



Designation: F2716 – 08 (Reapproved 2020)

Standard Practice for Comparison of Nonmetallic Flat Gaskets in High Pressure Saturated Steam¹

This standard is issued under the fixed designation F2716; 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 (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice provides a means of comparing various nonmetallic flat gasket materials, Classification **F104**, in saturated steam service under controlled conditions. While the practice is designed primarily for flat gaskets, it also can be applied to various form-in-place gasket materials upon modification. The practice may be used for quality control or material comparison purposes as agreed upon between producer and user. This practice is consistent with Fluid Sealing Association test method, FSA-NMG-204-02, with regard to fixtures used and procedure.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *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.*

1.4 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

A193/A193M Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications

A194/A194M Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both

F104 Classification System for Nonmetallic Gasket Materials

2.2 ASME Standards:³

ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges

ASME PCC-1 Guidelines for Pressure Boundary Bolted Flange Joint Assembly

2.3 ESA/FSA Standards:⁴

ESA/FSA Publication No. 009/98 Guidelines for Safe Seal Usage - Flanges and Gaskets

FSA-NMG-204-02 Standard Test Method for Performance of Non-Asbestos Gaskets in High Pressure, Saturated Steam

3. Significance and Use

3.1 This practice may be used to evaluate Classification **F104** gasket materials using saturated steam and standard ASME RF (raised face) flanges. This practice is intended for use as quality control or material comparison tool and should not be used to predict performance.

4. Apparatus

4.1 The test equipment shall consist of the following components:

4.1.1 *Hot Air Circulating Oven*, equipped with temperature controls and capable of maintaining temperatures up to $570 \pm 5^\circ\text{F}$ ($299 \pm 3^\circ\text{C}$).

4.1.2 *Scales*, capable of maintaining an accuracy of ± 0.1 g with a nominal capacity of 12 kg.

4.1.3 *Flange Fixture*—A2 in. cast steel Class 600 fixture made from one weld neck flange capped by welding to boiler code and one blind flange (see Fig. 1). Flange surfaces are 275 to 325 RMS $\mu\text{in.}$ (7.0 to 8.3 μmm), flatness range 0.002 in. (0.05 mm). Each fixture shall have an identification number.

¹ This practice is under the jurisdiction of ASTM Committee F03 on Gaskets and is the direct responsibility of Subcommittee F03.10 on Composite Gaskets.

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² 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.

³ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990, <http://www.asme.org>.

⁴ Available from Fluid Sealing Association (FSA), 994 Old Eagle School Road, Suite 1019, Wayne, PA 19087-1866.

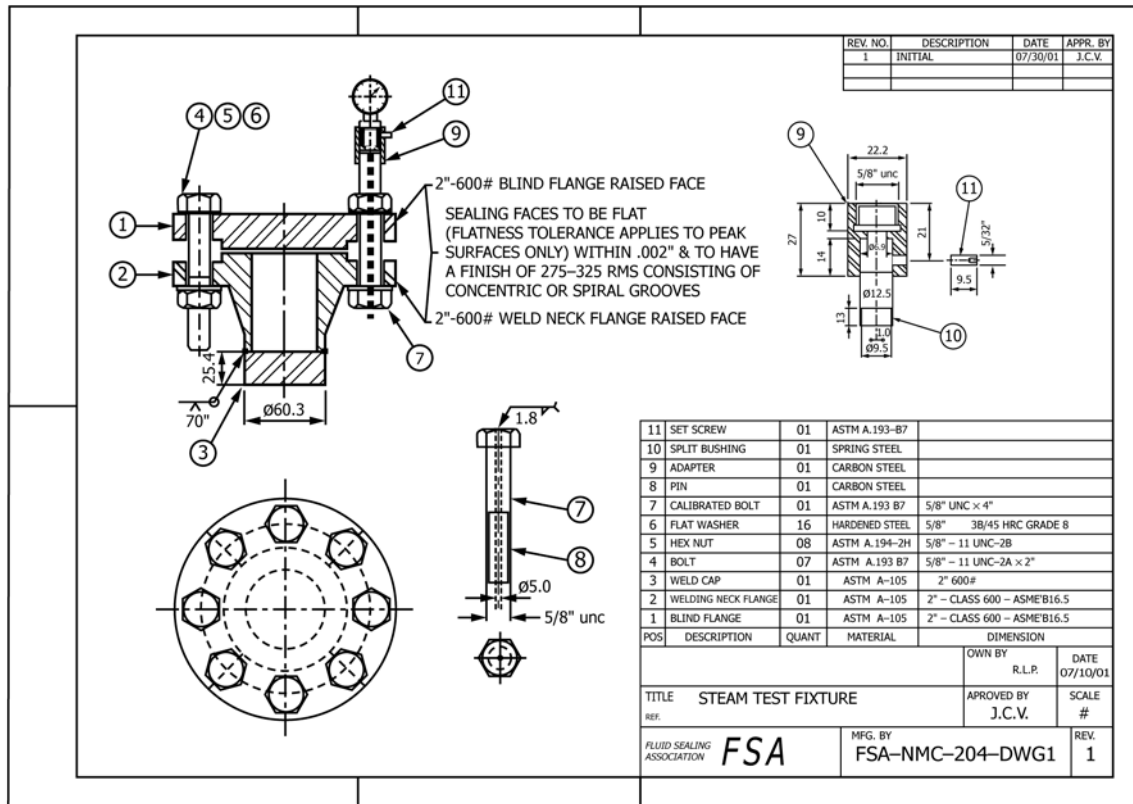


FIG. 1 FSA Steam Test Fixture

4.1.4 *Flange Protectors*—To help ensure safe operation, use standard metal flange protectors.

4.1.5 Fasteners:

4.1.5.1 Seven $\frac{5}{8}$ -in. bolts, 4 in. long, per Specification **A193/A193M**, Grade B7.

4.1.5.2 One calibrated bolt modified by the insertion of a calibration pin as detailed in **Fig. 1**.

4.1.5.3 Eight $\frac{5}{8}$ -in. hexagonal nuts per Specification **A194/A194M**, Grade 4, coarse thread.

4.1.5.4 Sixteen $\frac{5}{8}$ -in. hardened steel washers (38-45 HRC), Grade 8.

4.1.6 *Calibrated Dial Indicator*, graduated to 0.0001 in. (0.0025 mm) and equipped with a 90° conical contact point to be used in conjunction with the adapter shown in **Fig. 1**.

4.1.7 *Torque Wrench*—One calibrated torque wrench with a minimum capacity of 70 ft·lbf (95 N·m).

4.1.8 *Torque Wrench*—One calibrated torque wrench with a range of 0 to 200 in·lbf (0 to 23 N·m).

4.1.9 *Bolt Lubricant*—High temperature-resistant molybdenum disulfide grease.

4.2 Preparation of Apparatus:

4.2.1 Prior to running any tests in a new fixture, the integrity of the assembled test fixture should be checked by running a test at a temperature at least 100°F (38°C) higher than the test temperature, without exceeding the temperature/pressure rating for the flange. A standard gasket material approved for these service conditions shall be used with water as the test fluid.

4.2.2 The maximum use temperature for the fixture with saturated steam is 563°F (295°C). Therefore, if a test tempera-

ture is not specified, this maximum shall be used as the default. However, any temperature that does not exceed this limit may be used if agreed upon by the producer and user.

4.2.3 Follow the steps in Section 9 for one cycle of a minimum of 24 h. Ensure that the gasket is acceptable for that temperature/pressure.

5. Test Specimen

5.1 The test specimen shall be a Class 600 2-in. (50-mm) ring gasket. It is recommended that a $\frac{1}{16}$ -in. (1.5-mm) thick gasket be used. However, other thicknesses can be used if agreed to by the producer and user.

5.1.1 See ASME B16.21, Table 8, for gasket dimensions.

5.1.2 See Classification **F104** for thickness tolerance.

5.1.3 Preconditioning of the test gasket is not necessary, since this test is designed for shelf stock gaskets.

6. Flange Limits

6.1 Ensure that the test pressure never exceeds the pressure/temperature rating of the flange class:

	Class 600 Cast Steel
@ 400°F (205°C)	Limited to 1270 psig (88.6 bar) or (8.87 MPa)
@ 500°F (260°C)	Limited to 1200 psig (83.8 bar) or (8.38 MPa)
@ 600°F (316°C)	Limited to 1095 psig (76.6 bar) or (7.66 MPa)
@ 700°F (371°C)	Limited to 1065 psig (74.5 bar) or (7.45 MPa)

7. Test Limits

7.1 Temperature/pressure properties for saturated steam from the steam table: