



Member of the FM Global Group

Approval Standard for Pressure Reducing Valves

Class Number 1362

October 1984

Foreword

The FM Approvals certification mark is intended to verify that the products and services described will meet FM Approvals' stated conditions of performance, safety and quality useful to the ends of property conservation. The purpose of Approval Standards is to present the criteria for FM Approval of various types of products and services, as guidance for FM Approvals personnel, manufacturers, users and authorities having jurisdiction.

Products submitted for certification by FM Approvals shall demonstrate that they meet the intent of the Approval Standard, and that quality control in manufacturing shall ensure a consistently uniform and reliable product. Approval Standards strive to be performance-oriented. They are intended to facilitate technological development.

For examining equipment, materials and services, Approval Standards:

- a) must be useful to the ends of property conservation by preventing, limiting or not causing damage under the conditions stated by the Approval listing; and
- b) must be readily identifiable.

Continuance of Approval and listing depends on compliance with the Approval Agreement, satisfactory performance in the field, on successful re-examinations of equipment, materials, and services as appropriate, and on periodic follow-up audits of the manufacturing facility.

FM Approvals LLC reserves the right in its sole judgment to change or revise its standards, criteria, methods, or procedures.

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I. INTRODUCTION

- 1.1 Pressure reducing valves are used to control the downstream water pressure in a fire protection system. They may be either direct acting which are operated automatically by inner hydraulic controls, or pilot-operated diaphragm type globe valves.
- 1.2 "Pressure reducing valves" as used in this standard includes the trim and/or associated devices, such as a pressure relief valve, necessary for the satisfactory and reliable operation of the pressure reducing valve.
- 1.3 FM Approval is based upon satisfactory evaluation of the product and the manufacturer in four major areas:
 - 1.3.1 Examination and tests on production samples are performed to evaluate 1) the proper operation and performance of the product as specified by the manufacturer and required by FM Approvals and, as far as practical; 2) the durability and reliability of the product.
 - 1.3.2 An examination of manufacturing facilities and audit of quality control procedures is made to evaluate the manufacturer's ability to produce the product which is examined and tested. These examinations are periodically repeated as part of FM Approvals' product follow-up program.
 - 1.3.3 Periodic re-examination of production samples is done to ensure continued conformity to requirements.
 - 1.3.4 Satisfactory field experience is the final test of approval. Unsatisfactory field experience may result in withdrawal of FM Approval.
- 1.4 FM Approval of pressure reducing valves is limited to their use in 1) systems where the valve can be exercised periodically by water flow and, 2) systems with devices which can automatically relieve excess pressure downstream of the valves.
- 1.5 The requirements of this standard are guidelines reflecting current FM Approval tests and practices. Devices which do not conform to these requirements may be approved if they meet the intent of this standard. Conversely, those that do conform may not be approved if other conditions govern.
- 1.6 Units of Measurement

Units of measurement are English system standard units. These are followed by their approximate equivalents in SI units, enclosed in parentheses. The Appendix lists the selected units for quantities used in this standard. Conversions to SI units are included.

II GENERAL

2.1 Sizes

The standard pressure reducing valve sizes associated with fire protection service are listed below. Others may be considered if there is a demonstrated need for them.

<i>in.</i>	<i>(mm)</i>	<i>in.</i>	<i>(mm)</i>	<i>in.</i>	<i>(mm)</i>
1½	(40)	3	(75)	10	(250)
2	(50)	4	(100)	12	(300)
2½	(65)	6	(150)	14	(350)
		8	(200)		

2.2 End Connections

The pressure reducing valves shall be provided with nationally recognized end connections.

2.3 Pressure Relief Valve

A 1½ in. (40 mm) or larger pressure relief valve must be supplied for installation with every pressure reducing valve. The pressure relief valve must have an adjustment range of 50 psi (345 kPa) or less to 200 psi (1379 kPa), maximum.

2.4 Rated Working Pressure

The pressure reducing valves and associated devices shall have a minimum rated working pressure of 175 psi (1207 kPa).

2.5 Materials

All materials shall be suitable for the intended application. Internal components of the pressure reducing valves and those of associated devices which, if corroded, would render the pressure reducing valve inoperative or reduce the performance to an unsatisfactory level shall be made of a material which has a corrosion resistance equal to or better than that of a bronze alloy with a minimum content of 80 percent copper.

2.6 Clearances

2.6.1 Clearances shall be provided between working parts and working and stationary parts so that corrosion or deposits of foreign matter within the assembly will not render the valve inoperative or reduce its performance to an unsatisfactory level.

2.6.2 To reduce the possibility of corrosion or the deposits of foreign material from lodging between the periphery of the disc holder, or equivalent component, and the inside of the valve body, a minimum clearance of ⅜ in. (9.5 mm) and ¾ in. (19.0 mm) shall be maintained in every position from open to closed for bronze and cast iron bodied valves, respectively.

2.7 Screen

A screen shall be provided to protect orifices or ports which are ¼ in. (6.4 mm) in diameter or less. The diameter of the holes in the screen shall be at least ⅓ in. (1.6 mm) less than the diameter of the smallest orifice to be protected. The total area of the openings in the screen shall be at least 20 times greater than the area of the orifice the screen is designed to protect.

2.8 Pressure Setting

Means shall be provided to lock or seal the pressure reducing valve at the adjusted pressure setting.

2.9 Position Indicator

A position indicator shall be provided to give visual indication of every position of the disc assembly, or equivalent component, from open to closed.

2.10 Manual Closing

A manual closing feature may be incorporated in the design of a pressure reducing valve. If such a feature is provided, a position indicator shall be provided to give visual indication of its position from open to closed and means shall be provided to lock it in the full open position.

2.11 Maintenance

2.11.1 The pressure reducing valves shall be fully serviceable while installed in the line without the use of special tools.

2.11.2 The components of the pressure reducing valves and those of associated devices shall be designed so as to preclude misassembly.

III MARKINGS

3.1 The pressure reducing valve shall be permanently marked with the following information which may be cast into the valve body or inscribed on a securely attached corrosion-resistant nameplate: the manufacturer's name and location, the model or type designation, the maximum rated working pressure, the year of manufacture, the size, a flow directional arrow, and the FM Approval mark.

3.2 The words OPEN and CLOSED (or SHUT) shall be cast or stamped in the proximity of the position indicator. The indicator shall point to these words when the valve is fully open or closed.

IV EXAMINATION AND TESTS

4.1 Preliminary Information

Prior to testing, the manufacturer shall provide the following information:

- Anticipated hydraulic performance data for the full operational range
- Minimum allowable flow rate for the maximum allowable pressure drop across the valve
- Maximum allowable flow rate for the minimum allowable pressure drop across the valve
- Friction loss data for the valve in its fully open position
- Assembly and detail drawings including materials specifications (ASTM or Unified Numbering System)
- Maintenance, operation and installation instructions.

4.2 Operation

4.2.1 The pressure reducing valve shall be tested at various pressures and flows to verify the manufacturer's anticipated hydraulic performance data.

4.2.2 The pressure relief valve shall be tested to determine the adjustable pressure range.

4.3 Friction Loss

Although requirements are not specified, the friction loss of approved pressure reducing valves shall be determined in the fully open position and at the flow rates tabulated below. Results shall be listed in the Approval Guide.

Valve Size		Flow	
in.	(mm)	gal/min	(dm ³ /min)
1½	(40)	100	(378)
2	(50)	200	(757)
2½	(65)	250	(946)
3	(75)	400	(1514)
4	(100)	750	(2839)
6	(150)	1500	(5678)
8	(200)	3000	(11,356)
10	(250)	4900	(18,500)
12	(300)	7000	(26,500)
14	(350)	9500	(35,900)

Note: For valves larger than 8 in. (200 mm) it shall be the responsibility of the manufacturer to submit friction loss data points.

4.4 Seat Leakage

4.4.1 With the outlet open to atmosphere, the inlet side of the pressure reducing valve shall be subjected to a hydrostatic pressure of 225 psi (11551 kPa) or at 50 psi (345 kPa) in excess of the rated working pressure, whichever is greater. If the design of the valve warrants, the outlet side of the valve may also be pressurized. The pressure differential between the inlet and outlet sides of the valve shall be 225 psi (1551 kPa) or 50 psi (345 kPa) in excess of the rated working pressure, whichever is greater. If the design of the valve includes a spring, the spring tension shall be in accordance with the manufacturer's recommendation for the applied hydrostatic pressure conditions. The applied hydrostatic pressure condition shall be maintained for 2 hours. There shall be no leakage past the seat of the valve during this test.

4.4.2 Pressure reducing valves equipped with a manual closing feature shall be closed manually and subjected to the conditions and requirements specified in paragraph 4.4.1. The torque applied to the stem to close the valve shall not exceed the following:

Valve Size		Torque	
in.	(mm)	lb·ft	(N·m)
1½	(40)	45	(60)
2	(50)	45	(60)
2½	(65)	55	(75)
3	(75)	55	(75)
4	(100)	75	(100)
6	(150)	110	(150)
8	(200)	150	(200)
10	(250)	185	(250)
12	(300)	225	(300)
14	(350)	225	(300)

4.4.3 The inlet of the pressure relief valve, when adjusted to open at 200 psi (1379 kPa) shall be subjected to hydrostatic pressures of 50, 100, and 175 psi (345, 689, and 1207 kPa) for 5 minutes at each pressure. There shall be no leakage past the seat during this test.

4.5 Stem Seal and Packing Replacement

4.5.1 If the pressure reducing valve has a manual closing feature, it shall have a stem seal designed to prevent water within the body from escaping to atmosphere. If packing is used, it shall be arranged so that the packing can be replaced with the valve in the wide open position and at its rated working pressure.

4.5.2 The pressure reducing valve, in a partially open position, shall be subjected to a hydrostatic pressure of 225 psi (1551 kPa) or at 50 psi (345 kPa) in excess of the rated working pressure, which is greater, for 2 hours. There shall be no leakage around the stem during this test.

4.6 Disc Assembly, or Equivalent Component/Disc Strength

With the inlet open to atmosphere, a hydrostatic pressure of two times the rated working pressure shall be applied to the outlet of the pressure reducing valve. This pressure shall be maintained for 5 minutes. During and at the conclusion of this test, no leakage, fracture, permanent distortion, or functional impairment shall occur.

4.7 Diaphragm Strength

Diaphragms in the pressure reducing valve, associated devices or pressure relief valve shall be subjected to a hydrostatic pressure of two times the rated working pressure for 5 minutes. During and at the conclusion of this test, there shall be no evidence of leakage or functional impairment.

4.8 Body Strength

The body of the pressure reducing valve, associated devices, and pressure relief valve shall be subjected to a hydrostatic pressure of four times the rated working pressure for 5 minutes without evidence of physical damage.

4.9 Durability

4.9.1 The pressure reducing valve and associated devices and the pressure relief valve shall be opened and closed 1000 times under representative pressures and flows. The valves shall continue to operate properly after this test and the leakage requirements specified in Paragraph 4.4 shall still apply.

4.9.2 The pressure reducing valve shall be subjected to the manufacturer's recommended minimum allowable flow rate for the maximum allowable pressure drop and to the maximum allowable flow rate for the minimum allowable pressure drop. Each of these conditions shall be maintained for 90 minutes without evidence of fluctuation, vibration, or damaging cavitation.

4.10 Operating Mechanism

The operating mechanism of a pressure reducing valve equipped with a manual closing feature shall be subjected to the following torques without failure or permanent distortion of parts:

<i>Valve Size</i>		<i>Torque</i>	
<i>in.</i>	<i>(mm)</i>	<i>lb•ft</i>	<i>(N•m)</i>
1½	(40)	60	(80)
2	(50)	75	(100)
2½	(65)	150	(200)
3	(75)	150	(200)
4	(100)	250	(350)
6	(150)	300	(400)
8	(200)	400	(550)
10	(250)	600	(800)
12	(300)	900	(1200)
14	(350)	900	(1200)

4.11 Other

At the discretion of FM Approvals, other tests may be performed to verify the integrity and reliability of an unusual design or material application.

APPENDIX
UNITS OF MEASUREMENT

FLOW: gal/min – “gallons per minute”
(dm³/min – “cubic decimeters per minute”)

$$\text{dm}^3 = 3.7854 \times \text{gal/min}$$

LENGTH: in. – “inches”
(mm – “millimeters”)

$$\text{mm} = 25.4 \times \text{in.}$$

PRESSURE: psi – “pounds per square inch”
(kPa – “kilopascals”)

$$\text{kPa} = 6.8948 \times \text{psi}$$