Designation: F147 – 87 (Reapproved 2017)

# Standard Test Method for Flexibility of Non-Metallic Gasket Materials[1]

This standard is issued under the fixed designation F147; 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.

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

## 1. Scope

1.1 This test method covers the determination of the flexibility of non-metallic gasket materials. It is designed for testing specimens cut from sheet goods or from the gasket in the finished form, as supplied for commercial use. Materials normally classified as rubber compounds are excluded since they are covered in Classification D2000.

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

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]

D2000 Classification System for Rubber Products in Automotive Applications

F104 Classification System for Nonmetallic Gasket Materials

F146 Test Methods for Fluid Resistance of Gasket Materials

## 3. Summary of Test Method

3.1 A specimen of the material is bent 180° around a mandrel of appropriate size relative to its thickness. Materials will be tested both with and across grain on material with grain orientation. An elevated-temperature exposure conditioning is used to simulate shelf life. A low-temperature exposure conditioning is used to simulate handling at low-temperature environments. Tests may also be conducted after immersion in various fluids in accordance with Test Methods F146.

## 4. Significance and Use

4.1 This test method is designed to measure the ability of non-metallic gasket materials to withstand handling, as would be encountered before and during installation of cut gaskets.

## 5. Apparatus

5.1 *Steel Die,* 12.7 by 154.4 mm (0.5 by 6 in.).

5.2 *Circulating-Hot-Air Oven,* maintained at 100 ± 1°C (212 ± 2°F).

5.3 *Cold Box,* capable of maintaining – 40 ± 1°C (–40 ± 2°F).

5.4 *Mandrels,* a series with diameters ranging from 4.8 to 101.6 mm (3⁄16 to 4 in.).

## 6. Test Specimens

6.1 The specimens shall be cleanly die-cut to provide sharp edges, free of tears, nicks, or abraded particles. The minimum thickness for asbestos (Type 1) and synthetic (Type 7) fiber containing materials shall be 0.4 mm (0.016 in.) and a maximum thickness of 6.3 mm (0.250 in.). The minimum thickness for cork (Type 2) composition shall be 3.2 mm (0.125 in.) and 1.6 mm (0.062 in.) for cork-rubber materials, with a maximum thickness of 4.8 mm (0.186 in.). The minimum thickness for cellulose (Type 3) gasket materials shall be 0.127 mm (0.005 in.) and the maximum thickness shall be 1.6 mm (0.062 in.). The minimum thickness for flexible graphite (Type 5) shall be 0.127 mm (0.005 in.) and a maximum of 0.8 mm (0.031 in.).

## 7. Conditioning

7.1 Condition specimens in accordance with Classification System F104.

[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.

## 8. Temperature of Test

8.1 Tests will be conducted on specimens that are at a temperature of 21 to 29°C (70 to 85°F) except for the low-temperature tests, where the specimen will be – 40 ± 1°C (–40 ± 2°F).

## 9. Procedure

9.1 Firmly hold the specimen at one point on a circular mandrel and force slowly but firmly under finger pressure to contact 180° of the full diameter. Repeat this flexure using decreasing mandrel diameters on a new length of specimen until failure occurs. Failure shall be any cracks, breaks, or surface separations at the end of the approximate time (5 ± 1 s) required to flex the specimen.

9.2 After exposure for 70 h at 100 ± 2°C (212 ± 3.6°F) in the circulating-hot-air oven, remove the specimens and cool to room temperature in accordance with the conditioning procedure in Classification System F104. Cork-containing materials shall be allowed to cool for 24 ± 1 h. Then perform the test procedure in 9.1 on the artificially aged specimen.

9.3 Expose the specimens and the mandrel for 6 h at – 40± 1°C (–40 ± 2°F) in a cold chamber. Without removing the specimens from the cold chamber perform the test procedure in 9.1 on the low-temperature specimen.

## 10. Report

10.1 Determine the results as the minimum diameter about which specimen could be flexed without exhibiting any signs of failure. This is to be reported on original, aged, and low-temperature tests or whichever are applicable. Both with and across grain will also be reported on grain oriented materials. A flexibility factor may be calculated by dividing this minimum diameter by the nominal original thickness, expressed to the nearest 0.4 mm (0.016 in.).

10.2 The report shall include the following:

10.2.1 Complete sample description including commercial designation, source, manufacturer, and thickness,

10.2.2 Date of production, if known, and deviations made in performing the test method, and

10.2.3 Test results expressed as the minimum diameter used without any signs of failure or as the flexibility factor as determined in 9.1, or both.

## 11. Precision and Bias

11.1 The results obtained from this test method are based on a visual examination, and the quantitative values associated with precision data are not obtainable with this test method.

## 12. Keywords

12.1 flexibility; grain orientation; shelf life