.

- If the pressure switch is inappropriate with the application replace the pressure switch.
- If the pressure switch is appropriate for the application, but the pressure recorded is higher, check the following items:
  - Air inlet equivalent length not to exceed 100 feet (elbows considered 10 Ft)
  - Blockage within the air inlet piping.

Check for System Component Problems.

- Check the room thermostats for proper function.
- Check zone valves or circulators for proper function.
- Check zone panels or relays for proper function.

Check for System Electrical Problems.

- Ensure the thermostat wire connection at the Room T-stat Snap-set is connected to C and 1 terminals and is secured.
- Ensure the system electrical is not feeding 24 volts through the thermostat wires connected to the Room Snap-set.
  - Having a secondary 24 volts incoming through the room snap-set could cause failure of the internal control components.

Check for the Function of the PERFORMANCE System Circulator and Relay 2.

- Access the control panel per Service Instruction 1.
- Turn the Secondary thermostat to the lowest setting.
- Initiate a “call for heat” within the primary heating system.
- Check voltage across terminals 12 and 6 for 24 volts. See Service Tip 1.
  - If voltage is not present, check for 24 voltages across terminals 5 and 6, terminals 7 and 6, and terminals 8 and 6 to ensure no Safety Limits are locked out.
- With voltage at terminals 12 and 6, check for 24 volts at terminals 13 and 6. If no voltage is present at terminals 13 and 6 check the thermostat wires at the Room T-stat Snap-set and check to ensure the primary system is communicating a “call for heat” to the PERFORMANCE.
- With voltage at terminals 13 and 6, check for 120 volts at terminals 3 and 2.
  - If no voltage is present at terminals 3 and 2, replace Relay 2. See Service Tip 2.
  - voltage is present at terminals 3 and 2, ensure the circulator is functioning properly.

Is the PERFORMANCE properly sized for the domestic water application?

- There are many methods of sizing various domestic hot water applications, i.e ASHRAE sizing tables, or ASPE domestic water heating design manual. Re-confirm the domestic hot water demand required for the application.
- Re-confirm the flow rates of the fixtures. Was the domestic demand based on showers heads at 2.0 gpm when they are actually 5.0 gpm? Use a bucket and a stopwatch to determine fixture flow rates.
  - Evaluate the hot water usage patterns for a day. Is the peak demand unusually high for the application?
  - Has the demand for domestic hot water changed since the system was installed? A bathroom remodeling project with a newly installed whirlpool tub will drastically change the domestic water demand.

The PERFORMANCE will provide domestic hot water at the following rates for a 10 minute dump period with a mixing valve setting for 120ºF:

PG-25	5.6 gpm
PG-30	6.1 gpm
PG-35	6.5 gpm
PG-40	7.4 gpm
PG-45	8.1 gpm

NOTICE

The outlet temperature after 10 minutes will be considerably lower that the initial draw of hot water. The overall temperature of the water collected during the draw will be approximately 110ºF.

Is the thermostatic mixing valve properly set?

- The operating range of the mixing valve is 90ºF to 120ºF.
- The mixing valve is equipped with a cap that may be locked into position. Adjust the mixing valve setting to the desired temperature prior to locking the cap.
- The manual valve located on the U-tube should be in the open position.

WARNING

Closing the manual valve on the U-tube will affect the amount of cold water supplied to the mixing valve and the overall function of the mixing valve. A potential scalding hazard may exist resulting in severe personal injury or death.

Does the mixing valve require cleaning due to scaling deposits?

1. Isolate the domestic water supply to the PERFORMANCE and relieve any existing pressure.

2. Remove the main valve body from the PERFORMANCE using the union connections.
3. Remove the blue cap and locking ring from the valve using a 2.5 mm L key wrench (supplied with the mixing valve).
4. The interior of the valve body can be removed by unscrewing the large hexagonal nut and sliding the interior components out. Ensure the orientation of the components is noted so that they can be reassembled in the correct manner.
5. A mild cleaner that is safe to use on plastic parts can be applied to any scale buildup and then brushed away with a small bristle brush like a toothbrush.
6. After cleaning and reassembling, the valve should be reset and tested for outlet mixed temperatures based on mixing valve settings. A record of the temperatures and valve settings should be retained for future checks.

Does the domestic water system contain a recirculation line?

- The recirculation line circulator must be controlled by an aquastat placed on the recirculation line.
- Not having an aquastat controlled recirculation will cause the mixing valve not to function properly and will affect the domestic performance of the unit.

NOTICE

It is recommended to set the operating limit of the recirculation aquastat a minimum of 10ºF below the setting of the mixing valve.

- Ensure the recirculation system contains a check valve to prevent back flow of cold water.

Is the thermostatic mixing valve properly set?

- The operating range of the mixing valve is 90ºF to 120ºF.
- The mixing valve is equipped with a cap that may be locked into position. Adjust the mixing valve setting to the desired temperature prior to locking the cap.
- The manual valve located on the U-tube should be in the open position.

WARNING

Closing the manual valve on the U-tube will affect the amount of cold supplied to the mixing valve and the function of the valve. A potential scalding hazard may exist resulting severe personal injury or death.

Does the valve require cleaning due to scaling deposits?

1. Isolate the domestic water supply to the PERFORMANCE and relieve any existing pressure.
2. Remove the main valve body from the PERFORMANCE using the union connections.
3. Remove the blue cap and locking ring from the valve using a 2.5 mm L Key wrench (supplied with the mixing valve).
4. The interior of the valve body can be removed by unscrewing the large hexagonal nut and sliding the interior components out. Ensure the orientation of the components is noted so that they can be reassembled in the correct manner.
5. A mild cleaner that is safe to use on plastic parts can be applied to any scale buildup and then brushed away with a small bristle brush like a toothbrush.
6. After cleaning and reassembling, the valve should be reset and tested for outlet mixed temperature based on mixing valve setting. A record of the temperatures and valve settings should be retained for future checks.

Is the expansion tank on the primary system properly sized?

- Each PERFORMANCE unit contains approximately 20 gallons of primary water that needs to be accounted for in the sizing of an expansion tank.

Conventional Expansion Tank

$$\text{Capacity Gallons} = \frac{\text{Heat Loss Btu/hr}}{5{,}000}$$

Diaphragm Expansion Tank Capacity

$$\text{Gallons} = \frac{\text{Heat Loss Btu/hr}}{7{,}000}$$

- Insufficient allowance for expansion on the boiler side can cause the pressure relief valve to lift or weep.

Is the expansion tank defective, water logged or improperly charged?

- Check for failed gaskets or bladders or a faulty Schrader valve.
- Use a tire gauge to check the charge pressure of the tank with the system pressure at 0 psig. The diaphragm expansion tank should be pre-charged to 12 psig.
- Check the location of the system circulator in relationship to the expansion tank and pressure relief valve. The relief valve may be sensing the head pressure of the circulator directly and not the actual system pressure.

Is the pressure relief valve functioning properly?

- Dirt and water deposits can accumulate under the valve seat.

Check the primary fill valve for defects.

- Is the valve filling the system to the correct pressure of 12 psig to 15 psig?
- Is the valve maintaining the correct system pressure?

Check for possible inner tank leak.

- If possible, isolate the outer tank of the PERFORMANCE by shutting the primary supply and return isolation valves off. Relieve the outer tank (primary) pressure. Observe the primary system pressure during that time.

Is there a thermal expansion tank installed on the domestic supply piping and is it properly sized?

- A thermal expansion tank is required if the domestic supply piping includes a backflow preventer or pressure reducing valve.
- Ensure the potable water thermal expansion tank is properly sized for a minimum 20 gallons volume and pre-charged at the incoming supply pressure.
- During long periods, when there is no draws of domestic hot water (i.e. overnight), the T&P relief valve may lift or weep due to thermal expansion, but may function properly during normal periods of domestic draws.

Is the thermal expansion tank defective, water logged or improperly charged?

- Check for failed gaskets or bladders or a faulty Schrader valve.
- Use a tire gauge to check the charge pressure of the tank. The charge pressure of the tank should be equivalent to the incoming supply pressure or the pressure measured downstream of a pressure reducing valve.

Check the incoming domestic supply pressure entering the PERFORMANCE.

- If the pressure is over 70 psig it is recommended to install a pressure-reducing valve. This will prevent any pressure spikes or increases in pressure due to thermal expansion, which may cause the T&P valve to lift or weep.

Check the domestic water system for possible sources of water hammering or pressure spikes.

- Some appliances such as clothes washers and dishwashers utilize fast acting valves, which may cause water hammering or pressure spikes through the domestic water system.
- Install water hammer arrestors as required per the manufacturer's instructions or install flexible connectors to isolate the tank from vibrations within the domestic water system.

Is the pressure relief valve functioning properly?

- Dirt and water deposits can accumulate under the valve seat.

If the relief valve continues to weeps. The valve may require replacement.

- Replace the T&P relief will the following relief valve or equivalent:

PG-25	Watts 100 XL-8
PG-30/35/40/45	Watts 40 XL-8

Is the source of the water from the PERFORMANCE?

- Check for possible water seepage through foundation cracks. Did the water appear after a heavy rain?
- Check overhead pipes for leaking connections or excessive condensation.

Is the source of the water from the T&P Relief Valve?

- Place a bucket under the discharge piping of the T&P relief valve and monitor it for the next several days. This is a procedure that can be completed by the homeowner.
- If the T&P relief valve is the source of water found, refer to the T&P Relief Valve section of this manual (page 17).

NOTICE

The discharge piping of the T&P relief valve is required to be directed towards a suitable place of drainage. Refer to the Installation manual for additional information regarding the discharge piping of the T&P relief valve.

Check all piping connections - primary connections and domestic connections

- Check all primary connections at or near the PERFORMANCE. A buildup of corrosion is a sure sign of a leak.
- Check the domestic connections. Check around the areas where the domestic connections enter the outer tank of the PERFORMANCE. Excessive water hammering in the domestic system may crack the welds around the domestic connections and the outer tank shell.

Is the source of the water from the pressure relief valve?

- Place a bucket under the discharge piping of the pressure relief valve and monitor it for the next several days. This is a procedure that can be completed by the homeowner.
- If the pressure relief valve is the source of water found, refer to the pressure relief valve section of this manual (page 16).

NOTICE

The discharge piping of the pressure relief valve is required to be directed towards a suitable place of drainage. Refer to the installation manual for additional information regarding the discharge piping of the pressure relief valve.

The water smells like “rotten eggs”.

The most common cause of water to smell like “rotten eggs” is a non-toxic sulfate reducing bacteria. The bacteria usually enters into the water system through a break in the supply piping or during construction/maintenance of the supply piping. The bacteria survives in the water system by converting sulfate (SO4) in the water to hydrogen sulfide (H2S) gas. It is this gas that creates the “rotten egg” smell. The presence of hydrogen sulfide can also affect the taste of the water. Along with the stench caused by these bacteria, black deposits, which typically indicate pipe or fitting corrosion may also appear in the water.

WARNING

In extremely high concentrations, hydrogen sulfide gas can be toxic. However, the gas is detectable prior to any harmful levels can be reached.

The bacteria will thrive in any water system under the following conditions:

- High levels of sulfur in the water.
- Activated hydrogen in the water from cathodic reactions within the tank.
- Water with little or no dissolved oxygen.
- Storing the domestic water below 140ºF.

Other causes of smelly or bad tasting water:

- Chlorides of magnesium and calcium gives water a bitter taste.
- Chloride of sodium will produce a salty tasting water.
- Sulfates above 50 ppm in the water gives the water a medicinal taste.
- Carbon dioxide in the water with a low pH results in water that is fizzy.
- Iron and tannic waters will produce water with a bad taste and odor.

The treatment of this situation requires the inner tank and water system to be shock chlorinated. Depending on the severity of the bacteria within the water system, several treatments may be required.

- To shock chlorinate the PERFORMANCE inner tank and water system, introduce (1) gallon of household bleach into the system.
- Flush the entire system by drawing hot water from every faucet or fixture until the smell of bleach has diminished.
- Repeat the procedure as needed.

Hot Water from the faucet appears milky.

When water is initially drawn from the faucet it appears to be milky or cloudy, but it becomes clear after the water is allowed to stand for several minutes. This is usually an indication that the water contains high levels of soluble gases such as oxygen, chlorine, carbon dioxide, hydrogen sulfide or others.

As the water system pressure increases, the amount of gas that the water can hold in a solution decreases. When air and gases are forced out of the heated water, the problem may be evident in one or both of the following conditions

- Gases, in the form of small bubbles, may make the water appear milky from the tap, but clear after several minutes when those bubbles will separate. Similar to the reaction that occurs as air bubbles form on the walls of a pan shortly before the water begins to boil.
- The release of dissolved gas can also create air pockets and air locks in the water system piping. This can cause spurts of air or gases when operating the hot water faucet.

There is generally no cure for milky water caused by dissolved gases, although it can be reduced with aerated faucets. In some applications the amount of air and gases precipitating out of the water will reduce in time. It should be noted that these gases are not harmful to the end user.

Discolored Water from the Hot Water Faucet

The water from the hot water faucet appears discolored: rusty, brown, black or yellow. Because the inner tank and sensing well is made of stainless steel, which by nature is resistant to corrosion, the problem is not tank related. The problem is usually a non-toxic iron reducing bacteria that are commonly found in soil, well water, and water treatment plants and piping systems. The bacteria usually thrives in those systems in which the soluble iron content exceeds 0.2 ppm. The bacteria will feed on the soluble iron in the water producing “rusty” color water as a by-product of the feeding process.

Variables in which the bacteria can thrive in:

- Elevated levels of iron and manganese in the water.
- Water with little or no dissolved oxygen.
- Water storage temperatures below 140ºF.

Items that can potentially increase the presence of the bacteria:

- Water softeners.
- Well water.
- Long periods of no water movement.

The treatment of this situation requires the inner tank and water system to be shock chlorinated. Depending on the severity of the bacteria within the water system, several treatments may be required.

- To shock chlorinate the PERFORMANCE inner tank and water system introduce (1) gallon of household bleach into the system.
- Flush the entire system by drawing hot water from every faucet or fixture until the smell of bleach has diminished.
- Repeat the procedure as needed.

WARNING

The start up of the PERFORMANCE should be performed by a qualified installer, service agency or the gas supplier. The start up procedure should include a complete combustion test. A complete combustion test must also be performed after any adjustments to the burner factory setting. Failure to comply with these requirements can result in severe personal injury, death or substantial property damage.

Combustion Test Guidelines

- The combustion test should be conducted using an electronic combustion analyzer or at minimum a "Fyrite" type CO2 analyzer.
- The combustion test sample can be taken at the test port on the flue hood of the PERFORMANCE.
- Ensure the vent system and air inlet duct system are install completely prior to start up and conducting a combustion test.

Combustion Test Parameters

O2 - 4.0 to 4.5%
CO2 - 9.5 to 10.0% Natural Gas
11.0% to 11.5% Propane
CO - 0 to 50 ppm

Combustion Adjustments

On all propane and high altitude applications the PERFORMANCE utilizes an air shutter in the air inlet adapter to regulate the volume of combustion air. The air inlet adapter is located on the upper left portion of the PERFORMANCE. The recommended air shutter settings are listed in Table 2:

Table 2: Recommended Air Shutter Settings (see page 25)

PG Model	Natural Gas Inches	Propane Inches	High Altitude Natural 5,000	High Altitude Natural 8,000	High Altitude Propane 5,000	High Altitude Propane 8,000	High Altitude Natural 9,000+	High Altitude Propane 9,000+
PG-25	N/R	3.5	N/A	N/A	N/A	N/A	N/A	N/A
PG-30	N/R	3.5	3.5	3.5	2.5	4	N/A	N/A
PG-35	N/R	3.5	3.5	3.5	3.5	3.75	N/A	N/A
PG-40	N/R	0	2	0	0	0	N/A	N/A
PG-45	N/R	0	0	0	0	0	0	0

N/R - Not Required N/A - Not Applicable

Air Shutter Adjustment

1. Remove the air inlet duct
2. Ensure the air shutter is set per the recommended setting listed in Table 2.
3. Re-install the air inlet duct and place the PERFORMANCE into operation.

4. Conduct a combustion test and compare the combustion levels with the recommended combustion parameters.
5. If applicable turn the unit OFF and remove the air inlet duct to re-adjust the air shutter to obtain the desired combustion levels.
   - Rotation of the air shutter clockwise (toward 0) will increase the O2 level.
   - Rotation of the air shutter counter-clockwise will decrease the O2 level.
   - The CO2 level will respond opposite of the O2 level.

WARNING

To perform the following procedure it is essential the service technician reads and follows the procedures closely. After any adjustments are completed it is essential to perform a combustion check before proceeding with further steps. Failure to follow these procedures can result in personal injury, death and substantial property damage.

If the O2 level of the Combustion Test is below 4.0% and the Air shutter is set at 0 or removed from the air inlet adapter:

- Adjust the gas valve throttle screw, a brass screw within a sleeve located on the upper portion of the venturi, as follows:
  1. Ensure the PERFORMANCE is OFF and no “calls for heat” are initiated.
  2. Using a flat head screwdriver turn the screw clockwise (inward) a 1/4 of a turn. It is important to note the initial start point of the screw prior to any adjustments.
  3. Place the PERFORMANCE back into service and conduct a combustion test.
  4. If necessary repeat the adjustment steps until the desired combustion level is met.

  Never <u>adjust the throttle more than 2 full turns.</u>

WARNING

Adjusting the throttle screw clockwise decreases the volume of gas injected into the burner. Adjustments beyond two full turns clockwise will greatly affect the operation of the burner and result in unstable combustion conditions.

WARNING

DO NOT adjust the throttle screw counter-clockwise beyond the initial factory set point. Adjustments counter-clockwise beyond the factory set point will increase the volume of gas injected into the burner and can result in unstable combustion condition and create dangerous levels of CO.

Propane and High Altitude Start Up

Problems occur during start up in propane applications due to the inconstancy of the BTU value and the quality of the propane gas. These problems can be compounded during start up on applications above 5,000 ft elevation where the quality of the gas is further compounded by the change in air density. In high altitude applications these problems may also occur on applications using natural gas.

Burner does not light-off, but ignition spark is present.

- Check and ensure all shut off valve(s) on the gas supply line(s) are open.
- For propane applications, ensure the propane tank is not empty.
- Check the function of the gas supply line components, meters and regulators.
- Refer to the Check for Grounding section on page 8.
- Check the air shutter setting per Table 2. If necessary adjust the air shutter setting by 1/2 increments counter-clockwise, which reduces the air opening and the amount of air injected into the burner.

If the burner ignites after adjusting the air shutter, a combustion test **must** be conducted per the procedures listed in the Combustion Test section (page 21 & 22).

If the burner does not ignite after adjusting the air shutter, then check the gap of the igniter.
Check and adjust the igniter gap:

1. Turn power supply to the unit OFF.
2. Remove the burner hood per Service Instruction 2.
3. Turn the main gas supply valve to the burner inlet OFF. Disconnect the gas supply piping to the burner.
4. Dismount the burner mounting plate from the unit by unbolting the (2) 17mm bolts located on each side of the blower assembly.
5. Pull the burner assembly and mounting plate back, carefully as not to damage the insulation gasket behind the mounting plate.
6. Check the gap between the igniter tip and the burner head surface. Reposition the gap to maximum distance of 1/4".
7. Proceed to **Check the integrity of the ignition spark.**

Check the integrity of the ignition spark.

1. With the burner dismounted from the unit restore power back to the unit, keeping the main gas supply disconnected.
2. Initiate a "call for heat".

WARNING

When performing this procedure use extreme caution not to touch the igniter or the burner head. Also, ensure the igniter does not contact any metal surfaces or have the opportunity to arc onto any adjacent metal surfaces.

3. After the blower initiates a pre-purge cycle for approximately 6 seconds the igniter should begin the trial for ignition. The spark from the igniter tip to the burner head surface should be a dark blue/purple color and several "strands" of spark should be noted.

If the spark does not appear strong and the igniter tip appears corroded:

1. Disconnect power to the burner.
2. Use emery cloth or fine grade sandpaper to clean the igniter tip. Ensure not to press hard on the igniter causing misalignment or damage.

The spark was adjusted and the spark appears strong:

1. Reassemble the burner assembly / mounting plate onto the unit.
2. Reconnect the gas piping to the inlet of the burner using pipe dope compatible to natural gas and/or propane.
3. Open the main gas supply valve to the unit and check for leaks. Repair any leaks found prior to placing the unit into service.

WARNING

Do not check for gas leaks with an open flame. Use a bubble test. Failure to check for gas leaks can cause severe personal injury, death or substantial property damage.

4. Turn the power supply to the unit ON, returning the unit to service.

If the burner does not ignite after adjusting the ignition gap, then check the function of the gas valve.

- The procedure for checking the gas valve is outlined on pages 9 and 10.

Burner has a High Pitch Whistle.

The burner will emit a high pitch whistle when the O2 level is below 3% on propane applications and some high altitude natural gas applications.

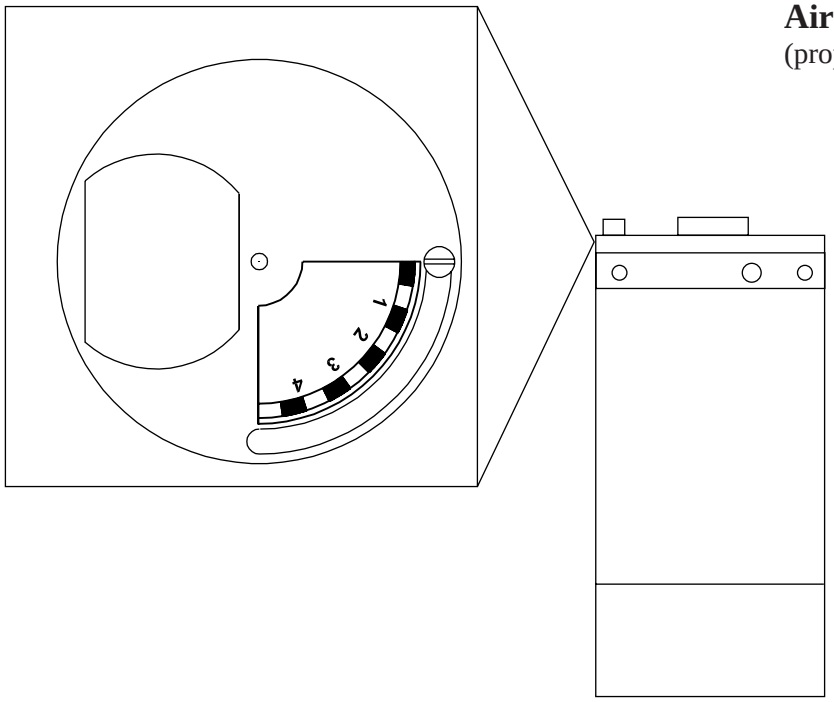
- Perform a complete combustion test and compare the combustion levels to the recommended combustion parameters listed on Page 21.

- If applicable adjust the air shutter setting in 1/2 increments counter-clockwise. This will open the air shutter allowing more air to be injected into the burner.

- If necessary adjust the throttle screw on the venturi as outlined in the procedures on Page 22.

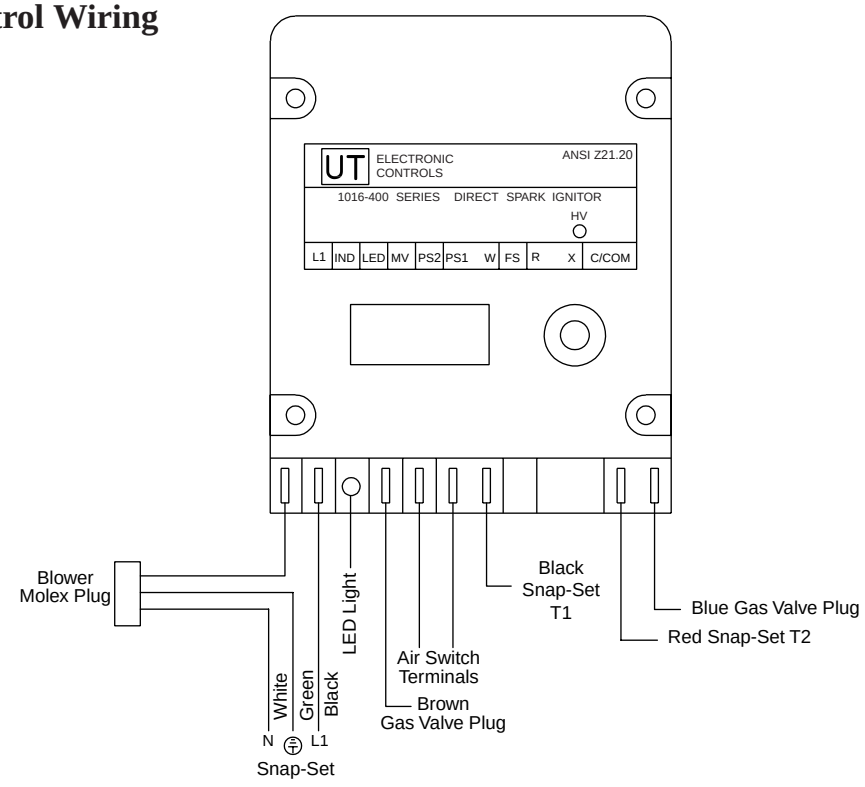
WARNING

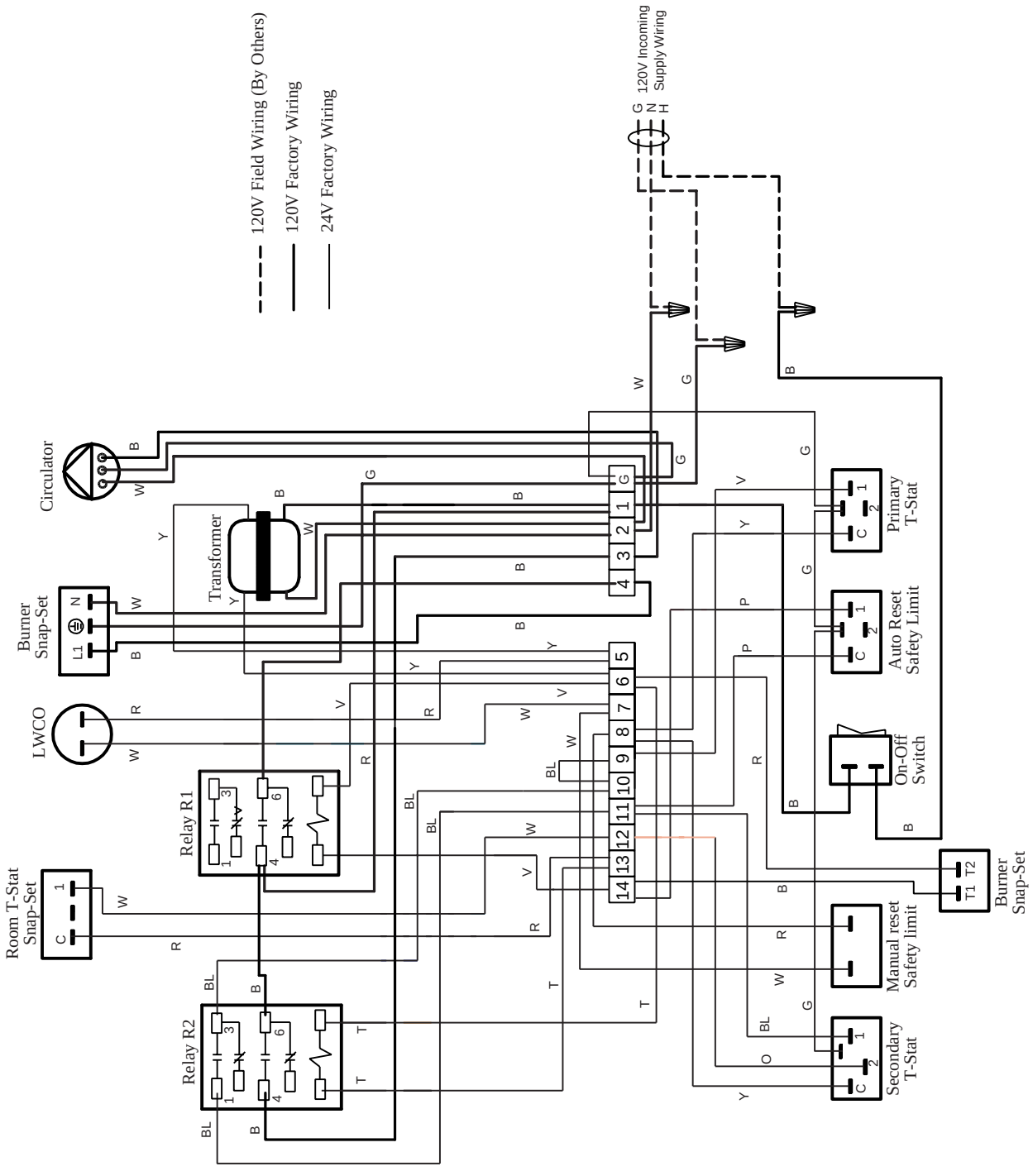
A complete combustion test must also be performed after any adjustments to the burner factory setting or to the air shutter. Failure to comply with these requirements can result in severe personal injury, death or substantial property damage.



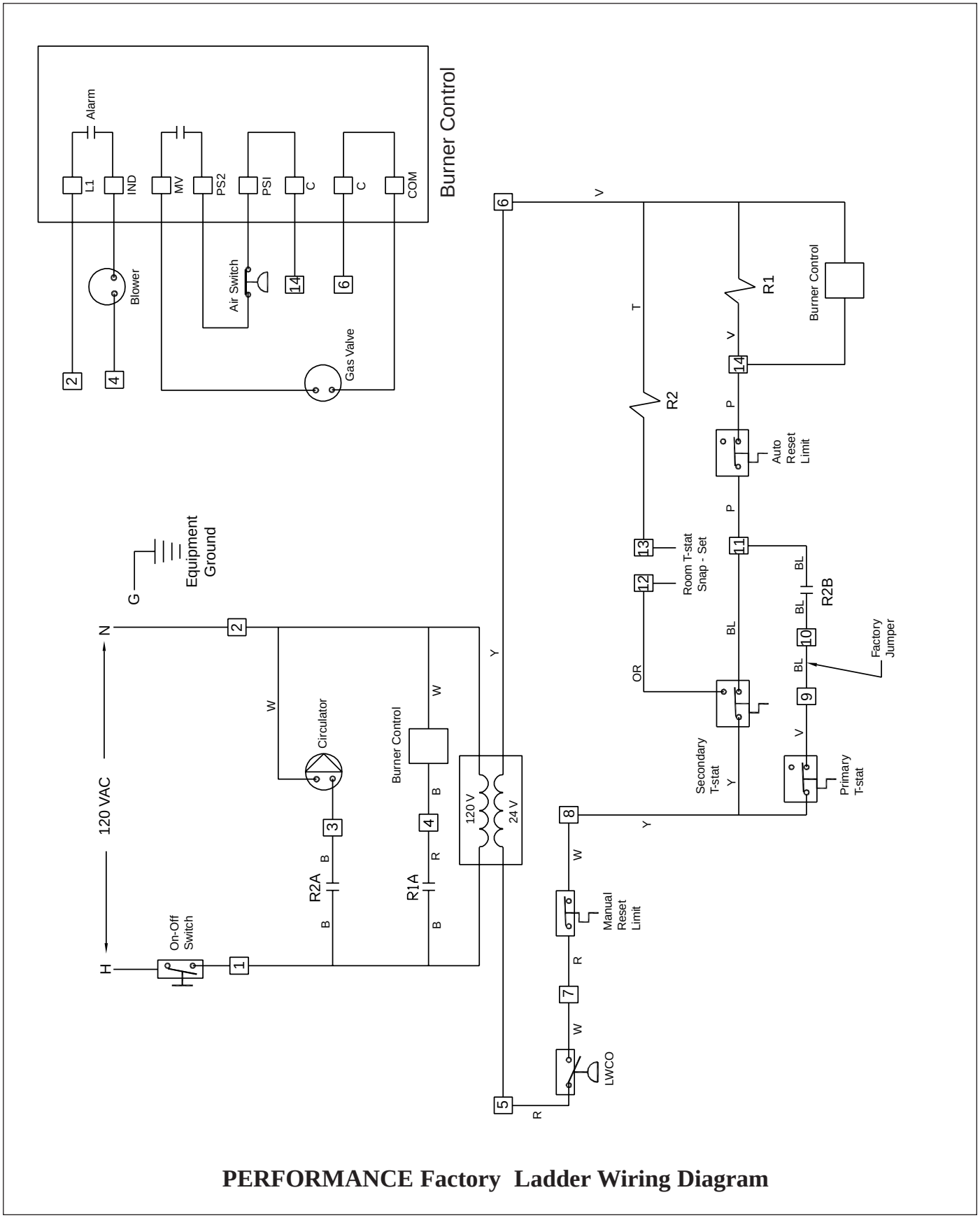
Air Shutter
(propane & high altitude applications)

Burner Control Wiring





PERFORMANCE Factory Wire Connection Diagram



PERFORMANCE Factory Ladder Wiring Diagram

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