



BASO Gas Products LLC

BG1600M51EF-1AA Universal Intermittent Pilot Ignition Control

Application

The BG1600M51EF-1AA Universal Intermittent Pilot Ignition Control replaces many existing intermittent pilot ignition controls made by various manufacturers. It is a safety control designed for indirect burner ignition and supervision, for use with all gases and applicable to gas-fired appliances.

The BG1600M51EF-1AA is a microprocessor based ignition control. The microprocessor provides reliable software control of all timings and operates a diagnostic Light-Emitting Diode (LED). It provides ignition sequence, flame monitoring, and safety shutoff for intermittent pilot boilers, furnaces and other heating appliances. For a complete listing of specifications, refer to the *Technical Specifications* section.

Installation

Parts Included

The BG1600M51EF-1AA is supplied with a parts kit containing:

- 6 labels for marking wires
- 1/4" terminal for sense wire
- 3 wire nuts
- Rajah adapter described below

This control uses 1/4" quick connect terminals for spark connection. If existing cable uses Rajah or 1/4" female spark plug connector, use the adapter shown in Figure 1.

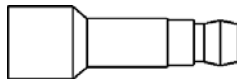


Figure 1: Rajah Adapter

IMPORTANT: Only qualified personnel should install or service BASO Gas Products®. These instructions are a guide for such personnel. Carefully follow all instructions for the appliance.

IMPORTANT: Make all gas installations in accordance with applicable local, national, and regional regulations.



WARNING: Risk of Explosion or Fire.

Do not install the control in an area that is exposed to water (for example, dripping, spraying, rain). Do not use the control if it has been exposed to water. Exposure to water may cause malfunction and can lead to an explosion or fire and may result in severe personal injury or death.

IMPORTANT: Verify that the control being replaced is in **Table 1** or confirm it is a suitable replacement using the specifications of the BG1600M51EF-1AA.

IMPORTANT: This control is approved for use with noise suppression (resistive) spark wires. If the application has copper wire, it must be replaced.

The BG1600M51EF-1AA replaces existing intermittent pilot ignition controls listed in Table 1 or controls with the following specifications:

- flame detection using flame rectification technology (ability of a flame to conduct and rectify current)
- Single rod (local sense) or dual rod (remote sense) flame sensing
- 100% shutoff/lockout with 5 minute continuous retry
- trial times of 25 seconds or longer
- prepurge period 1 second or less
- main burner 400,000 BTU/hr maximum
- pilot burners with flow rates of 1,500 Btu/hr or less
- with or without automatic vent damper
- must be used with redundant gas valves and not subjected to temperatures below -40°F (-40°C) or above 170°F (77°C)

Table 1: Replacement Part Numbers

| Part Number | Original Manufacturer |
|-------------|-----------------------|
| S86A1001 | Honeywell |
| S86A1019 | Honeywell |
| S86A1027 | Honeywell |
| S86A1035 | Honeywell |
| S86B1017 | Honeywell |
| S86B1025 | Honeywell |
| S86C1007 | Honeywell |
| S86C1015 | Honeywell |
| S86C1031 | Honeywell |
| S86C1049 | Honeywell |
| S86C1056 | Honeywell |
| S86D1005 | Honeywell |
| S86D1021 | Honeywell |
| S86E1002 | Honeywell |
| S86E1010 | Honeywell |
| S86E1028 | Honeywell |
| S86E1036 | Honeywell |
| S86E1044 | Honeywell |
| S86E1051 | Honeywell |
| S86E1069 | Honeywell |
| S86E1077 | Honeywell |
| S86E1101 | Honeywell |
| S86E1119 | Honeywell |
| S86E1127 | Honeywell |
| S86F1000 | Honeywell |
| S86F1018 | Honeywell |
| S86F1026 | Honeywell |
| S86F1042 | Honeywell |
| S86F1059 | Honeywell |
| S86F1067 | Honeywell |
| S86F1075 | Honeywell |
| S86F1083 | Honeywell |
| S86F1091 | Honeywell |
| S86G1008 | Honeywell |

| Part Number | Original Manufacturer |
|-------------|-----------------------|
| S86G1016 | Honeywell |
| S86G1032 | Honeywell |
| S86G1057 | Honeywell |
| S86G1073 | Honeywell |
| S86H1006 | Honeywell |
| S86H1022 | Honeywell |
| S86H1048 | Honeywell |
| S86H1055 | Honeywell |
| S86H1089 | Honeywell |
| S86H1097 | Honeywell |
| S86H1105 | Honeywell |
| S86H1121 | Honeywell |
| S86H1147 | Honeywell |
| S90A1005 | Honeywell |
| S90B1003 | Honeywell |
| S90B1011 | Honeywell |
| S8600A1001 | Honeywell |
| S8600B1009 | Honeywell |
| S8600B3013 | Honeywell |
| S8600C1015 | Honeywell |
| S8600C3003 | Honeywell |
| S8600F1000 | Honeywell |
| S8600F1034 | Honeywell |
| S8600F1042 | Honeywell |
| S8600H1006 | Honeywell |
| S8600H1022 | Honeywell |
| S8600H1048 | Honeywell |
| S8600H1055 | Honeywell |
| S8600H1071 | Honeywell |
| S8600H1089 | Honeywell |
| S8600H1097 | Honeywell |
| S8600H1105 | Honeywell |
| S8600H3002 | Honeywell |
| S8600M1005 | Honeywell |

| Part Number | Original Manufacturer |
|-------------|-----------------------|
| S8600M1013 | Honeywell |
| S8600M1021 | Honeywell |
| S8600M1105 | Honeywell |
| S8600M2003 | Honeywell |
| S8600M3001 | Honeywell |
| S8600M4009 | Honeywell |
| S8610A1009 | Honeywell |
| S8610B1007 | Honeywell |
| S8610B1015 | Honeywell |
| S8610C1005 | Honeywell |
| S8610C1013 | Honeywell |
| S8610C3001 | Honeywell |
| S8610F1008 | Honeywell |
| S8610F1016 | Honeywell |
| S8610F1024 | Honeywell |
| S8610F1032 | Honeywell |
| S8610H1012 | Honeywell |
| S8610H1038 | Honeywell |
| S8610H1046 | Honeywell |
| S8610H1053 | Honeywell |
| S8610H1079 | Honeywell |
| S8610H1095 | Honeywell |
| S8610H3000 | Honeywell |
| S8610H3026 | Honeywell |
| S8610M1003 | Honeywell |
| S8610M1029 | Honeywell |
| S8610M3009 | Honeywell |
| S8610U1003 | Honeywell |
| S8610U1011 | Honeywell |
| S8610U3009 | Honeywell |
| S8620H1002 | Honeywell |
| S8620H1028 | Honeywell |
| CSA35A-617R | Johnson Controls |
| CSA35A-618R | Johnson Controls |
| CSA42A-600R | Johnson Controls |

| Part Number | Original Manufacturer |
|--|-----------------------|
| CSA42A-601R | Johnson Controls |
| CSA42A-602R | Johnson Controls |
| CSA42A-603R | Johnson Controls |
| CSA42A-604R | Johnson Controls |
| CSA43A-600R | Johnson Controls |
| CSA44A-600R | Johnson Controls |
| CSA45A-601R | Johnson Controls |
| CSA45A-602R | Johnson Controls |
| CSA46A-600R | Johnson Controls |
| CSA48A-600R | Johnson Controls |
| CSA49A-600R | Johnson Controls |
| CSA49A-605R | Johnson Controls |
| CSA51A-601R | Johnson Controls |
| CSA52A-600R | Johnson Controls |
| G600AX-1,2,3 | Johnson Controls |
| G600AY-1 | Johnson Controls |
| G600LX-1,2 | Johnson Controls |
| G600LY-1 | Johnson Controls |
| G600MX-1 | Johnson Controls |
| G600NX-1 | Johnson Controls |
| G600RX-1 | Johnson Controls |
| G60AAA-1 | Johnson Controls |
| G60AAG-1,2,3,4,5,6,7 | Johnson Controls |
| G60CAA-1,3 | Johnson Controls |
| G60CAG-1,2,3,4,5,6,7,8,9 | Johnson Controls |
| G60CBA-1,2,3 | Johnson Controls |
| G60CBG-1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17 | Johnson Controls |
| G60CCA-1 | Johnson Controls |
| G60CCG-1 | Johnson Controls |
| G60CPG-1 | Johnson Controls |
| G60DBG-1 | Johnson Controls |
| G60DCG-1,2,3,4 | Johnson Controls |
| G60GBA-1 | Johnson Controls |

| Part Number | Original Manufacturer |
|--------------------------|-----------------------|
| G60GBG-1 | Johnson Controls |
| G60KAG-1 | Johnson Controls |
| G60PAG-1,2,3,4,5,6 | Johnson Controls |
| G60PAJ-1 | Johnson Controls |
| G60PAK-1,2 | Johnson Controls |
| G60PFH-1,2 | Johnson Controls |
| G60PVL-1 | Johnson Controls |
| G60QAG-1,2,3,4 | Johnson Controls |
| G60QAK-1 | Johnson Controls |
| G60QBG-1,2,3,4,5,6,7,8,9 | Johnson Controls |
| G60QBH-1 | Johnson Controls |
| G60QBK-1,2,3 | Johnson Controls |
| G60QBL-1,2 | Johnson Controls |
| G60QCG-1 | Johnson Controls |
| G60QCJ-1 | Johnson Controls |
| G60QCL-1 | Johnson Controls |
| G60QDG-1 | Johnson Controls |
| G60QFL-1 | Johnson Controls |
| G60QGH-1 | Johnson Controls |
| G60QHL-1,2 | Johnson Controls |
| G60QJL-1 | Johnson Controls |
| G60QLG-1 | Johnson Controls |
| G60QLK-1 | Johnson Controls |
| G60QPG-1 | Johnson Controls |
| G60QPK-1 | Johnson Controls |
| G60QPL-1 | Johnson Controls |
| G60QQJ-1 | Johnson Controls |
| G60QRH-1,2,3 | Johnson Controls |
| G60QRL-1,2,3 | Johnson Controls |
| G60QSL-1 | Johnson Controls |
| G60QTH-1 | Johnson Controls |
| G60QTL-1 | Johnson Controls |
| G60RAG-1 | Johnson Controls |
| G60RBG-1,2,3 | Johnson Controls |

| Part Number | Original Manufacturer |
|-----------------------|-----------------------|
| G60RBK-1,2 | Johnson Controls |
| G60RCG-1,2 | Johnson Controls |
| G60RCJ-1 | Johnson Controls |
| G60RDG-1 | Johnson Controls |
| G60RDK-1 | Johnson Controls |
| G60RGL-1 | Johnson Controls |
| G60RHL-1 | Johnson Controls |
| G60RHP-1 | Johnson Controls |
| G60RPL-1 | Johnson Controls |
| G60RSL-1 | Johnson Controls |
| G60ZAG-1,2 | Johnson Controls |
| G65BBG-1 through 8 | Johnson Controls |
| G65BBM-1,2,3,4 | Johnson Controls |
| G65BCG-1 | Johnson Controls |
| G65BCM-1 | Johnson Controls |
| G65BFG-1 | Johnson Controls |
| G65BKG-1,2,3 | Johnson Controls |
| G65BKM-1,2,3 | Johnson Controls |
| G65BLG-1,2 | Johnson Controls |
| G65DBM-1,2,3 | Johnson Controls |
| G65DCM-1 | Johnson Controls |
| G65DFM-1 | Johnson Controls |
| G65DKM-1 | Johnson Controls |
| G65DLM-1 | Johnson Controls |
| G66AG-1,2 | Johnson Controls |
| G66BG-1 | Johnson Controls |
| G66MG-1,2 | Johnson Controls |
| G66NG-1 | Johnson Controls |
| G670AW-1, 2 | Johnson Controls |
| G67AG-3,4,7,8,9,10,11 | Johnson Controls |
| G67BG-2,3,4,5 | Johnson Controls |
| G67MG-1,2,3,4 | Johnson Controls |
| G67NG-2,4 | Johnson Controls |
| G770LGA-1,2 | Johnson Controls |
| G770LGC-1,2,3,4 | Johnson Controls |

| Part Number | Original Manufacturer |
|---------------------|-----------------------|
| G770LHA-1,2 | Johnson Controls |
| G770LHC-1 | Johnson Controls |
| G770MGA-1,2,3 | Johnson Controls |
| G770MGC-1,2,3,4,5,6 | Johnson Controls |
| G770MHA-1,2 | Johnson Controls |
| G770MHC-1 | Johnson Controls |
| G770NGA-1 | Johnson Controls |
| G770NGC-4,5,6,7 | Johnson Controls |
| G770NHA-1 | Johnson Controls |
| G770NHC-1 | Johnson Controls |
| G770RGA-1,2,3 | Johnson Controls |
| G770RHA-1,2 | Johnson Controls |
| G775RGA-1 | Johnson Controls |
| G775RHA-1,2 | Johnson Controls |
| G779LHA-1 | Johnson Controls |
| Y79ABC-1 through 7 | Johnson Controls |
| Y79ABD-1,2 | Johnson Controls |
| Y79BBA-1,2 | Johnson Controls |

| Part Number | Original Manufacturer |
|---------------|-----------------------|
| 780-001 | Robertshaw |
| 780-002 | Robertshaw |
| 780-715 | Robertshaw |
| 780-735 | Robertshaw |
| 780-736 | Robertshaw |
| 780-737 | Robertshaw |
| 780-845 | Robertshaw |
| SP715 | Robertshaw |
| SP715A | Robertshaw |
| SP735 | Robertshaw |
| SP735D | Robertshaw |
| SP735L | Robertshaw |
| 50D49-350 | White-Rodgers |
| 50D49-360 | White-Rodgers |
| IPI-24-00 | Camstat |
| 05-203025-005 | Fenwal |
| 05-203026-005 | Fenwal |
| 1003-3 | HSC |
| 1003-300 | HSC |

Replacing the Existing Ignition Control



CAUTION: Risk of Electric Shock.

Disconnect power supply before making electrical connections to avoid electric shock.



WARNING: Risk of Explosion or Fire.

Shut off the gas supply at the main manual shutoff valve before installing or servicing the control. Failure to shut off the gas supply can result in the release of gas during installation or servicing, which can lead to an explosion or fire, and may result in severe personal injury or death.



WARNING: Risk of Explosion, Fire, or Electric Shock. Label all wires before they are disconnected when replacing or servicing the BG1600M51EF-1AA. Wiring errors can cause improper or dangerous operation and may result in an explosion, fire, or electric shock leading to severe personal injury or death.

To remove the existing ignition control:

1. Shut off power to the appliance.
2. Turn off the gas at the main manual shutoff valve adjacent to the appliance. (If the manual shutoff valve services more than one appliance, be sure to light the other pilots before leaving the installation.)
3. Label each wire with the correct terminal designation prior to disconnection, using the labels provided with the parts kit.
4. Disconnect the wires from the existing control.
5. Disconnect the vent damper plug/cable (if used) from the ignition control.
6. Remove the screws holding the ignition control to the valve (if direct valve-mount model) or remove the screws holding the control to the appliance chassis (if foot-mount model).
7. Remove the old ignition control and discard.

IMPORTANT:

Do not mount the control where it can be exposed to direct infrared radiation from the main burner or to temperatures in excess of the maximum product temperature rating.

8. Mount the new control with #6 sheet metal or machine screws through the mounting holes in the enclosure.
9. Refer to the *Wiring* section for electrical connections and wiring diagrams. Perform the *Checkout* section before leaving the installation.
10. Check all wiring for proper connections and make sure your system is properly grounded, including the pilot burner igniter.

Note: The BG1600M51EF-1AA is **NOT** designed to replace ignition controls with the following specifications:

- pilot flame detection by any means other than flame rectification
- trial for ignition period of less than 25 seconds
- prepurge greater than 4 seconds
- standing pilot applications

Wiring



WARNING: Risk of Explosion or Fire.

Locate all safety, limit, and operating controls in series with the thermostat terminal (TH) on the ignition control. Improper installation may cause gas leaks, which can lead to an explosion or fire and may result in severe personal injury or death.

Refer to Figure 2 through Figure 5 for wiring diagrams. All wiring should be in accordance with the National Electrical Code (NEC) and all other local codes and regulations.

Check the voltage rating marked on the control and make sure it is suited to the application. Use a Class 2 transformer capable of providing 24 VAC under maximum load, including valves. A transformer having excessive primary impedance due to poor coupling affects the ignition potential.

The high-voltage spark transformer cable is noise suppression (resistive) type rated for at least 15kV and must not be in continuous contact with a metal surface. Use standoff insulators. Ensure that the flame sensor wire and high voltage spark transformer cable are separated from one another by a minimum of 1/4 in. (6.35 mm) and are not wrapped around any pipe, other wiring, or accessories.

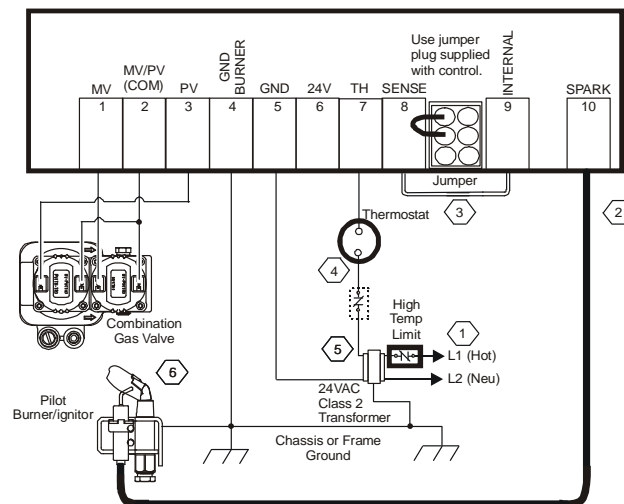
The control is supplied with a jumper wire between Sense and Internal terminals and is ready for internal (one rod) flame sense. With the jumper in, flame is sensed through the high voltage spark wire. The jumper must be removed for external (two rod) flame sense and the sense electrode wired to the Sense terminal.

Note: A shorting plug that jumpers pins 2 and 3 of the damper connector is supplied with the control. The shorting plug must be used if a vent damper is not used. When a vent damper has been connected and power turned on, an internal fuse in the control will blow and the control will only operate with a vent damper connected. Now you cannot disconnect the vent damper plug and put back the shorting plug. The ignition control will not work.



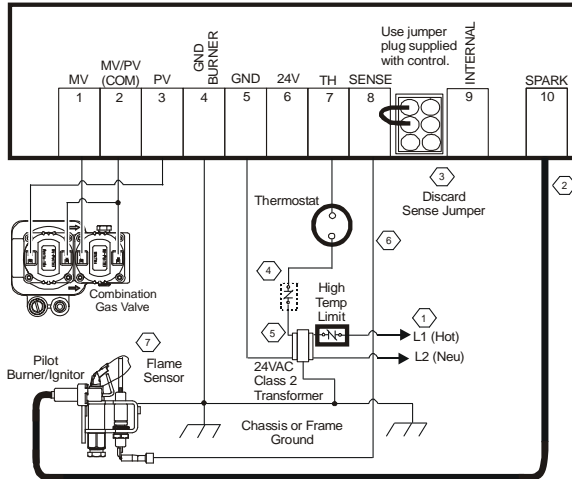
WARNING: Risk of Electric Shock.

Before applying power to the control, connect the high voltage cable to the spark transformer terminal and spark electrode (pilot burner assembly). Verify the ground wire is attached to the pilot burner and the control ground terminal strip. Failure to follow this procedure can cause electric shock and may result in severe personal injury or death.



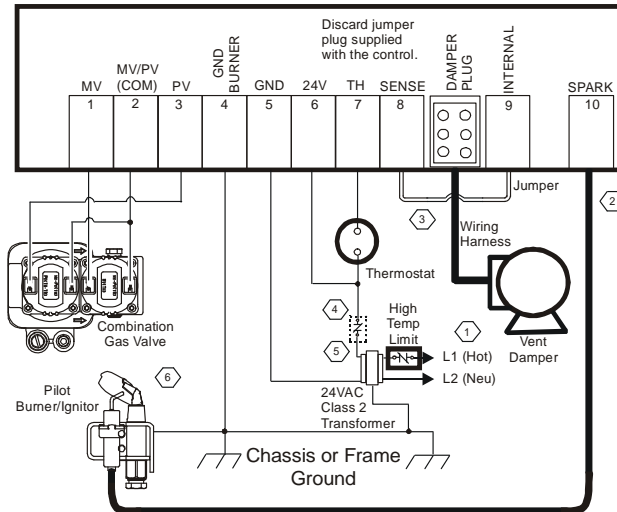
- ① Power Supply. Provides disconnect means and overload protection as required.
- ② Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
- ③ For single rod application, leave jumper wire in as received.
- ④ Alternate location for limit controller.
- ⑤ Controls in 24V circuit must not be in ground leg to transformer.
- ⑥ Sensor rod must be 3/8" (9.53 mm) to 1/2" (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 2: Wiring for 1 Rod Flame Sense with Vent Damper Jumper Plug



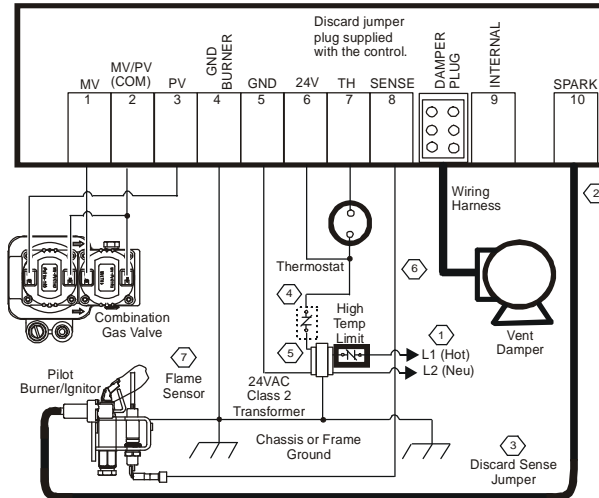
- ① Power Supply. Provides disconnect means and overload protection as required.
- ② Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
- ③ For two rod application, remove jumper wire before installation.
- ④ Alternate location for limit controller.
- ⑤ Controls in 24V circuit must not be in ground leg to transformer.
- ⑥ Maximum cable length 48 inches (1,220 mm).
- ⑦ Sensor rod must be 3/8" (9.53 mm) to 1/2" (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 3: Wiring for 2 Rod Flame Sense with Vent Damper Jumper Plug



- ① Power Supply. Provides disconnect means and overload protection as required.
- ② Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
- ③ For single rod application, leave jumper wire in as received.
- ④ Alternate location for limit controller.
- ⑤ Controls in 24V circuit must not be in ground leg to transformer.
- ⑥ Sensor rod must be 3/8" (9.53 mm) to 1/2" (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 4: Wiring for 1 Rod Flame Sense with Vent Damper



- ① Power Supply. Provides disconnect means and overload protection as required.
- ② Maximum cable length 48 inches (1,220 mm). (Resistive wire recommended.)
- ③ For two rod applications remove jumper wire before installation.
- ④ Alternate location for limit controller.
- ⑤ Controls in 24V circuit must not be in ground leg to transformer.
- ⑥ Maximum cable length 48 inches (1,220 mm).
- ⑦ Sensor rod must be 3/8" (9.53 mm) to 1/2" (12.7 mm) of the sensor tip should be in the flame for proper sensing signal.

Figure 5: Wiring for 2 Rod Flame Sense with Vent Damper

Setup and Adjustments

Instructions for Specific Models

Follow the instructions below for replacement of specific control models.

Replacing Honeywell® S8610U1003 and S86xx Controls

The BG1600M51EF-1AA control has 1/4 inch terminals whose general locations and labels match the S8610U1003 and other S86xx controls. If a two rod flame sense is used, the 3/16 inch terminal on the flame sense wire must be replaced with the 1/4 inch terminal provided in the parts kit. Verify that the spark wire is noise suppression (resistive) type and replace if necessary.

Replacing Johnson Controls® G600AX-1 and G600LX-1

The G600AX-1 and G600LX-1 use the same terminal numbers as the G77x without text labels. Use the Rajah spark adapter included in the parts kit. Verify that the spark wire is noise suppression (resistive) type and replace if necessary.

Table 2: Replacing Johnson Controls® G779LHA-1 and G77x

| Wire Function | G77x | BG1600M |
|------------------------------------|--------------|----------------|
| Main Valve | 3 MV | 1 MV |
| Valve Common | Ground Plate | 2 MV/PV |
| Pilot Valve | 1 PV | 3 PV |
| Pilot Burner Ground | Ground Plate | 4 GND (BURNER) |
| Power Supply Ground | Ground Plate | 5 GND |
| 24VAC Power (if damper is used) | 6 24V | 6 24V |
| Thermostat | 2 THS | 7 TH |
| Sense Electrode (if two rod sense) | 4 SENSE | 8 SENSE |

If the G77x uses a spike type high voltage connector. It will be necessary to replace the spark cable assembly.

Table 3: Replacing Robertshaw® 780-845

| Wire Function | 780-845 | BG1600M |
|---------------------------------------|---------|-------------------|
| Main Valve | MV | 1 MV |
| Valve Common | PV-MV | 2 MV/PV |
| Pilot Valve | PV | 3 PV |
| Pilot Burner Ground | GND | 4 GND (BURNER) |
| Power Supply Ground | TR | 5 GND |
| Thermostat | TH | 7 TH |
| Sense Electrode (if two rod sense) | SENSE | 8 SENSE |

Note: Verify that the spark wire is noise suppression (resistive) type and replace if necessary.

Checkout



WARNING: Risk of Explosion or Fire.

Verify that there are no gas leaks by testing with appropriate equipment. Never use a match or lighter to test for the presence of gas. Failure to test properly can lead to an explosion or fire and may result in severe personal injury or death.

Make sure all components function properly by performing the following test.

1. Before starting the appliance, perform a safety inspection of piping, burners and venting. Check for water leaks, etc. Check all wiring for proper connections. Be sure the system is properly grounded, including ground connection to the pilot burner.
2. With the gas and thermostat off, turn on power to the appliance.
3. Turn the thermostat to a high setting and verify that the control goes through the operating sequence to a shutoff condition.
Note: The burner does not light because the gas is off.
4. Turn off the thermostat.
5. Turn on the gas and purge gas lines of all air.
6. Check for gas leaks on all pipe joints upstream of the gas valve with a soap solution.
7. Turn the thermostat to the highest setting and verify successful ignition and a normal run condition for at least 5 minutes. If the appliance fails to run, see the *Troubleshooting* section.

8. Check for gas leaks on all pipe joints downstream of the gas valve with a soap solution.
9. Turn the thermostat down for at least 30 seconds and then back up again. Verify successful ignition at least five times.
10. Return the thermostat to a normal temperature setting before leaving the installation.



WARNING:

The control module can not be serviced by user. If any faults are detected, the control module must be replaced. If control module has been opened or any attempts to repair are done, the warranty is void.

Operation

Operating Mode Definitions

The following definitions describe the BG1600M51EF-1AA operating conditions.

- **Prepurge:** Initial time delay between thermostat contact closure and activation of the spark circuit and pilot valve.
- **Trial for Ignition:** Total time the pilot valve is energized and spark/sense sequence is activated in an attempt to light the pilot. The control attempts to prove flame within the trial-for-ignition time.
- **100% Shutoff:** If the control does not prove the presence of pilot burner flame within the trial for ignition, the spark circuit and pilot valve are de-energized.
- **Recycle:** If 100% shutoff occurs, the control delays 5 minutes (recycle delay period) and begins another trial for ignition.
- **Run:** Main valve is energized and spark turns off after pilot flame is proven. The main valve remains energized until the thermostat is satisfied.
- **Flameout:** Loss of proven flame. Should a flameout occur, the main valve de-energizes and spark recurs within 2.0 seconds.
- **Lockout:** An internal or external fault has caused the control to de-energize the spark circuit and valve relays. The thermostat contacts must be opened for 30 seconds and then closed to begin another trial for ignition.
- **Inter-Purge:** Period between trials for ignition when both the gas valve and spark are de-activated to allow unburned gas to escape before the next trial.

Sequence of Operation

The heating cycle starts when a call for heat from the thermostat supplies 24VAC to the TH terminal. The automatic vent damper (if used) is energized and when fully open, turns on the power to the ignition control. After a 1 second maximum diagnostic period, the spark will start and the pilot valve will turn on, starting the trial for ignition period.

During the trial for ignition period, the control sparks for 4 seconds while rapidly flashing LED. It then turns off the spark and LED for 1 second while checking pilot flame sense. This cycle will repeat until pilot flame is detected or trial time is over.

When pilot flame is detected, the spark will stop, main valve will turn on and the LED will stay on continuously. The control will remain in this state until the pilot flame is lost or the call for heat ends. If pilot flame is lost, LED, main and pilot valves are turned off for 0.5 seconds and a new trial for ignition sequence will start.

If pilot flame is not detected during the trial for ignition period, the pilot valve will be shut off. The control will wait for 5 minutes while blinking the LED at the end of each 15 seconds. When the 5 minute period is over a new trial for ignition sequence will start. The control will recycle continuously until flame is proven or call for heat ends.

Table 4: LED Indications During Normal Operation

| Flash Code | Flash Code Indication |
|-------------------------------|--|
| Steady On | Flame detected, main burner on |
| .1 Second On .1 Second Off | Trial time spark on trying to light pilot burner |
| .5 Second Every 15 Seconds | In 5 minute recycle period |

Troubleshooting

If the system does not function properly, determine the cause using the procedures in this section.

Before proceeding with troubleshooting the system, check the following.

Preliminary Checks

- Are all mechanical and electrical connections tight?
- Is the system wired and ground correctly?
- Is gas inlet pressure per manufacturer's specifications?
- Is the system powered?
- Is the thermostat calling for heat?



WARNING: Risk of Personal Injury.

Do not place face, hands, or other parts of the body in or near the burner area when the LED is flashing (recycle mode). When the LED is flashing, the control may at any time (while in the recycle mode) re-energize the burner control system and ignite the burner which may result in electric shock from contact with the electrode or severe burn injury from firing of the burner.

LED Error Indications

If the control module's internal diagnostics detect a fault it will go into lockout. Spark and both valves will be turned off. The LED will flash an error code .25 seconds on and .25 seconds off for each count of the error code with 1 second off between codes. The control will remain in this condition until power is removed by turning off the call

for heat. A flashing LED error code indicates either a problem with wiring, or a component not working, or the control module is faulty. Try to cycle the control again. If the error repeats then see Table 5 for troubleshooting.

Table 5: LED Error Indications

| Flash Code | Flash Code Description | Troubleshooting Guide |
|-------------|--------------------------------|---|
| No LED "ON" | No Power | <ol style="list-style-type: none"> With the MOLEX Vent Damper jumper plug installed, check for 24 volts on terminal 7 (TH) and terminal 5 (GND). If using a Vent Damper, make sure it is connected and working and check for 24 volts on terminals 6 (24V) and 7 (TH) to terminal 5 (GND). Check for 24 volts on the secondary coil of the incoming transformer. |
| 1 | No flame in trial time | <ol style="list-style-type: none"> Check if the gas is turned "ON". With the MOLEX Vent Damper jumper plug installed, check for 24 volts on terminal 7 (TH) and terminal 5 (GND). If using a Vent Damper, make sure it is connected and working and check for 24 volts on terminals 6 (24V) and 7 (TH) to terminal 5 (GND). If no spark, check spark wire and connection to terminal 10 (SPARK) and spark ground to terminal 4 (GND BURNER). Check if PV is wired to terminal 3 (PV) and common is wired to terminal 2 (MV/PV COM). Check for 24 volts at the PV coil. |
| 2 | Flame sense circuit error | <ol style="list-style-type: none"> Check Flame Sensor tip is in the flame. For proper sensing the rod tip must be 3/8"(10mm) to 1/2"(13 mm) in the flame. Check Flame Sensor circuits; <ol style="list-style-type: none"> For 1 Rod Flame Sense circuit, check Spark/Flame Sensor is wired to terminal 10 (SPARK) and terminal 4 (GND BURNER). And check Jumper wire is installed between terminal 8 (SENSE) and terminal 9 INTERN). For 2 Rod Flame Sense circuit, check Flame Sensor is wired to terminal 8 (SENSE) and terminal 4 (GND BURNER). |
| 3 | PV (Pilot Valve) circuit error | <ol style="list-style-type: none"> Check for 24 volts on terminal 3 (PV) and terminal 2 (MV/PV COM). Check if PV is wired to terminal 3 (PV) and common is wired to terminal 2 (MV/PV COM). Check for 24 volts at the PV coil. |
| 4 | MV (Main Valve) circuit error | <ol style="list-style-type: none"> Check for 24 volts on terminal 1 (MV) and terminal 2 (MV/PV COM). Check MV is wired to terminal 1 (MV) and common is wired to terminal 2 (MV/PV COM). Check for 24 volts at the MV coil. |
| 5 | Internal Control error | <ol style="list-style-type: none"> Review all ground connections. Check if using fiber core resistive wire for Spark Wire. |
| 6 to 9 | Internal Control error | <ol style="list-style-type: none"> Software error – Restart control module. |

NOTE: If the Troubleshooting Guide has been used for an error code being flashed, and the Control Module is not working, then the Control Module maybe faulty. Replace the Control Module.

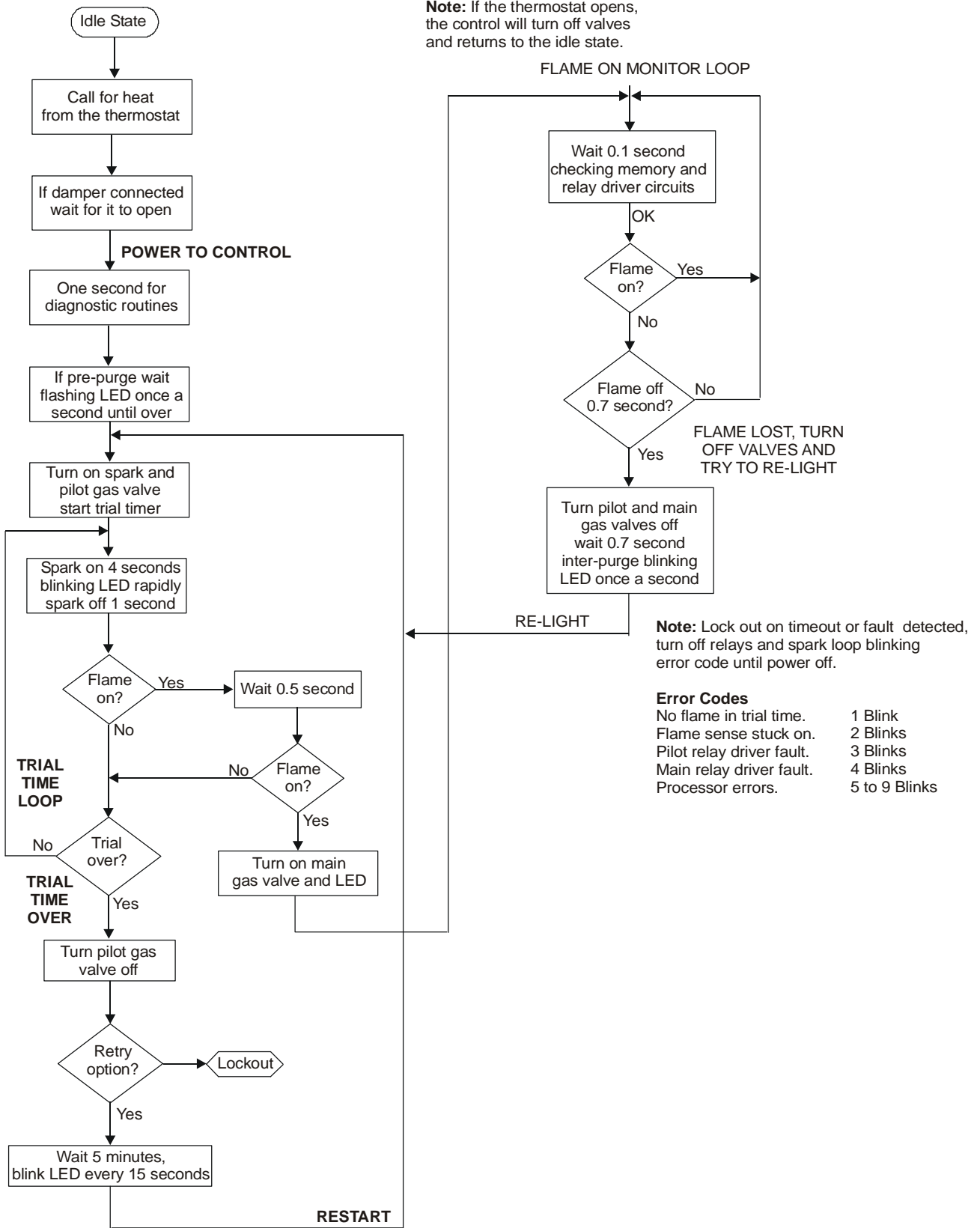


Figure 6: Sequence of Operation

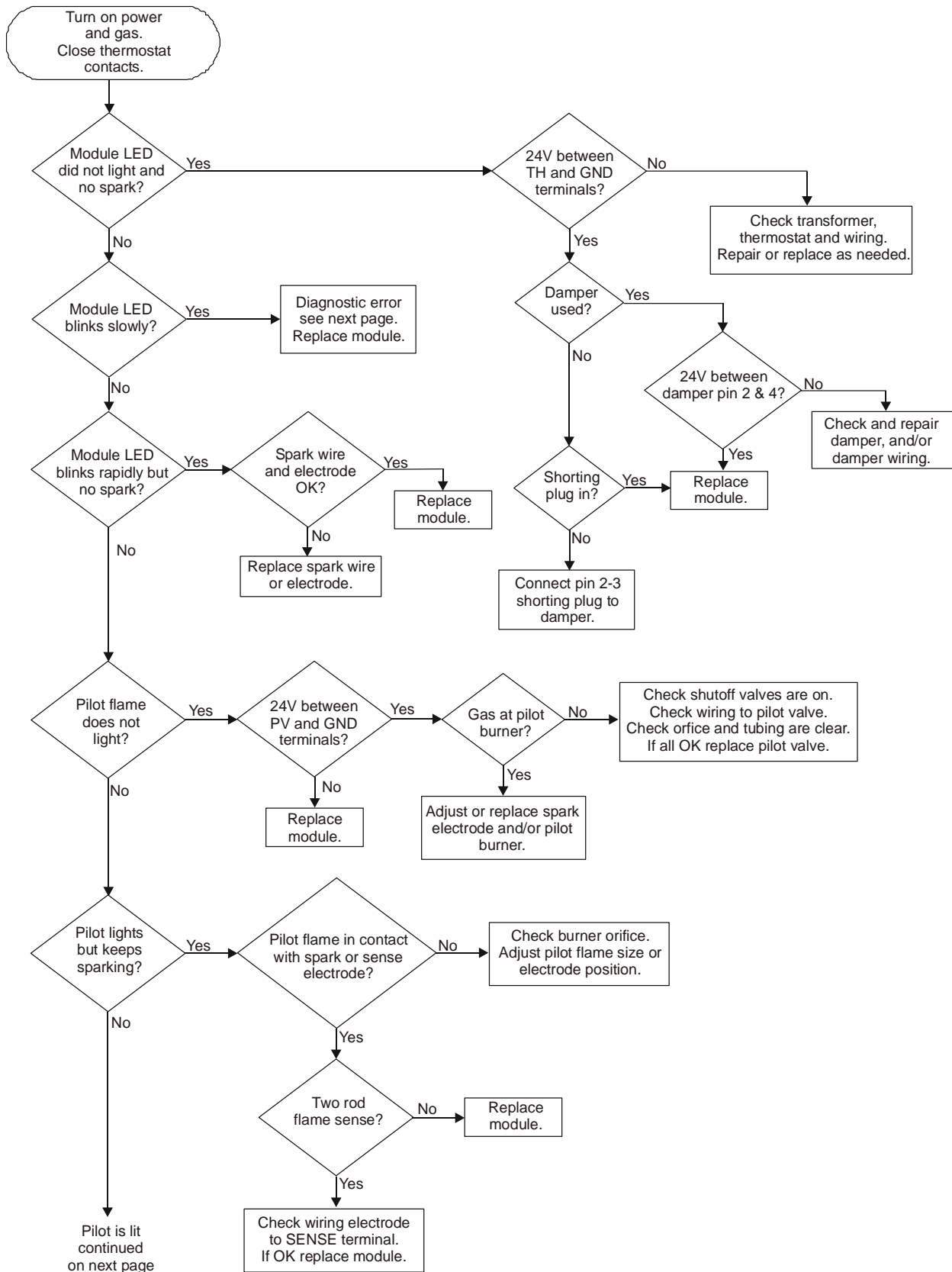


Figure 7: Troubleshooting Flow Chart (1 of 2)

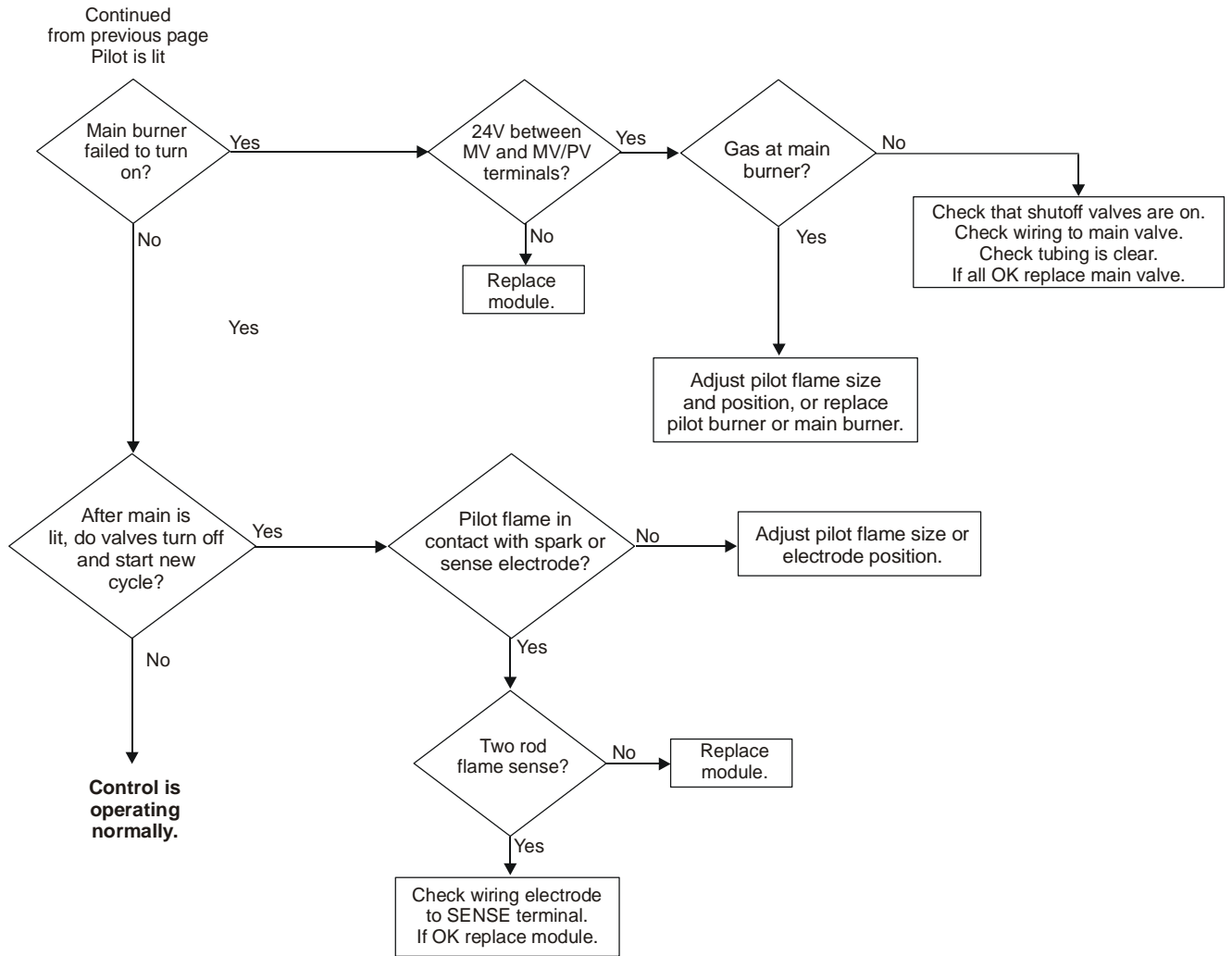


Figure 8: Troubleshooting Flow Chart (2 of 2)

Maintenance Requirements in Severe Environments

Regular preventive maintenance is important in any application, but especially so in commercial cooking, agricultural, and industrial applications because:

- In many such applications, particularly commercial cooking, the equipment operates 100,000 to 200,000 cycles per year. Such heavy cycling can wear out the gas control in one to two years. A normal forced air furnace, for which the controls were originally intended, typically operates less than 20,000 cycles per year.
- Exposure to water, dirt, chemicals, and heat can damage the ignition control module or the gas control and shut down the control system. A NEMA 4 enclosure can reduce exposure to environmental contaminants.



WARNING: Risk of Explosion or Fire. Do not attempt to take the ignition control module apart or to clean it. Improper reassembly and cleaning may cause unreliable operation, which can lead to an explosion or fire, and may result in severe injury, property damage or death.

Maintenance frequency must be determined individually for each application. Some considerations are:

- **Cycling Frequency** – Appliances that may cycle more than 20,000 times annually should be checked monthly.
- **Intermittent Use** – Appliances that are used seasonally should be checked before shutdown and again before the next use.
- **Consequence of Unexpected Shutdown** – Where the cost of an unexpected shutdown would be high, the system should be checked more often.
- **Dust, Wet, or Corrosive Environment** – Since these environments can cause the controls to deteriorate more rapidly, the system should be checked more often.

Repairs and Replacement



CAUTION: Risk of Electric Shock.

Disconnect power supply before making electrical connections to avoid electric shock.



WARNING: Risk of Explosion or Fire.

Shut off the gas supply at the main manual shutoff valve before installing or servicing the control. Failure to shut off the gas supply can result in the release of gas during installation or servicing, which can lead to an explosion or fire, and may result in severe injury or death.



WARNING: Risk of Explosion, Fire, or Electric Shock. Label all wires before they are disconnected when replacing or servicing the BG1600M51EF-1AA. Wiring errors can cause improper or dangerous operation and may result in an explosion, fire, or electric shock leading to severe personal injury or death.

Field repairs must not be made to the BG1600M51EF-1AA control. Any attempt to repair this assembly voids the manufacturer's warranty. For a replacement control, contact the original equipment manufacturer or the nearest BASO Gas Products distributor.

All other accessories, such as flame sensors, electrode assemblies, pilot assemblies, and leads can be obtained through the original equipment manufacturer or a BASO Gas Products distributor.

Ignition Control Accessories

Table 6: Ignition Control Accessories

| Part Number | Description |
|---------------|--|
| RAA1600A-601D | Rajah to 1/4" Spade Adapter (box of 50) |
| RAA1600A-601H | Rajah to 1/4" Spade Adapter (bag of 10) |
| WHA40A-600D | 18" Resistive Wire Harness with (2) 1/4" Terminals (box of 25) |
| WHA40A-600H | 18" Resistive Wire Harness with (2) 1/4" Terminals (bag of 1) |
| WHA40A-601D | 18" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (box of 25) |
| WHA40A-601H | 18" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (bag of 1) |
| WHA40A-602D | 24" Resistive Wire Harness with (2) 1/4" Terminals (box of 25) |
| WHA40A-602H | 24" Resistive Wire Harness with (2) 1/4" Terminals (bag of 1) |
| WHA40A-603D | 24" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (box of 25) |
| WHA40A-603H | 24" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (bag of 1) |
| WHA40A-604D | 36" Resistive Wire Harness with (2) 1/4" Terminals (box of 25) |
| WHA40A-604H | 36" Resistive Wire Harness with (2) 1/4" Terminals (bag of 1) |
| WHA40A-605D | 36" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (box of 25) |
| WHA40A-605H | 36" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (bag of 1) |
| WHA40A-606D | 48" Resistive Wire Harness with (2) 1/4" Terminals (box of 25) |
| WHA40A-606H | 48" Resistive Wire Harness with (2) 1/4" Terminals (bag of 1) |
| WHA40A-607D | 48" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (box of 25) |
| WHA40A-607H | 48" Resistive Wire Harness with (1) 1/4" Terminal and 1 Rajah Terminal (bag of 1) |

Cut out and leave near control.

| LED Indications During Normal Operation | |
|--|--|
| Steady On | Flame detected, main burner on |
| .1 Second On, .1 Second Off | Trial time spark on trying to light pilot burner |
| .5 Second Every 15 Seconds | In 5 minute recycle period |
| LED Error Indications .25 Second On and .25 Second Off | |
| 1 | No flame in trial time |
| 2 | Flame sense circuit error |
| 3 | Pilot valve circuit error |
| 4 | Main valve circuit error |
| 5 to 9 | Internal control error |

Notes

Technical Specification

| | | |
|--|---|----------------------------|
| Product | BG1600M51EF-1AA Universal Intermittent Pilot Ignition Control | |
| Ignition Type | Indirect | |
| Ignition Source | High voltage spark, capacitive discharge | |
| High Voltage Cable Maximum Length | 48 in. (1,220 mm) (Resistive wire recommended, rated for at least 15Kv.) | |
| Flame Sense Cable Maximum Length | 48 in. (1,220 mm) | |
| Flame Detection Means | Flame Rectification | |
| Flame Detection Type | Local or Remote | |
| Minimum Flame Current | 0.15 microamperes | |
| Flame Failure Response Time | 2 seconds maximum | |
| Maximum Spark Gap | 0.2 in. (5.1 mm) | |
| Number of Trials Before 100% Shutoff | One | |
| Trial-for-Ignition Time | 25 seconds then 100% shutoff (pilot and main gas) | |
| Prepurge Time | 1 second maximum | |
| Automatic Recycle Delay Period | 5 minutes | |
| Power Requirements | Control: | 24 VAC (+/- 20%), 50/60 Hz |
| | Operation Current: | 0.2 A nominal + valves |
| Contact Rating | Main Valve: | 2 A maximum |
| | Pilot Valve: | 1 A maximum |
| Wiring Connections | 1/4 in. (6.35 mm) male spade | |
| Maximum Firing Rate | 400,000 Btu/hr (117 kW) | |
| Ambient Operating and Storage Temperature | -40 to 170°F (-40 to 77°C) | |
| Humidity | 95% RH noncondensing | |
| Type of Gas | Natural, Liquefied Petroleum (LP), Manufactured, Mixed or LP Gas-Air Mixture | |
| Packaging | Bulk pack supplied to original equipment manufacturer (individual pack [-1AAC] or individual overpack [-1AAE, 20 per box] optional) | |
| Bulk Pack Quantity | 25 | |
| Pack Weight | Bulk pack (-1AAD) 14 lb (6.36 kg) Individual pack (-1AAC) 1 lb (.454 kg) Individual overpack (-1AAE) 18 lb (8.17 kg) | |
| Agency Listing | CSA Certificate Number 246569-2161442 | |
| Specifications Standards | ANSI Standard Z21.20 CAN/CSA-C22.2 No. 199 | |

The performance specifications are nominal and conform to acceptable industry standards. All agency certification of BASO products is performed under dry and controlled indoor environmental conditions. Use of BASO products beyond these conditions is not recommended and may void the warranty. If the product is exposed to water (dripping, spraying, rain, etc.) or other harsh environments, it must be protected. The original equipment manufacturer or end user is responsible for the correct application of BASO products. For questionable applications, please consult BASO Gas Products LLC. BASO Gas Products LLC shall not be liable for damages or product malfunctions resulting from misapplication or misuse of its products.

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