Designation: C 443M – 98
METRIC

Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets [Metric][1]

This standard is issued under the fixed designation C 443M; 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 Department of Defense.

1. Scope

1.1 This specification covers flexible watertight joints for circular concrete sewer and culvert 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 C 14M or Specification C 76M, and precast manhole section conforming in all other respects to Specification C 478M, provided that if there is conflict in permissible variations in dimensions the requirements of this specification for joints shall govern.

1.2 This specification is the metric counterpart of Specification C 443.

NOTE 1—This specification covers the design, material, and performance of the rubber gasket joint only. Joints covered by this specification are normally adequate for hydrostatic pressures up to 90 kPa (9 m) without leakage, when tested per Section 10. 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.

2. Referenced Documents

2.1 *ASTM Standards:*

C 14M Specification for Concrete Sewer, Storm Drain, and Culvert Pipe [Metric][2]

C 76M Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe [Metric][2]

C 478M Specification for Precast Reinforced Concrete Manhole Sections [Metric][2]

C 822 Terminology Relating to Concrete Pipe and Related Products[2]

D 395 Test Methods for Rubber Property—Compression Set[3]

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension[3]

D 471 Test Method for Rubber Property—Effect of Liquids[3]

D 573 Test Method for Rubber—Deterioration in an Air Oven[3]

D 1149 Test Method for Rubber Deterioration—Surface Ozone Cracking in a Chamber[3]

D 2240 Test Method for Rubber Property—Durometer Hardness[3]

3. Terminology

3.1 *Definitions:* For definitions of terms relating to concrete pipe, see Terminology C 822.

4. Basis of Acceptance

4.1 The acceptability of the pipe 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 be extruded or molded and cured in such a manner that any cross section will be dense, homogeneous, and free of porosity, blisters, pitting, and other imperfections. The gaskets shall be extruded or molded to the specified size within a tolerance of ± 6 % on any dimension, measured at any cross section. The rubber gasket shall be fabricated from a high-grade rubber compound. The basic polymer shall be natural rubber, synthetic rubber, or a blend of both acceptable to the owner and meeting the physical requirements prescribed in Section 6.

6. Physical Requirements for Gaskets

6.1 *Standard Gasket Requirement*—The gaskets shall meet with the following physical requirements:

Tensile strength, min	8 MPa
Elongation at break, min, %	350
Shore durometer hardness:	
Min	35[A]
Max	65[A]
Compression set, max, % of original deflection	25

[1] This specification is under the jurisdiction of ASTM Committee C-13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.08 on Rubber Gaskets.

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[2] *Annual Book of ASTM Standards*, Vol 04.05.

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

Accelerated aging, max % of original	
Decrease in tensile strength	15
Decrease in elongation	20
Liquid immersion, max % weight increase	
Water absorption by weight, max, %	10
Ozone resistance	no cracks in accordance with Test Method D 1149

[A] Allowable variation ±5 from manufacturer's specified hardness provided the actual hardness is within the limits of 35 to 65.

6.2 *Oil Resistant Gasket Requirements*—The compound shall contain not less than 50 % by volume oil resistant polymer and shall meet the following physical requirements:

Tensile strength, min	8 MPa
Elongation at break, min, %	350
Shore durometer hardness, nominal:	
Min	35[A]
Max	65[A]
Durometer aging, max increase	15
Compression set, % (22 h at 70°C)	25
Accelerated aging (96 h at 70°C):	
Decrease in tensile strength, max, % of original	20
Decrease in elongation, max, % of original	40
Liquid immersion (max % volume change):	
Oil, ASTM #3 (70 h at 100°C)	50
Water (48 h at 70°C)	15
Ozone resistance, 72 h exposure in 50 PPMM ozone concentration at 40°C	no visible cracking

[A] Allowable variation ±5 from manufacturers specified hardness provided the actual hardness is within the limits of 35 to 65.

6.3 If a splice is used in the manufacture of the gasket, the strength shall be such that the gasket shall withstand 100 % elongation over the part of the gasket which includes the splice with no visible separation of the splice. While in the stretched position, the gasket shall be rotated in the spliced area a minimum of 180° in each direction in order to inspect for separation. In addition, any portion of the splice shall be capable of passing a bend test without visible separation. The bend test for gaskets is defined as wrapping the portion of the unstretched gasket containing the splice a minimum of 180° and a maximum of 270° around a rod. For O-ring gaskets the diameter of the rod shall be equal to the cross-section diameter of the gasket. For noncircular gaskets, the rod diameter shall not be less than 13 mm or more than 25 mm.

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.

7.1.2 All surfaces of the joint upon or against which the gasket may bear 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 shall be of such design that they will withstand the forces caused by the compression of the gasket when tested in accordance with Section 10.

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 axis, except that tapers up to 5° may be used if proven adequate by plant tests as specified in Section 10 and approved by the owner. The conic surface on the spigot or tongue may 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 thickness of the applied gasket including the manufacturer's tolerances of the joint and gasket. The joint design shall provide for the deflection of a pipe unit by opening one side of the outside perimeter of the joint 13 mm wider than the assembled position without reducing its watertightness. Where greater deflections are required than provided by the joint design, beveled joints or elbows must be provided.

7.1.6 The gasket shall be the sole element depended upon to make the joint flexible and watertight. The gasket shall be a continuous ring which fits snugly into the annular space between the overlapping surfaces of the assembled pipe joint to form a flexible watertight seal.

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

7.1.8 Where the particular 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*—If permitted by the owner, manufacturers may submit to the owner detailed designs for joints and gaskets other than those described in Section 7. Design submissions shall include joint geometry, 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. Alternative joint designs shall be acceptable provided the designs are approved by the owner prior to manufacture and provided the test pipe comply with the specified tests.

8. Permissible Variations in Dimensions

8.1 The planes formed by the ends of nonbeveled pipe shall not vary from the perpendicular to the pipe axis by more than 5 mm for internal diameters 750 mm and smaller; or by more than 6 mm for internal diameters 825 to 1350 mm inclusive; or not more than 10 mm for internal diameters 1500 mm and larger.

8.2 The manufacturer's tolerances for the width of the annular space between the gasket bearing surfaces shall not vary by more than ±10 % of the uncompressed thickness of the applied gasket.

9. Test Methods for Gaskets

9.1 The physical properties of the gaskets shall be determined in accordance with the following methods:

9.1.1 *Tensile Strength and Elongation*—Test Method D 412.