



Designation: **C443—20** C443 – 21

Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets¹

This standard is issued under the fixed designation C443; 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 specification covers flexible leak-resistant joints for concrete pipe and precast manhole sections, using rubber gaskets for sealing the joints, where infiltration or exfiltration is a factor in the design. The specification covers the design of joints and the requirements for rubber gaskets to be used therewith, for pipe conforming in all other respects to Specification C14, Specification C76, or Specification C507 and precast manhole section conforming in all other respects to Specification ~~C478~~C478/C478M, provided that if there is conflict in permissible variations in dimensions the requirements of this specification for joints shall govern.

1.2 A complete metric companion to Specification C443 has been developed—C443M; therefore, no metric equivalents are presented in this specification.

NOTE 1—This specification covers the design and performance of the rubber gasket joint only. Joints covered by this specification are adequate for hydrostatic pressures up to 13 psi (30 ft), when tested in accordance with Section 9. Infiltration or exfiltration quantities for an installed pipeline are dependent upon many factors other than the joints, and allowable quantities must be covered by other specifications and suitable testing of the installed pipeline and system.

1.3 *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.*

¹ This specification is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.08 on Joints for Precast Concrete Structures.

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2. Referenced Documents

2.1 *ASTM Standards*:²

C14 Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe

C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

~~C478~~C478/C478M Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric) C0478_C0478M

C507 Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

C822 Terminology Relating to Concrete Pipe and Related Products

C1619 Specification for Elastomeric Seals for Joining Concrete Structures

3. Terminology

3.1 *Definitions*—For definitions of terms relating to concrete pipe, see Terminology C822.

4. Basis of Acceptance

4.1 The acceptability of the pipe or manhole joints and gaskets shall be determined by the results of the physical tests prescribed in this specification, if and when required, and by inspection to determine whether the pipe joints and gaskets conform to this specification as to design and freedom from defects.

5. Materials and Manufacture for Gaskets

5.1 All rubber gaskets shall comply with Specification C1619 in terms of materials and manufacture. The gaskets shall be extruded or molded to the specified size within a tolerance of $\pm 3\%$ on any dimension, measured at any cross section.

6. Physical Requirements for Gaskets

6.1 *Standard Gasket Requirements*—All rubber gaskets shall meet the dimensions, tolerances, and physical requirements of Specification C1619, Class C.

6.2 *Oil Resistant Gasket Requirements*—All rubber gaskets shall meet the dimensions, tolerances, and physical requirements of Specification C1619, Class D.

7. Design of Joints

7.1 The manufacturer shall furnish the owner with the detailed design of the joint or joints including design and durometer hardness of the rubber gasket proposed to be furnished under this specification.

7.1.1 The joint design shall consist of a bell or groove on one end of a unit of pipe, and a spigot or tongue on the adjacent end of the joining pipe or manhole.

7.1.2 All surfaces of the joint upon or against which the gasket is capable of bearing shall be smooth, free of spalls, cracks or fractures, and imperfections that would adversely affect the performance of the joint.

7.1.3 The joints of the pipe or manhole shall be of such design that they will withstand the forces caused by the compression of the gasket when joined, without cracking or fracturing when tested in accordance with Section 9.

7.1.4 The angle of taper on the conic surfaces of the inside of the bell or groove and the outer surface of the spigot or tongue where the gasket seats shall be not more than 3.5° measured from the pipe or manhole axis, except that tapers up to 5° are not prohibited if proven adequate by plant tests as specified in Section 9 and approved by the owner. The conic surface on the spigot or tongue shall be modified to properly contain and seat the gasket.

7.1.5 The annular space between the gasket-bearing surfaces of the assembled and centered joint shall be not more than 75 % of the uncompressed height of the applied gasket including all manufacturing tolerances of the joint and gasket applied. The joint

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.

design shall provide for the deflection of a pipe or manhole unit by opening one side of the outside perimeter of the joint by ½ in. wider than the assembled position without reducing its leak resistance. Where greater deflections are required than provided by the joint design, beveled joints or elbows must be provided.

7.1.6 The manufacturer's design tolerances for the width of the annular space between the gasket bearing surfaces shall not vary by more than ±10 % of the uncompressed height of the applied gasket designated in the design. The manufacturer shall designate tolerances for the gasket bearing surfaces that ensure the joint will fully assemble without concrete interference with designated gasket applied.

7.1.7 The gasket shall be the sole element depended upon to make the joint flexible and leak resistant. The gasket shall be a continuous ring of circular or non-circular cross-section which fits snugly into the annular space between the overlapping surfaces of the assembled pipe or manhole joint to form a flexible leak-resistant seal.

7.1.8 The gasket shall not be stretched more than 30 % of its original circumference when seated on the spigot or tongue end of the pipe or manhole.

7.1.9 Where the particular joint design utilizing a rubber gasket dictates the use of a lubricant to facilitate assembly, the lubricant composition shall have no detrimental effect on the performance of the gasket and joint due to prolonged exposure.

NOTE 2—Joints in an assembled position are defined as joints in the position after assembly in accordance with the manufacturer's design.

7.2 *Alternative Joint Designs*—When agreed upon by the owner, manufacturers are not prohibited from submitting to the owner detailed designs for joints and gaskets other than those described in Section 7. Design submissions shall include joint geometry, all tolerances, gasket characteristics, proposed plant tests, gasket splice bend tests, and such other information as required by the owner to evaluate the joint design for field performance. Joints and gaskets of alternative joint designs shall ~~at least meet all test requirements of this specification if permitted by the owner. specification.~~ Alternative joint designs shall be acceptable provided the designs are approved by the owner ~~prior to manufacture~~ and provided the test pipe or manhole joint comply with the specified tests.

8. Permissible Variations in Dimensions

8.1 The planes formed by the ends of manhole sections or nonbeveled pipe shall not vary from the perpendicular to the pipe or manhole axis by more than 3/16 in. for internal diameters or equivalent diameters 30 in. and smaller; or by more than ¼ in. for internal diameters or equivalent diameters 33 to 54 in. inclusive; or not more than 3/8 in. for internal diameters or equivalent diameters 60 in. and larger.

8.2 The manufacturing tolerances for the width of the annular space between the gasket bearing surfaces of the produced pipe or manhole and furnished gasket shall not vary by more greater than those used in the design of the joint within 7.1.57.1.6 or those verified through the proof-of-design performance testing in accordance with Section approved by 97.2, and in no case shall those values be greater than 12.5 % of the annular space.

8.3 Manufactured pipe or manhole joints found to be outside of the design tolerance limits described within 7.1.6 shall meet this standard only if they comply with all provisions within 7.2, Alternative Joint Designs.

9. Performance Requirements for Joints

9.1 When required by the ~~owner, owner or verification of alternative design,~~ assembled joints shall pass the following performance tests without leakage at the joints, and the manufacturer shall have the option of allowing the assembled joints to stand under a pressure of 13 psi or less, for a maximum of 24 h prior to the test:

9.1.1 *Pipes or Manholes in Straight Alignment*—Hydrostatic pressure tests on joints shall be made on an assembly of two sections, properly connected in accordance with the joint design. At the option of the owner a second such test shall be required. Suitable bulkheads shall be provided either within the pipe or manhole, adjacent to and on either side of the joint, or at the outer ends of the two joined sections. No fillings or packings shall be placed prior to the hydrostatic tests. After the sections are fitted together with the gasket or gaskets in place, the assembly shall be subjected to an internal hydrostatic pressure of 13 psi (30 ft) pressure head for 10 min. Moisture or beads of water appearing on the surface of the joint will not be considered as leakage. If leakage of joints should initially occur, the manufacturer shall have the option to extend the test period up to 24 h.

9.1.2 *Pipes or Manholes in Maximum Deflected Position*—Upon completion of the test for pipes in straight alignment in 9.1.1, the test sections shall be deflected to create a position $\frac{1}{2}$ in. wider than the assembled position on one side of the outside perimeter of each joint and shall be subjected to an internal hydrostatic pressure of 10 psi for 10 min. Moisture or beads of water appearing on the surface of the joint will not be considered as leakage.

9.1.3 Unless prohibited by the owner at or before the time of placing an order for pipe or manholes, the manufacturer has the option to test the joint to the parameters established in 9.1.1 and 9.1.2 by methods which pressurize the rubber gasketed joint either internally or externally.

NOTE 3—The user of this standard is advised that sections may be tested in a horizontal or vertical orientation.

10. Storage

10.1 The lubricant shall be stored in accordance to the lubricant manufacturer's recommended temperature range.

11. Inspection

11.1 The quality of the materials and the finished pipe or manhole joint and gasket shall be subject to inspection and approval by an inspector employed by the owner.

12. Certification

12.1 When requested by the owner, the manufacturer shall furnish written certification that the joint lubricant conforms to all requirements of this specification for the specific gaskets supplied.

13. Marking

13.1 *Lubricant*—The following information shall be clearly marked on each container of lubricant.

13.1.1 Name of lubricant manufacturer.

13.1.2 Usable temperature range for application and storage.

13.1.3 Shelf life.

13.1.4 Lot or batch number.

14. Repairs

14.1 Spalled areas, manufacturing imperfections, or damage during handling, of each pipe end, are not prohibited from being repaired and will be acceptable, if in the opinion of the owner, the repaired pipe conforms to the requirements of 7.1.2; provided the circumferential length of a single area to be repaired shall not exceed one fourth of the inside diameter or equivalent diameter of the pipe or the circumferential length of several areas combined does not exceed one half of the inside diameter or equivalent diameter of the pipe.

14.2 At the option of the owner, the pipe joint that has been repaired shall be subjected to the designated hydrostatic test in accordance with 9.1.1 and shall be accepted if it passes the hydrostatic test requirements.

15. Rejection

15.1 Joints and gaskets shall be subject to rejection upon failure to conform to any of the requirements of this specification. Pipe that is damaged because of carelessness or continuing failure to prevent recurrent imperfections in manufacture or damage during handling shall be subject to rejection.

15.2 Gaskets shall be subject to rejection whenever they show surface checking, weathering, or other deterioration prior to installation in the work.

16. Keywords

16.1 concrete pipe; joints; manhole; rubber gaskets

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APPENDIXES

(Nonmandatory Information)

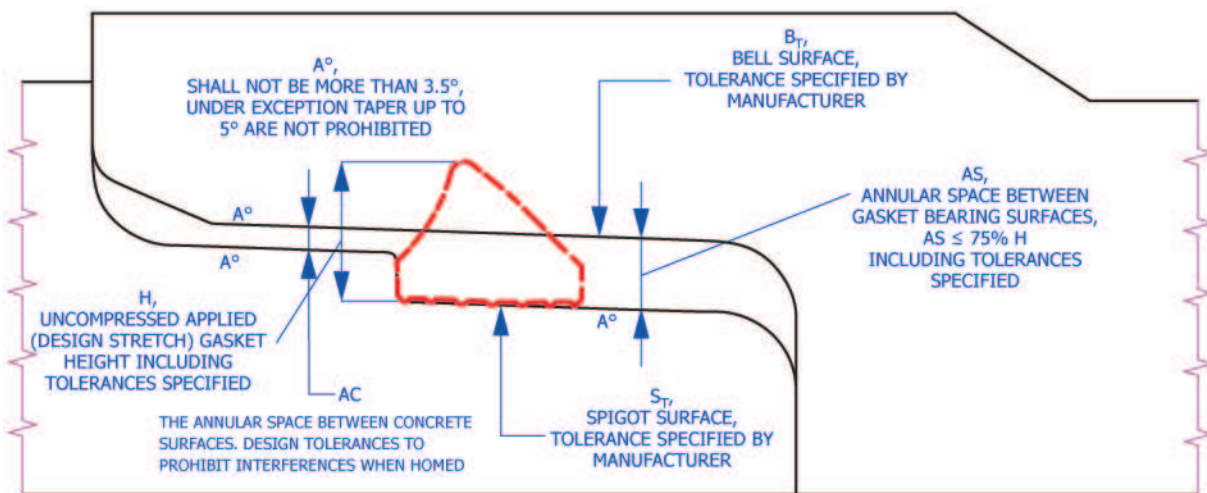
X1. DESIGN TERMS GRAPHIC

X1.1 See Fig. X1.1.

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$B_T + S_T \leq 10\% H$, BUT NOT GREATER THAN MANUFACTURER SPECIFIED DESIGN TOLERANCE

NOTE: GASKET PROFILE SHOWN IS FOR INFORMATIVE PURPOSES ONLY AND IS NOT INTENDED TO IMPLY IT TO BE THE PREFERRED OR INTENDED GASKET SHAPE FOR THIS STANDARD. OTHER GASKET PROFILES ARE ACCEPTABLE IF IN COMPLIANCE TO THE PROVISIONS WITHIN STANDARD

FIG. X1.1 Single Offset Joint Geometry Design Terms and Tolerance Locations

X2. SAMPLE CALCULATIONS

X2.1 See **Fig. X2.1**.

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