

IRI Requirements For Gas Burner Systems

Reference: IM.4.2.0 & IM.4.2.1, June 1, 2000

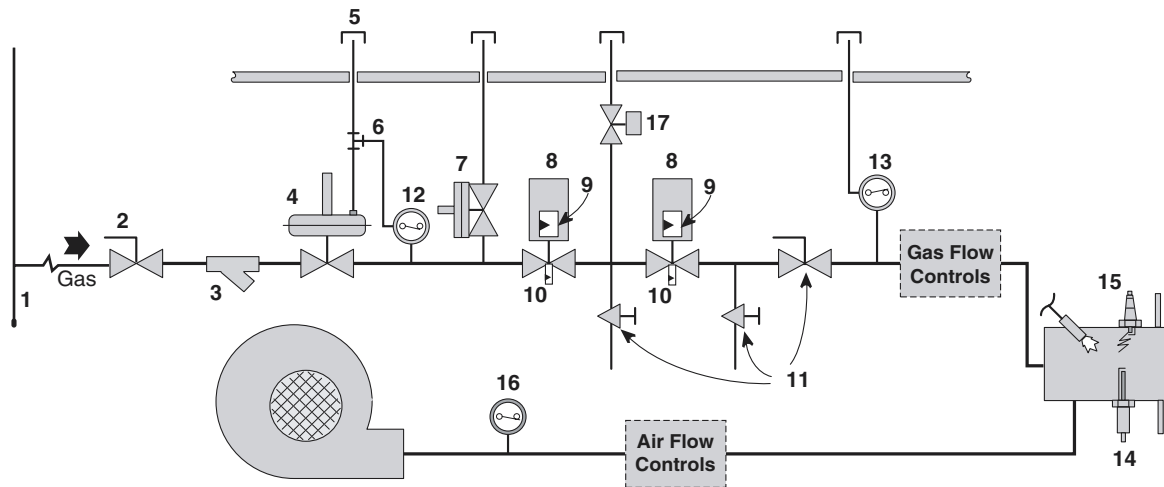
General Remarks:

These schematic and notes condense the gas burner system requirements of GE Global Asset Protection Services - Industrial Risk Insurers (IRI) publications "IM.4.2.0 OVENS AND FURNACES - NFPA 86-1999" and "IM.4.2.1 HEAT TREAT FURNACES WITH INTERNAL QUENCH TANKS". They should provide most of the engineering information required to lay out burner air and gas trains. IRI follows the requirements of NFPA 86 but makes additional clarifications and changes for increased safety.

In addition to the requirements shown on the following schematic, IRI also requires that the combustion control system have the following features. Numbers in parenthesis reference the paragraphs in IM.4.2.0, IM.4.2.1, and NFPA 86.

- 1) **NFPA:** Safety control circuits must be single phase, one side grounded, with all breaking contacts in the "hot", ungrounded, circuit protected line and not exceed 120V. **IRI:** Any time delay used to avoid nuisance shutdowns from momentary power fluctuations cannot exceed 5 seconds and any timer must not be adjustable above this maximum. (5-2)
- 2) **NFPA:** Prior to energizing spark or lighting pilot, a timed pre-purge of at least four standard cubic feet of air per cubic foot of heating chamber volume is required. **IRI:** Any adjustable purge timer must clearly show its setting, have limited access, and be periodically inspected. Any employee with access must be trained on its setting and consequences if not set properly. (5-4.1.2)
 - a. **NFPA:** Airflow must be proven and maintained during the purge. **IRI:** The location of pressure switch sensing points must be analyzed against all other conditions (such as dirt accumulation and damper positions in the system) to assure it will truly prove the required airflow. (5-4.1.2.1)
 - b. **NFPA:** Where the capacity exceeds 400,000 Btu/hr (117kW) at least one of the safety shutoff valves must be proved closed and interlocked to the purge. **IRI:** Both safety shutoff valves shall be proved closed and interlocked. (5-7.2.2)
- 3) **IRI:** The trial for ignition for pilots or main burners must not exceed 10 seconds. (5-4.2.1, 5-4.2.2) Directly control the spark from a listed flame safeguard. (5-2.3)
- 4) **NFPA:** All safety interlocks must be connected in series ahead of the safety shutoff valves. Interposing relays are allowed when the required load exceeds the rating of available safety contacts, or where the safety logic requires separate inputs, AND the contact goes to safe state on loss of power, AND each relay serves only one interlock. **IRI:** An interposing relay can be powered by more than one safety limit if the safety shutoff valves derive power in series through the limits. When one limit opens then the fuel is shutoff to all burners that use the interposing relay as a permissive. (5-2.7)
- 5) **NFPA:** Any motor starters, circulation, and exhaust fans required for safe combustion or purge must be proven. (5-6.3) **IRI:** Use a rotation switch if pressure switches or sail switches are not suitable. (5-5.1)
- 6) **NFPA-IRI:** A listed manual reset excess temperature limit control is required except where the system design cannot exceed the maximum safe temperature. (5-16)
- 7) **NFPA-IRI:** Piping and electrical schematics of the proposed system must be submitted to the local IRI office in whose jurisdiction the system will be located. Drawings must include the various device settings, switch positions, configurations and notes on options. Stamped approval is required before construction begins. (1-4)
- 8) **NFPA-IRI:** The user has the responsibility to establish a program of inspection, testing, and maintenance with documentation performed at least annually. (5-2.5.2)

Piping Schematic



Item	Description	Reference Paragraph
1	Facility to install drip leg or sediment trap for each fuel supply line. Must be a minimum of 3" long.	4-2.4.4
2	Individual manual shutoff valve to each piece of equipment. 1/4 turn valves recommended. Must be in an accessible location near the floor.	4-2.4.1
3	Filter or strainer to protect downstream safety shutoff valves.	4-2.4.3
4	Pressure regulator required wherever plant supply pressure exceeds level required for proper burner function or is subject to excessive fluctuations.	4-2.4.5.1
5	Regulator vent to safe location outside the building with water protection & bug screen. <ul style="list-style-type: none"> • Vent piping can terminate inside the building when gas is lighter than air, vent contains restricted orifice, and there is sufficient building ventilation, where there are high clearances between the equipment and roof and there are no ignition sources. • Vent piping not required for lighter than air gases at less than 1 psi, vent contains restricted orifice, and there is sufficient ventilation. Vent piping not required for ratio regulator. 	4-2.4.5.2
6	Gas pressure switches may be vented to regulator vent lines if backloading won't occur. No vent line required if switch has no diaphragm.	4-2.4.5.5
7	Relief valve required if gas pressure at regulator inlet exceeds rating of safety shutoff valve. Physical location can be upstream to meet application requirements.	5-7.1.7
8	Two listed* safety shutoff valves required for each main and pilot gas burner system. Both safety shutoff valves must close after interruption of interlocks, combustion safeguard, or operating controls; no exceptions allowed for multiple burner systems. A single valve can be used for explosion resistant radiant tube systems.	5-7.2.1 5-7.1.2
9	Position indication (not proof-of-closure) required on safety shutoff valves to burners or pilots in excess of 150,000 Btu/hr (44 kW). Electrical indicators must not replace mechanical indicators.	5-7.1.8
10	For capacities over 400,000 Btu/hr (117 kW) both safety shutoff valves must have a closed position switch to interlock with the pre-purge.	5-7.2.2
11	Permanent and ready means for checking leak tightness of safety shutoff valves. Test in progressive intervals starting weekly, monthly, quarterly, then annually.	5-7.2.3
12	Listed* low gas pressure switch (normally open, makes on pressure rise).	5-8.1
13	Listed* high gas pressure switch (normally closed, breaks on pressure rise).	5-8.2
14	Flame Supervision: <ul style="list-style-type: none"> • Piloted burners <ul style="list-style-type: none"> - <i>Continuous pilot</i>: Two flame sensors must be used, one for the pilot flame and one for the main burner flame. - <i>Intermittant pilot</i>: Can use a single flame sensor for self-piloted burners (from same port as main, or has a common flame base and has a common flame envelope with the main flame). - <i>Interrupted pilot</i>: A single flame sensor is allowed. • Line, Pipe, Radiant burners <ul style="list-style-type: none"> - If the burners are adjacent and light safely and reliably from burner to burner, then a single sensor is allowed if it is located at the farthest end from the source of ignition. • Continuous (>24 hr) operation with UV scanners must use self checking style scanners (or use flame rods instead). 	5-9 5-9.2.1 5-9.2.2 5-9.2

Continued on next page

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15	Spark Ignition: <ul style="list-style-type: none"> • Except for explosion resistant radiant tube systems, direct spark igniters must be shut off after main burner trial-for-ignition. • If a burner must be ignited at reduced input (forced low fire start), an ignition interlock must be provided to prove control valve position. • Trial-for-ignition of the pilot or main must not exceed 10 seconds. An exception is allowed where fuel accumulation in the heating chamber can not exceed 25% of the lower explosive limit and the authority having jurisdiction approves a written request for extended time. • Manual (pushbutton) ignition systems must be designed to prevent further spark after the trial-for-ignition until a full purge is first completed. 	5-15.2 5-15.1 5-4.2.2 5-15																		
16	Listed* combustion air flow or pressure proving switch (normally open, makes on pressure rise).	5-6.4																		
17	A Listed* normally open (N.O.) vent valve with vent pipe run to a safe outside location is required when the line capacity exceeds 400,000Btu/hr (117kW). Do not manifold to other vent lines. Size the vent line according to the following table. <table border="1" data-bbox="578 600 992 894" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Fuel Line Size</th> <th>Vent Line Size</th> </tr> </thead> <tbody> <tr> <td>≤ 1½"</td> <td>¾"</td> </tr> <tr> <td>2"</td> <td>1"</td> </tr> <tr> <td>2½"</td> <td>1¼"</td> </tr> <tr> <td>3½"</td> <td>1½"</td> </tr> <tr> <td>4"</td> <td>2"</td> </tr> <tr> <td>5½"</td> <td>2½"</td> </tr> <tr> <td>6½"</td> <td>3"</td> </tr> <tr> <td>8"</td> <td>3½"</td> </tr> </tbody> </table> <p>As an alternate to using a vent valve, use a valve tightness proving system that is automatically activated upon startup and shutdown</p>	Fuel Line Size	Vent Line Size	≤ 1½"	¾"	2"	1"	2½"	1¼"	3½"	1½"	4"	2"	5½"	2½"	6½"	3"	8"	3½"	5-7.2.1
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*Underwriters Laboratory (UL) listing is accepted throughout the United States. Listed products can be found in the UL Gas and Oil Equipment Directory, available from Underwriters Laboratory, Inc. Publications Stock, 333 Pfingsten Road, Northbrook, IL 60062-2096. Factory Mutual (FM) listed equipment is also acceptable in most jurisdictions and can be found in the FM Approval Guide available from Factory Mutual Research Corporation, 115 Boston-Providence Turnpike, Norwood, MA 02062.

More information can be obtained by contacting:

Industrial Risk Insurers
 85 Woodland Street
 Hartford, CT 06102-5010
 860-520-7329
 860-520-7559 fax
<http://www.industrialrisk.com>

National Fire Protection Association
 1 Batterymarch Park
 Quincy, MA 02269-9101
 800-344-3555
 508-895-8300
<http://www.nfpa.org>

