Designation: F2837 – 10

Standard Test Method for Hot Compression Properties of Gasket Materials[1]

This standard is issued under the fixed designation F2837; 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 a means of measuring the hot compression properties of a gasket material by measuring its creep under a constant load at both room temperature and while increasing the temperature. Short term creep properties including both cold and hot creep, total creep and compression set of a gasket material can be determined.

1.2 The values stated in SI units are to be regarded as standard. The values given 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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F104 Classification System for Nonmetallic Gasket Materials

3. Terminology

3.1 *Symbols*:

T_0 = original specimen thickness

T_1 = cold thickness under load (specimen thickness after a 5-min hold under load at room temperature)

T_2 = hot thickness under load (specimen thickness at maximum test temperature under load)

T_3 = final specimen thickness (after specimen has been removed from the machine and cooled)

T_{s0} = original calibration ring thickness

T_{s1} = calibration ring thickness (after a 5-min hold under load at room temperature)

T_{s2} = calibration ring thickness (at maximum test temperature under load)

T_{s3} = final calibration ring thickness (after specimen has been removed from the machine and cooled)

4. Summary of Test Method

4.1 Specimens cut from gasket material are subjected to a stress perpendicular to the flat surface of the specimen for a specified time at room temperature, and then the temperature is increased at a defined rate while the stress remains constant. The recommended maximum temperature limit for the test is 300°C (572°F). The desired gasket load for the test is 25.5 MPa (3700 psi). Dimensional changes to the thickness are determined while the gasket is under stress and after the stress has been removed. Tests may be performed on a gasket material at various temperatures or stresses as agreed upon between the producer and the user, to determine the relationship between temperatures at a constant stress.

5. Significance and Use

5.1 The hot compression properties of a gasket material, including creep resistance and compression set, are 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 if a material exhibits too much creep at elevated temperature that it 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 hot compression properties. 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.

5.2 Samples are to be tested with a raised profile insert or calibration ring described in 6.3 and Fig. 1 so that the area (2042 mm^2 (3.17 $in.^2$)) remains constant during the test.

6. Apparatus

6.1 *Testing Machine*, for applying a known value of compressive stresses to specimens. The machine should be capable of applying a stress of up to 51.7 MPa (7500 psi) (tolerance of ±5 %), depending on the indent resistance of the steel platens and the means of reading the applied load.

[1] This test method is under the jurisdiction of ASTM Committee F03 on Gaskets and is the direct responsibility of Subcommittee F03.40 on Chemical 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.

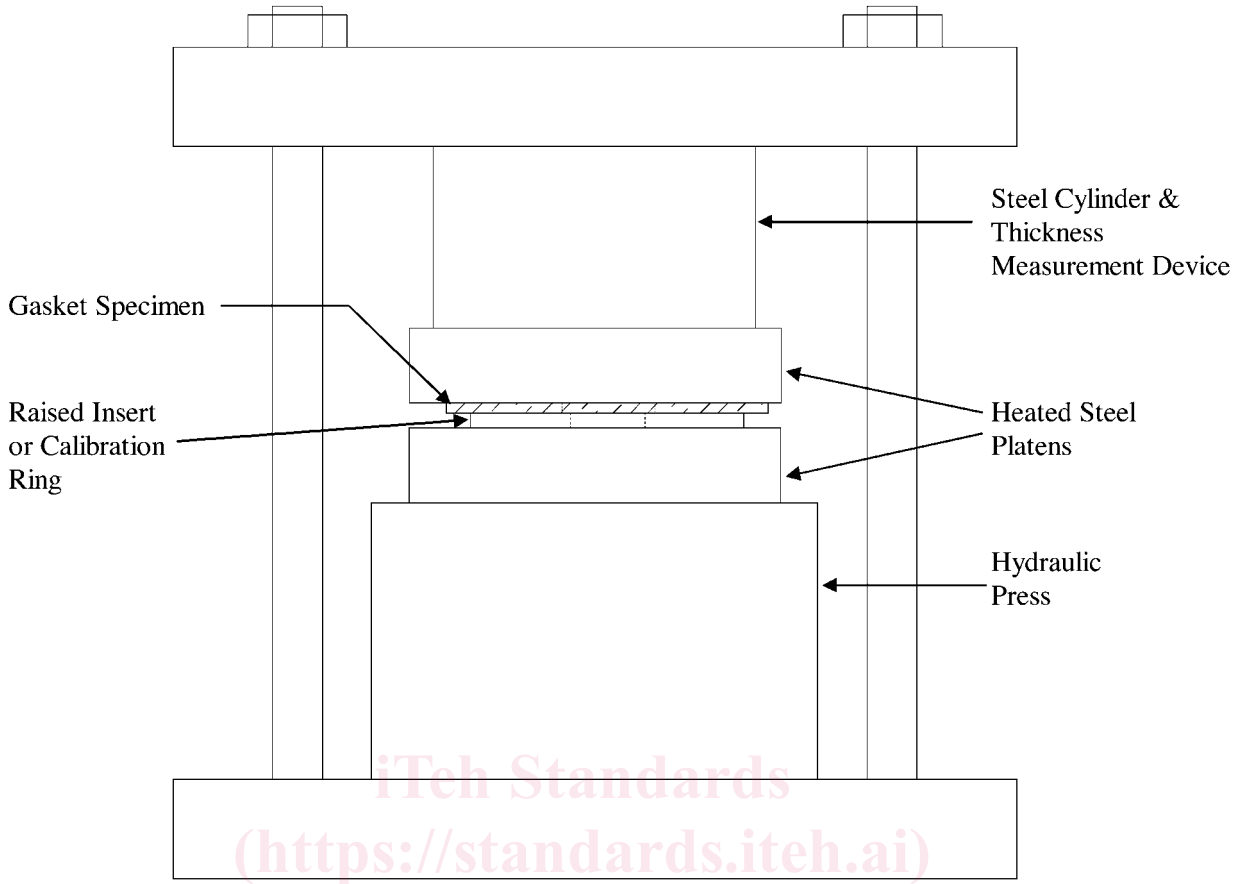

FIG. 1 Test Assembly for Determining Hot Compression

6.2 *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 152 mm (6 in.). The faces of the platens shall be plane parallel with a surface finish of 0.25 to 0.50 µm Ra (10 to 20 µin Ra). Fig. 1 shows a suitable arrangement of steel platens and test specimen.

6.3 *Insert or Calibration Ring*—A raised profile insert or calibration ring with a minimum raised height of 1.6 mm (0.063 in.) having a 75 ± 0.5 mm (2.953 ± 0.02 in.) outside diameter by 55 ± 0.5 mm (2.165 ± 0.02 in.) inside diameter made of the same material as the platens (Rockwell of C 35 to 40 or equivalent) is required. The faces of the insert shall be plane parallel and have a surface finish of 0.25 to 0.50 µm Ra (10 to 20 µin Ra).

6.4 *Device for Applying Heat to Platens*, sufficient to achieve a desired temperature at interface with gasket material specimens. In some cases, the loading device itself may be heated, such as with a hot press. Any appropriate means is acceptable. The device shall be capable of increasing the temperature at a constant rate of 8°C (14°F) per minute. The temperature difference between the two platens shall not exceed 5°C (9°F) at any time. The recommended elevated temperature is 300°C (572°F). Other temperatures may be employed as desired, or as agreed upon between the producer and the user.

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

6.6 *Dial or Thickness Measuring Device*—An indicating dial, or dials, graduated in 0.025 mm (0.001 in.), or a digital device, to show or record the thickness of the specimen during the test. Readings shall be estimated to the nearest 0.002 mm (0.0001 in.).

6.7 *Shield*—A safety shield for protection from severe outgassing that may occur during the test.

6.8 *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.

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

6.10 *Water-Cooled Disc*—A metal disc cooled by water that acts as a heat exchanger that can be placed between the platens to lower the temperature between tests, is recommended to shorten the cycle time between tests. Water-cooled platens may be used as well.

6.11 *Metal Foil* (for example, Inconel, nickel, stainless steel), capable of low creep at the desired maximum test