

Seat Tightness of Pressure Relief Valves

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Seat Tightness of Pressure Relief Valves

1 Scope

This standard describes methods of determining the seat tightness of metal- and soft-seated pressure relief valves, including those of conventional, bellows, and pilot-operated designs.

The maximum acceptable leakage rates are defined for pressure relief valves with set pressures from 103 kPa gauge (15 psig) to ~~41,379~~ kPa gauge (6000 psig). If greater seat tightness is required, the purchaser shall specify it in the purchase order. ↖ 41,400

The test medium for determining the seat tightness—air, steam, or water—shall be the same as that used for determining the set pressure of the valve.

For dual-service valves, the test medium—air, steam, or water—shall be the same as the primary relieving medium.

To ensure safety, the procedures outlined in this standard shall be performed by persons experienced in the use and functions of pressure relief valves.

Caution—When looking for leakage, the observer shall use a mirror or some other indirect means of observation so that the observer’s face is not in line with the outlet of the valve, in case the valve accidentally pops.

2 Testing with Air

2.1 Test Apparatus

A test arrangement for determining seat tightness with air is shown in Figure 1. Leakage shall be measured using a tube with an outside diameter of 7.9 mm (⁵/₁₆ in.) and a wall thickness of 0.89 mm (0.035 in.). The tube end shall be cut square and smooth. The tube opening shall be 12.7 mm (¹/₂ in.) below the surface of the water. The tube shall be perpendicular to the surface of the water.

Arrangement shall be made to safely relieve or contain body pressure in case the valve accidentally pops (see Figure 2).

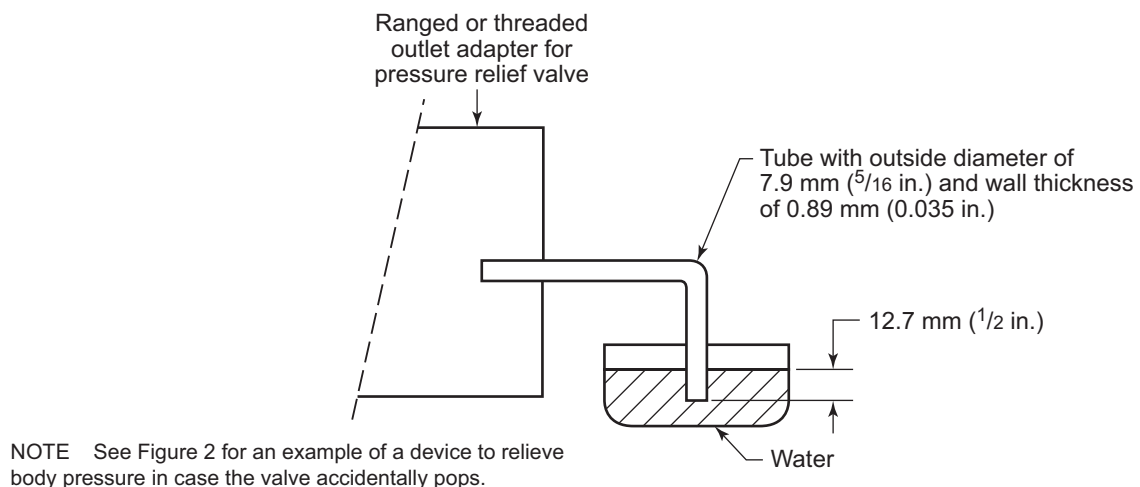


Figure 1—Apparatus to Test Seat Tightness with Air

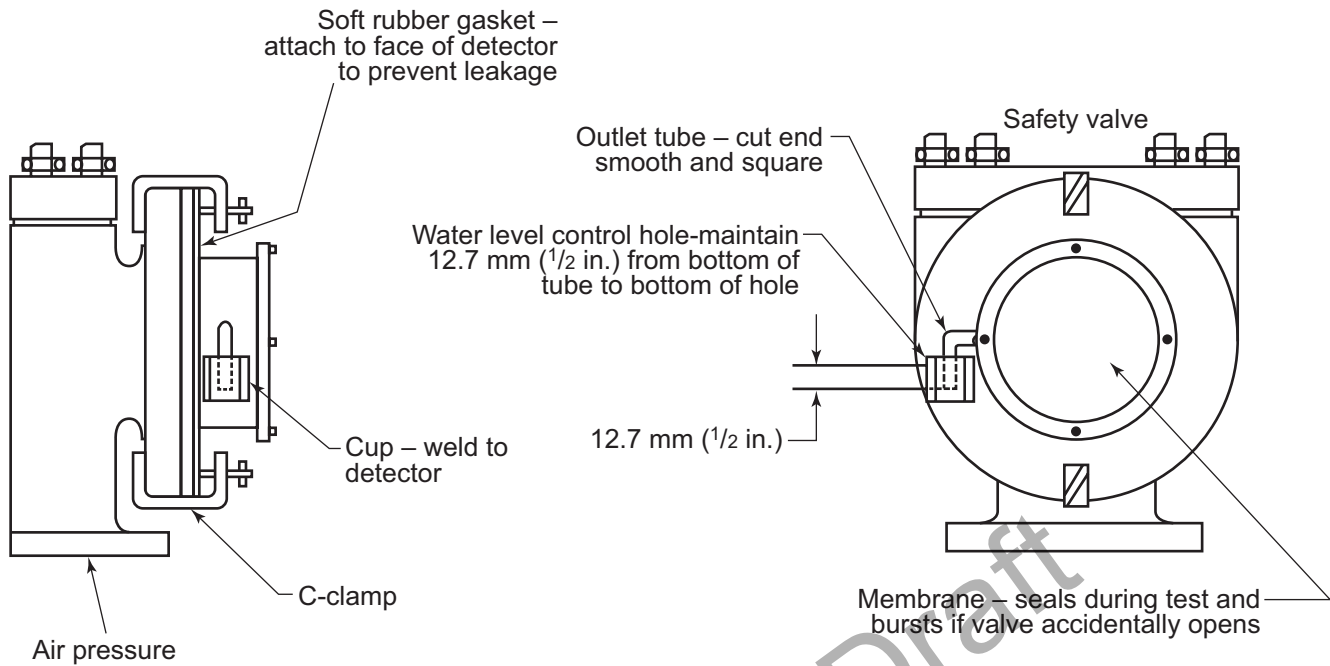


Figure 2—Device to Relieve Body Pressure Caused by Accidental Popping of the Valve

2.2 Procedure¹

2.2.1 Test Medium

The test medium shall be air (or nitrogen) near ambient temperature.

2.2.2 Test Configuration

The valve shall be vertically mounted on the test stand, and the test apparatus shall be attached to the valve outlet, as shown in Figure 1. All openings—including but not limited to caps, drain holes, vents, and outlets—shall be closed. See Figure 2 for an example of a device to relieve body pressure in case the valve accidentally pops.

2.2.3 Test Pressure

For a valve whose set pressure is greater than 345 kPa gauge (50 psig), the leakage rate in bubbles per minute shall be determined with the test pressure at the valve inlet held at 90 % of the set pressure. For a valve set at 345 kPa gauge (50 psig) or less, the test pressure shall be held at 34.5 kPa (5 psi) less than the set pressure.

2.2.4 Leakage Test

Before the leakage test, the set pressure shall be demonstrated, and all valve body joints and fittings should be checked with a suitable solution to ensure that all joints are tight.

Before the bubble count, the test pressure shall be applied for at least one minute for a valve whose nominal pipe size is 50 mm (2 in.) or smaller; two minutes for a valve whose nominal pipe size is 65 mm, 80 mm, or 100 mm (2½ in.,

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3 in., or 4 in.), and five minutes for a valve whose nominal pipe size is 150 mm (6 in.) or larger. The valve shall then be observed for leakage for at least one minute.

2.3 Acceptance Criteria

For a valve with a metal seat, the leakage rate in bubbles per minute shall not exceed the appropriate value in Table 1. For a soft-seated valve, there shall be no leakage for one minute (0 bubble/min).

Table 1—Maximum Seat Leakage Rates for Metal-Seated Pressure Relief Valves

| Set Pressure at 15.6 °C (60 °F) kPa (psig) KPa gauge | Orifice Diameter Less Than or Equal to 18 mm (0.700 in) | | Orifice Diameter Greater Than 18 mm (0.700 in) | |
|---------------------------------------------------------------|---------------------------------------------------------|----------------------------------------------------------------------|------------------------------------------------|----------------------------------------------------------------------|
| | Leakage Rate (Bubbles/min) | Approximate Leakage/24 hr Standard m ³ (ft ³) | Leakage Rate (Bubbles/min) | Approximate Leakage/24 hr Standard m ³ (ft ³) |
| 103 → 13 to 6896 (15 to 1000) | 40 | 0.017 (0.60) | 20 | 0.0085 (0.30) |
| 6,900 → 10,300 (1500) | 60 | 0.026 (0.90) | 30 | 0.013 (0.45) |
| 13,800 (2000) | 80 | 0.034 (1.20) | 40 | 0.017 (0.60) |
| 17,200 (2500) | 100 | 0.043 (1.50) | 50 | 0.021 (0.75) |
| 20,700 (3000) | 100 | 0.043 (1.50) | 60 | 0.026 (0.90) |
| 27,600 (4000) | 100 | 0.043 (1.50) | 80 | 0.034 (1.20) |
| 34,500 → 34,400 (5000) | 100 | 0.043 (1.50) | 100 | 0.043 (1.50) |
| 41,400 (6000) | 100 | 0.043 (1.50) | 100 | 0.043 (1.50) |

3 Testing with Steam

3.1 Procedure²

3.1.1 Test Medium

The test medium shall be saturated steam.

3.1.2 Test Configuration

The valve shall be vertically mounted on the steam test stand.

3.1.3 Test Pressure

For a valve whose set pressure is greater than 345 kPa gauge (50 psig), the seat tightness shall be determined with the test pressure at the valve inlet held at 90 % of the set pressure. For a valve set at 345 kPa gauge (50 psig) or less, the test pressure shall be held at 34.5 kPa (5 psi) less than the set pressure.

3.1.4 Leakage Test

Before starting the seat tightness test, the set pressure shall be demonstrated, and the test pressure shall be held for at least three minutes. Any condensate in the body bowl shall be removed before the seat tightness test. Air (or nitrogen) may be used to dry condensate.

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After any condensate has been removed, the inlet pressure shall be increased to the test pressure. Tightness shall then be checked visually using a black background. The valve shall then be observed for leakage for at least one minute.

3.2 Acceptance Criteria

For both metal- and soft-seated valves, there shall be no audible or visible leakage for one minute.

4 Testing with Water

4.1 Procedure³

4.1.1 Test Medium

The test medium shall be water near ambient temperature.

4.1.2 Test Configuration

The valve shall be vertically mounted on the water test stand.

4.1.3 Test Pressure

For a valve whose set pressure is greater than 345 kPa gauge (50 psig), the seat tightness shall be determined with the test pressure at the valve inlet held at 90 % of the set pressure. For a valve set at 345 kPa gauge (50 psig) or less, the test pressure shall be held at 34.5 kPa (5 psi) less than the set pressure.

4.1.4 Leakage Test

Before starting the seat tightness test, the set pressure shall be demonstrated, and the outlet body bowl shall be filled with water, which shall be allowed to stabilize with no visible flow from the valve outlet. The inlet pressure shall then be increased to the test pressure. The valve shall then be observed for 1 minute at the test pressure.

4.2 Acceptance Criteria

For a metal-seated valve whose inlet has a nominal pipe size of 1 in. or larger, the leakage rate shall not exceed 10 cm³/h/in. of nominal inlet size. For a metal-seated valve whose inlet has a nominal pipe size of less than 1 in., the leakage rate shall not exceed 10 cm³/h. For soft-seated valves, there shall be no leakage for one minute.

5 Testing with Air—Another Method

5.1 Type of Valve to be Tested

Valves with open bonnets—bonnets that cannot be readily sealed, as specified in 2.2.2—may be tested in accordance with this section instead of Section 2.

This alternative method shall not be used to test valves in which air bubbles can travel to the open bonnet through any passageway inside the valve guide without being observed at the valve outlet.

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5.2 Procedure ⁴

5.2.1 Test Medium

The test medium shall be air (or nitrogen) near ambient temperature.

5.2.2 Test Configuration

The valve shall be vertically mounted on the air test stand. The valve outlet shall be partially sealed with water to about 12.7 mm (¹/₂ in.) above the nozzle's seating surface.

5.2.3 Test Pressure

For a valve whose set pressure is greater than 345 kPa gauge (50 psig), the leakage rate in bubbles per minute shall be determined with the test pressure at the valve inlet held at 90 % of the set pressure. For a valve set at 345 kPa gauge (50 psig) or less, the test pressure shall be held at 34.5 kPa (5 psi) less than the set pressure.

5.2.4 Leakage Test

Before starting the seat tightness test, the set pressure shall be demonstrated, and the outlet body bowl shall be filled with water to the level of the partial seal. The inlet pressure shall then be increased to the test pressure and held at this pressure for one minute before the bubble count. The valve shall then be observed for leakage for at least one minute.

5.3 Acceptance Criteria

For a valve with a metal seat, the leakage rate in bubbles per minute shall not exceed 50 % of the appropriate value in Table 1. For a soft-seated valve, there shall be no leakage for one minute (0 bubbles/min).

⁴ Users of procedures should not rely exclusively on the information contained in this document. Sound business, scientific, engineering, and safety judgment should be used in employing the information contained herein. Where applicable, authorities having jurisdiction should be consulted.

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