



Standard Practice for Design and Construction of Nonmetallic Enveloped Gaskets for Corrosive Service¹

This standard is issued under the fixed designation F336; 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 covers the designs, sizes, classifications, and construction of enveloped gaskets for severe corrosive applications. The envelope serves as the corrosion resistant member of the composite gasket and is a nonmetallic material such as polytetrafluoroethylene, PTFE, or related materials. The inserts are nonmetallic gasketing materials with or without metal reinforcement. Other types of composite gaskets are covered in Classification **F868**.

1.2 This standard is based directly upon ANSI B16.21–2011; for that reason units are as ANSI stated in inches.

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

- D3294** Specification for Polytetrafluoroethylene (PTFE) Resin Molded Sheet and Molded Basic Shapes
- D3308** Specification for PTFE Resin Skived Tape
- F104** Classification System for Nonmetallic Gasket Materials
- F112** Test Method for Sealability of Enveloped Gaskets
- F868** Classification for Laminated Composite Gasket Materials

2.2 Other Document:

- ASME B16.21 – 2011** Nonmetallic Flat Gaskets for Pipe Flanges³

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, Three Park Avenue, New York, NY 10016.

3. Significance and Use

3.1 The gaskets covered by this practice can be used on, but are not limited to, equipment constructed of the following materials: (a) stoneware, (b) glass and glass-lined, (c) tantalum (solid and lined), (d) titanium (solid and lined or clad), (e) zirconium (solid and lined or clad), (f) silver (solid and lined), and (g) nickel and nickel alloys (solid and clad).

3.2 The gaskets provided for herein are for the following: (a) pipe flanges (flat or raised face), (b) vessel nozzles, (c) circular openings in vessels in excess of 12 in. (305 mm) diameter, and (d) oval openings in vessels.

4. Sizes

4.1 The gasket nominal size listed in inches, **Table 1**, will be the same as used on the following pipe flanges in accordance with ASME B16.21 – 2011:

| Pipe Size | ASME |
|-------------|------------------------------|
| ½ to 24 in. | B16.21 – 1992, Table 5 and 6 |
| Over 24 in. | B16.21 – 1992, Table 1 and 2 |

4.2 Commercial dimensional tolerances apply, unless otherwise agreed upon between the seller and the purchaser.

5. Materials and Manufacture

5.1 The gaskets covered by this practice shall be made of nonmetallic materials, except when a metal support is desired in the insert.

5.2 Materials should be selected, both for inserts and envelopes, that will withstand the conditions under which they are to be subjected in service.

5.3 A list of reference literature for determining material suitability in corrosive environments is available from ASTM Headquarters. It is entitled, "Materials of Construction ASTM F-3.50.10 Corrosion Data Literature."⁴

5.4 The design of the envelope classifies the enveloped gasket as follows:

- 5.4.1 *Split*, knife cut (**Fig. 1** and **Fig. 2**).
- 5.4.2 *Machined* (**Fig. 3** and **Fig. 4**).

⁴ Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:F03-1001.

TABLE 1 Nominal Gasket Sizes^A

NOTE 1—Refer to Fig. 1 through Fig. 6 for explanation of gasket component details.

NOTE 2—Split design inserts not to be smaller than nominal pipe size.

NOTE 3—Inside diameter of folded and machined design envelopes will adjoin the insert inside diameter assuring noninterference with flow through pipe.

NOTE 4—Full face gaskets shall have envelope outside diameter same as ring gasket outside diameter.

NOTE 5—Sizes 14 in. (356 mm) and larger may be made from machined envelopes depending upon material shape availability.

| Insert (2) (See Note 1) | | Envelope (1) (See Note 1) | | | | |
|-------------------------|-------------------------|-------------------------------------|---|--------------------------|---------------------------|---------------------------|
| Nominal Pipe Size, in. | II. Inside Diameter (B) | III. Full Face Outside Diameter (D) | IV. Flat Ring Gasket Outside Diameter (C) | V. (Each Side) Thickness | VI. Inside Diameter (A) | VII. Outside Diameter (C) |
| | in. | in. | in. | in. | in. | in. |
| 1/2 | 0.84 | 3.50 | 1.88 | 0.015 | 0.50 | 1.88 |
| 3/4 | 1.06 | 3.88 | 2.25 | 0.015 | 0.75 | 2.25 |
| 1 | 1.31 | 4.25 | 2.62 | 0.020 | 1.00 | 2.62 |
| 1 1/4 | 1.66 | 4.63 | 3.00 | 0.020 | 1.25 | 3.00 |
| 1 1/2 | 1.91 | 5.00 | 3.38 | 0.020 | 1.50 | 3.38 |
| 2 | 2.38 | 6.00 | 4.12 | 0.020 | 2.00 | 4.12 |
| 2 1/2 | 2.88 | 7.00 | 4.88 | 0.020 | 2.50 | 4.88 |
| 3 | 3.50 | 7.50 | 5.38 | 0.020 | 3.00 | 5.38 |
| 3 1/2 | 4.00 | 8.50 | 6.38 | 0.020 | 3.50 | 6.38 |
| 4 | 4.50 | 9.00 | 6.88 | 0.020 | 4.00 | 6.88 |
| 5 | 5.56 | 10.00 | 7.75 | 0.020 | 5.00 | 7.75 |
| 6 | 6.62 | 11.00 | 8.75 | 0.020 | 6.00 | 8.75 |
| 8 | 8.62 | 13.50 | 11.00 | 0.020 | 8.00 | 11.00 |
| 10 | 10.75 | 16.00 | 13.38 | 0.020 | 10.00 | 13.38 |
| 12 | 12.75 | 19.00 | 16.13 | 0.020 | 12.00 | 16.12 |
| 14 | 14.00 | 21.00 | 17.75 | 0.015 | not applicable—see Note 5 | 17.00 |
| 16 | 16.00 | 23.50 | 20.25 | 0.015 | | 19.00 |
| 18 | 18.00 | 25.00 | 21.62 | 0.015 | | 21.00 |
| 20 | 20.00 | 27.50 | 23.88 | 0.015 | | 23.00 |
| 24 | 24.00 | 32.00 | 28.25 | 0.015 | | 27.00 |
| 30 | 30.00 | 38.75 | 34.75 | 0.015 | | 33.00 |
| 36 | 36.00 | 46.00 | 41.25 | 0.015 | | 39.00 |
| 42 | 42.00 | 53.00 | 48.00 | 0.015 | | 45.00 |
| 48 | 48.00 | 59.50 | 54.50 | 0.015 | | 51.00 |
| 54 | 54.00 | 66.25 | 61.75 | 0.015 | | 57.00 |
| 60 | 60.00 | 73.00 | 68.12 | 0.015 | | 63.00 |
| 72 | 72.00 | 86.50 | 81.38 | 0.015 | | 75.00 |
| 84 | 84.00 | 99.75 | 94.25 | 0.015 | | 87.00 |
| 96 | 96.00 | 113.25 | 107.25 | 0.015 | | 99.00 |

^A Extracted from American National Standard Nonmetallic Gaskets for Pipe Sizes (ANSI B16.21–2011), with the permission of the publisher. The American Society of Mechanical Engineers, United Engineering Center, Three Park Avenue, New York, NY 10016.

5.4.3 *Tape Folded*, made endless by joining tape ends with a heat sealing procedure (Fig. 5 and Fig. 6).

6. Insert Classification⁵

6.1 *Constructions*—Two insert constructions are covered as follows:

- 6.1.1 *Construction 1*—Single layer.
- 6.1.2 *Construction 2*—Multiple layer.

⁵ See Fig. 1 through Fig. 6.

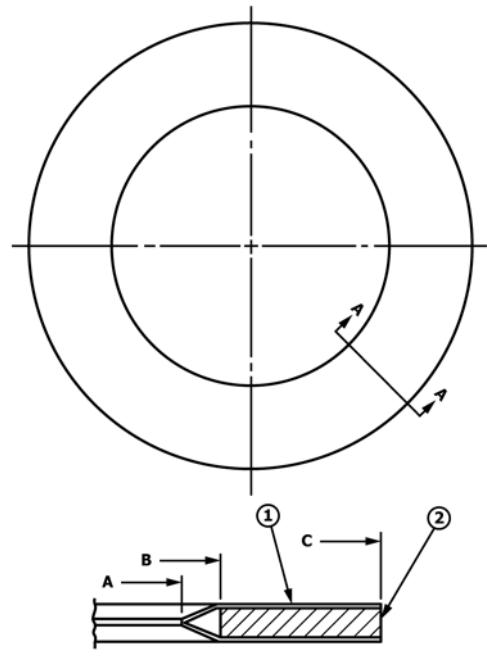


FIG. 1 Split Design (Flat Ring)

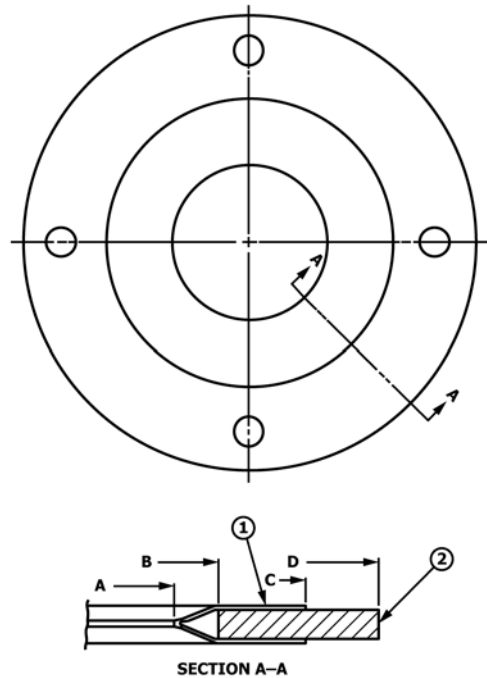


FIG. 2 Split Design (Full Face)

6.2 *Grades*—Multiple layer constructions include the following:

- 6.2.1 *Grade 1*—Two layers, any combination of nonmetallic homogenous materials.
- 6.2.2 *Grade 2*—Three layers, any combination of nonmetallic homogenous materials.
- 6.2.3 *Grade 3*, Three layers, the two outer layers nonmetallic homogenous materials, the inner layer (core) metallic.

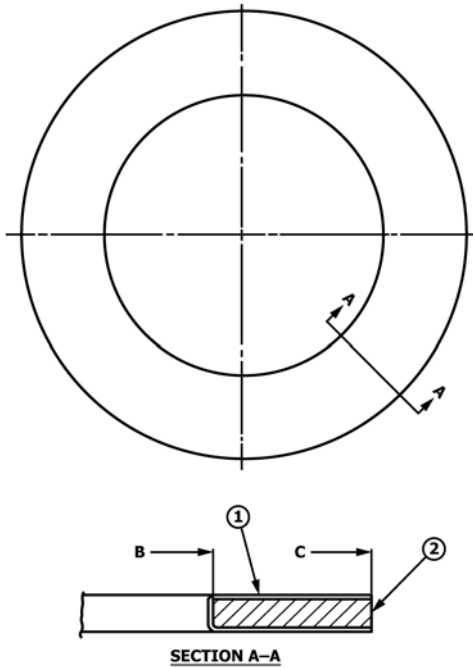


FIG. 3 Machined Design (Flat Ring)

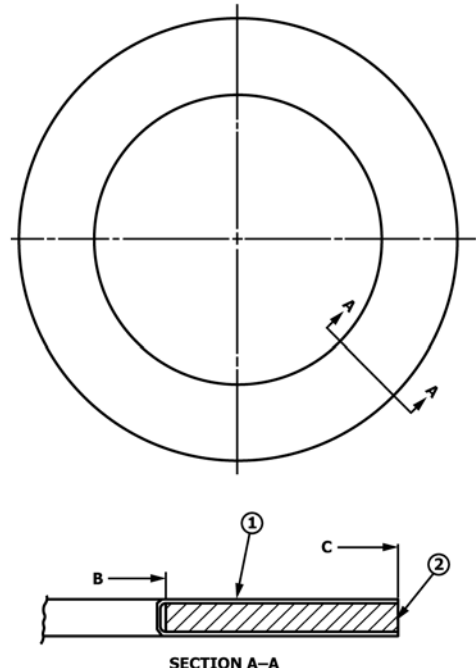


FIG. 5 Folded Design (Flat Ring)

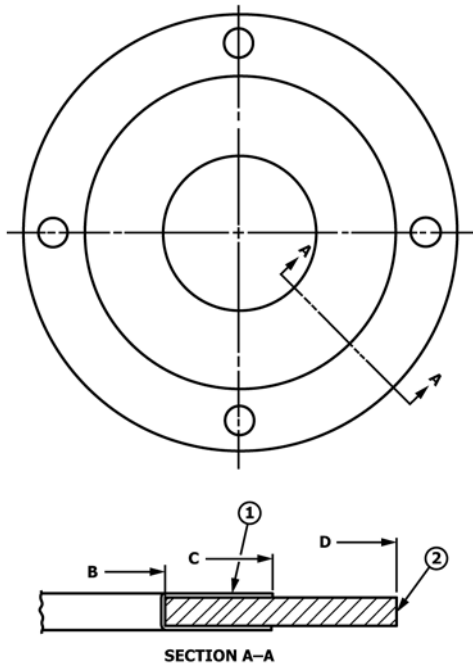


FIG. 4 Machined Design (Full Face)

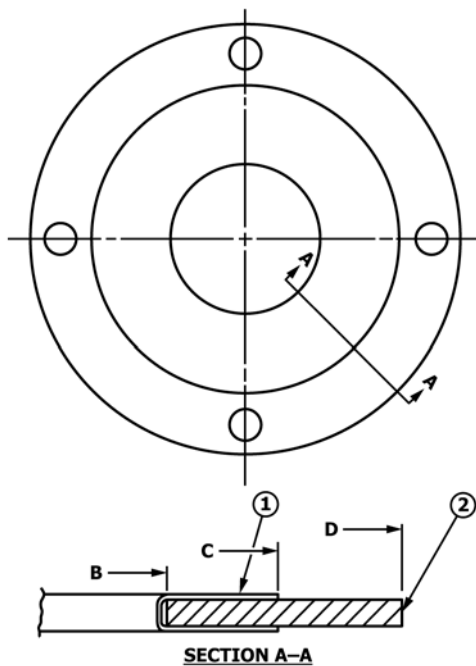


FIG. 6 Folded Design (Full Face)

6.3 *Type*—This classification covers insert material types as follows:

6.3.1 *Nonmetallic*—Any recognized nonmetallic gasket material in accordance with Classification F104, taking into consideration limitations with regard to temperature and pressure.

6.3.2 *Metallic*—Inner layer (core) metallic material in Construction 2, Grade 3.

6.3.2.1 Flat solid metal center.

6.3.2.2 Corrugated metal center.

6.3.2.3 Perforated metal center.

6.3.2.4 Braided metal center.

6.3.2.5 As specified.

6.4 Construction 2, multiple layer inserts may be pre-assembled by gluing, taping, or any other suitable method before inserting in the envelope.

6.5 Elastomeric materials with high flow or creep properties have a tendency to stretch and split the envelope and are not recommended unless special provisions are made in the design.



6.6 Insert materials are not required to be corrosion-resistant in most cases since they are separated from the corrosives by the corrosion-resistant envelope.

6.7 Extremely hard materials (such as solid metal or phenolic laminates) are not recommended for single layer construction inserts or the outer inserts in multiple layer constructions since excessive bolt torquing would be required to effect a satisfactory seal.

6.8 For determining the suitability of inserts to seal satisfactorily, Test Method F112 is recommended.

7. Inspection

7.1 Inspect electrically the corrosion-resistant materials used as shields for enveloped gaskets after all machining and

forming has been completed, using the methods described in Specifications D3308 for tape and D3294 for machined articles, Type 1, Grade 1.

7.2 Commercial dimensional tolerances apply unless otherwise agreed upon between the seller and the purchaser.

8. Keywords

8.1 corrosive service; enveloped; gaskets; nonmetallic; polytetrafluoroethylene (PTFE)

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