

IAS U.S. REQUIREMENTS 3-92

FOR

EXCESS FLOW VALVES

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PART I CONSTRUCTION

1.1 SCOPE

1.1.1 These requirements apply to excess flow gas valves (see Part IV, Definitions), hereinafter referred to as valves, not exceeding 2-inch pipe size.

1.1.2 Valves shall be constructed entirely of new unused parts and materials.

1.1.3 These requirements apply to valves for use with natural, manufactured and mixed gas, liquefied petroleum (LP) gases and LP gas-air mixtures at operating pressures not in excess of 250 psig.

1.1.4 Valves covered by these requirements shall be capable of operation at ambient temperatures of 32EF to 125EF. They shall also be capable of operation at a higher temperature, a lower temperature, or both when so specified by the manufacturer (see 2.1.2).

1.1.5 Valves covered by these requirements are intended to limit the flow of gas in the event that the flow of gas in the service line exceeds the level specified by the valve manufacturer.

1.2 GENERAL

1.2.1 The construction of parts not covered by these requirements shall be in accordance with reasonable concepts of safety, substantiality and durability.

All specifications as to construction set forth herein may be satisfied by the construction actually prescribed or such other construction as will provide at least equivalent performance.

1.2.2 The mechanisms of valves shall be protected by substantial enclosures so as to prevent interference with the safe operation of the devices.

1.2.3 Pins, stems or other linkage passing through the valve body or casing shall be sealed to provide gas tight construction.

1.2.4 Valves shall be constructed with mechanical means

which will prevent gas flow in excess of the manufacturer's specified maximum flow rate at maximum inlet operating pressure.

1.2.5 An automatic reset type device shall have a bypass to allow for equalization of pressures. The area of the bypass shall not exceed that of a No. 60 size drill [0.040 inch (1.02 mm) diameter].

1.2.6 Valves that employ automatic reset features shall reset only when designed to do so.

### 1.3 EQUIPMENT AND DATA TO BE FURNISHED BY THE MANUFACTURER

The manufacturer shall furnish the following equipment and data to the testing agency:

- a. Representative valves, as specified by the testing agency;
- b. Drawings, blueprints, photographs which describe each model valve as specified by the testing agency;
- c. Minimum and maximum operating pressure (in pounds per square inch) (see 1.1.3);
- d. Rated closing flow rate with 1,000 Btu per cubic foot, 0.64 specific gravity gas.
- e. Maximum operating pressure differential.
- f. Mounting classification (see 2.1.1).

### 1.4 ASSEMBLY

1.4.1 Valves shall be constructed to discourage disassembly in the field. Construction which requires the use of a special tool for disassembly is considered to meet this provision.

1.4.2 Parts of the valve coming in contact with a diaphragm shall not have sharp edges which might chafe or abrade it.

1.4.3 Springs shall be protected against abrasion and shall be guided or arranged to minimize binding, buckling or other interference with their free movement.

### 1.5 CONNECTIONS

1.5.1 When pipe threads are used, connections shall be provided with cleanly cut taper pipe threads in accordance with the Standard for Pipe Threads, General Purpose (Inch) ANSI/ASME B1.20.1-1983.

1.5.2 Pipe thread length and length to shoulder dimensions shall not be less than shown in Table I.

1.5.3 A valve equipped with pipe or tubing threads shall be designed to accept a wrench for use in assembly and disassembly to piping.

1.5.4 Inlet and outlet gas connections shall be designed so that when a pipe which is threaded two threads beyond standard (for the size in question) is run into the threaded portion of the valve body, it will not adversely affect the operation of the valve.

1.5.5 Connections for attachment to semi-rigid tubing shall comply with SAE specifications for automotive tube fittings as contained in the 1986 SAE Handbook.

TABLE I

MINIMUM THREAD LENGTH AND LENGTH TO SHOULDER

Minimum Lengths (Inches)

<u>Nominal Pipe Size</u>	<u>Length of Thread*</u>	<u>Length to Shoulder Male Thread**</u>	<u>Length to Shoulder Female Thread***</u>
1/8	0.25	0.3924	0.3096
1/4	0.32	0.5946	0.4500
3/8	0.36	0.6006	0.4622
1/2	0.43	0.7815	0.6057
3/4	0.50	0.7935	0.6247
1	0.58	0.9845	0.7478
1-1/4	0.67	1.0085	0.7678
1-1/2	0.70	1.0252	0.7678
2	0.75	1.0582	0.7838

Use where threads are back relieved. (Reference: the Standard for Malleable-Iron Threaded Fittings, 150 and 300 lb., ANSI/ASME B16.3-1985.)

\*\* Male thread =  $L_4$  (over-all length of male thread).

\*\*\* Female thread =  $L_1 + L_3 + 1$  pitch.

( $L_1$ ,  $L_3$  and  $L_4$  as specified in ANSI B1.20.1-1983.)

## 1.6 BOLTS, NUTS AND SCREWS

Bolts, nuts, machine screws and other threaded parts used in covers, housings, casings and external mounting brackets shall have threads conforming to, as applicable, the standard for Unified Inch Screw Threads (UN and UNR Thread Form), ANSI B1.1-1982; International Organization for Standardization Standard for ISO General Purpose Screw Threads - Basic Profile, ISO 68-1973; or International Organization for Standardization Standard for ISO General Purpose Metric Screw Threads - General Plan, ISO 261-1973.

## 1.7 ADJUSTMENTS

1.7.1 Suitable means for maintaining the positions of all adjustments shall be provided. Lock nuts or adjusting nuts held by springs or compression will be considered satisfactory, except where their adjustment can be accidentally disturbed.

1.7.2 Bypass or other field adjustments shall be capped or otherwise protected in such a manner as to resist tampering or accidental change in adjustment.

## 1.8 MATERIALS

1.8.1 The manufacturer shall supply evidence acceptable to the testing agency that all materials have been evaluated and found to be suitable for their intended usage. Test data based on ASTM or other appropriate test procedures, certifications or historical data may be submitted for this purpose. The evidence shall show that the materials have been evaluated, as appropriate, for resistance to moisture, corrosion and the effects of fuel gases, including sulfur compounds therein, and that non-metallic diaphragm and seal materials exposed to atmosphere are suitably resistant to the effects of ozone.

1.8.2 Valve bodies and casings shall be of material having a melting point of not less than 800EF.

## 1.9 INSTRUCTIONS

Complete instructions covering installation and proper operation shall be furnished by the manufacturer.

Included in these instructions shall be:

- a. Manufacturer's or dealer's name and address.
- b. Model number.
- c. Maximum and minimum operating temperatures (see 1.1.4).
- d. Maximum and minimum operating pressure rating in psig.
- e. The type(s) of gas for which intended.
- f. Valve closing flow rate (see 1.3-d and e).
- g. Mounting position(s).
- h. Bypass flow rate for automatic reset valve (see 2.8).

#### 1.10 MARKING

1.10.1 Excess flow gas valves shall bear a marking on which appears the following:

- a. Manufacturer's or dealer's name, trademark, or symbol.
- b. Model designation.
- c. A marking stating "Excess Flow Gas Valve."
- d. The maximum and minimum operating pressure in pounds per square inch.
- e. Direction of gas flow.
- f. Closing flow rate.
- g. Symbol of the organization making the tests for compliance with these requirements.
- h. For an automatic reset valve, the bypass flow rate (see 2.8)

1.10.2 Each valve shall bear a date code marking. This marking shall consist of at least four consecutive digits determined as follows:

- a. The first and second digits shall indicate the calendar year in which the component was manufactured (e.g., 92 for 1992).
- b. The third and fourth digits shall indicate the week in which the component was manufactured (e.g., 03 for the third week of the year). For purposes of this marking, a week shall begin at 0001 hours on Sunday and end at 2400 hours on Saturday.

A date code may be used for more than 1 week; however, it shall not be used for more than 4 consecutive weeks, nor more than 2 weeks into the next calendar.

Additional numbers, letters or symbols may follow the four digit number specified in "a" and "b". If additional numbers are used, they must be separated from the date code.

1.10.3 A marking to identify these requirements shall be provided for each valve, as follows:

"CSA Requirements 3.92 U.S. for Excess Flow Gas Valves."

This marking may be located on the package or on a notice placed inside the package in which the valve is shipped.

## PART II PERFORMANCE

### 2.1 GENERAL

2.1.1 The tests specified herein shall be conducted with the valve mounted in the manufacturer's specified upright position. If one or more of the following optional mounting classifications are selected by the manufacturer, additional tests, as specified under 2.5 shall be conducted.

Horizontal - any position on a horizontal axis with respect to the inlet connection.

Vertical - any position on a vertical axis with respect to the inlet connection.

Limited Horizontal - any position from upright to 90 degrees from upright on a horizontal axis with respect to the inlet connection.

Multipoise - any position on a horizontal, vertical or intermediate axis with respect to the inlet connection.

If the manufacturer has not selected any of the optional mounting classifications, sufficient tests shall be conducted to determine compliance with 2.5 when the valve is tilted 10 degrees in any direction from the manufacturer's specified upright position.

2.1.2 Unless otherwise specified, the tests specified herein shall be conducted at operating ambient temperatures specified by the manufacturer as follows:

- a. At operating ambient temperatures of 32EF and 125EF if the specified operating ambient temperature range is from 32EF to 125EF; or
- b. 32EF and a maximum operating ambient temperature above 125EF, if the specified minimum operating ambient temperature is 32EF and the maximum operating ambient temperature is above 125EF; or
- c. 125EF and a minimum operating ambient temperature below 32EF, if the specified maximum operating ambient temperature is 125EF and the minimum operating ambient temperature is below 32EF; or
- d. Both the minimum and maximum specified operating ambient temperatures if the operating ambient

temperature range extends below 32EF and above 125EF.

## 2.2 TEST GASES

Unless otherwise specified herein, either gas or air may be used for the tests.

## 2.3 STRENGTH AND DEFORMATION

2.3.1 All parts of a valve subjected to gas pressure, except a diaphragm, shall withstand a static pressure of 5 times the maximum rated operating pressure for the valve.

### Method of Test

A separate valve not to be used for the conduct of other tests shall be tested.

The inlet and outlet of the valve under test shall be connected to a suitable hydraulic system under room temperature conditions (77 " 10EF). The pressure shall be raised slowly to five times the manufacturer's specified rated pressure for the valve and held at that pressure for 1 minute.

For a diaphragm type valve, the diaphragm shall be substantially removed to permit the test media to flow freely to both sides of the diaphragm.

There shall be no sign of rupture or mechanical dislocation of parts of the enclosure communicating with the atmosphere.

2.3.2 A valve shall be capable of withstanding, without deformation impairing valve operation, breakage or leakage, the turning effort shown in Table II exerted by assembling to piping or tubing.

This test shall not apply to valves having flange connections.

TABLE II

<u>Nominal Outlet Connections Size, Inches</u>	<u>Turning Effort, Inch-Pounds</u>
1/8	170

1/4	220
3/8	280
1/2	375
3/4	560
1	750
1-1/4	875
1-1/2	940
2	1190

Method of Test

This test shall be conducted at room temperature (77 " 10EF).

A wrench of suitable size shall be used to apply the turning force. SAE 10 viscosity machine oil shall be applied to the taper threads of steel pipe nipples, which shall be inserted in the inlet and outlet of the valve and turned up hand tight. With the inlet nipple secured in a vise, the specified turning effort shall be applied to the outlet nipple. For other than straight through type valves, the tests shall be repeated as outlined above except with the outlet nipple inserted in the vise and the turning effort applied to the inlet nipple.

Valves designed for tubing connections shall be tested as outlined above except that the torque shall be applied at opposite ends of the valve body through wrench flats or bosses and not to the tubing fittings.

There shall be no evidence of deformation, breakage, or impairment of operation as a result of making up inlet and outlet connections.

After relaxation of the applied torque, the valve shall comply with the provisions of 2.4.

2.3.3 A valve shall be capable of withstanding the bending moment generated when subjected to the applicable static load specified in Table III.

This test shall not apply to valves having tubing connections.

TABLE III

<u>Nominal Pipe Size,</u> <u>Inches</u>	<u>Static Load,</u> <u>Pounds</u>
1/8	14
1/4	16
3/8	18

1/2	20
3/4	22
1	25
1-1/4	30
1-1/2	35
2	45

#### Method of Test

This test shall be conducted at room temperature (77 " 10EF).

The valve under test and suitable lengths of standard weight pipe of the same size as the valve connections shall be made up into a pressure-tight assembly. The inlet and outlet pipes shall be connected to an air pressure system capable of applying the test pressures specified in Table IV.

With the valve in the upright position, the outlet pipe shall be clamped as close to the valve as possible in a vise or other suitable rigid support. The appropriate static load specified in Table III shall then be applied to the inlet pipe as close to the valve as possible at a 90-degree angle from the direction of the outlet tapping. If the inlet and outlet connections are of different sizes, the static load for the larger size shall be applied.

While subjected to this load, the valve shall be cycled on and off 10 times, after which the valve shall be checked for external leakage as specified in 2.4 and shall not exceed the allowable leakage rates.

## 2.4 LEAKAGE

2.4.1 Excess flow valves when tested with air at the test pressures of 1-1/2 times maximum operating pressure, shall not leak externally more than 20 cc/hr.

#### Method of Test

This test shall be conducted at both the manufacturer's specified minimum and maximum operating ambient temperatures (see 2.1.2) and at 1-1/2 times the maximum specified operating pressure.

The inlet(s) and outlet(s) of the valve shall be connected to a pneumatic system capable of supplying clean dry air at the specified test pressure. Air shall be admitted slowly and maintained at the specified test pressure. Leakage, corrected to

standard conditions of 30 inches mercury and 60EF, shall be determined by a flow measuring device, capable of accurately indicating the allowable flow, located between the air supply and the valve.

2.4.2 For manual reset type excess flow valves, leakage of air through a valve in the closed position, assumed as the result of normal operation, shall not exceed a rate, corrected to standard conditions of 30 inches mercury column and 60EF, equivalent to 2 cubic feet of propane gas per hour for valves having seal-off diameters of 1 inch or less, or of 2 cubic feet per hour per inch of seal-off diameter for valves having seal-off diameters of greater than 1 inch.

#### Method of Test

This test shall be conducted at both the manufacturer's specified minimum and maximum operating ambient temperatures and at the leakage test pressures specified in Table IV.

The inlet of the valve shall be connected to a pneumatic system capable of supplying clean dry air at the specified leakage test pressure. An airtight connection shall be made to the valve outlet, terminating in a flow measuring device capable of accurately indicating flow rates equal to the maximum permissible leakage, corrected to standard conditions of 30 inches mercury column and 60EF.

With the valve in the closed position, assumed as the result of normal operation, the leakage test pressure shall be applied to the valve inlet for a period of not less than 2 minutes. During this time, the flow measuring device shall not indicate a total leakage, through the main valve seat, in excess of the maximum permitted.

#### 2.5 OPERATION

2.5.1 An excess flow valve shall operate to shut off the gas at not more than 110 percent, or less than 80 percent of the rated closing flow rate specified by the manufacturer. After closure, the flow rate shall not exceed that specified in 2.8.

2.5.2 Three samples of each style and size shall comply with this test. Separate tests are to be conducted with each sample installed in each intended mounting position (see 1.3-f).

2.5.3 The test sample shall be set-up as outlined in the following method of test. A manometer or calibrated pressure-gauge reading in increments of not more than 0.1 inch water column shall be installed on the upstream side of the test sample to indicate the closing pressure.

#### Method of Test

- a. This test shall be conducted at the manufacturer's specified minimum ambient temperature. The inlet pressure shall be adjusted to the maximum operating pressure. The test is conducted by slowly opening the manual valve on the outlet side of the excess flow valve until the excess flow valve closes. At the instant of closing, the pressure differential across the valve and the flow rate shall be recorded. This condition shall be maintained for one minute. Spontaneous resetting or oscillating of the by-pass flow mechanism is considered a noncompliance. This test shall be repeated for a total of three determinations of the closing flow rate.
- b. Piping and other restrictions are to be removed from the outlet side of the valve. The inlet pressure is to be slowly increased until the excess flow valves closes. At the instant of closing, the flow rate and inlet pressure are to be recorded. This condition shall be maintained for one minute. Spontaneous resetting or oscillating of the by-pass flow mechanism is considered a noncompliance. The flow of air through the system is then to be interrupted. This test shall be repeated for a total of three determinations of the closing flow rate.

The tests outlined in "a" and "b" above shall be repeated at the manufacturer's specified maximum ambient temperature.

Standard weight pipe of proper size, reamed to remove burrs caused by cutting, shall be fitted to the inlet and outlet connections of the automatic valve. When a valve is provided with semi-rigid tubing connections, fittings and semi-rigid tubing of the proper size, reamed to remove burrs caused by cutting, shall be used instead of standard weight pipe.

The length of straight run of pipe before the inlet pressure tap shall not be less than 50 pipe diameters (I.D.), or in accordance with the principles established for pipe tap connections as presented in Orifice Metering of Natural Gas (Gas Measurement Committee Report No. 3, 1969) of the American Gas

Association. The length of straight run of pipe between the automatic valve and any downstream controlling means shall be 10 pipe diameters (I.D.).

Two short lengths of pipe or metal tubing having a small diameter shall be securely attached to the pipe or semi-rigid tubing, one before the inlet and the other after the outlet connection. The pressure tap before the inlet shall be located 5 pipe diameters from the discharge end of the inlet pipe or tubing.

The pressure tap after the outlet connection shall be located 5 pipe diameters from the inlet end of the discharge pipe or tubing.

A 1/16-inch diameter drill shall be inserted in each short length of pipe or metal tubing and a hole drilled through the wall of the larger pipe or semi-rigid tubing, care being taken to remove any burrs caused thereby.

The valve to be tested, shall be placed in the manufacturer's specified upright position. The pressure tap on the inlet side and the pressure tap on the outlet side shall be connected to independent pressure measuring devices having an accuracy of 1 percent as well as to a differential gage (one tap being connected to each side) which has an accuracy of 1 percent. An adjustment control valve system of the same size as the valve under test, permitting precise control, shall be installed not less than the above specified number of pipe or tubing diameters from the automatic valve or combination control under test.

A typical arrangement of the test apparatus is shown in Figure 1.

The capacity of the device shall be determined with the valve in the widest open position it naturally assumes under normal operating conditions, with the enclosure temperature maintained at the manufacturer's maximum specified operating ambient temperature. No manual adjustments of the opening shall be made.

The inlet pressure to the valve shall be set at the manufacturer's specified maximum allowable inlet pressure. The flow rate through the valve shall be adjusted to the maximum flow that can be obtained before the valve shuts off.

The capacity shall be measured by means of a direct reading flow measuring device suitable for air, and selected so as to provide a reading of volumetric accuracy within plus or minus 1 percent of the rated flow. Corrections shall be made to standard conditions of 60EF and 30 inches of mercury.

When the inlet and outlet connections of a valve differ in size, the observed pressure drop shall be corrected for the change in velocity pressure.

The closing flow rate of the valve shall again be determined, as outlined above, except the enclosure temperature shall be maintained at 32EF.

The capacity of the valve shall be calculated using the following formula:

FIGURE 1

$$q_{sc} = KQ_1 \frac{P_t \times \text{sp gr}_t}{pd_t \times \Theta_t}$$

or, since

$$\text{sp gr}_t = \frac{\text{sp gr}_1 (P_t - at) + at (\text{sp gr}_2)}{P_t}$$

then

$$q_{sc} = KQ_1 \frac{\text{sp gr}_1 (P_t - at) + at (\text{sp gr}_2)}{pd_t \times \Theta_t}$$

where:

- K = 5218 for U.S. customary units (345.543 for metric units)
- $q_{sc}$  = capacity with gas of 1,000 Btu per cu. ft. (37.2 MJ/m<sup>3</sup>) and 0.64 sp. gr. [saturated with water at 60EF (15.5 C) and 30 in. mercury column (101.3 kPa)] at which a pressure drop of 0.3 inch equivalent water column (7.5 Pa) occurs, Btu per hr. (kW),
- $Q_1$  = quantity of test gas (or air) as metered, cu. ft. per hr. (m<sup>3</sup>/hr.),
- $\text{sp gr}_1$  = specific gravity of dry test gas (or air) referred to dry air as 1.0,
- $\text{sp gr}_t$  = corrected or actual specific gravity of test gas (or air) as metered,
- $P_t$  = absolute pressure of test gas (or air) as metered, in. mercury column (kPa),
- at = aqueous tension of water vapor in test gas (or air), in. mercury column (kPa),
- $\text{sp gr}_2$  = 0.62 = specific gravity of water vapor referred to dry air as 1.0,
- $pd_t$  = observed pressure drop (corrected for difference in velocity head, if any, due to change of area at points tappings are taken), in. water column (Pa), and

$\theta_i$  = temperature of test gas (or air) as metered, ER absolute (K).

In the event the flow areas at the inlet and outlet tappings are different:

$$pd_i = pd_o + h_{v1} - h_{v2}$$

where:

The velocity head, in. water column, at the inlet tapping ( $h_{v1}$ ) or outlet tapping ( $h_{v2}$ ) is found by the following formula:

$$h_v = \frac{C \times Q_i^2 \times P \times \text{sp gr}_i}{D^4 \theta_i}$$

and:

C =  $1.0335 \times 10^{-5}$ , for U.S. customary units ( $2.1923 \times 10^{-10}$  for metric units),

$pd_o$  = pressure drop between inlet and outlet pressure tappings on manifold as observed, in. water column (kPa),

D = inside diameter of pipe at inlet or outlet pressure tapping, in. (mm), and

P = absolute pressure of test gas (or air) at inlet or outlet pressure tapping, in. mercury column (kPa).

## 2.6 RESET

An excess flow gas valve shall be capable of being reset without excessive force as follows:

a. Manual Reset Type. This valve type shall be capable of being reset at the manufacturer's maximum specified inlet pressure with either:

1. A torque of 10 inch-pounds at an angular velocity of 180 degrees per second; or
2. A linear force of 10 pounds; or

3. A back-pressure applied downstream of the device as specified by the manufacturer.
- b. Automatic Reset Type. This valve type shall reset only when either of the following conditions are met:
  1. Inlet and outlet gas pressure of the valve are allowed to equalize.
  2. Gas pressure upstream of the valve is reduced to atmospheric pressure.

An automatic reset type excess flow valve shall comply with the following method of test:

#### Method of Test

This test may be conducted in conjunction with Section 2.5.

This test shall be conducted at the manufacturer's specified minimum ambient temperature.

The test apparatus shown in Fig. 1 shall be used. A branch tee with a No. 60 orifice discharging to the atmosphere shall be placed between the test valve and the outlet adjustment control valve. The test valve shall be caused to close using the procedure described in Section 2.5.3a. After closure, the outlet adjustment control valve shall be completely closed. The test valve shall not reset. The flow rate shall be observed to verify that no resetting has occurred. Flow through the No. 60 orifice shall then be reduced to zero by blocking the outlet of the orifice. The test valve shall reset within one minute after the inlet and outlet pressures have equalized. The outlet adjustment control valve shall be slowly reopened and the flow rate observed to verify that resetting has occurred.

The test valve shall then be caused to close using the above procedure. The inlet pressure shall be reduced to zero psig. After one minute at pressure equilibrium, the inlet pressure shall be increased and the flow rate observed to verify that the test valve has been reset.

These tests shall be repeated for a total of three determinations.

The tests outlined above shall be repeated at the manufacturer's specified maximum ambient temperature.

## 2.7 ENDURANCE

An excess flow gas valve shall perform its intended function without failure or impairment of operation when cycled 100 times as specified in the following Method of Test.

### Method of Test

The device previously tested under Leakage (2.4) and Operation (2.5) shall be used for this test.

The setup and procedure described in 2.5 and 2.6 shall be used to produce a closing/reset cycling rate not to exceed that specified by the manufacturer.

The valve shall be cycled 50 times at the specified minimum temperature and 50 times at the specified maximum temperature.

Following cycling, the valve shall comply with sections 2.4, 2.5, and 2.6.

## 2.8 BYPASS FLOW RATE

An excess flow gas valve that incorporates a bypass shall not have a bypass flow rate greater than 10 cubic feet per hour of air when corrected to 30 inch Hg and 60EF.

### Method of Test

A gas tight connection shall be made to the inlet and outlet of the device. With the valve in the closed position, the rate of flow shall be determined at the maximum inlet pressure specified by the manufacturer and in the manufacturer's specified upright position. If the valve is designed for use in positions other than upright, additional tests to determine the rate of flow shall be conducted when the valve is installed in other positions.

## 2.9 MARKING MATERIAL ADHESION AND LEGIBILITY

The adhesive quality and legibility of all marking materials shall not be adversely affected when the marking materials are exposed to heat and moisture as specified in the following Method of Test.

### Method of Test

These tests shall be conducted on two devices as received and following the completion of the tests specified in 2.7 or equivalent periods of time and temperature. The manufacturer shall have applied the marking materials to the devices as they would be applied in production.

Each sample of marking material shall exhibit:

- a. Good adhesion and no curling at the edges;
- b. No illegible or defaced printing by rubbing with thumb or finger pressure; and
- c. Good adhesion when a dull metal blade (as the back of a pocketknife blade) is held at right angles to the applied marking and scraped across the edges of the marking.

The manufacturer shall supply evidence that the marking materials and adhesives will not be adversely affected by water.

Good adhesion qualities shall be obtained under all of the above test conditions.

Final acceptance of marking materials shall be based on the suitability of the application of the marking material to the device.

### PART III MANUFACTURING AND PRODUCTION TESTS

The manufacturer shall submit to the certifying agency a plan which is mutually acceptable to the manufacturer and the certifying agency and which describes the programs and test procedures specified in 3.1, 3.2, 3.3 and the records to be kept by the manufacturer.

3.1 The manufacturer shall use a program to qualify raw materials, parts, assemblies and purchased components.

3.2 The manufacturer shall test each device covered by these requirements at room temperature for:

- a. External and internal leakage (2.4);
- b. Operation (2.5).

3.3 The manufacturer shall use a program which includes a mutually acceptable schedule(s) to:

- a. Conduct high temperature operation tests;
- b. Conduct low temperature operation tests;
- c. Conduct strength tests (2.3);
- d. Conduct reset tests (2.6);
- e. Conduct endurance tests (2.7).

3.4 The manufacturer's test method(s) specified in 3.2 and 3.3 shall be capable of relating back to the test(s) specified in the requirement.

#### PART IV DEFINITIONS

BODY. The principal structure of the device which contains and supports an actuating mechanism and constitutes the main gas passage.

BTU. Abbreviation for British Thermal Unit. The quantity of heat required to raise the temperature of 1 pound of water 1°F.

BURNER. A device for the final conveyance of the gas, or a mixture of gas and air, to the combustion zone.

BYPASS. A passage, provided in the body of the device or in a gas line around the body, which permits a gas flow from the inlet to the outlet connections of the device entirely independent of the action of the valve.

FIELD INSTALLATION AND WIRING. Field installation and wiring is involved when the automatic valve is initially installed in the field in accordance with the National Electrical Code, ANSI/NFPA 70-1987, but remote from the original equipment manufacturer's factory control and supervision.

LIQUEFIED PETROLEUM GASES. The terms "Liquefied Petroleum Gases," "LPG" and "LP-Gas" as used in these requirements shall mean and include any material which is composed predominantly of any of the following hydrocarbons, or mixtures of them; propane, propylene, butanes (normal butanes or isobutane), and butylenes.

ORIFICE. The opening in a cap, spud, or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.

SPECIFIC GRAVITY. As applied to gas, specific gravity is the ratio of the weight of a given volume to that of the same volume of air, both measured under the same conditions.

TOOLS, SPECIAL. Those tools that are not available on the open retail market.

VALVE.

1. Automatic. An automatic or semi-automatic device consisting essentially of a valve and operator, which

may or may not be a function of a combination control (see definition), that controls the gas supply to the burner(s) during operation of an appliance. The operator may be actuated by application of gas pressure on a flexible diaphragm, by electrical means, by mechanical means or by other means.

2. Diaphragm Type Automatic. A device consisting of an automatic valve actuated by means of the application of gas pressure upon a flexible diaphragm.
3. Excess Flow Type. A device actuated by a predetermined gas flow rate to shut off or limit the flow of gas to the downstream system.
4. Electric Type Automatic. A device actuated by electrical energy for controlling the gas supply.
5. Semi-Automatic. A valve that is opened manually and closed automatically, or vice versa.
6. Safety Shutoff. A valve that is automatically closed by the safety control system or by an emergency device. Such valve may be of the automatic or manually opened type.
7. Thermally Actuated. An automatic valve which utilizes the heat generated by the resistance of an electrical component in opening or closing the valve.

APPENDIX A TABLE OF CONVERSION FACTORS