Designation: F1574 – 03a (Reapproved 2017)

Standard Test Method for Compressive Strength of Gaskets at Elevated Temperatures[1]

This standard is issued under the fixed designation F1574; 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 test method covers the determination of compressive strength characteristics (crush-extrusion resistance) of gasket materials at elevated temperature.

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

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 and health 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]

F104 Classification System for Nonmetallic Gasket Materials

F1315 Test Method for Density of a Sheet Gasket Material

3. Summary of the Test Method

3.1 Specimens cut from gasket material are subjected to various stresses perpendicular to the flat surface of the specimens for a specified time at 150°C (302°F). Dimensional changes to the thickness and in the plane of the specimen are determined while it is under stress and after the stress has been removed. A graphical display of percent deformation plotted against the applied stress will enable determination of a compressive yield stress point beyond which the material will no longer decrease in thickness without also extruding in the planar dimensions. This condition is also revealed by physical measurements of the change in size of the specimens in the planar dimensions. Tests may be performed at various temperatures, as agreed upon between the producer and the user, to determine the relationship between temperature and compressive behavior.

4. Significance and Use

4.1 The compressive strength or crush-extrusion resistance of a gasket material is a major factor with regard to the selection of a given material for use in a particular sealing application. The significance of the test method is based, in part, on the assumption that a material, once it has been crushed or extruded, will no longer function as effectively as a seal. This assumption can only be used as a guide, however, since exact yield or failure points are difficult to define for gasket materials (which are usually viscoelastic in nature). Two or more materials can be compared to determine differences in their resistance to compressive stress. A sample of material can be compared to an established standard or previously determined characteristics on original lots of the same material, for quality assurance purposes. See 6.2 for discussion of specimen area and geometry effects.

5. Apparatus

5.1 *Testing Machine*[3], for applying a known value of compressive stresses to specimens. The machine should be capable of applying a stress of up to 520 MPa (75 400 psi) (tolerance of ±5 %), depending on the indent resistance of the steel platens and the means of reading the applied load.

5.2 *Hardened Steel Platens, Two* (Rockwell of C35 to 40 or equivalent), circular shape, larger than the specimen diameter. A suitable size is a diameter of approximately 100 mm (3.94 in.). The surface finish shall be RMS 0.25 to 0.50 µm (10 to 20 µm). Fig. 1 shows a suitable arrangement of steel platens and test specimen.

[1] This test method is under the jurisdiction of ASTM Committee F03 on Gaskets and is the direct responsibility of Subcommittee F03.20 on Mechanical Test Methods.

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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] Examples of such equipment include Baldwin-Southwark, Instron, Tinius-Olsen, MTS, or any type of pressing device which has been properly calibrated to apply a known force.

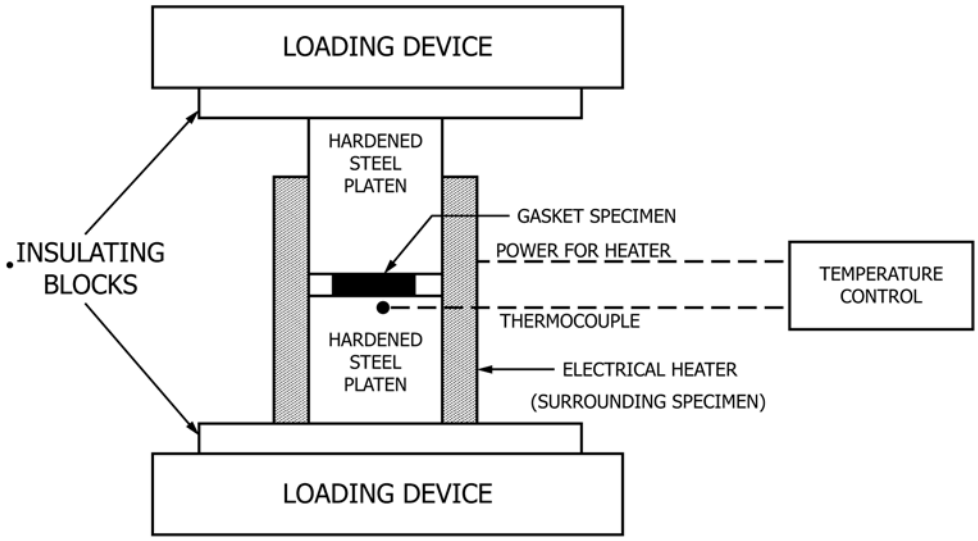

FIG. 1 Device for Testing Gasket for Compressive Strength at Elevated Temperature

5.3 *Device for Applying Heat to Platens* sufficient to achieve a desired temperature at interface with gasket material specimens. An example of this device is also shown in Fig. 1, where a resistance heater surrounds the hardened platens. In some cases, the loading device itself may be heated, such as with a hot press. Any appropriate means is acceptable. The recommended elevated temperature is 150 ± 5°C (302 ± 9°F). Other temperatures may be employed as desired, or as agreed upon between the producer and the user.

5.4 *Temperature Measuring Device* for use at interface, such as a thermocouple assembly and a means for recording the voltage.

5.5 *Dies*—Cutting dies for specimens of desired size and shape. The inside faces of the dies shall be polished and be perpendicular to the plane formed by the cutting edges for a depth sufficient to prevent any bevel on the edge. The die shall be sharp and free of nicks in order to prevent ragged edges on the specimen. The bore and outside diameter shall be concentric.

5.6 *Lead Pellets, Solder Plugs, or Similar Soft Metallic Particles,* approximately 1.6 mm [0.063 in.] in diameter.

5.7 *Micrometer,* for making specimen thickness measurements in accordance with Classification F104.

5.8 *Micrometer,* for measuring metallic particle thickness.

5.9 *Vernier Calipers* or other suitable device for making linear dimensional measurements in the plane of the specimens, capable of reading to the nearest 0.025 mm (0.001 in.) or less.

6. Test Specimens

6.1 The gasket shall be die cut in the shape of an annulus, which may be considered indicative of an area of a gasket. The area shall be sufficiently small as to allow an applied stress of up to 520 MPa (75 400 psi) (±5 %). Three specimens should be prepared for each applied stress at which the material is to be evaluated.

6.2 The recommended annular specimen size is 23.8 ± 0.5 mm (0.937 ± 0.02 in.) outside diameter by 12.7 ± 0.5 mm (0.500 ± 0.02 in.) inside diameter. Therefore, this size will have an annular width of approximately 5.5 mm (0.219 in.), where the annular width is the difference between the outer and inner radius. The area will be approximately 323 mm^2 (0.5 in.^{2}). If, because of loading capacity or agreement between the producer and the user, a specimen of different area is tested, it is recommended that the annulus width be kept constant at 5.5 mm (0.219 in.) so as not to introduce additional variation to the test. If comparisons between two or more laboratories are to be made, the specimen area and annulus width should be the same.

6.3 The recommended test specimen thickness may vary depending on the type of testing machine employed, type of material being evaluated, and the application to which the results are directed. The exact effect of specimen thickness on the test results is not being addressed in this test method, other than to acknowledge it will most likely influence the results and should be a part of the report as specified in Section 10. See Table 3 in Classification F104 for recommended thicknesses for different types of materials.

7. Conditioning

7.1 Condition the cut specimens in accordance with the appropriate procedure specified in Classification F104 with respect to the type of gasket material from which the specimens are cut.

8. Procedure

8.1 Determine applied stress at which the gasket material will be evaluated. It should be representative of typical operating conditions for the gaskets made of the material, and should include additional higher and lower stress conditions when a full range evaluation of the material is desired. Several different stresses should be selected to cover the entire range. A series of stresses in increments of 70 MPa (10 152 psi) is recommended, to a maximum of 520 MPa (57 400 psi) or until