

8/27/04

## **NFPA Requirements for Gas Burner Systems**

**Reference: NFPA 86 – Ovens and Furnaces, 2003 Edition**

### **General Remarks:**

The schematic and notes on the following page condense the gas burner system requirements of National Fire Protection Association (NFPA) 86 into an easy-to-use format. They should provide most of the engineering information required to lay out burner air and gas trains. Numbers in parentheses refer to the applicable paragraphs of the standard.

In addition to the requirements shown on the schematic, NFPA 86 also requires that the combustion control system have the following features:

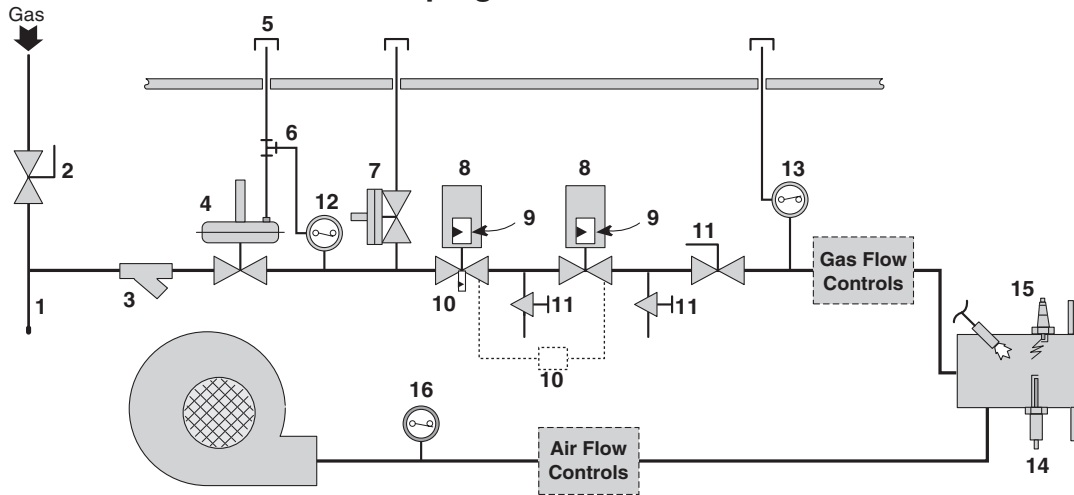
- 1) All safety devices must be listed for their intended service (7.2.1), including purge and ignition timers (7.2.3).
- 2) Safety control circuits must be single phase, one side grounded, with all breaking contacts in the “hot”, ungrounded, circuit protected line not exceeding 120V. (7.2.11)
- 3) Prior 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 (7.4.1).
  - a) Airflow must be proven & maintained during the purge.
  - b) Safety shutoff valve must be closed and when the chamber input exceeds 400,000 Btu/hr (117 kW) it must be proved closed and interlocked. Proof of closure can be achieved by either a proof of closure switch on at least one valve or a valve proving system.
- 4) Exceptions to a re-purge are allowed for momentary shutdowns if (any one): (7.4.1.5)
  - a) Each burner is supervised, each has safety shutoff valves, and the fuel accumulation in the heating chamber can not exceed 25% of lower explosive limit.
  - b) Each burner is supervised, each has safety shutoff valves, and at least one burner remains on in same chamber.
  - c) The chamber temperature is more than 1400°F (760°C).
- 5) Exception to the pre-purge is allowed for explosion resistant radiant tube systems. (7.4.1.4)
- 6) 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 safety logic requires separate inputs, AND the contact goes to a safe state on loss of power, AND each relay serves only one interlock. (7.2.7)
- 7) Any motor starters required for combustion must be interlocked into the safety circuit. (7.6.3)
- 8) A listed manual reset excess temperature limit control is required except where the system design can not exceed the maximum safe temperature. (7.16)
- 9) The user has the responsibility for establishing a program of inspection, testing, and maintenance with documentation performed at least annually. (7.2.5.2)

The scope of NFPA 86 extends to all the factors involved in the safe operation of ovens and furnaces, and anyone designing or building them should be familiar with the entire standard. Copies can be purchased from:

The National Fire Protection Association  
1 Batterymarch Park  
Quincy, MA 02269-9101  
800-344-3555 (508-895-8300 if outside U.S.)  
www.nfpa.org

# Piping Schematic

Tech Note  
Section 2  
Sheet R-1  
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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.	6.2.5.3
2	Individual manual shutoff valve to each piece of equipment. 1/4 turn valves recommended.	6.2.5.1
3	Filter or strainer to protect downstream safety shutoff valves.	6.2.5.3.3
4	Pressure regulator required wherever plant supply pressure exceeds level required for proper burner function or is subject to excessive fluctuations.	6.2.5.4
5	Regulator vent to safe location outside the building with water protection & bug screen. • Vent piping not required for listed regulator/vent limiter combination. Vent piping not required for ratio regulator/zero governor.	6.2.5.4
6	Gas pressure switches may be vented to regulator vent lines if backloading won't occur.	6.2.5.4.8
7	Over pressure protection required if gas pressure at regulator inlet exceeds rating of any downstream part.	7.7.1.8
8	Two listed* safety shutoff valves required for each main and pilot gas burner system. A single valve can be used for explosion resistant radiant tube systems.	7.7.2.1
9	Visual position indication required on safety shutoff valves to burners or pilots in excess of 150,000 Btu/hr (44 kW).	7.7.1.9
10	Proof of closure switch or valve proving system required for capacities over 400,000 Btu/hr (117 kW).	7.7.2.2
11	Permanent and ready means for checking leak tightness of safety shutoff valves.	7.7.2.3
12	Listed* low gas pressure switch (normally open, makes on pressure rise).	7.8.1
13	Listed* high gas pressure switch (normally closed, breaks on pressure rise).	7.8.2
14	Flame Supervision: • Piloted burners - <i>Continuous pilot</i> : Two flame sensors must be used, one for the pilot flame and one for the main burner flame. - <i>Intermittent 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 - 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.	7.9.2 7.9.2.1  7.9.2.2
15	Spark Ignition: • 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 15 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.	7.4.2.4  7.15 7.4.2
16	Listed* combustion air flow or pressure proving switch (normally open, makes on pressure rise).	7.6.2

\*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.