

Key	Safety shutoff valve requirements		
	Under 150,000 Btu/hr	150,000 to 400,000 Btu/hr	Over 400,000 Btu/hr
Safety shutoff valve			
Safety shutoff valve with visual identification			
Safety shutoff valve with visual identification and proof of closure			

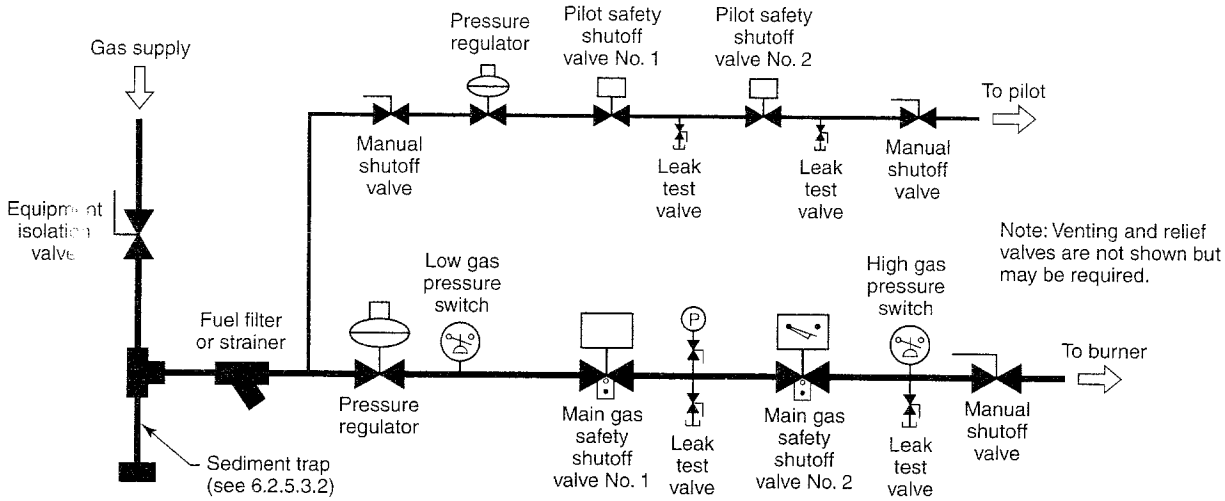


FIGURE A.7.7.2 Typical Piping Arrangement Showing Fuel Gas Safety Shutoff Valves.

pressure. Particular attention should be paid to lubricated plug valves if used as manual shutoff valves in order to ensure that they have been properly serviced prior to the valve seat leakage test.

The referenced publications in Annex M include examples, although not all-inclusive, of acceptable leakage rate methodologies that the user can employ.

Figure A.7.7.2.4(a) through Figure A.7.7.2.4(c) show examples of gas piping and wiring diagram for leak testing.

The following example is predicated on the piping diagram shown in Figure A.7.7.2.4(a) and the wiring diagram shown in Figure A.7.7.2.4(b).

With the oven burner(s) shut off, the equipment isolation valve open, and the manual shutoff valve located downstream of the second safety shutoff valve closed, proceed as follows:

- (1) Connect the tube to leak test valve No. 1.
- (2) Bleed trapped gas by opening leak test valve No. 1.
- (3) Immerse the tube in water per Figure A.7.7.2.4(c). If bubbles appear, the valve is leaking and the manufacturer's instructions should be referenced for corrective action. Examples of acceptable leakage rates are given in Table A.7.7.2.4.
- (4) Apply auxiliary power to safety shutoff valve No. 1. Close leak test valve No. 1. The tube should be connected to leak test valve No. 2 and immersed in water per Figure A.7.7.2.4(c).
- (5) Open leak test valve No. 2. If bubbles appear, the valve is leaking and the manufacturer's instructions should be referenced for corrective action. Examples of acceptable leakage rates are given in Table A.7.7.2.4.

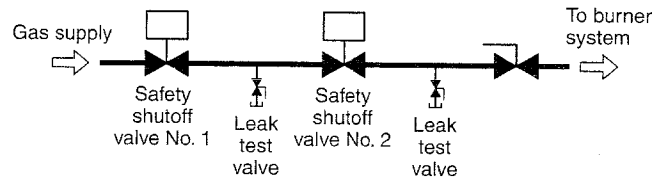


FIGURE A.7.7.2.4(a) Example of a Gas Piping Diagram for Leak Test.

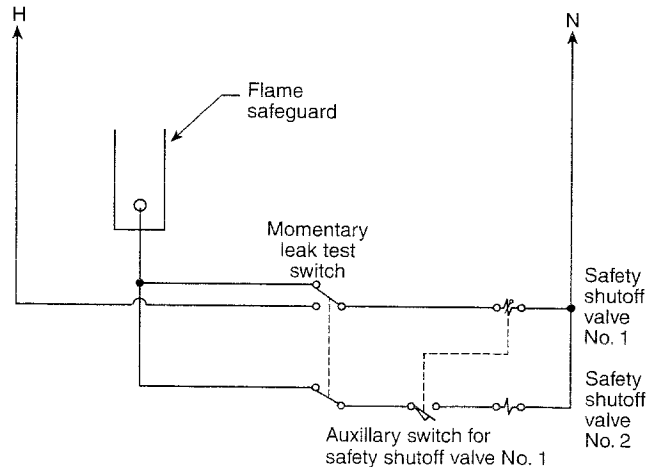


FIGURE A.7.7.2.4(b) Example of a Wiring Diagram for Leak Test.

Table A.7.7.2.4 Acceptable Leakage Rates

NPT Nominal Size (in.)	DN Nominal Size (mm)	UL 429, ANSI Z21.21/CSA 6.5				FM 7400				EN 161			
		ft ³ /hr	ml/hr cc/hr	ml/min cc/min	Bubbles/ min	ft ³ /hr	ml/hr cc/hr	ml/min cc/min	Bubbles/ min	ft ³ /hr	ml/hr cc/hr	ml/min cc/min	Bubbles/ min
0.38	10	0.0083	235	3.92	26	0.014	400	6.7	44	0.0014	40	0.67	4
0.50	15	0.0083	235	3.92	26	0.014	400	6.7	44	0.0014	40	0.67	4
0.75	20	0.0083	235	3.92	26	0.014	400	6.7	44	0.0014	40	0.67	4
1.00	25	0.0083	235	3.92	26	0.014	400	6.7	44	0.0014	40	0.67	4
1.25	32	0.0083	235	3.92	26	0.014	400	6.7	44	0.0021	60	1.00	7
1.50	40	0.0124	353	5.88	39	0.014	400	6.7	44	0.0021	60	1.00	7
2.00	50	0.0166	470	7.83	52	0.014	400	6.7	44	0.0021	60	1.00	7
2.50	65	0.0207	588	9.79	65	0.014	400	6.7	44	0.0021	60	1.00	7
3.00	80	0.0249	705	11.75	78	0.014	400	6.7	44	0.0035	100	1.67	11
4.00	100	0.0332	940	15.67	104	0.014	400	6.7	44	0.0035	100	1.67	11
6.00	150	0.0498	1,410	23.50	157	0.014	400	6.7	44	0.0053	150	2.50	17
8.00	200	0.0664	1,880	31.33	209	0.014	400	6.7	44	0.0053	150	2.50	17

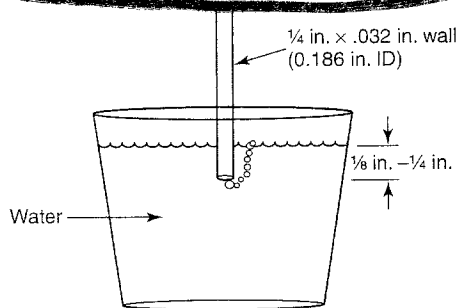


FIGURE A.7.7.2.4(c) Bubble Test for a Safety Shutoff Valve.

A.7.9.2 Ultraviolet detectors can fail in such a manner that the loss of flame is not detected. When these detectors are placed in continuous service, failures can be detected by using a self-checking ultraviolet detector or by periodically testing the detector for proper operation.

A.7.9.2.2 Two examples of burner arrangements considered to be a single burner with one flame safeguard installed at the end of the assembly are shown in Figure A.7.9.2.2(a) and Figure A.7.9.2.2(b).

A.7.11 Wherever the temperature of fuel oil can drop below a safe level, the increased viscosity prevents proper atomization. No. 2 and No. 4 fuel oils can congeal if their temperature falls below their pour point, whether or not preheaters are used.

Wherever the temperature of the fuel oil rises above a safe level, vaporization of the oil takes place before atomization and causes a reduction in fuel volume severe enough to create substantial quenching of the flame.

A.7.16 The excess temperature set point should be set no higher than the maximum temperature specified by the manufacturer. If flammable or combustible materials are being processed in an oven or dryer, the set point should be set at a temperature that will not allow the material to reach its autoignition temperature. Set point limits based on autoignition temperature do not apply to special atmosphere furnaces and fume incinerators. If, for process reasons, the work must be protected from reaching an elevated temperature that is

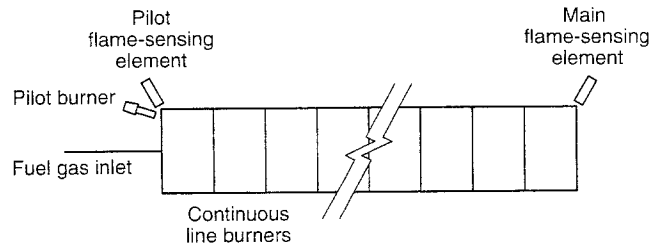


FIGURE A.7.9.2.2(a) An Example of a Combustion Safeguard Supervising a Pilot for a Continuous Line Burner During Light-Off and the Main Flame Alone During Firing.

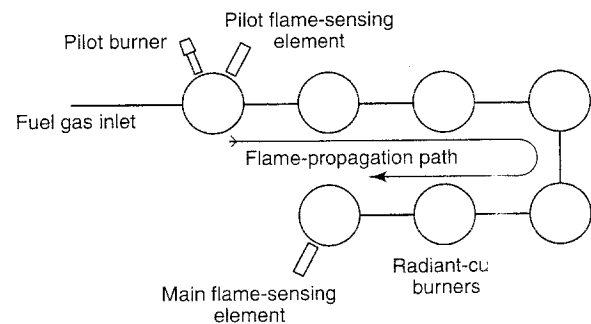


FIGURE A.7.9.2.2(b) An Example of a Combustion Safeguard Supervising a Group of Radiant-Cup Burners Having Reliable Flame-Propagation Characteristics from One to the Other by Means of Flame-Propagation Devices.

lower than the oven excess temperature set point, an additional temperature limit controller can be used or the operating temperature controller can be interlocked or alarmed as needed for this purpose.

For a constant speed exhaust fan, as the oven temperature increases, the oven exhaust flow in standard cubic feet per minute decreases. A high temperature excursion reduces safety ventilation and could cause a flammable vapor explosion in ovens and dryers provided with safety ventilation.