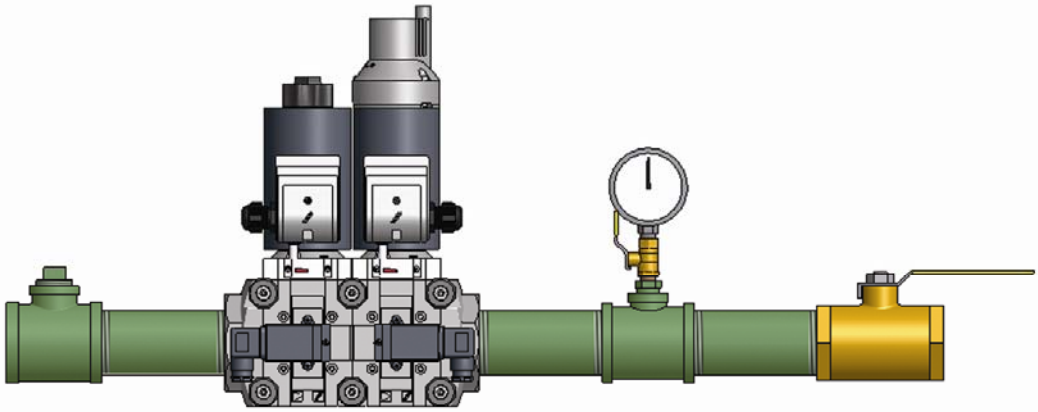
PGM PREPIPED GAS MANIFOLD



WARNING

These instructions are intended for use only by experienced, qualified combustion start-up personnel. Adjustment of this equipment and its components by unqualified personnel can result in fire, explosion, severe personal injury, or even death.

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WARNING

This equipment is potentially dangerous with the possibility of serious personal injury and property damage. Hauck Manufacturing Company recommends the use of flame supervisory equipment and fuel safety shutoff valves. Furthermore, Hauck urges rigid adherence to National Fire Protection Association (NFPA) standards and insurance underwriter's requirements. Operation and regular preventative maintenance of this equipment should be performed only by properly trained and qualified personnel. Annual review and upgrading of safety equipment is recommended.

A. GENERAL INFORMATION

The Hauck Prepiped Gas Manifold (PGM) is a factory-assembled, prepiped gas train that permits easy, fast installation. Hauck PGM is designed to meet National Fire Protection Association (NFPA) standards as well as stand up to the adverse conditions commonly experienced at many industrial, rotary drying and asphalt plants. The PGM not only satisfies the need for a prepiped manifold that adheres to recommended component and piping practices, but also assists in meeting the system requirements commonly necessary for installation approval. The 2100, 3100, and 6100 series PGMs will service any clean fuel gas up to **8.5 psig (58.6 kPa)**; the 2400 and 6400 Series PGMs will service up to **7.25 psig (50.0 kPa)**.

The PGM consists of several components:

COMPONENT	FUNCTION
Low Gas Pressure Switch	Notify combustion control system that gas pressure has gone below recommended gas pressure; shut down burner. Wired normally open.
Main Fuel Safety Shutoff Valve	Provide positive automatic shutoff of gas and accommodate proof of closure switches and visual indication of valve position.
Vent Valve (Optional)	Normally open solenoid piped between the main and blocking safety shutoff valves. This valve will vent gas when both safety shutoff valves are de-energized.
Blocking Fuel Safety Shutoff Valve (Not part of 6000 Series PGM)	Provide positive automatic shutoff of gas and accommodate proof of closure switches and visual indication of valve position.
High Gas Pressure Switch	Notify combustion control system that gas pressure has exceeded a safe operating pressure; shut down burner. Wired normally closed.
Gas Pressure Gauge	Display gas pressure during initial set-up and operation
Outlet Shutoff Valve	Provide manual shutoff of gas on outlet side of PGM. Allow leak testing of the shutoff valves and servicing of components downstream of manifold.

Table 1. PGM Components

Additional upstream components required in the fuel gas supply system per NFPA are available as prepiped regulator gas manifolds (RGMs) which include an equipment isolation valve, sediment trap, strainer, fuel gas regulator, and overpressure protection.

B. RECEIVING & INSPECTION

Upon receipt, check each item on the bill of lading and/or invoice to determine that all equipment has been received. A careful examination of all parts should be made to ascertain if there has been any damage in shipment.

IMPORTANT

If the installation is delayed and the equipment is stored outside, provide adequate protection as dictated by climate and period of exposure. Special care should be given to all motors and bearings, if applicable, to protect them from rain or excessive moisture.

C. CAPACITIES

	2000 SERIES			
	2100 (MAXON)		2400 (KROMSCHRODER)	
CONNECTION SIZE	(scfh)	C_v	(scfh)	C_v
3/4 NPT	2,100	9.7	1,480	6.8
1 NPT	2,540	11.7	2,810	13.0
1-1/4 NPT	4,990	23.0	3,690	17.0
1-1/2 NPT	6,570	30.2	5,930	27.3
2 NPT	10,420	48.0	7,110	32.7
2-1/2 NPT	16,440	75.6	13,840	63.6
3 NPT	22,860	105	19,760	90.9
4" FLG	51,710	238	30,090	138
6" FLG	66,300	305	47,030	216

	6000 SERIES			
	6100 (MAXON)		6400 (KROMSCHRODER)	
CONNECTION SIZE	(scfh)	C_v	(scfh)	C_v
3/4 NPT	2,490	11.5	1,910	8.8
1 NPT	3,270	15.0	3,500	16.1
1-1/4 NPT	5,960	27.4	4,710	21.7
1-1/2 NPT	8,190	37.7	7,530	34.6
2 NPT	12,730	58.6	9,350	43.0
2-1/2 NPT	22,280	102	15,280	70.3
3 NPT	30,610	141	24,170	111
4" FLG	63,480	292	37,370	172
6" FLG	100,600	462	60,280	277

Notes:

1. 2000 Series PGMs meet NFPA requirements for single burner or unison light-off multiple burner industrial applications and have dual safety shutoff valves.

2. 6000 Series PGMs meet NFPA requirements for multiple burner industrial applications and have a single safety shutoff valve. In addition, a single safety shutoff valve with proof of closure and visual indication is required at each burner in a multiple burner application, and special features are required in the associated control system (see Hauck Application Sheet GJ76).

3. Flange connections are ANSI 125 lb rated flanges.

4. Electrical enclosure rating of the safety shutoff valve actuator is NEMA 4 for 2100 and 6100 Series PGMs, and IP 65 for 2400 and 6400 Series PGMs.

5. Maximum inlet pressure to the 2100 and 6100 Series PGMs is **8.5 psig**, and for the 2400 and 6400 Series PGMs is **7.25 psig**.

6. Flow based on natural gas with 0.59 s.g., 60°F, **2 psig** inlet pressure and **0.5 psig** pressure drop through the PGM; consult Hauck for different application conditions.

7. To calculate Btu/hr throughput, multiply natural gas flow in scfh by actual higher heating value (HHV) in Btu/ft^3.

C. CAPACITIES (Continued)

	2000 SERIES			
	2100 (MAXON)		2400 (KROMSCHRODER)	
CONNECTION SIZE	(nm^3/hr)	C_v	(nm^3/hr)	C_v
3/4 NPT	56.3	9.7	39.6	6.8
1 NPT	68	11.7	75.3	13.0
1-1/4 NPT	134	23.0	98.8	17.0
1-1/2 NPT	176	30.2	159	27.3
2 NPT	279	48.0	190	32.7
2-1/2 NPT	440	75.6	371	63.6
3 NPT	612	105	529	90.9
4" FLG	1,390	238	806	138
6" FLG	1,780	305	1,260	216

	6000 SERIES			
	6100 (MAXON)		6400 (KROMSCHRODER)	
CONNECTION SIZE	(nm^3/hr)	C_v	(nm^3/hr)	C_v
3/4 NPT	66.7	11.5	51.2	8.8
1 NPT	87.6	15.0	93.8	16.1
1-1/4 NPT	160	27.4	126	21.7
1-1/2 NPT	219	37.7	202	34.6
2 NPT	341	58.6	250	43.0
2-1/2 NPT	597	102	409	70.3
3 NPT	820	141	647	111
4" FLG	1,700	292	1,000	172
6" FLG	2,690	462	1,610	277

Notes:

1. 2000 Series PGMs meet NFPA requirements for single burner or unison light-off multiple burner industrial applications and have dual safety shutoff valves.

2. 6000 Series PGMs meet NFPA requirements for multiple burner industrial applications and have a single safety shutoff valve. In addition, a single safety shutoff valve with proof of closure and visual indication is required at each burner in a multiple burner application, and special features are required in the associated control system (see Hauck Application Sheet GJ76).

3. Flange connections are ANSI 125 lb rated flanges.

4. Electrical enclosure rating of the safety shutoff valve actuator is NEMA 4 for 2100 and 6100 Series PGMs, and IP 65 for 2400 and 6400 Series PGMs.

5. Maximum inlet pressure to the 2100 and 6100 Series PGM's is **58.6 kPa**, and for the 2400 and 6400 Series PGMs is **50 kPa**.

6. Flow based on natural gas with 0.59 s.g., 0°C, **13.8 kPa** inlet pressure and **3.4 kPa** pressure drop through the PGM; consult Hauck for different application conditions.

7. To calculate kW throughput, multiply natural gas flow in nm^3/hr by actual lower heating value (LHV) in MJ/nm^3, then multiply by 0.278 kW•hr/MJ.

C. CAPACITIES (Continued)

	3100 (MAXON)	
CONNECTION SIZE	SCFH	C_v
2 NPT	20,000	47.7
2-1/2 NPT	31,880	76.1
3 NPT	43,810	105
4" FLG	101,100	241
6" FLG	134,200	320
6" X FLG	224,100	535

Notes:
1. 3100 Series PGMs meet NFPA requirements for single burner asphalt applications and have dual automatic safety shutoff valves.

2. Flange connections are ANSI 125 lb rated flanges.

3. Electrical enclosure rating of the safety shutoff valve actuator is NEMA 4 for all 3100 Series PGMs.

4. Maximum inlet pressure to 3100 Series PGM is **15 psig**.

5. Flow based on natural gas with 0.59 s.g., 60°F, **5 psig** inlet pressure and **1.5 psig** pressure drop through the PGM; consult Hauck for different application conditions.

6. To calculate Btu/hr throughput, multiply natural gas flow in scfh by actual higher heating value (HHV) in Btu/ft^3.

METRIC CAPACITIES

	3100 (MAXON)	
CONNECTION SIZE	(nm^3/hr)	C_v
2 NPT	536	47.7
2-1/2 NPT	854	76.1
3 NPT	1,170	105
4" FLG	2,710	241
6" FLG	3,590	320
6" X FLG	6,000	535

Notes:
1. 3100 Series PGMs meet NFPA requirements for single burner asphalt applications and have dual automatic safety shutoff valves.

2. Flange connections are ANSI 125 lb rated flanges.

3. Electrical enclosure rating of the safety shutoff valve actuator is NEMA 4 for all 3100 Series PGMs.

4. Maximum inlet pressure to 3100 Series PGM is **103 kPa**.

5. Flow based on natural gas with 0.59 s.g., 0°C, **34.5 kPa** inlet pressure and **10.3 kPa** pressure drop through the PGM; consult Hauck for different application conditions.

6. To calculate kW throughput, multiply natural gas flow in nm^3/hr by actual lower heating value (LHV) in MJ/nm^3, then multiply by 0.278 kW•hr/MJ.

D. DIMENSIONS

See appropriate Dimension sheet for detailed dimensional information.

E. INSTALLATION

1. Prepare an area to install the manifold. Ideally, make provisions to isolate the manifold from plant or equipment vibration by installing a flexible connection between the manifold and the connection to the equipment being supplied with gas. The manifold should be mounted close enough to the burner(s) that the gas will be delivered to the burner before the trial for ignition times out in the combustion control system. The PGM must be leveled when installed.

> **CAUTION**
> All new installations should have an equipment isolation valve, sediment trap, strainer, fuel gas regulator, and overpressure protection installed upstream of the PGM to protect the safety shutoff valves from foreign material and over pressurization of downstream components. These components are available in a prepiped regulator gas manifold (RGM); consult Hauck.

2. Before making any connection to the PGM, have the main gas supply line purged. Purge the line long enough to remove any debris that may be in the line.

> **WARNING**
> If the gas line is not properly purged, debris can get into the safety shut-off valves. If this occurs, the shut-off valves may not fully close.

3. Fabricate and/or install a support structure for the manifold. Typically, if the installation location permits, the manifold can be supported by a rack below it or held up by a structure above the manifold. Hauck does not recommend installing a PGM without a support structure.

> **NOTE**
> When installing the manifold, the position indication windows on safety shut-off valves must be visible to operators. If the position indication windows are not visible, consult Hauck.

4. Once purged and properly supported, remove any inlet covers from the manifold and connect the inlet of the PGM to the gas supply line. For flanged connections, verify that a gasket is present between the supply flange and the inlet flange. Tighten all bolts on the flange. For threaded connections, use a suitable pipe sealant and tighten the supply connection to the manifold inlet. Hauck recommends the use of a high quality thread sealant with teflon (Loctite 565 or equal) for natural gas and propane gas service.

> **NOTE**
> When using a teflon based pipe sealant, avoid over-engagement of connections. Teflon will reduce the friction on the pipe threads and multiply the force when pipes are tightened. Valves, fittings and pipe can crack when over-engaged.

5. Connect the outlet of the PGM to the burner gas inlet or other appropriate connection. See Figure 1 for typical gas piping layouts.

6. When the PGM piping connections are complete, begin wiring the electrical components on the manifold. Consult the external wiring diagrams specific to your system for connection points. Be sure to use dust and water tight fixtures for electrical connections. In general, the following connections will be present:

Low Gas Pressure Switch
Main Valve Power & Neutral
Main Valve Proof Of Closure
Vent Valve Power & Neutral (If Applicable)
Blocking Valve Power & Neutral (If Applicable)
Blocking Valve Proof Of Closure (If Applicable)
High Gas Pressure Switch
Valve Open Switch (If Applicable)

7. Upon completing the piping and electrical connections, the manifold should be leak tested with compressed air or an inert gas.

CAUTION
Do not use water or the intended fuel gas to leak test the PGM.

a. First, close the gas cock to the pressure gauge and the manual shut-off valves on the up and downstream sides of the PGM.
b. Remove the pipe plug on the upstream side of the manifold and energize the shut-off valves.
c. Pressurize the manifold with compressed air through the opening made in step b.

CAUTION
Do not exceed **8.5 psig (58.6 kPa)** when leak testing 2100, 3100, and 6100 Series PGMs. **EXCEPTION:** Do not exceed **7.25 psig (50.0 kPa)** when leak testing 2400 and 6400 Series PGMs.

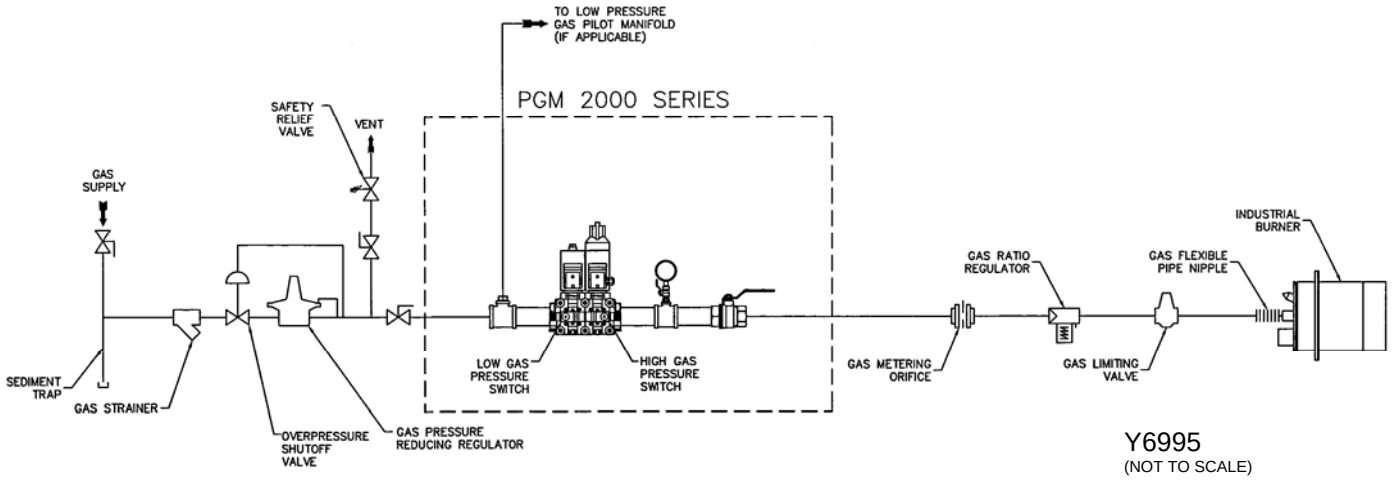
d. Once the PGM is pressurized, the manifold should be leak tested according to accepted practices. One method is to spray a solution of dishwashing liquid and water over all connection points and observe if any bubbles appear. Bubbles will indicate leaks. If any leaks appear, immediately repair them. Repeat the leak test until all leaks are repaired. Consult the local Gas Company for other leak test methods if necessary.

8. When all leaks are repaired, initially set the low gas pressure switch to **0.5 psig (3.4 kPa)** (upstream side of manifold). Then, initially set the high gas pressure switch to **2 psig (13.8 kPa)** (downstream side of manifold). Before subjecting the manifold to the fuel gas, cycle the automatic shut-off valves 10 times to prepare the seat and disk for operation. For asphalt or aggregate drying applications, initially set the low gas pressure switch to **0.5 psig (3.4 kPa)** and set the high gas pressure switch to **5 psig (34.5 kPa).** Open the gas cock and shutoff valves closed in step 7.

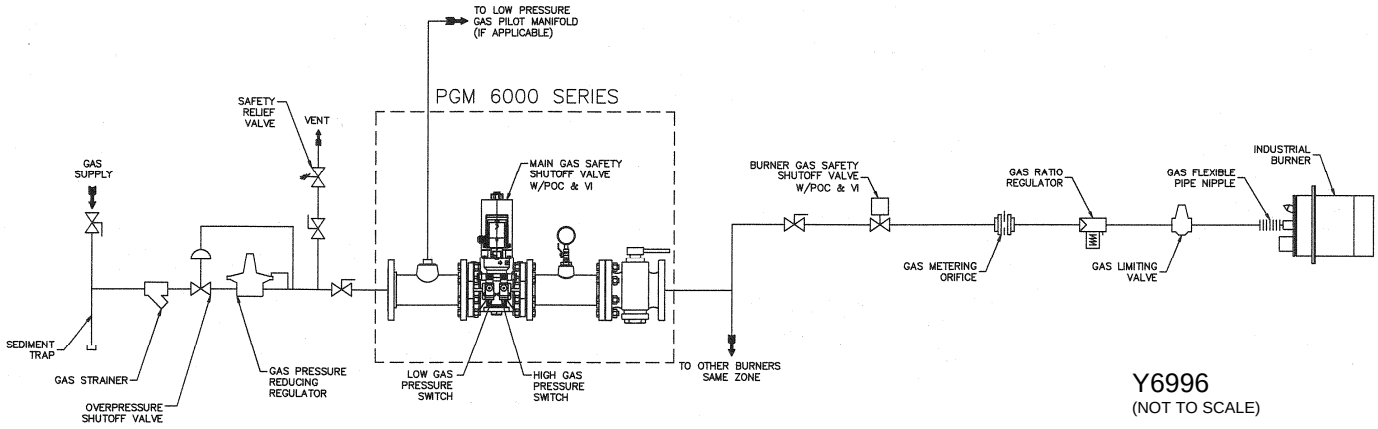
9. Pipe the vent valve outlet (if applicable) to an appropriate area according to your installation requirements.

10. The PGM is now ready for operation.

Industrial Single Burner Gas Layout



Industrial Multiple Burner Gas Layout



Asphalt Single Burner Gas Layout

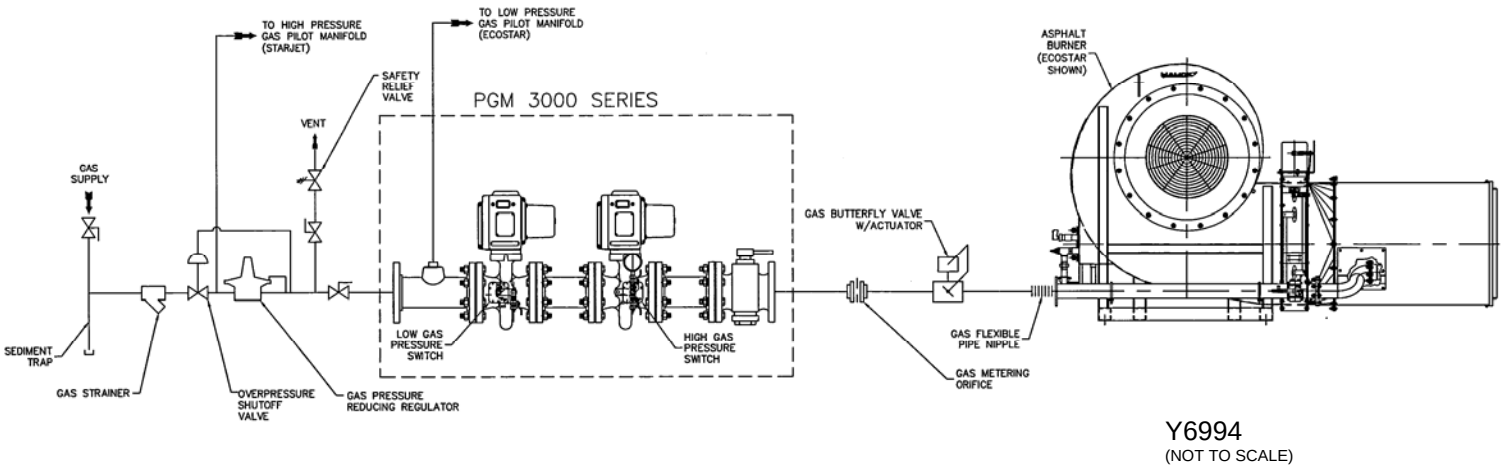


Figure 1. Typical Gas Piping Layouts

F. OPERATION

Typical gas pressures will not exceed **2 psig (13.8 kPa)** for industrial applications, and will not exceed **5 psig (34.5 kPa)** for asphalt applications. Before setting the gas pressure, verify the maximum pressure rating for each component downstream of the PGM. For example, reducing regulators, ratio regulators and other valves can be damaged if their pressure rating is exceeded. Adjust the gas control regulator to the appropriate gas pressure. Gas pressure can be measured at the inlet tap of the main shutoff valve. Once the gas pressure is correct, sequence the combustion control panel and begin fuel flow through the manifold. PGM outlet pressure can be measured by reading the pressure gauge on the downstream side of the manifold.

CAUTION

Maximum gas pressure to the 2100, 3100, and 6100 Series PGMs should not exceed **8.5 psig (58.6 kPa)**. **EXCEPTION:** Maximum gas pressure to the 2400 and 6400 Series PGMs should not exceed **7.25 psig (50.0 kPa).**

NOTE

When utilizing a 6000 Series PGM in a multiple burner installation, a single safety shutoff valve with proof of closure and visual indication is required at each burner to ensure compliance to NFPA 86 requirements. In addition, special features are required in the associated control system to interlock the single safety shutoff valve in the PGM with the single safety shutoff valve at each burner (see Hauck Application Sheet GJ76).

G. SHUTOFF VALVE LEAK TESTING

In addition to leak testing the entire manifold, the automatic shutoff valves must also be leak tested. Both the main and blocking valve must be leak tested and the high and low pressure switches must be tested on a yearly basis at minimum. Refer to the gas piping diagram for leak testing shown in Figure 2.

WARNING

If the gas line is not properly purged, debris can get into the safety shut-off valves. If this occurs, the shut-off valves may not fully close.

CAUTION

Do not exceed **8.5 psig (58.6 kPa)** when leak testing 2100, 3100, and 6100 Series PGMs. **EXCEPTION:** Do not exceed **7.25 psig (50.0 kPa)** when leak testing 2400 and 6400 Series PGMs.

NOTE

For 6000 Series PGMs, ignore reference made to Safety Shutoff Valve No. 2 in the shutoff valve leak testing sequence.

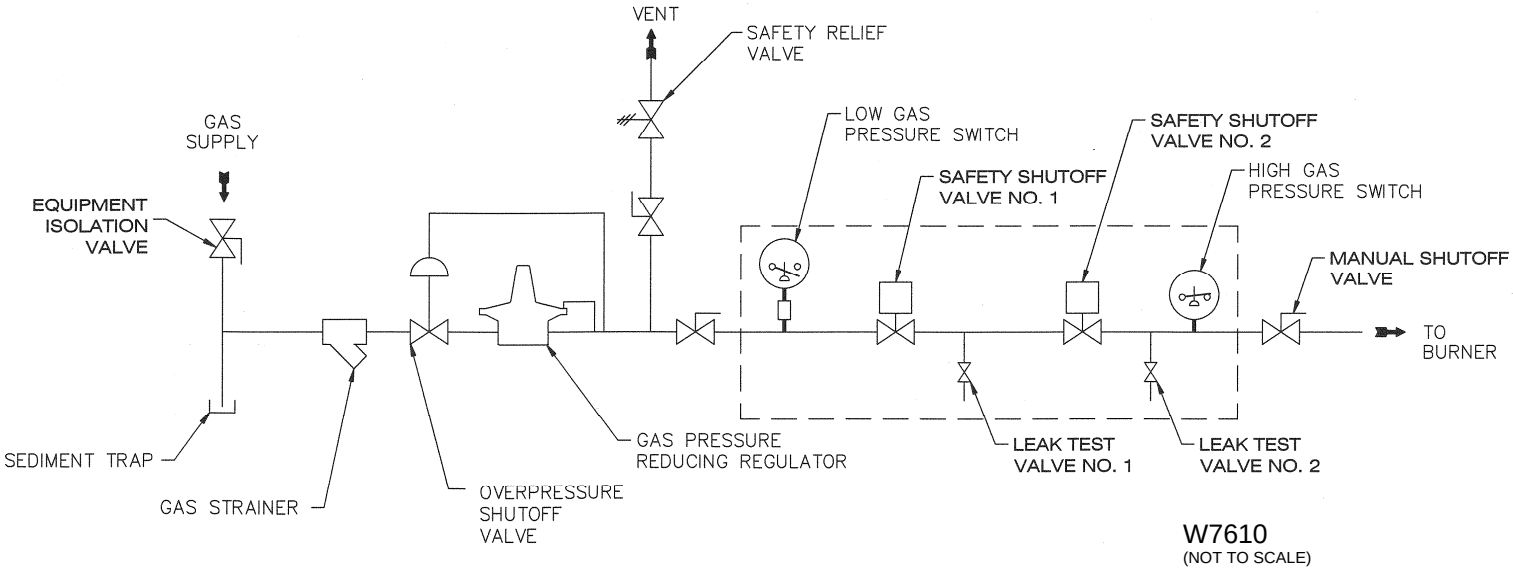


Figure 2. Gas Piping Diagram for Leak Testing

1. Shutoff the burner(s) and furnace.
2. Close the manual shutoff valve downstream of Safety Shutoff Valve No. 2.
3. Open the equipment isolation valve upstream of Safety Shutoff Valve No. 1.
4. Bleed off trapped gas by opening **both** Leak Test Valves No. 1 and No. 2.
5. Close Leak Test Valve No. 2.
6. Connect 3/16" (4.8mm) ID tubing to Leak Test Valve No. 1 and immerse the open end of the tubing in a container of water. Hold the tubing vertically 1/8 to 1/4" (3 to 6 mm) below the surface. If bubbles appear, record the leakage rate in bubbles/min and refer to the **IMPORTANT** note at the end of this section.
7. Close Leak Test Valve No. 1 and apply auxiliary power to open Safety Shutoff Valve No.1.
8. Wait several minutes so that any leakage through Safety Shutoff Valve No. 2 will have time to fill the pipe between Safety Shutoff Valve No. 2 and the manual shutoff valve.
9. Connect the tubing to Leak Test Valve No. 2 and immerse the open end in water as before. Open Test Valve No. 2. If bubbles appear, record the leakage rate in bubbles/min and refer to the **IMPORTANT** note at the end of this section.
10. When no leaks are detected, open the shutoff valve at the outlet of the PGM and return to normal operation.

IMPORTANT

The fact that bubbles are present during the leak test does not necessarily mean that a safety shutoff valve is not functioning properly in the closed position. Refer to the National Fire Protection Association's publication NFPA 86 for acceptable leakage rates for a given pipe size per UL, ANSI, CSA, FM or EN standards. **If the acceptable bubbles/min leakage rate is exceeded, the safety shutoff valve is leaking and the manufacturer's instructions should be referenced for corrective action.**

WARNING

Do not attempt to operate the combustion system until all leaks are repaired.

H. MAINTENANCE

The PGM manifold requires minimal maintenance. On a yearly basis as a minimum, the manifold must be leak tested and any leaks should be repaired immediately. The pressure switches must also be tested on a yearly basis at minimum. Any manual lubricated plug valve should be re-lubricated and leak tested as dictated by the application. Lubrication interval will depend on temperature, pressure and frequency of operation. Engineering data sheets on installation, maintenance and operation of the lubricated plug valve are available from Hauck (Milliken Valve Company Sheets: S 1010 – Installation, S 1020 – Maintenance, and S 1030 – Operation).

I. RECOMMENDED SPARE PARTS

ITEM	QUANTITY	PART NO.	DESCRIPTION
1	1	See Parts List	Switch, Low Gas Pressure
2	1	See Parts List	Switch, High Gas Pressure
3	1	61254	Gauge, Pressure, 0-5 psig

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CONTROL SYSTEM SPECIAL FEATURES TO MEET NFPA 86 REQUIREMENTS FOR MULTIPLE BURNER GAS APPLICATIONS

Prior to startup of the burner system, it is required that the heating chamber be purged to remove any possible accumulation of flammable vapors.(1) One of the conditions for this purge to begin is that the safety shutoff valve is "proved closed". (2) For a multiple burner system firing into a common heating chamber this purge does not need to be repeated after a flame failure or burner shutdown provided that one of the following conditions exists:

A) the heating chamber is proven to be operating above the auto-ignition temperature of 1400°F (760°C)(3), or

B) at least one of the burners of a multiple burner system remains in operation and can provide for ignition of any unintended release of fuel through the inoperative burners.(4)

There are three options that can be utilized to comply with NFPA 86 2011 Edition's "proof of closure" requirement. The first uses two gas safety shutoff valves at each burner; the second uses one gas safety shutoff valve in the main supply gas train, plus two gas safety shutoff valves at each burner; and the third option utilizes one gas safety shutoff valve in the main gas supply line and a single gas safety shutoff valve at each burner.

For Option 1, specific requirements and a typical gas piping layout (see Figure 1) are as follows:

Gas Safety Shutoff Valves

1. The main (first) gas safety shutoff valve at each burner requires both a proof of closure switch and visual indication.(5)
2. The blocking (second) gas safety shutoff valve at each burner requires only visual indication. (NOTE: IRI systems require proof of closure on both gas safety shutoff valves and a normally open vent valve between the main and blocking gas safety shutoff valve).

Electrical Wiring

The proof of closure switch in the main (first) gas safety shutoff valve at each burner must be connected in series with the purge limits.

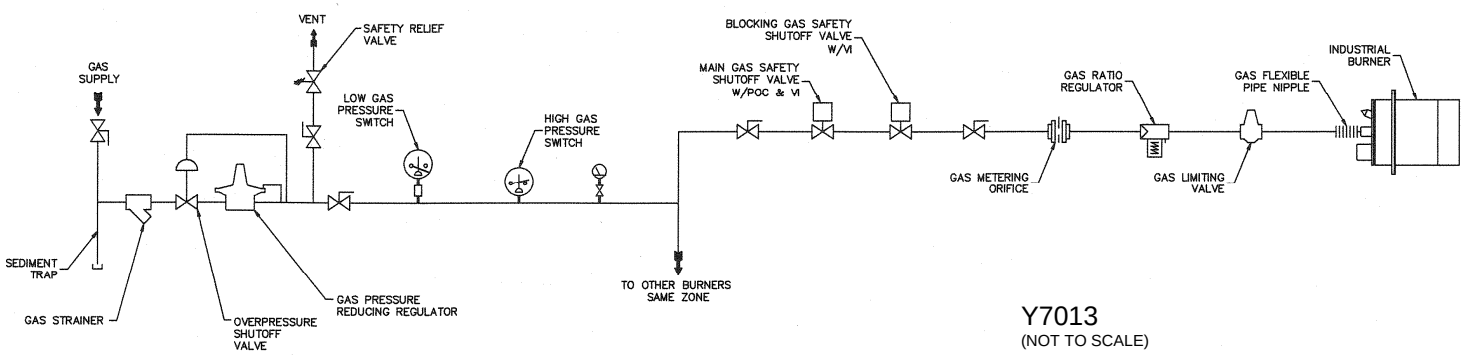

Figure 1. Option 1 Typical Gas Piping Layout

For Option 2, one additional gas safety shutoff valve is required (compared to Option 1), but the field wiring is reduced since only one proof of closure switch is required. Specific requirements and a typical piping schematic (see Figure 2) are as follows:

Gas Safety Shutoff Valves

1. The main gas safety shutoff valve in the main gas train requires both a proof of closure switch and visual indication.(5)
2. The two burner gas safety shutoff valves at each burner require visual indication only.

Electrical Wiring

The proof of closure switch contact in the main gas safety shutoff valve must be connected in series with the purge limits. (5) Other than for monitoring, there is no need to incorporate proof of closure switches in the individual burner gas safety shutoff valves into the control system.

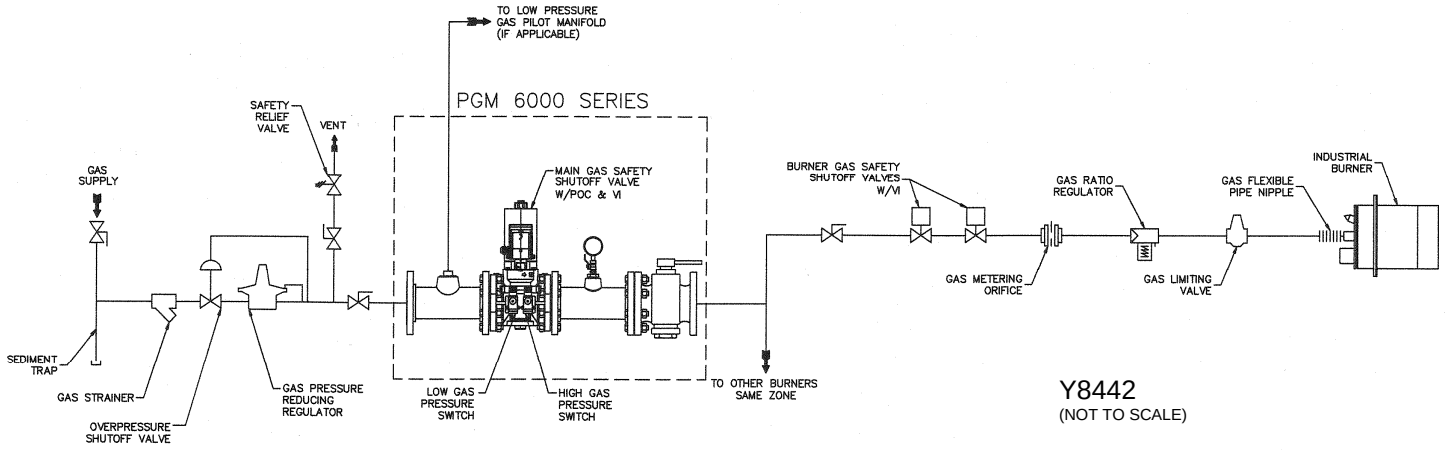

Figure 2. Option 2 Typical Gas Piping Layout

For Option 3, fewer gas safety shutoff valves are required (compared to option 2), but field wiring and the complexity of the control system increases. Also, the potential exists for the entire heating system to be shut down in the event that the single gas safety shutoff valve at a burner is not proved closed. Specific requirements and a typical piping layout (see Figure 3) are as follows:

Gas Safety Shutoff Valves

1. As with Option 2, the main gas safety shutoff valve will require both a proof of closure switch and visual indication.(5)
2. The burner gas safety shutoff valve at each burner requires both a proof of closure switch and visual indication.(6)

Electrical Interlocking of Burner Gas Safety Shutoff Valves

1. The proof of closure switch contact in the main gas safety shutoff valve must be connected in series with the purge limits.
2. Two wires from each burner gas safety shutoff valve closed switch must also be run back to the control panel.
3. A normally open auxiliary relay contact for each burner must be connected in parallel with its associated valve closed switch.
4. These parallel switch/relay circuits must be connected in series to energize an off-delay timer set at a maximum of five seconds.
5. A normally open contact of this off-delay timer must be wired in series with the purge timer circuit and the main gas safety shutoff valve.

Circuit Operation

1. Provided that all burner gas safety shutoff valve closed switches are closed, the off-delay timer contact will close.
2. If all safety and purge limits are satisfied and the main gas safety shutoff valve proof of closure switch contact is closed, the purge timer will be enabled.
3. After purge time is complete, the main gas safety shutoff valve will be enabled.
4. If a burner goes out and the burner gas safety shutoff valve **fails to close** within five seconds, the timer will complete its off-delay and its normally open contacts will be de-energized. This will in turn de-energize the main gas safety shutoff valve and disable the purge timer circuit.

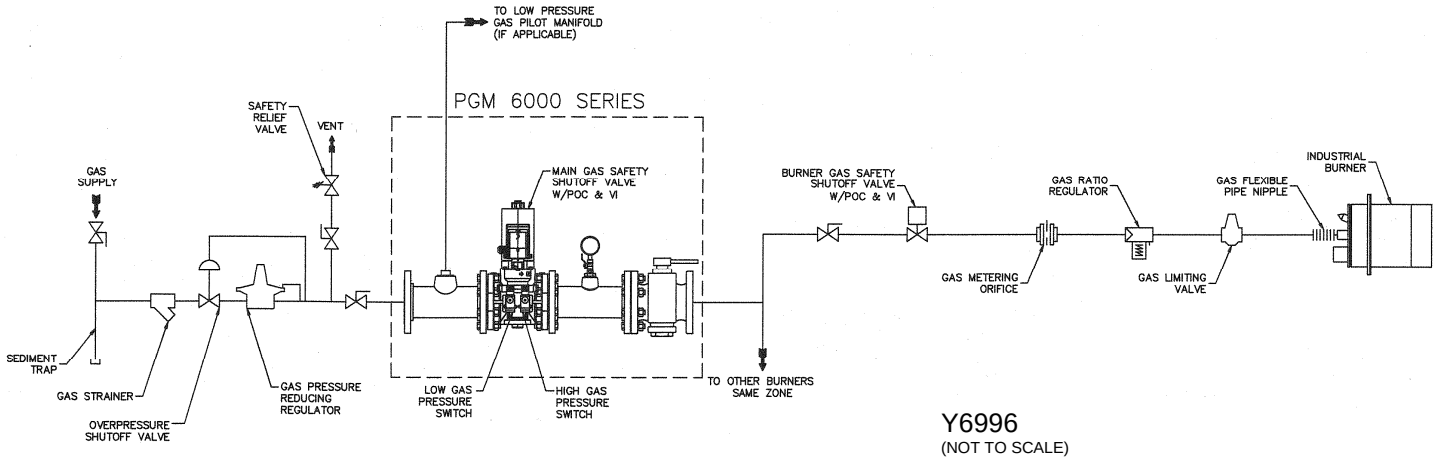

Figure 3. Option 3 Typical Gas Piping Layout

Reference NFPA 86 2011 paragraphs:

(1) 8.5.1.1

(2) 8.5.1.2 (C) (2)

(3) 8.5.1.8 (1)

(4) 8.5.1.8 (2)

(5) 8.8.2.2 and Annex A.8.8.2.2

(6) 8.8.1.3