



Standard Specification for Non-Metallic Expansion Joints¹

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

1. Scope

1.1 This specification provides the minimum requirements for construction, materials, performance, and dimensional requirements of arch-type non-metallic expansion joints.

1.2 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 The following safety hazards caveat pertains only to the test method described in this specification. *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:

A 395 Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures²

D 1418 Practice for Rubber and Rubber Latices—Nomenclature³

2.2 Federal Standard:

Code of Federal Regulations, Title 30, Chapter I, Mine Safety and Health Administration⁴

2.3 ANSI Standards:

B16.1 Cast Iron Pipe Flanges and Flanged Fittings⁵

B16.5 Steel Pipe Flanges and Flanged Fittings⁵

B16.24 Bronze Flanges and Flanged Fittings⁵

3. Terminology

3.1 Definitions:

3.1.1 *floating metallic flange type*—expansion joint having the tube, fabric plies, and cover brought up from the joint body to form a bead.

NOTE 1—This bead is molded into a groove in the metallic flange. Retaining rings are not required with this design.

3.1.2 *integral rubber flange type*—expansion joint having the tube, fabric plies, and cover brought up from the joint body to form a rubber flange.

NOTE 2—Additional plies or other reinforcement may be used in the flange to meet service conditions. Retaining rings must be used with this design.

3.1.3 *maximum allowable working pressure (MAWP)*—manufacturer's recommended maximum continuous operating pressure (lb/in.² (Pa)).

3.1.4 *non-metallic flanged expansion joint*—flexible connector fabricated from natural or synthetic rubber and fabrics, usually with metal reinforcement, to isolate vibration and noise and provide stress relief in piping systems caused by thermal changes and other system movements.

4. Ordering Information

4.1 Orders for products under this specification shall include the following information:

4.1.1 Inside diameter of connecting pipes (joint ID).

4.1.2 Face-to-face dimension that is the flange-to-flange dimension into which the expansion joint is to be installed.

4.1.3 Maximum and minimum operating pressure in pounds-force per square inch gage (pascals).

4.1.4 Maximum and minimum operating temperature in °F (°C).

4.1.5 Flange drilling in accordance with the appendix titled "Common Flange Dimension/Drilling Chart" of the *Technical Handbook on Rubber Expansion Joints and Flexible Pipe Connectors*⁶ (herein referred to as the *Technical Handbook*) or in accordance with special customer requirements.

4.1.6 Fluid to be handled.

4.1.7 This ASTM specification designation.

4.1.8 Movement data requirements (including shock or vibratory excursions if applicable).

4.1.9 Design certification burst test if required (see 9.1).

4.1.10 Hydrostatic or special tests if required (see 9.2).

¹ This specification is under the jurisdiction of ASTM Committee F25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.11 on Machinery and Piping Systems.

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² *Annual Book of ASTM Standards*, Vol 01.02.

³ *Annual Book of ASTM Standards*, Vol 09.01.

⁴ Available from Superintendent of Documents, Government Printing Office, Washington, DC 20402.

⁵ Available from American Society of Mechanical Engineers (ASME), ASME International Headquarters, Three Park Ave., New York, NY 10016-5990.

⁶ The *Technical Handbook on Rubber Expansion Joints and Flexible Pipe Connections* is available from Fluid Sealing Association, 2017 Walnut St., Philadelphia, PA 19103.

4.1.11 Certification of expansion joint if required (see Section 12).

4.1.12 Certified detailed drawing of the expansion joint if required (see 12.2).

5. Materials and Manufacture

5.1 Expansion joints shall be fabricated with an elastomeric tube reinforced with multiple plies of woven cloth or tire cord covered with synthetic rubber. The inner tube shall be a natural rubber, synthetic rubber, or blend of synthetic rubber that meets the requirements of this specification. The woven cloth or tire cord shall be nylon, polyester, fiberglass, or aramid. Cotton is not acceptable. The reinforcing fabric shall be impregnated with a compatible friction stock. Additional reinforcement to the fabric may be provided in the body of the expansion joint and may be solid metal rings or wire imbedded in the synthetic rubber. Tensile properties of the wire, if used, shall be as given in 5.2. Body rings, if used, must be welded before being installed in the expansion joint body. Welds must be 100 % penetration.

5.1.1 The list of elastomers used in expansion joints and rubber pipe in accordance with the *Technical Handbook*⁶ lists acceptable natural rubber and synthetic elastomers for construction of non-metallic expansion joints.

5.2 Reinforcing wire shall have properties that allow the expansion joints to meet the requirements of this specification.

5.3 All expansion joints shall be manufactured with a cover of Hypalon or Neoprene (Chloroprene), in accordance with Practice D 1418. This cover material must consist of 100 % Hypalon or Chloroprene (not blended with any other elastomer) plus normal additives to provide for curing and a durometer between 50 and 75 on the Shore A Scale. Neoprene and Hypalon are selected as the best fire-retardant elastomer of the common types used for expansion joints. This material shall be certified flame resistant as outlined in 10.3.

5.4 *Integral Flanges*—The tube, fabric plies, and cover shall be brought up from the joint body to form an integral flange. This rubber flange shall extend beyond the bolt holes of the retaining ring.

5.5 *Floating Metallic Flanges*—The metal flanges shall have a groove to accept the molded bead in the body at each end of the expansion joint bellows.

5.6 *Arches*—Arches may be either straight sided or long radius depending on the manufacturer's standard construction. The arch size and shape determine the movement capability of the joint. Minimum movement capability of single arch joints shall be in accordance with the *Technical Handbook*⁶ table titled "Expansion Joint Movement Force/Spring Rate Capability." Movement capability information for multiple arch designs shall be available from the manufacturer.

5.7 *Metallic Flanges*:

5.7.1 Flanges shall be drilled in accordance with the *Technical Handbook*⁶ appendix titled "Common Flange Dimension/Drilling Chart" or in accordance with the customer order as required, to match the mating flanges.

5.7.2 Metallic flanges shall meet the material requirements and pressure-temperature ratings in accordance with ANSI B16.1, B16.5, or B16.24.

5.8 *Retaining Rings*—Retaining rings for the integral flange type are installed behind the flanges and are drilled to match the flange drilling. The sections supplied for each flange should be split at the bolt holes to ensure a proper seal at all points when the bolts are tightened. The edge next to the rubber flange shall be broken or bevelled to prevent cutting the rubber flanges. Retaining rings must be a minimum thickness of $\frac{3}{8}$ in. (9.5 mm) and shall be made of steel or ductile iron. Carbon steel shall be galvanized. Ductile iron shall be in accordance with Specification A 395.

6. Other Requirements

6.1 All expansion joints shall be designed for a minimum burst pressure of four times the maximum allowable working pressure. The design shall be based on analytical or experimental test of expansion joints of similar construction, class, type, and size. The design shall be certified by tests if ordered (see 4.1.9).

6.2 *Performance Requirements*—Single arch expansion joint movement shall not exceed the limits of the *Technical Handbook*⁶ table referred to in 5.6 unless the manufacturer certifies that a proposed design can exceed the listed minimum movement capability to meet a special requirement greater than the minimum listed. Multiple arch-joint movement shall be of the manufacturer's certified design.

6.3 *Pressure Rating*—Expansion joints shall be limited to the pressures listed in the table "Pressure Characteristics of Rubber Expansion Joints" of the *Technical Handbook*⁶.

7. Dimensions and Permissible Variations

7.1 Expansion joints shall be dimensioned in accordance with the *Technical Handbook*⁶ table titled "Expansion Joint Movement/Force/Spring Rate Capability."

8. Workmanship, Finish, and Appearance

8.1 *Tube*—The tube shall be free from cuts and breaks or severe abrasions. Small depressions and indentations are acceptable as long as the surface of the elastomer is not broken.

8.2 *Integral Rubber and Fabric Flange*:

8.2.1 The face of an integral rubber and fabric flange shall be free of cuts or obvious breaks and shall be covered with rubber. The most critical portion of the flange is from the inside diameter of the joint out to the bolt holes.

8.2.2 Bolt holes shall be drilled cleanly through the rubber flange. The retaining rings shall be checked for proper alignment with bolt holes.

8.2.3 The outer edge of the flange shall be sealed with rubber, so that moisture from the atmosphere cannot attack the reinforcing fabrics.

8.2.4 The surface of the rubber flange against which the retaining rings are installed shall be covered with rubber. The surface may be irregular and building form tooling marks are not objectionable.

8.3 *Expansion Joint Cover and Body*—The cover of a joint does not contribute to the strength of the joint. Its purpose is to keep fluids from the atmosphere or surroundings from being absorbed into the body plies of fabric. Surface blemishes, such as flash, nylon wrap markings, grooves, and other indentations

in the cover, over the arch, or in the body area, are not harmful as long as the body fabric is not exposed.

9. Number and Type of Tests

9.1 *Prototype Test:*

9.1.1 When required by the purchaser, an expansion joint of each size and type shall be burst tested to determine its maximum allowable working pressure (see 10.1).

9.1.2 The outer covering material of the expansion joint shall be tested to determine its self-extinguishing characteristics (see 10.3).

9.2 *Production Test*—When required by the purchaser, an expansion joint shall be hydrostatically tested to 1.5 times its maximum allowable working pressure at its rated maximum operating temperature (see 10.2).

10. Test Methods

10.1 *Burst Test*—Fill each joint to be tested with water before the application of pressure, allowing all air in the joint to escape. Apply pressure at a uniform rate until failure of the joint occurs. Consider the pressure at which any fluid leakage first occurs as the bursting pressure of the joint. The maximum allowable working pressure of the joint shall be less than or equal to $\frac{1}{4}$ the bursting pressure determined by this test.

10.2 *Hydrostatic Test*—Fill each joint to be tested with water before the application of pressure, allowing all air in the joint to escape. Apply pressure at a uniform rate up to the test pressure. The joint shall show no sign of leakage at the test pressure.

10.3 *Flame Resistance Test*—Test four specimens of the joint, $\frac{1}{2}$ by 6 in. (12.7 by 152.4 mm) by the thickness of the expansion joint, in accordance with 30 CFR 18.65(b) through (d). Consider the expansion joint flame resistant if the tests of the four specimens meet the test requirements in 30 CFR 18.65(e).

11. Inspection

11.1 Inspection of the material shall be agreed upon between the purchaser and the supplier as part of the purchase contract.

12. Certification

12.1 When specified in the purchase order or contract, the manufacturer's certification shall be furnished to the purchaser stating that samples representing each lot have been manufactured, tested, and inspected in accordance with this specification and the requirements have been met. When specified in the purchase order or contract, a report of the test results shall be furnished.

12.2 When specified in the purchase order or contract, a certified drawing detailing the expansion joint shall be provided.

13. Product Marking

13.1 Each expansion joint shall be permanently marked or tagged with the following information:

13.1.1 Manufacturer's name or trademark.

13.1.2 Nominal diameter.

13.1.3 Manufactured date (month and year).

13.1.4 Maximum allowable working pressure and temperature (psi/°F (Pa/°C)).

13.1.5 Face-to-face dimension.

13.1.6 ASTM designation and year of issue of this specification.

14. Quality Assurance

14.1 The manufacturer of the expansion joint shall maintain the quality of the joints that are designed, tested, and marked in accordance with this specification. At no time shall a joint be sold with this specification designation that does not meet the requirements herein.

15. Keywords

15.1 arch-type non-metallic expansion joints; expansion joints

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