GGIG-99

INSTALLATION & OWNER'S MANUAL

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GEMINI™ NATURAL GAS AND PROPANE-FIRED BOILER

Companion Document to the "Installation and Owner's Manual - TBIG" for the Thermific™ Gas-Fired Boiler

A.G.A. Design-Certified
Complies with ANSI Z21.13
Low Press. Boiler

ASME Code, Section IV
Certified by Patterson-Kelley

C.G.A. Approved
Complies with CAN 1-3.1
Ind. & Comm. Boilers

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It is essential to read, understand, and follow the recommendations of this manual before installing, operating, or servicing this equipment. Failure to do so could result in serious injury, death, and/or property damage.

The information and instructions herein pertain only to equipment supplied by Patterson-Kelley Company. Patterson-Kelley is not responsible for equipment supplied by others, nor for any adverse effects such equipment might have on equipment supplied by Patterson-Kelley.

Warning!

This boiler requires VAPORIZED propane or natural gas. Under NO CIRCUMSTANCES may liquid fuel of any kind be introduced in the boiler.

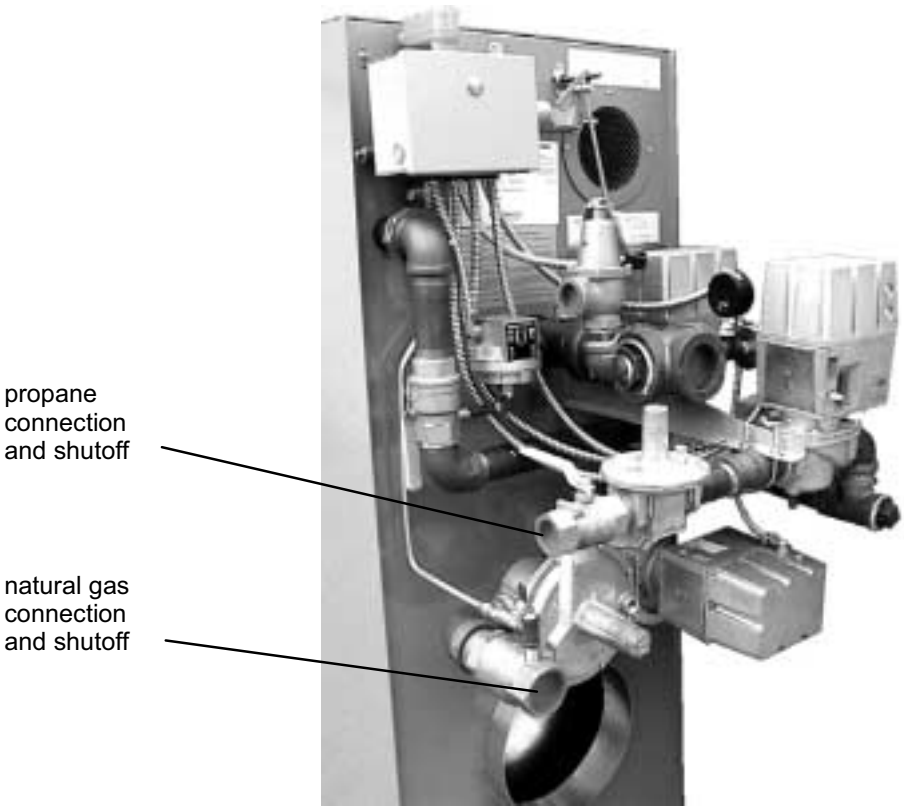


Figure 1-1 Twin-Fuel Gas Train
(Shows 1500/1700/1900 Series; refer to Figure 5-1 for 700/900/1200 Series)

1

1.0 INTRODUCTION

The twin-fuel option for the Patterson-Kelley Gemini™ gas-fired boiler allows the boiler to be fired by propane in the event that the supply of natural gas is temporarily interrupted or restricted. The necessary fittings, valves, piping, and controls for twin-fuel operation are factory installed.

This document is a **companion** to the "Installation and Owner's Manual - TBIG" for the standard Thermific® boiler. Both documents must be used together. This companion document describes those safety, installation, adjustment, and maintenance procedures which **differ** from the single-fuel model. Information which applies to both models is found in the main manual.

2

2.0 DESCRIPTION

2.1 PRINCIPLE OF OPERATION

Natural gas and propane are permanently piped to separate connections on the boiler. Each branch of the gas train is fitted with a regulator and a motorized gas valve. The regulators are adjusted to properly fire the boiler from their respective sources. Boiler and control functions are the same for both fuels.

In the event of interruption or restriction of the natural gas supply, changeover to propane is made **manually** by a selector switch on the boiler (or by a signal from a remote switch or controller).

When the natural gas supply is reestablished, changeover is made by restoring the selector switch to its normal position (or by sending the appropriate signal from the remote controller).

3

3.0 SAFETY

3.1 GENERAL

The Gemini™ gas-fired boiler **must** be:

- Installed by qualified personnel in accordance with designs prepared by qualified facility engineers including: structural, mechanical, electrical, and other applicable disciplines.
- Operated and serviced in accordance with a comprehensive safety program determined and established **by the customer** and complying with all safety provisions of this manual. Do not attempt to operate or service the boiler until such a program has been established.
- Operated and serviced by qualified, properly trained personnel in accordance with all applicable laws and regulations.

3.2 TRAINING

It is **essential** to read, understand, and follow the recommendations of this manual before installing, operating, or servicing this equipment. Failure to do so could result in serious injury, death, and/or property damage.

Proper training is the best protection against accidents. Operating and service personnel must be thoroughly familiar with the basic construction of the Gemini™ boiler, the use and locations of the controls, the opera-

tion of the boiler, adjustment of its various mechanisms, and all applicable safety precautions. If any of the provisions of this manual are not fully and completely understood, contact the Patterson-Kelley Sales Department at (570) 421-7500 for assistance.

3.3 SAFETY FEATURES

It is the responsibility of the customer to maintain the safety features of this machine, such as: guards, safety labels, safety controls, interlocks, lockout devices, etc., in place and operable.

3.4 SAFETY LABELS

The safety labels shown above are affixed to your boiler. Although the labels are of high quality, they may become dislodged or unreadable over time. Contact Patterson-Kelley at (570) 421-7500 for replacement labels.

3.5 SAFETY PRECAUTIONS

Provide a suitable location for the boiler, away from normal personnel traffic, with adequate working space, adequate clearances, proper ventilation and lighting, with a structure sufficiently strong and rigid to support the weight of the boiler, all piping, and accessories.

3.5.1 Electrical Hazards

- High voltage! Shock hazard. Properly lockout/tagout the electrical service and all other energy sources before working on or near the machine.
- Install a lockable disconnect switch.

3.5.2 Burn, Fire, and Explosion Hazards

- Burn, fire, and explosion hazards! Installation must be in strict conformance to all applicable codes and standards including NFPA 54 and ANSI Z223.1, (or in Canada, CAN-B 149). Install all required vent

lines for gas devices. See Section 4 below.

- Hazard from incorrect fuels! Possible fire, explosion, overheating, and damage. Do not use any fuels except **vaporized** natural gas and propane. Under no circumstances is liquid fuel of any kind to be introduced in the boiler.
- Hazard from incorrect fuel connections! Possible fire, explosion, overheating, and damage. Do not attempt to connect the propane supply to the natural gas connection, or vice versa.
- Fire and explosion hazards! Close both the natural gas and propane shutoffs before servicing boiler.
- Burn hazard! Possible hot surfaces. Do not touch gas vent during firing operation. Use only factory recommended B-vent components.
- Fire and explosion hazards! Use caution when servicing burner. Propane is heavier than air and may linger in the combustion chamber, vent lines, or elsewhere.
- Gas leak hazard! Make sure all connections to main burner are tight when reassembling the burner. These connections **cannot** be tested after burner is assembled.
- Gas leak hazard! Test motorized gas valves annually for leakage as described in Section 4.4.6.
- Gas leak hazard! All threaded gas connections must be made using a pipe compound that is resistant to propane. **Do not** use Teflon™ tape on threaded gas piping.
- Gas leak hazard! Check entire gas train for leaks after installation. If there is a smell of gas, shut down the boiler and obtain immediate assistance from trained service personnel and/or your local fire department.
- Overfire hazard! Possible fire and explosion from excess gas pressure. Make sure that gas inlet pressure does not exceed 14 inches W.C. to the regulator on either the natural gas or propane supply line.
- Overfire hazard! Possible fire and explosion. Possible malfunction of regulators and/or motorized gas valves. Maintain all gas train components in good condition. Do not alter wiring connections. Annual inspection by factory-trained personnel for proper set-up and operation is recommended.
- Overfire and underfire hazards! Possible fire, explosion, overheating, and component failure. Do not attempt to adjust firing rate of the boiler. The firing rate must be adjusted **only** by factory trained personnel.

3.5.3 Crush Hazards

General Warning

- Lifting hazards! Use properly rated lifting equipment to lift and position the boiler. The load is unbalanced. Test balance before lifting 3 ft. above the floor. Do not allow personnel beneath the lifted load. Refer to approximate weights in the table below:

Boiler Size	Weight in Pounds
700,000 Btu	650
1,000,000 Btu	650
1,200,000 Btu	765
1,500,000 Btu	1,100
1,700,000 Btu	1,100
2,000,000 Btu	1,100

3.5.4 Chemical Hazards

- Environmental hazard! The motorized gas valves may contain hydraulic oil. Use safe procedures for the disposal of all lubricants.

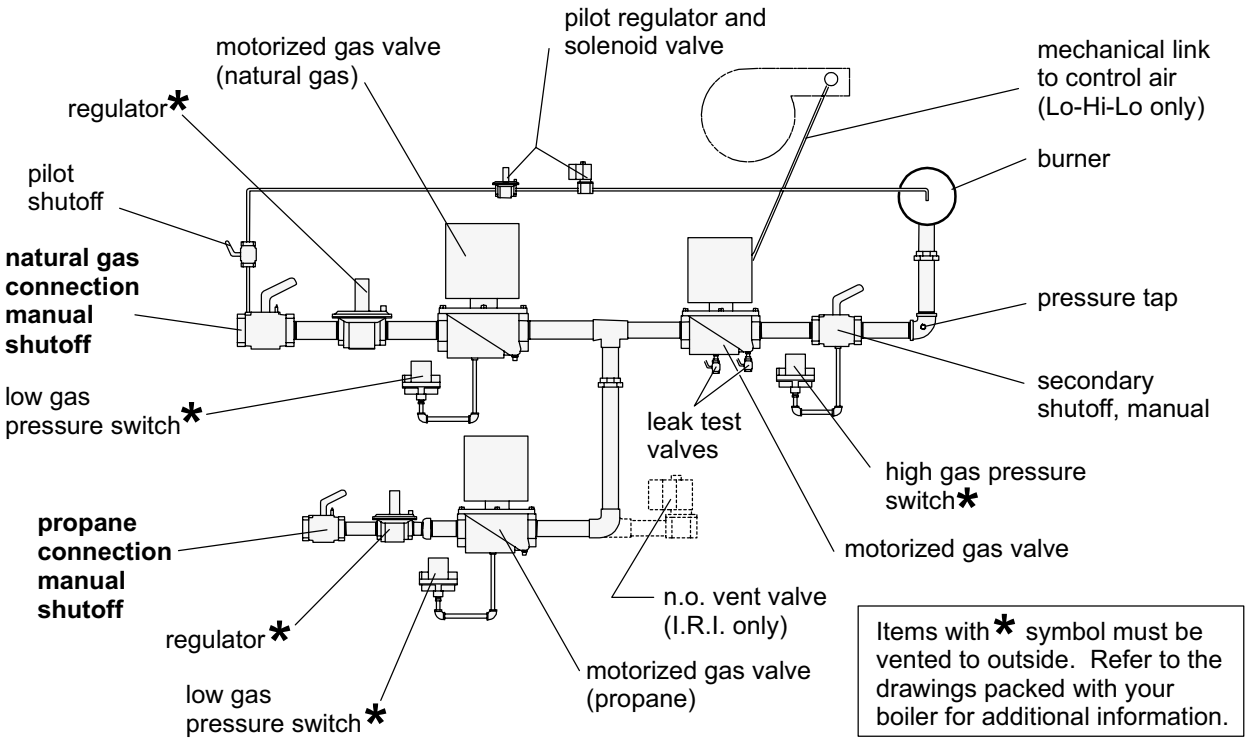


Figure 4-1 Piping Schematic for the Twin-Fuel Gas Train

4

4.0 INSTALLATION

Gas Train Connection Sizes		
	Natural Gas	Propane
700/1000/1200 Series	1 1/4"	1"
1500/1700/2000 Series	2"	1 1/4"

4.1 GENERAL

Installation of the twin-fuel Gemini™ boiler is similar to that of the single-fuel model. Refer to "Thermific® Gas-Fired Boiler - Installation and Owner's Manual - TBIG" pages 2 through 10.

The following procedures are **different** from those for the single-fuel model, and are described in this Section:

- Gas Piping

  Gas Bleeds and Vents
- Pre-Start Check List
- Pre-Start Safety Checks and Adjustments

  Test of Ignition Safety System

  Test of Low Water Cutoff

  Test of High Limit Control

  Test of Gas Pressure Switch

Gas Pressure Adjustment

Test of Motorized Gas Valves

4.2 GAS PIPING

Before making the gas hook-up, make sure the boiler is being supplied **only** with the fuels shown on the boiler nameplate. The boiler is designed to operate on **vaporized** natural gas and propane only. **Do not** use any type of liquid fuel. **Do not** attempt to fuel the boiler with MAPP gas, sewage gas, coal gas, or other fuels.

Gas train connection sizes are shown in the Gas Train Connection table on the previous page for the different models available.

The boiler shall be installed such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, control replacement, etc.).

The two gas pressure regulators supplied with the boiler are set during a factory fire-test to provide the proper pressure to the main burner: 6 inches W.C. inlet pressure to the regulators for both natural gas and propane.

The gas train components are designed to handle a maximum inlet pressure of 14 inches W.C.(1/2 psig). If the available gas pressure exceeds 14 inches W.C. on either the natural gas or propane supply a suitable intermediate gas pressure regulator of the "lock up" type must be provided to reduce the pressure to less than 14 inches W.C. All boilers are designed to operate at rated input with a minimum inlet pressure of 6 inches W.C. with natural gas, 6 inches W.C. with LP gas.

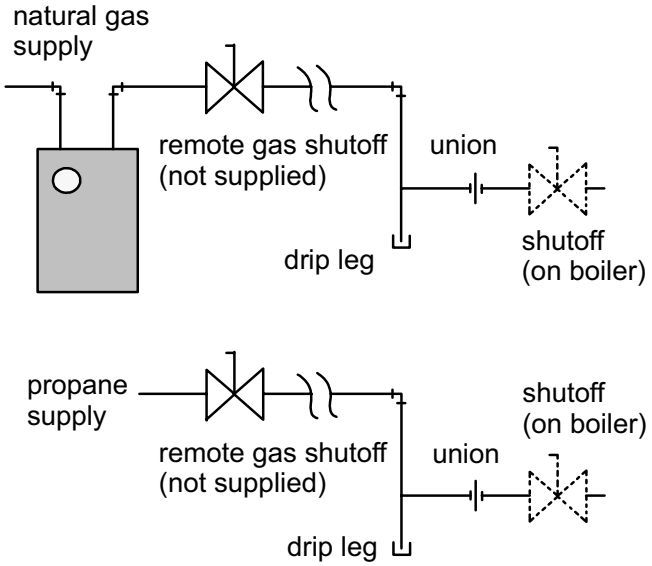


Figure 4-2 Gas Supply Piping
(Refer to table above for connection sizes.)

Install a sediment trap (drip leg) and a union connection ahead of the primary manual shutoff valves on the boiler as shown in the figure above.

All gas piping must be installed in accordance with National Fuel Gas Code, ANSI Z223.1, latest edition, and any other local codes which may apply; in Canada gas piping must be installed in accordance with CAN-B 149.

General Warning

Warning! All threaded connections must be made using a pipe compound that is resistant to the action of liquefied petroleum gases. Do not use Teflon™ tape on gas line threads.

The boiler and all gas piping connections must be pressure tested and must be checked for leaks before being placed into service. Test with compressed air or gas if possible.

The boiler must be disconnected at both boiler manual

shutoff valves (located at the end of the supplied gas train) from the gas and propane supply systems during any pressure testing of the system at pressures in excess of 1/2 psig (14 inches W.C.).

During any pressure testing of the gas supply piping system at pressures equal to or less than 1/2 psig (14 inches W.C.), the boiler should be isolated from the gas supply piping system by closing both manual shutoff valves.

Some leak test solutions, including soap and water, may cause corrosion. These solutions should be rinsed off with water after testing.

4.2.1 Gas Bleeds and Vents

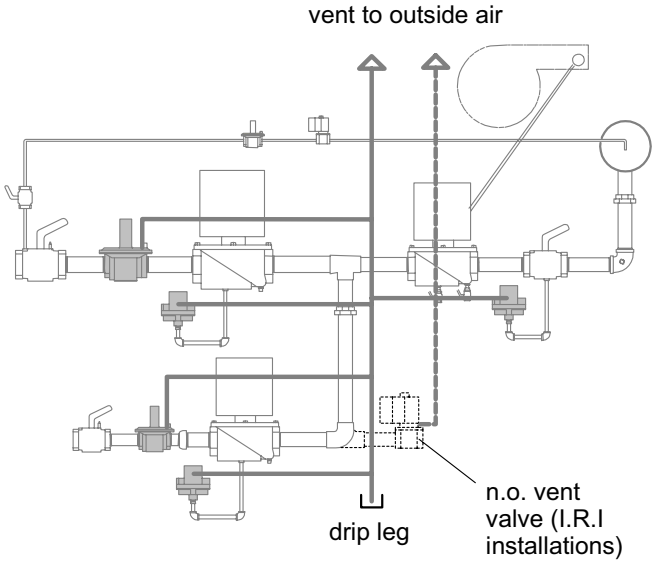


Figure 4-3 Schematic Diagram of Bleeds and Vents

Gas vents to outdoor air must be provided for the pressure regulators and gas pressure switches. **If approved** by authorities having jurisdiction, vents may be manifolded in accordance with accepted engineering practices to minimize backpressure.

The pilot regulator is equipped with a vent limiting device and does not require external venting!

If equipped for I.R.I. (Industrial Risk Insurers) the normally open vent valve must be vented independently from other vented devices, as shown above.

4.3 PRE-START CHECK LIST

Before firing the boiler make sure the following items have been completed.

1. Flue gas from the boiler is properly vented.
2. Gas connections have been made and the gas lines purged of air.
3. Water connections are complete, and the boiler and system have been filled and purged of air.
4. The boiler is connected to a 120 volt power source with a lockable disconnect (customer supplied) having adequate overload protection.
5. Combustion air openings are not obstructed in any way and have adequate capacity.
6. The boiler is placed the proper distance from any combustible walls, in accordance with the "Clearances" section of the “Installation and Owner’s Manual,” page 3.
7. Relief valves have been piped to floor drains.

4.4 PRE-START SAFETY CHECKS AND ADJUSTMENTS

Before placing the boiler in operation, perform all the following safety checks and adjustments. This work **must** be performed by qualified service personnel.

Warning! High voltage! Shock hazard. Properly lockout/tagout the electrical service and all other energy sources before working on or near the machine.

For testing control circuits **only,** the service power shutoff switch (located inside the auxiliary panel at the rear of the boiler) may be used to de-energize the system in lieu of normal lockout/tagout procedures. Use **extreme caution** when using this alternative.

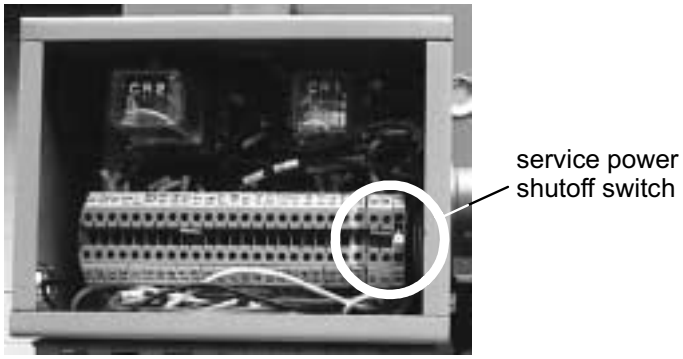


Figure 4-4 Service Power Shutoff Switch (located inside the auxiliary panel at the back of the boiler)

General Warning

Warning! After checking controls by manual readjustment, make sure they are always returned to their proper settings.

NEVER attempt to operate a boiler that has failed to pass all the safety checks outlined below.

4.4.1 Test of Ignition Safety System

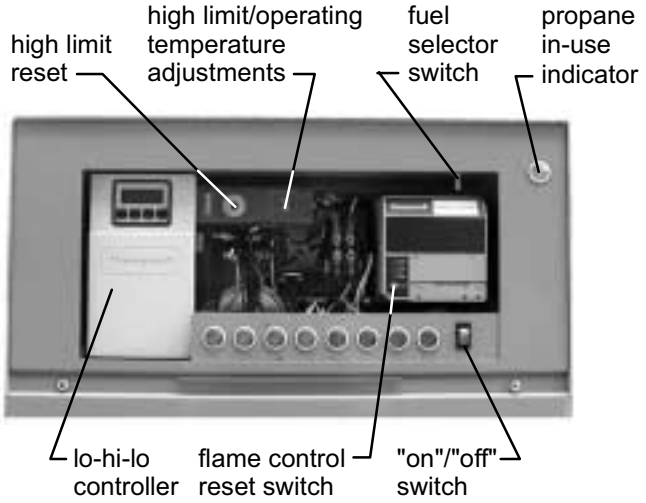


Figure 4-5 Lo-Hi-Lo Control Panel (faceplate opened)

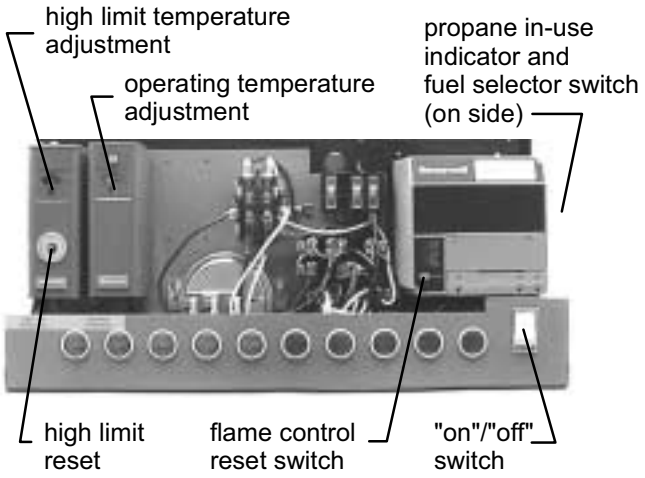


Figure 4-5a On-Off Control Panel (faceplate opened)

The boiler is provided with an ignition safety system.

1. Open the faceplate on the control panel. Disconnect wire # 17 (Lo-Hi-Lo) or # 26 (On-Off) at the terminal block on the control panel. Disconnecting this wire disables the main gas valve, ensuring that gas cannot flow during the test.
2. Turn on the circulating water pump. With the natural gas shutoff and secondary shutoff open and the pilot gas cock open, turn the operating temperature control until the boiler cycles "on."
3. Observe the operation of the boiler. After all the safety limits on gas pressure, water flow, and temperature are satisfied, the blower will run and prepurge the boiler. When air flow is established, the ignition transformer and pilot will operate. Both functions will be indicated by separate green lights on the control panel. If a satisfactory pilot is established, the green "Ignite" light will extinguish and the pilot will remain on, alone, for 10 seconds. After 10 seconds, the green "Main Gas" light will go on. (The main gas valve will not open with the wire disconnected and gas cannot flow to the burner). The "Pilot" will remain on, along with the "Main Gas," for another 10 seconds and then go out. Since the main flame cannot be burning, at this point there will be no flame signal and the flame safeguard programmer will assume a "Flame Failure" and will either re-cycle through the complete pre-purge and ignition cycle or, if in-

surance or local codes require, go to a "lockout" mode. Lockout will require manual reset of the flame safeguard.

4. After completing this test, turn off the boiler and reconnect the wire to the main gas valve. Replace the control panel faceplate.

4.4.2 Test of Low Water Cutoff

The boiler is furnished with a flow-switch-type low water cutoff in the outlet nozzle.

1. Make sure the boiler is off.
2. Turn the system pump off, stopping water flow in the system. Do not shut the pump off while the boiler is operating.
3. Turn the boiler back on. It should **not** operate, and a red indicator for "Low Water" or "Water Flow" should be illuminated.

Perform appropriate tests on any external probe-type low water cutoff.

4.4.3 Test of High-Limit Control

The boiler is furnished with a high-limit cut off.

1. With the main burner operating, turn down the temperature setting on the "high-limit" thermostat until the main burner shuts off. The high-limit switch must be reset manually after testing.

   This check should also be made for the "Operating Temperature" control. (The green "Heat" indicator will go out.) (See the “Installation and Owner’s Manual,” page 8 for Lo-Hi-Lo units.)
2. Readjust thermostats to desired operating temperature and set high-limit temperature, typically 20° F above operating temperature.

4.4.4 Test of Gas Pressure Switch

Figure 4-6 Gas Pressure Switch

The boiler is furnished with a low gas pressure switch.

1. Slowly close the manual shutoff valve (on the natural gas supply) while the burner is operating. The low gas pressure switch should shut down the main burner before combustion problems are encountered. When the gas pressure switch opens, the "Low Gas" or "Gas Press" indicator will illuminate.
2. Reopen the manual shutoff valve. The "Low Gas" or "Gas Press" indicator should remain on until the low gas pressure switch is reset.

4.4.5 Gas Pressure Adjustment

Figure 4-7 Regulator

The gas pressure is set initially during a factory fire-test. A final adjustment must be made after the boiler has been installed, as follows:

See rating plate for the minimum and maximum gas pressure of the boiler.

Each boiler is furnished with three plugged taps in the gas train for test gauge connections. Two taps are located at the natural gas and propane manual shutoff valves and are for measuring the gas supply pressure (1/4" I.P.S.). The supply pressure during main burner operation must be greater than the minimum indicated on the rating plate (6 inches W.C. for natural gas, 6 inches W.C. for propane). The remaining tap is located downstream from the secondary manual shutoff valve at the elbow where the gas line enters the back of the cabinet and is for measuring the manifold gas pressure (1/8" I.P.S.).

If a replacement Lo-Hi-Lo actuator is required, follow manufacturer's instructions and pre-set the "Lo" fire setting of the actuator the same as the original actuator. This must be performed by qualified service personnel.

To adjust gas pressure, first connect an appropriate pressure-sensing device at the manifold tap, then remove seal cap from regulator. Turn adjusting screw clock-wise to increase pressure, counter-clockwise to decrease pressure. The manifold gas pressure on the "Rating Plate," affixed to the back of the cabinet, is provided only as a guide to the proper setting. The manifold gas pressure indicated on the "Factory Fire-test" label (affixed to the back of the cabinet) should be used to achieve the proper firing rate of the individual boiler as installed. Replace seal cap after adjustment.

4.4.6 Leak Testing of Valves

Annually test for by-pass leaks on all motorized gas valves. If gas flows when the motorized gas valve is closed it is defective.

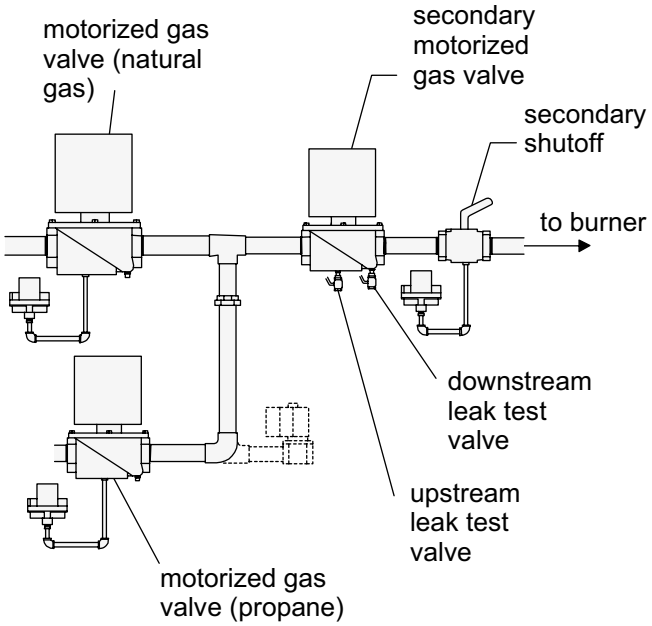


Figure 4-8 Leak Testing of Valves

Each branch of the gas train must be tested separately, as follows:

1. **Open** the natural gas connection manual shutoff. **Close** the propane connection manual shutoff. (Refer to Figure 4-1.)
2. Close the secondary shutoff (downstream of all motorized valves).
3. Attach a short piece of hose to the **downstream**

leak test valve. (Refer to Figure 4-8 above.) Insert the free end of the hose in a cup of water.

4. Open the downstream leak test valve and check for bubbles in the hose. If there are no bubbles the secondary motorized gas valve is OK. If there are bubbles, replace the valve.
5. Attach the hose to the **upstream** leak test valve.
6. Open the upstream leak test valve and check for bubbles in the hose. If there are no bubbles the natural gas motorized gas valve is OK. If there are bubbles, replace the valve.

To test the propane branch of the gas train, **open** the propane connection manual shutoff. **Close** the natural gas connection manual shutoff. Then repeat steps 5 - 6 above.

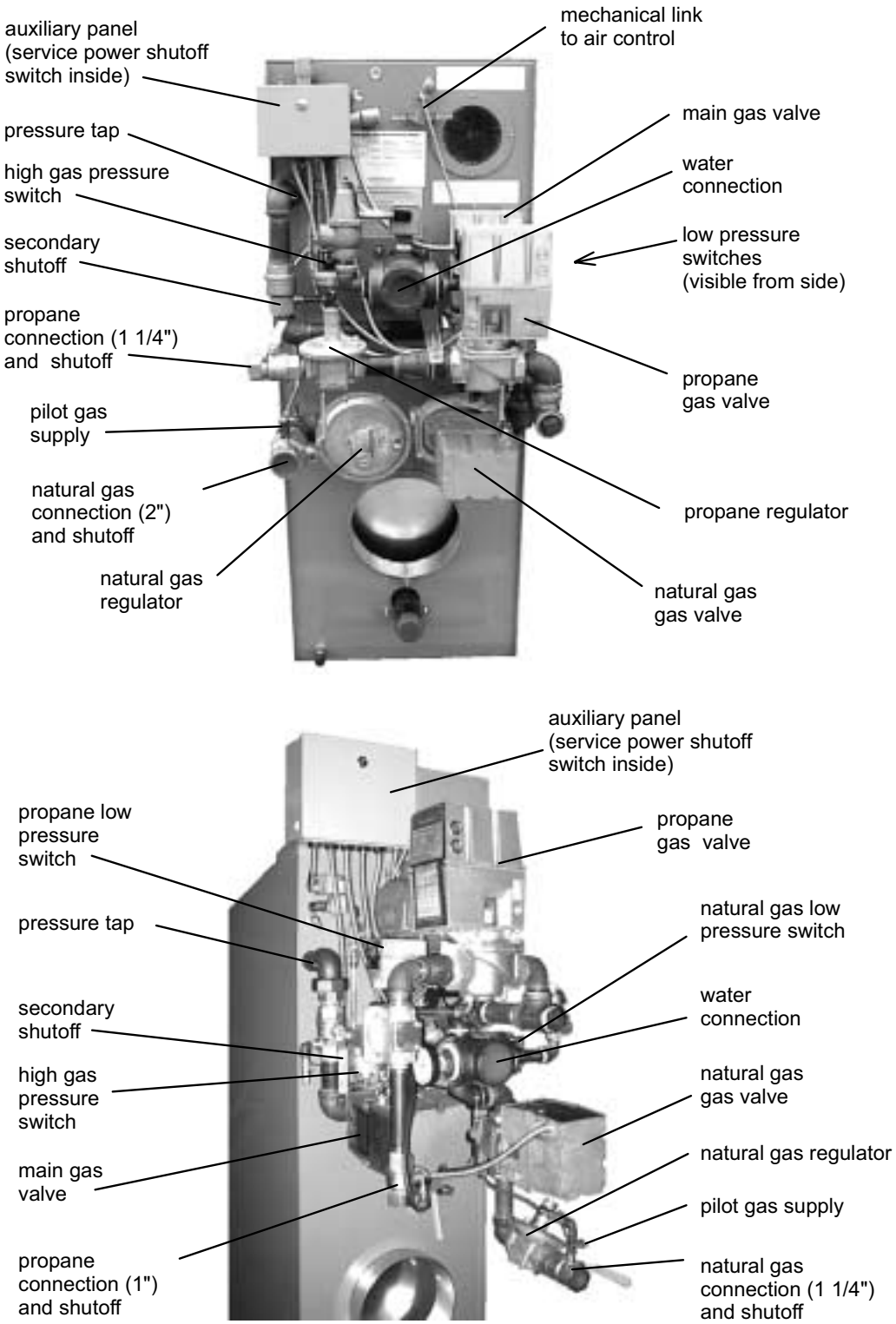


Figure 5-1 Twin-Fuel Gas Train
(Top photo shows 1500/1700/1900 series; bottom shows 700/900/1200 series)

5

5.0 OPERATION

5.1 GENERAL

The basic operation and control functions of the Gemini™ twin-fuel gas boiler are similar to the single-fuel models.

5.1.1 Tests

Safe lighting and other performance criteria were met with the gas manifold and control assembly provided on this boiler when the boiler underwent tests specified in ANSI Z21.13, latest edition, or CAN 1-3.1 in Canada. (See "Factory Firetest" label.)

5.1.2 Starting System

Do not use this boiler if any part has been under water. Immediately call a qualified service technician to inspect the boiler and to replace any part of the control system and any gas control which has been under water.

5.2 LIGHTING AND SHUT-DOWN PROCEDURES

5.2.1 Lighting Procedures

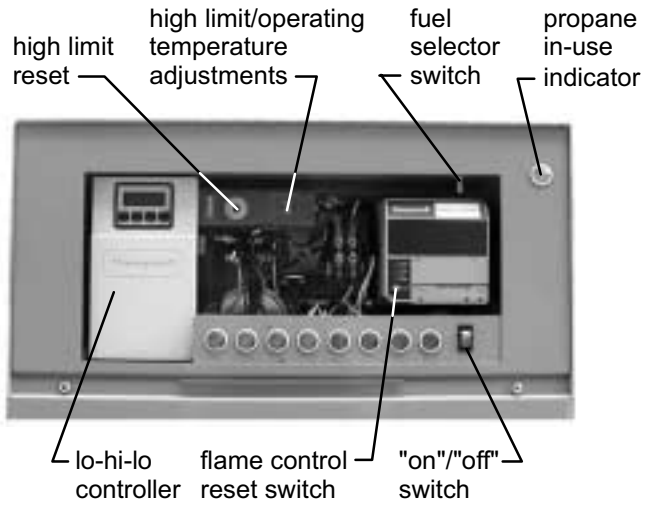


Figure 5-2 Lo-Hi-Lo Control Panel

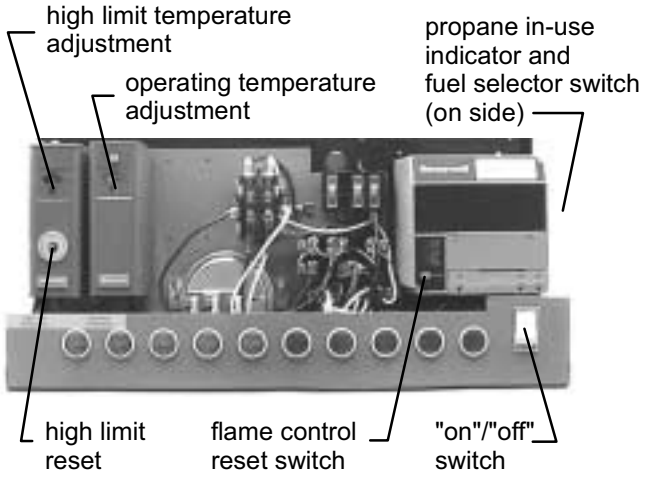


Figure 5-2a On-Off Control Panel

1. Close main (natural gas and propane) and pilot shutoffs.
2. Turn the On/Off switch to "OFF" position.
3. Wait 5 minutes.
4. Open main (natural gas and propane) and pilot shutoffs.
5. Turn the On/Off switch to "ON" position.
6. Push reset button on flame safeguard programmer control.
7. Push reset on low gas pressure switch (and high pressure gas switch if applicable).
8. Check to be sure that pilot has been established.

The controller will now complete the automatic firing sequence.

5.2.2 Normal Shut-Down Procedures

1. Close all manual gas shutoffs.
2. Turn off electric power.

5.2.3 Emergency Shut-Down

Natural gas, propane, and pilot gas shutoff valves on the boiler must be closed immediately if an emergency situation occurs.

If overheating occurs or the gas supply fails to shut off at the boiler, to reduce the possibility of an electrical arc, **do not** turn off or disconnect **any** electrical supply. Instead, shut off the **gas supplies** remote from the boiler.

5.3 SWITCHOVER TO PROPANE OPERATION

Switchover from natural gas to propane is made **manually**, as follows:

1. Turn the fuel selector switch located on the main control panel from natural gas to propane.

   The boiler will go through a complete shutdown and restart procedure when the fuel source is changed.

If the changeover is controlled by a **remote signal,** the switch on the auxiliary control panel should be set at "Automatic" for both natural gas and propane operation; operation of the remote switch will change the fuel source.

During natural gas service interruptions or restrictions, sufficient natural gas is usually available to operate the pilot. In the event of complete failure of the natural gas supply, contact Patterson-Kelley at (570) 421-7500 for assistance.

General Warning

Warning! In the event of low pressure in either the natural gas or propane supply the higher pressure gas could backfeed into the lower pressure line. This could result in unsafe operation of other devices connected to the higher pressure supply.

Always shut off the gas cock to a line which exhibits low pressure.

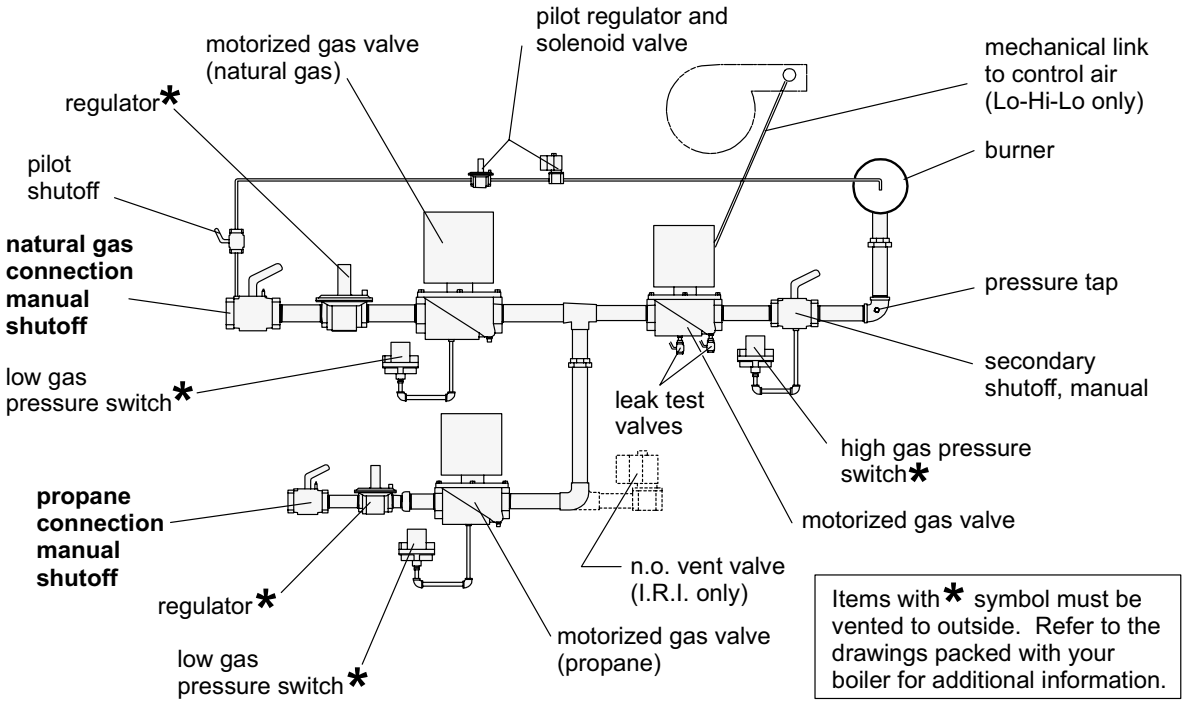


Figure 7-1 Piping Schematic for the Twin-Fuel Gas Train

7

7.0 MAINTENANCE

7.1 GENERAL

Warning! High voltage! Shock hazard. Properly lock-out/tagout the electrical service and all other energy sources before working on or near the machine.

For testing control circuits **only,** the service power shutoff switch (located inside the auxiliary panel) may be used to de-energize the system in lieu of normal lockout/tagout procedures. Use **extreme caution** when using this alternative.

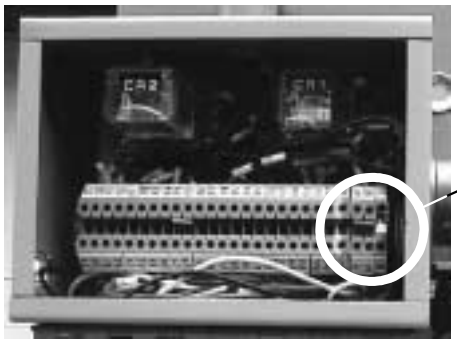


Figure 7-2 Service Power Shutoff Switch (located inside the auxiliary panel at the back of the boiler)

Maintenance of the twin-fuel gas boiler is similar to that of the standard model. Refer to pages 11 through 14 of the "Installation and Owner's Manual - TBIG."

In the case of the twin-fuel boiler, the phrase “main gas cock” or “main gas valve” as used in the “Installation and Owner’s Manual” applies to the manual shut-offs for **both** the natural gas and propane supplies.

7.2 SEQUENCE OF OPERATION

Status (red and green) indicators located on the front of the control panel of this boiler are specifically designed to indicate the sequence of operations and the cause of common problems. Careful observation of indicators should provide a guide to most operational conditions and problems.

Refer also to the wiring diagrams in Section 8.

The sequence of operation for the twin-fuel model differs slightly from the standard model:

1. When the On/Off (main power) switch is turned on, a green indicator marked "Power" or the amber switch is illuminated. Power is applied through a series of normally closed limit switches, including water flow, gas pressure, and high temperature, and through the operating temperature control to the flame-safeguard programmer.
2. The water flow limit switch is closed when there is adequate water flow through the boiler.
3. When adequate gas pressure is available, the low gas-pressure limit switch is closed. Manual reset is required following conditions resulting in low gas pressure.
4. If the temperature sensed by the high-limit temperature control is below the set limit, the normally closed position of the switch sends power to the operating temperature control. Manual reset is required following conditions exceeding high-temperature limit. The limit series is complete unless an external control is placed ahead of the water flow limit (replacing the red jumper wire).
5. When heat is required, as indicated by outlet water temperature, power is applied to Terminal 6 of the programmer, which initiates the burner operating sequence, and to an indicator marked "Heat."
6. The programmer first energizes Terminal 4 which supplies power to the contactor for the blower motor and the air flow switch, which initially shows low air flow with the "LowAir" indicator. This indicator will remain on until sufficient air flow is sensed.
7. A time delay of 10 seconds (standard) or 30 seconds (depending on insurance or local code requirements) occurs after the air proving switch closes and the programmer signals a continuation of the start sequence. During this time period the combustion chamber is pre-purged to eliminate any residual combustible gas or combustion products.
8. A 10-second "trial-for-ignition" period is initiated with both Terminals 10 and 8 being energized. Terminal 10 of the programmer powers the ignition transformer and the "Ignite" indicator. The transformer output creates a spark at the igniter. Terminal 8 powers the pilot gas valve and the indicator for "Pilot."
9. When a pilot flame is detected by the flame rod, a signal is sent to Terminal F in the programmer. Terminal 10 is de-energized shutting off the spark ignition and the pilot remains on for ten seconds during the flame establishing period.
10. After the flame establishing period, Terminal 9 is energized, which opens the motorized main gas valve and the motorized gas valve to the fuel supply in use and lights the "Main Gas" indicator. The boiler fires. After ten seconds, Terminal 8 is de-energized and the pilot valve and indicator light are extinguished.

    An auxiliary panel prevents the motorized gas valves for natural gas and propane to be open at the same time.

    Lo-Hi-Lo: When Terminal 9 is energized, the Lo-Hi-Lo valve will be maintained in the low fire position for "low fire start" for ten seconds. If the operating temperature control calls for high fire, the programmer will initiate high fire (Terminal 21) at the same time the pilot valve and indicator is de-energized.

    A power failure during operation closes all motorized gas valves and shuts down the boiler. When power is restored the controller recycles to Step 1;

all steps and safety checks are repeated. The motorized gas valves cannot reopen in the absence of ignition.

11. When the desired water temperature is reached, the operating control switch opens and the programmer is de-energized at Terminal 6 and the indicator for "Heat" is turned off. This action also de-energizes Terminal 9, thus closing both main gas valves and turning off the indicator for "Main Gas."
12. When the water temperature is reduced by the load on the system, the operating control switch will close again. The operating sequence will recycle to step 5, provided that the limits on water flow, gas pressure, and high temperature are all met.

8.0 PARTS AND TECHNICAL SUPPORT

Spare parts and replacement parts can be ordered from Patterson-Kelley by calling (570) 421-7500. Ask for the Boiler Department. The fax number is (570) 476-7247. Refer to the parts list shown on the assembly drawing provided with this manual.

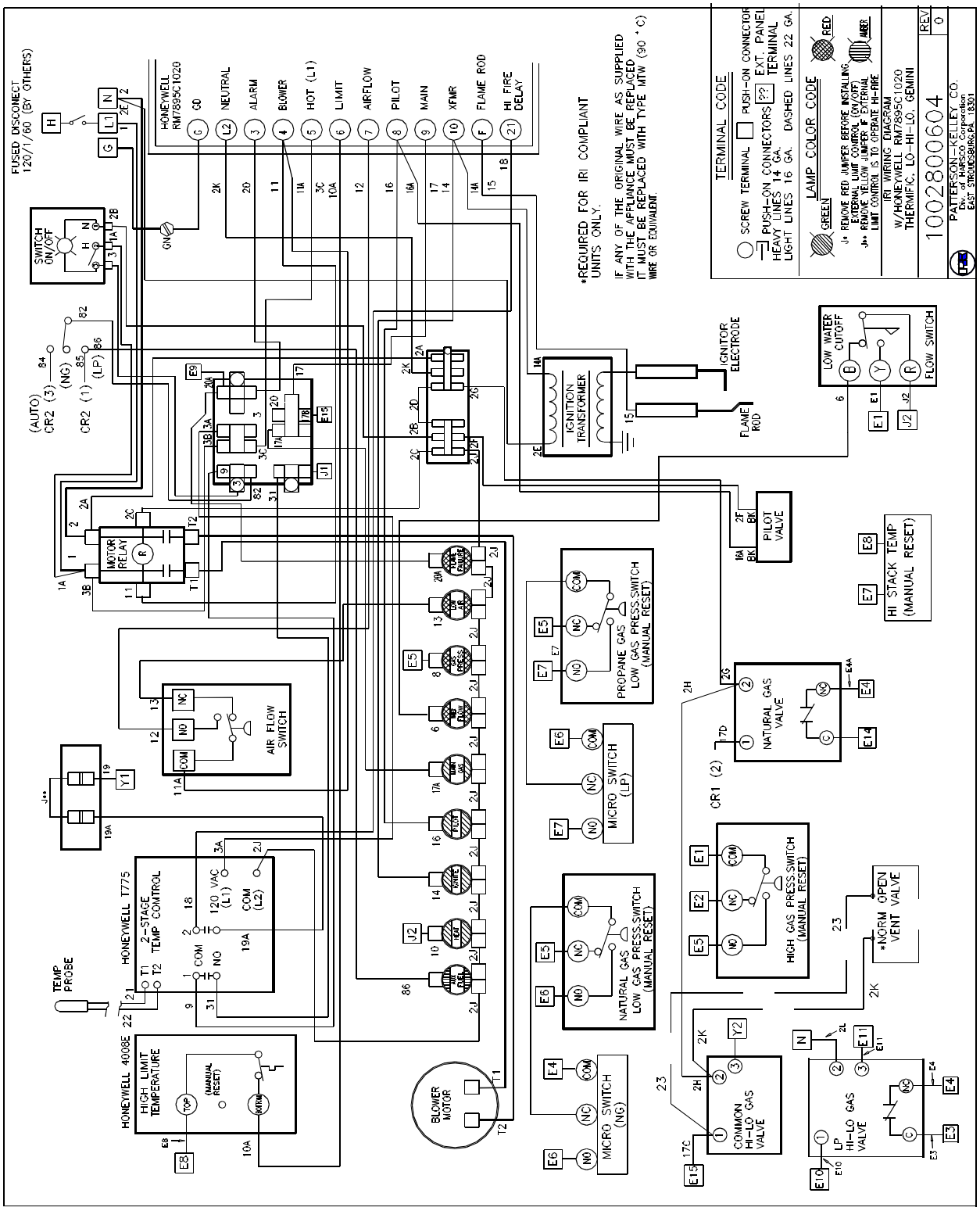
Technical information is also available at the above number.

Before calling, please have the model number and serial number of your boiler available.

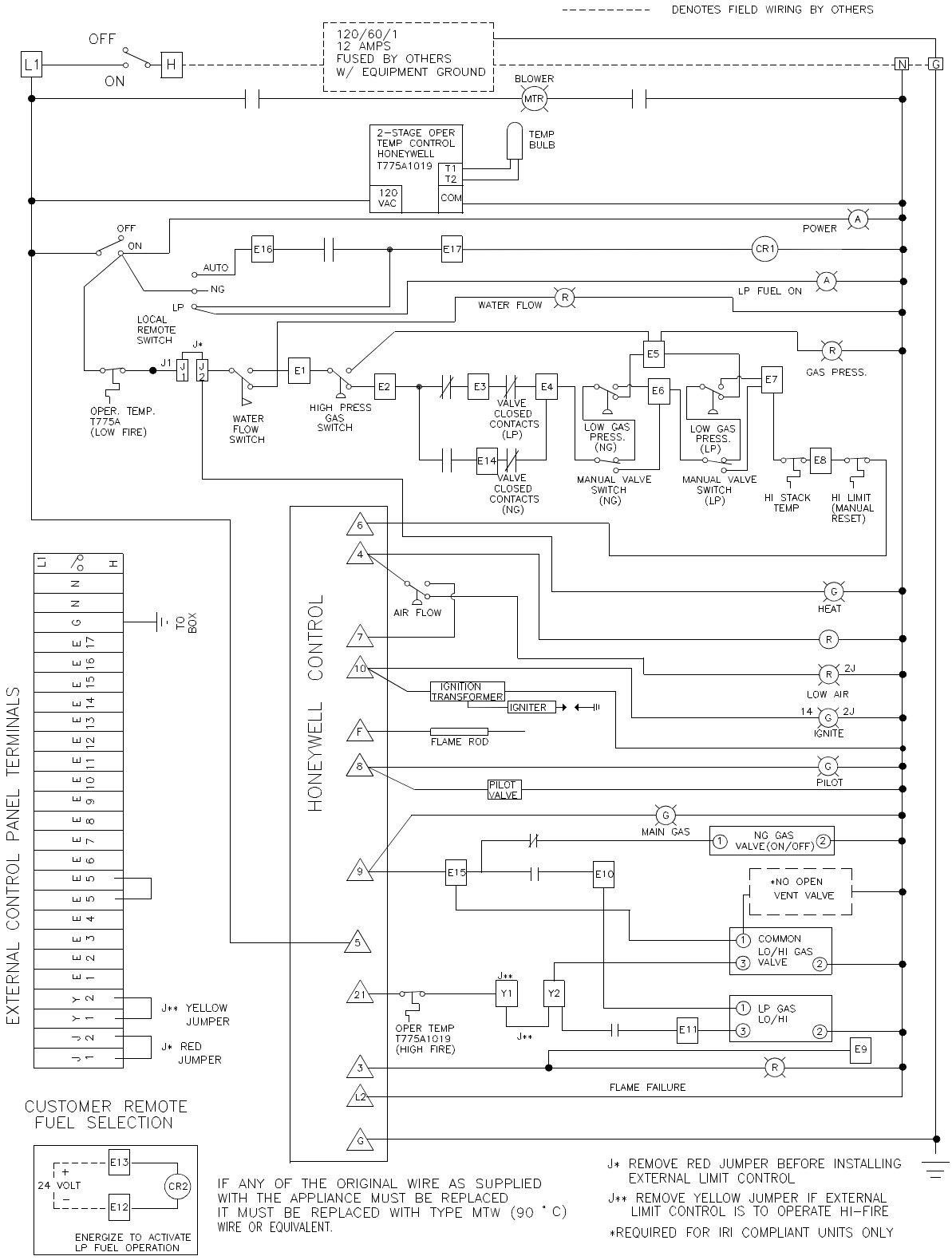
8.1 WIRING DIAGRAMS

Wiring and control schematic drawings are shown on the following pages.

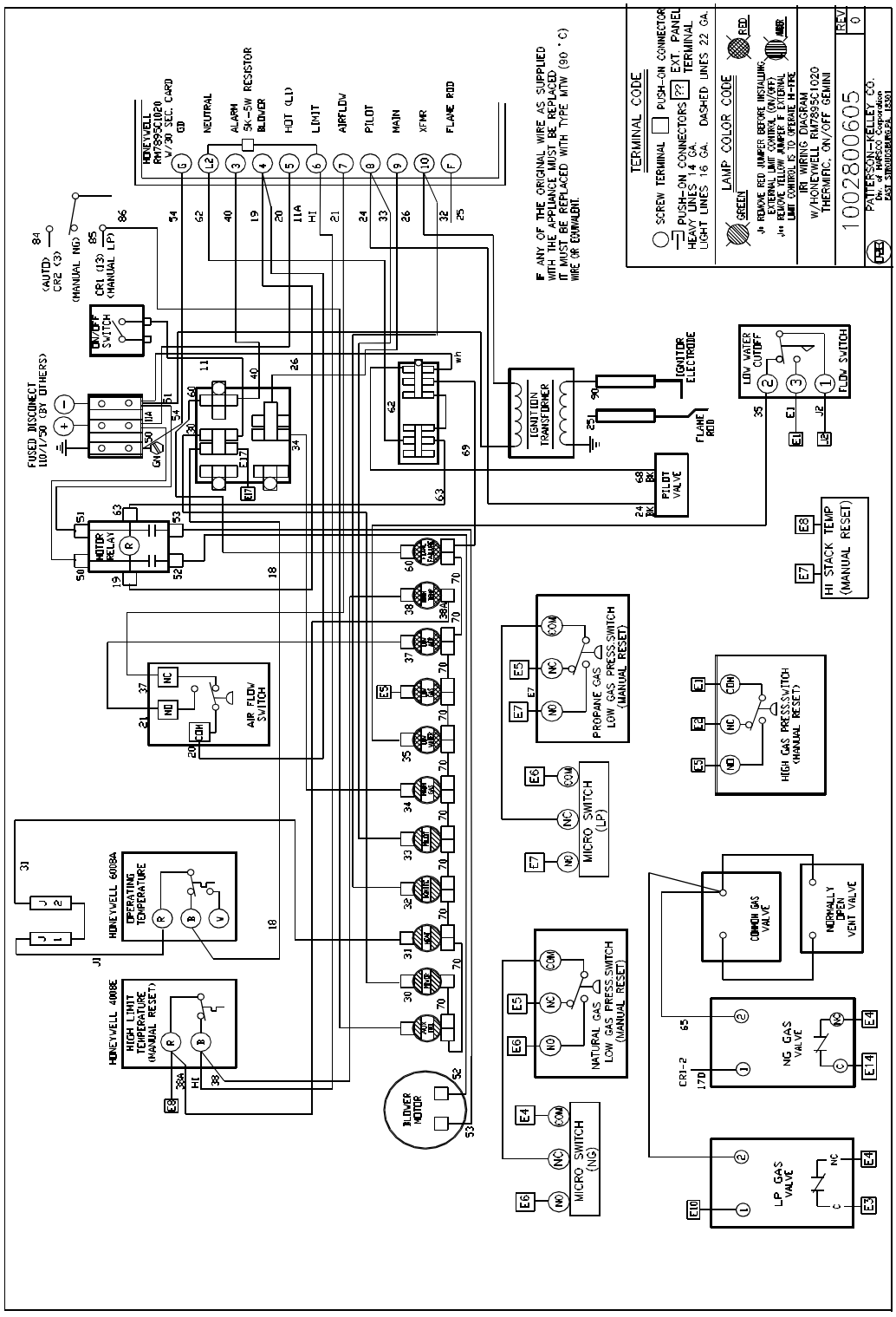
8.1.1 Wiring Diagram (Lo-Hi-Lo)



8.1.2 Control Logic Diagram (Lo-Hi-Lo)



8.1.3 Wiring Diagram (On-Off)



8.1.4 Control Logic Diagram (On-Off)