



Designation: F37 – 06 (Reapproved 2019)

## Standard Test Methods for Sealability of Gasket Materials<sup>1</sup>

This standard is issued under the fixed designation F37; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

### 1. Scope

1.1 These test methods provide a means of evaluating the sealing properties of sheet and solid form-in-place gasket materials at room temperature. Test Method A is restricted to liquid leakage measurements, whereas Test Method B may be used for both liquid and gas leakage measurements.

1.2 These test methods are suitable for evaluating the sealing characteristics of a gasket material under different compressive flange loads. The test method may be used as an acceptance test when the producer and user have agreed to specific test conditions for the following parameters: test medium, internal pressure on medium, and flange load on gasket specimens.

1.3 These test methods use a small-diameter narrow-width gasket as the test specimen under relatively low gasket loads and relatively low pressures. Test Method F2378 is another sealability test method that uses a larger gasket specimen and higher internal pressures and flange loads.

1.4 The values stated in SI units are to be regarded as the standard. The values in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* (For specific hazard or warning statements, or both, see 5.2.11, Section 6, 6.3, 8.2.4, 11.3.2, and 11.4.2.)

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

<sup>1</sup> These test methods are under the jurisdiction of ASTM Committee F03 on Gaskets and are the direct responsibility of Subcommittee F03.10 on Composite Gaskets.

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### 2. Referenced Documents

#### 2.1 ASTM Standards:<sup>2</sup>

D471 Test Method for Rubber Property—Effect of Liquids  
D2000 Classification System for Rubber Products in Automotive Applications

E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

F38 Test Methods for Creep Relaxation of a Gasket Material

F104 Classification System for Nonmetallic Gasket Materials

F2378 Test Method for Sealability of Sheet, Composite, and Solid Form-in-Place Gasket Materials

#### 2.2 ANSI Standard:<sup>3</sup>

B57.1 Compressed Gas Cylinder Valve Outlet and Inlet Connections

#### 2.3 ASTM Adjuncts:

Leakage Test Fixtures<sup>4</sup>

### 3. Summary of Test Methods

3.1 Both test methods utilize a test specimen compressed between the surfaces of two smooth steel flange faces. After the specified flange load is applied, the test medium is introduced into the center of the annular gasket compressed between the flanges and the specified pressure is applied to the medium. For liquid sealability tests (Test Methods A and B), Reference Fuel A (see Test Method D471, Motor Fuel Section of Annex) is recommended and the leakage rate is measured by a change in the level of a sight-glass located in the line upstream from the gasket testing fixture. Nitrogen is the recommended gas for the gas sealability test (Test Method B) and the leakage rate is measured by a change in the level of a water manometer located in the line upstream from the gasket testing fixture.

3.1.1 Test Method A uses a test fixture (Fig. 1) by which an external load is transferred into the fixture to produce a compressive force on the gasket specimen.

<sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

<sup>4</sup> Available from ASTM International Headquarters. Order Adjunct No. ADJF0037. Original adjunct produced in 1962.

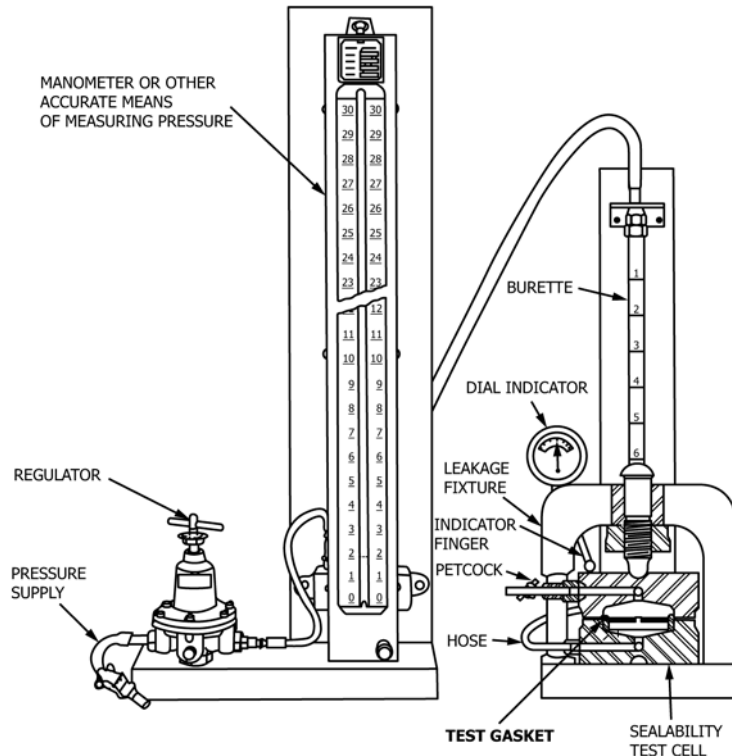


FIG. 1 Test Assembly for Determining Sealability of Gasket Materials by Liquid Leakage Measurements—Test Method A

3.1.2 Test Method B uses a test fixture (Fig. 2 and Fig. 3) in which the flanges are held within a four-bolt cage that permits loading the flanges at various force levels. The flange load is measured by a transducer held within the cage.

3.2 Results of the sealability tests are expressed as a leakage rate in millilitres per hour for the test specimen under the specific conditions of the test.

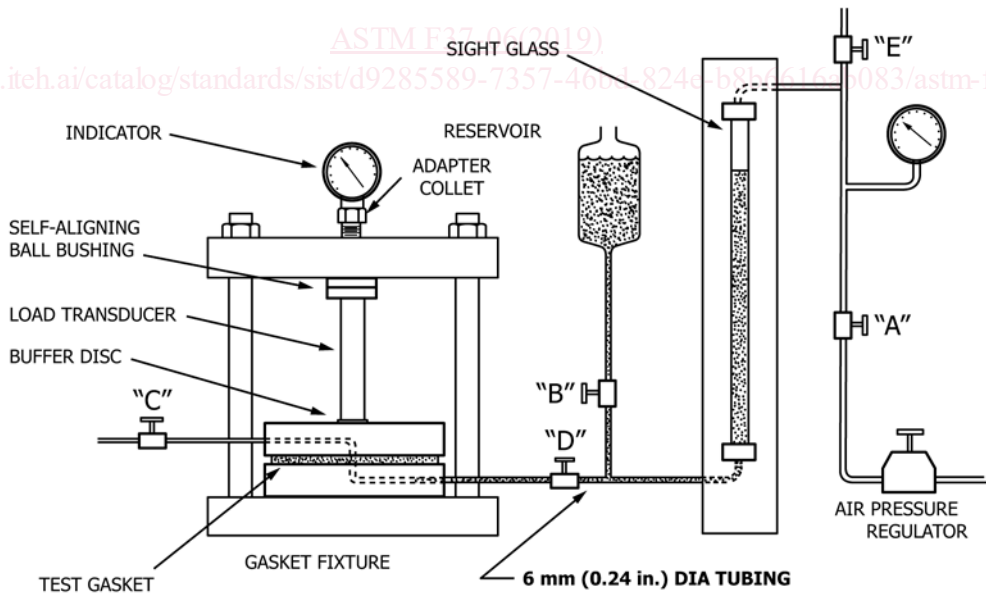


FIG. 2 Test Assembly for Determining Sealability of Gasket Materials by Liquid Leakage Measurements—Test Method B

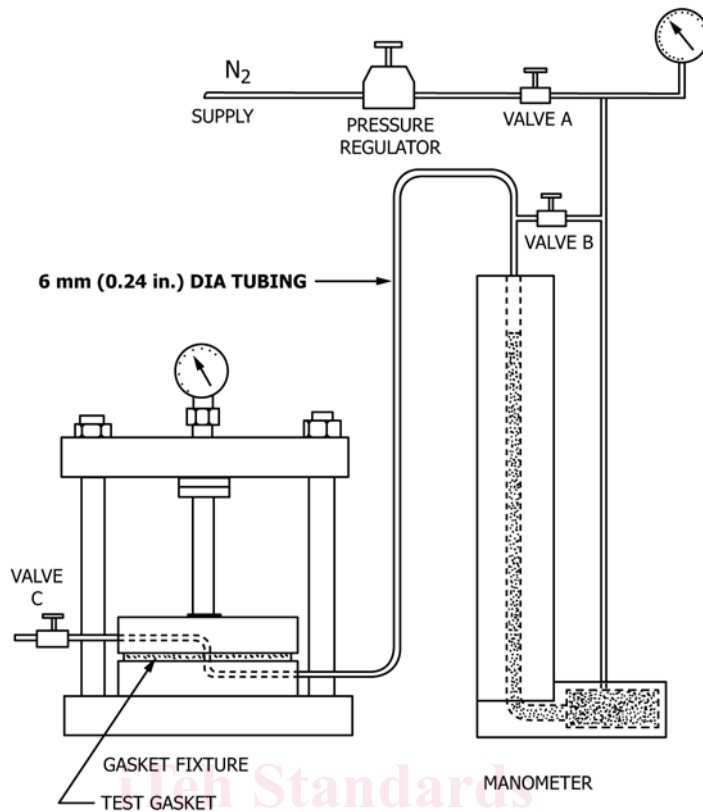


FIG. 3 Test Assembly for Determining Sealability of Gasket Materials by Gas Leakage Measurements—Test Method B

#### 4. Significance and Use

4.1 These test methods are designed to compare gasket materials under controlled conditions and to provide a precise measure of leakage rate.

4.2 These test methods are suitable for measuring leakage rates as high as 6 L/h and as low as 0.3 mL/h. In many cases, “zero” leakage may not be attainable.

4.3 These test methods evaluate leakage rates after time periods that are typically 5 to 30 min under load. Holding a gasket material under load for extended time periods may give different results.

4.4 If the fluid being used in the test causes changes, such as swelling, in the gasket material, then unpredictable results may be obtained.

#### 5. Apparatus

##### 5.1 Test Method A:

5.1.1 *Compressed Air Supply and Regulator*—A source of compressed air with a suitable regulator to control the pressure at a point between 0 and 101.4 kPa (14.7 psi).

5.1.2 *Manometer or Pressure Gauge*—A 101.4-kPa (14.7-psi) manometer or suitable pressure gauge to read the pressure to the nearest 0.67 kPa (0.1 psi).

5.1.3 *Buret*, 10-mL capacity, graduated in 0.05 mL, with a connection at each end for flexible hose.

5.1.4 *Leakage Test Fixture*, including a suitable dial indicator graduated in 0.025 mm (0.001 in.) and mounted as shown in Fig. 1. (See 2.3.)

5.1.5 *Petcock*, inserted in the upper flange to bleed air from the fixture.

5.1.6 *Hose*, flexible, suitable to withstand the pressure and liquid specified for the test being run. Piping the system with rigid copper or stainless steel tubing may result in less variation during testing.

5.1.7 *Loading Device*—A suitable means of applying an accurate external load to the leakage test fixture and of maintaining the load within  $\pm 1.0\%$ . Loading shall range from a minimum of 862 kPa (125 psi) to a maximum of 27.6 MPa (4000 psi).

##### 5.2 Test Method B:

5.2.1 *Nitrogen Supply Cylinder and Pressure Regulator*—A cylinder of dry nitrogen with a suitable regulator to control the outlet pressure.

5.2.2 *Pressure Gauge*, suitable for measuring 690-kPa (100-psig) pressure precisely. A 114-mm (4.5-in.) diameter Bourdon-type gauge with scale calibrated in 3.4-kPa (0.5-psig) graduations is recommended.<sup>5,6</sup>

5.2.3 *Test Fixture Cage*, consisting of top and bottom platens and four threaded studs with nuts, in accordance with

<sup>5</sup> The sole source of supply of the apparatus (1900 Series, 200 psi pressure range) known to the committee at this time is U.S. Gauge Division, PO Box 152, Sellersville, PA 18960.

<sup>6</sup> If you are aware of alternative suppliers, please provide this information to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,<sup>1</sup> which you may attend.

**Fig. 2** and **Fig. 3**.<sup>6,7</sup> Orient the fixture cage base horizontally and use a bubble level on the cage top platen to improve alignment of the top and bottom platen during compression of the gasket.

**5.2.4 Test Fixture Flanges**, an upper and a lower, that support the gasket being tested. The surface finish shall be 0.41 to 0.82  $\mu\text{m}$  (16 to 32  $\mu\text{in.}$ ) Ra.

**5.2.5 Load Transducer Assembly**, consisting of a calibrated load transducer, the diameter of which is dependent upon the load range desired (**Note 1**); an indicator rod that projects up the center of the transducer; a self-aligning ball bushing<sup>6,8</sup> that fits on the load transducer; and a precision dial indicator (50 mm (2 in.) in diameter and a total range of 0.152 mm (0.006 in.), with scale divisions of 0.013 mm (0.0005 in.))<sup>6,9</sup> for measuring the deflection of the transducer.

**NOTE 1**—Load transducers of various sizes will provide different load ranges. A transducer with a shaft diameter of 8.10 mm (0.319 in.) will deflect 0.025 mm/4.45 kN (0.001 in./1000 lbf). A transducer with a shaft diameter of 11.0 mm (0.433 in.) will deflect 0.025 mm/8.90 kN (0.001 in./2000 lbf). A deflection of 0.076 mm (0.003 in.) should not be exceeded, or damage to the test fixture may result.

**5.2.6 Steel Buffer Disk**—This disk of annealed steel prevents the hardened-steel transducer from damaging the top of the flange.

**5.2.7 Adapter Collet**—The adapter collet is used to attach the dial indicator to the threaded end of the load transducer. When attached properly, the indicating member on the load transducer contacts the actuating button on the dial indicator.

**NOTE 2**—Depending on the exact equipment used, sometimes the adapter collet used in Test Methods **F38**, Test Method B, can be used with this fixture.

**5.2.8 Manometer**—A standard Meriam-type 101.4-kPa (14.7-psi) manometer suitable for use with water and suitable for 2.07-MPa (300-psig) pressure. The scale shall be calibrated with 1.0-mm (0.04-in.) graduations.

**5.2.9 Sight Glass and Reservoir**—The liquid testing procedure requires a liquid reservoir that may be any metal container of approximately 1500-cm<sup>3</sup> (100-in.<sup>3</sup>) capacity that can be piped into the system and conveniently filled. A sight-glass made from 2.07-MPa (300-psig) boiler-gauge glass tubing is used for observing the fluid level. A piece of 16-mm (0.625-in.) outside diameter glass tubing approximately 280-mm (11-in.) long has proven satisfactory. This glass gauge shall be assembled with appropriate fittings and a stand. The scale used with the gauge shall be calibrated with 1.0-mm (0.04-in.) graduations. If desired, the manometer described in **5.2.8** can be used as a sight-glass (see **9.2**).

**5.2.10 Tubing, Fittings, and Valves**—Suitable high-pressure flexible tubing and either flare or compression adapter fittings may be used. Piping the system with rigid copper or stainless steel tubing may result in less variation during testing. Small

hand valves shall be used where indicated. The tubing connecting the manometer or sight-glass to the test fixture shall be of small bore to reduce the internal volume. Capillary tubing with a 1.6-mm (0.0625-in.) inside diameter is suggested.

**5.2.11 Laboratory Stress-Strain Equipment**—Suitable tension equipment with calibrated load cell to produce and measure a force required for a given deflection of the transducer tube. The tension equipment shall have an accuracy of  $\pm 5\%$  of the load value read. (**Warning**—The maximum force that can be safely applied to the equipment is 44.48 kN (10 000 lb).)

**5.2.12** Prepare some type of holding fixture to hold the bottom platen of the test fixture cage when the nuts at the top are tightened.

## 6. Hazards

**6.1** Normal safety practices required for operating pressure equipment shall be observed by the personnel conducting the tests.

**6.2** A suitably mounted, transparent safety shield shall be used as a barrier between the operator and the pressurized glass tubing.

**6.3** All components of the system must be designed to safely accommodate a maximum working pressure of 1.03 MPa (150 psig), in order to satisfy the requirements of the user and ensure the safety of the operator. (**Warning**—The maximum force that can be safely applied to the equipment is 44.48 kN (10 000 lb).)

**6.4** Care shall be exercised to ensure proper support of nitrogen gas cylinders and pressure regulators used for operating pressure control in accordance with ANSI Standard B57.1. Full details are also included in the *Handbook of Compressed Gases*.<sup>10</sup>

## 7. Test Specimens

### 7.1 Preparation of Test Specimens for Test Method A:

**7.1.1** When sheet gasket material (see Classification **F104**) is to be tested, test specimens shall be die-cut so that the edges are flat, clean, and free of burrs. If necessary the test specimens shall be flattened to remove any rollover of the specimen edges generated during die cutting. The size shall be 32.26 to 32.31 mm (1.270 to 1.272 in.) in inside diameter and 44.20 to 44.32 mm (1.740 to 1.745 in.) in outside diameter. The thickness shall be approximately 0.76 mm (0.030 in.) unless otherwise agreed upon between the producer and user. The assumed average area of this test specimen is 719.35 mm<sup>2</sup> (1.115 in.<sup>2</sup>).

**7.1.2** For reporting purposes, measure the thickness of the gasket test specimens with a micrometer in accordance with Classification **F104**.

**7.1.3** The test specimens shall be inspected and rejected for surface irregularities, such as scratches, tears, and clumps of fibers.

### 7.2 Preparation of Test Specimens for Test Method B:

#### 7.2.1 Sheet Gasket Material (see Classification **F104**):

<sup>7</sup> The sole source of supply of the apparatus known to the committee at this time is Metal Samples Co., Inc., Route 1, PO Box 152, Munford, AL 36268.

<sup>8</sup> The sole source of supply of the apparatus (Model 6SF10) known to the committee at this time is The Timken Company (Torrington Company), 1835 Dueber Ave. SW, Canton, OH 44706-0932.

<sup>9</sup> The sole source of supply of the apparatus (No. 25209) known to the committee at this time is The L.S. Starrett Company, Athol, MA.

<sup>10</sup> Available from the Compressed Gas Association, Inc., 500 Fifth Ave., New York, NY 10110.