Designation: C 1166 – 06

Standard Test Method for Flame Propagation of Dense and Cellular Elastomeric Gaskets and Accessories[1]

This standard is issued under the fixed designation C 1166; 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 laboratory procedure for determining flame propagation characteristics of a dense or cellular elastomeric gasket (such as expansion, lock-strip or compression gasket) or an accessory (such as a setting block, spacer or shim) when exposed to heat and flame, with no significance being attached to such matters as fuel contribution, rate of flame spread, smoke developed, or the nature and temperature of the products of combustion.

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

1.3 *This standard should be used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions and should not be used to describe or appraise the fire-hazard or fire-risk of materials, products, or assemblies under actual fire conditions. However, results of the test may be used as elements of a fire-hazard assessment or a fire-risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire risk of a particular end use.*

1.4 *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.*

1.5 The committee with jurisdiction over this standard is not aware of any comparable standards published by other organizations.

2. Referenced Documents

2.1 *ASTM Standards:*

C 717 Terminology of Building Seals and Sealants

C 864 Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

3. Terminology

3.1 *Definitions*—For definitions of terms used in this standard, see Terminology C 717.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *dense material*, *n*—material that is free of porosity, as described in Specification C 864.

4. Summary of Test Method

4.1 In this test method, a specimen 13 by 25 by 460 mm (½ by 1 by 18 in.) mounted in a vertical position within the test chamber, is exposed to a gas flame at the lower end for 15 min with dense materials or 5 min with cellular materials, and ventilated at no more than 18.3 m/min (60 ft/min). The length of the flame is measured and provides a numerical value for the propagation of flame along the specimen.

5. Significance and Use

5.1 This test method is designed to differentiate the flame propagation characteristics of dense or cellular elastomeric compounds used in gaskets, setting blocks, shims, or spacers. It is a small scale test which enables the specifier to exercise engineering judgment in the selection of materials.

5.2 In this test method, the specimens are subjected to a specific laboratory fire test exposure condition. If different test conditions are substituted or the anticipated end-use conditions are changed, it may not be possible by or from this test method to predict changes in the performance characteristics. Therefore, the results are valid only for the fire test exposure condition described in this test method.

5.3 If the results obtained by this test method are to be considered in the total assessment of fire risk, then all pertinent established criteria for fire risk assessment developed by ASTM Committee E-5 must be included in the consideration.

6. Apparatus

6.1 *The Test Chamber*, may be any enclosure that will permit circulation of air past the specimen during burning. A hood or ventilated spray booth is recommended to remove any noxious products of combustion, provided the velocity of air past the specimen does not exceed 18.3 m/min (60 ft/min).

[1] This test method is under the jurisdiction of ASTM Committee C24 on Building Seals and Sealants and is the direct responsibility of Subcommittee C24.73 on Compression Seal and Lock Strip Gaskets.

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NOTE 1—Air velocities greater than 18.3 m/min (60 ft/min) will have an extinguishing effect upon the flame and will present an unrealistic evaluation of the flame propagation of the compound.

6.2 *Bunsen Burner*, with a barrel nominally 9.5 mm (0.38 in.) in diameter.

6.3 *Natural Gas*, used for fuel.

6.4 *Measuring Device*, capable of measuring to 0.1 in.

7. Sampling and Test Specimens

7.1 *Sampling*:

7.1.1 When the finished product does not lend itself to testing (see Note 2) or to the taking of test specimens because of complicated shape, small size, metal or fabric inserts or other conditions, standard test strips shall be prepared. The standard specimens for testing are described in 7.2.

NOTE 2—A chimney effect caused by lengthwise channels or holes in finished products makes it impossible to obtain uniform results using actual manufactured products.

7.1.2 When possible, the completed manufactured product, or a suitable section thereof shall be used for the test. Representative samples of the batch extrusions being examined shall be selected at random as required.

7.2 *Test Specimens*:

7.2.1 The test specimen shall be 13 mm (½ in.) thick, 25 mm (1 in.) wide and 460 mm (18 in.) long, made in accordance with 7.1.

7.2.2 The test specimen shall be free of permanent set producing a curved section within the specimen that will not permit it to hang vertically. It shall also be free of abnormally porous sections and foreign materials.

7.2.3 All test specimens shall be made from the same compound, same dated batch, and shall have the same apparent density and state of cure as the product they represent.

7.2.4 This test method requires six test specimens that have been cut randomly from the same extrusion labeled R1 through R6.

8. Conditioning

8.1 Condition all test specimens at 23.9 ± 1.1°C (75 ± 5°F) for at least 24 h prior to testing.

9. Procedure

9.1 Measure the original length of all test specimens.

9.2 Secure the specimen in a vertical position within the test chamber using a ring stand with a clamp positioned at the top of the specimen. Locate the specimen high enough to permit the burner to be placed beneath it. Use two wire loops to retain the position of the sample over the flame. Place one wire loop 51 mm (2 in.) from the end to be ignited and the other 127 mm (5 in.) from the end to be ignited. Fasten the wire loops to the stand holding the specimen.

9.3 Light and adjust the burner to produce a blue flame approximately 38 mm (1.5 in.) high. A metal flame gage is recommended for a consistent height.

9.4 Place the lighted burner directly below the specimen so that the top of the inner cone of the flame just touches the lowest part of the specimen (see Note 3). The burner is to remain in this position for 15 min and 5 min respectively for dense and cellular material dictates, and then shall be extinguished and removed. If the specimen moves through heat deformation, the burner needs to be moved so as to keep it under the lowest point of the specimen for the given test time.

NOTE 3—Every flame, no matter how hot, has a kindling height above which its temperature is too low to kindle the specimen. For the specified flame, this height is considerably less than 460 mm (18 in.). Therefore, if a specimen burns above this kindling height, it does so on its own heat of combustion and is considered to propagate flame.

9.5 Permit the specimen to continue burning until it no longer propagates flame.

9.6 After flame has extinguished, quench specimen with water (even though specimen may still be glowing).

9.7 Remove loose chart with a stiff brush.

9.8 Measure the remaining unburned length of the specimen. Consider the unburned length to be that remaining after the removal of loose elastomer char that no longer can perform for intended use. This may be uneven, and therefore requires two measurements

10. Calculation

10.1 Calculate the average flame propagation (*FP*) for R1 through R6 according to the following equation:

$$FP = \frac{([R1_o - R1_f] + [R2_o - R2_f] + [R3_o - R3_f] + [R4_o - R4_f] + [R5_o - R5_f] + [R6_o - R6_f])}{6} \quad (1)$$

where:

$R1_o$ = original R1,
$R1_f$ = final R1,
$R2_o$ = original R2,
$R2_f$ = final R2, etc.

11. Report

11.1 Include the following information:

11.1.1 Identification of each specimen, R1 through R6,

11.1.2 The original length of each test specimen,

11.1.3 The average of two measurements resulting from an uneven burn,

11.1.4 A statement as to whether the sample melted, burned, propagated fire through burning droplets, or other method of deterioration, and

11.1.5 Variation, if any, from the specified test procedure.

12. Precision and Bias [2]

12.1 *Precision*:

12.1.1 *Repeatability (within a given laboratory)*—The interval for four materials tested by four recognized fire testing laboratories was 0.85 in., 4.7 %. In future use of this test method, the difference between two results (defined as the average of six individual results) obtained in the same laboratory on the same material will be expected to exceed 0.85 in., 4.7 % of original, only 5 % of the time.

12.1.2 *Reproducibility (between laboratories)*—The interval for four materials tested by four recognized fire testing laboratories is 1.3 in., 7.2 % of original length. In future use of

[2] Supporting data is available from ASTM Headquarters. Request RR: C24-1029.

this test method, the difference between two test results (defined as the average of six individual results) obtained in different laboratories on the same material will be expected to exceed 1.3 in. only 5 % of the time.

13. Keywords

13.1 elastomer; flame propagation; flammability; gasket