Designation: C1896 – 20

Standard Specification for Joints for Concrete Arch Pipe Using Profile Rubber Gaskets[1]

This standard is issued under the fixed designation C1896; 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 specification covers flexible joints for concrete arch pipe, using rubber gaskets for leak resistant joints. The specification covers the design of joints and the requirements for rubber gaskets to be used therewith, for arch pipe conforming in all other respects to Specification C506 provided that if there is conflict in permissible variations in dimensions the requirements of this specification for joints shall govern.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C497 Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile

C822 Terminology Relating to Concrete Pipe and Related Products

C506 Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe

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 joints and gaskets shall be determined by the results of the physical test 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 The gasket shall be fabricated from a rubber compound. The basic polymer shall be natural rubber, synthetic rubber, or a blend of both meeting the physical requirements prescribed in Specification C1619.

5.1.1 Gaskets for standard use shall meet Class C requirements. Gaskets which require oil resistant properties shall meet Class D requirements.

5.2 *Profile Cross-Section Gaskets:*

5.2.1 Profile cross-section gaskets shall be extruded or molded to the design size within a tolerance of ±1/64 in. (±0.4 mm) or ±3.0 % on any dimension, measured at any cross section, whichever is larger.

5.2.2 Profile cross-section gaskets shall have the nominal design cut length tolerance of ±3 % for extruded and spliced gaskets.

6. Design of Joints

6.1 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.

6.1.1 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.

6.1.2 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.

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

6.1.4 The angle of taper on the surfaces of the inside of the bell or groove and the outer surface of the spigot or tongue

[1] This test method 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.

Current edition approved Sept. 15, 2020. Published September 2020. DOI: 10.1520/C1896-20.

[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.

where the gasket seats shall be not more than 3.5° measured from the pipe 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 surface on the spigot or tongue shall be modified to properly position and seat the gasket.

6.1.5 The space between the gasket-bearing surfaces of the assembled and centered joint shall be not more than 75 % of the uncompressed thickness of the installed gasket with all manufacturing tolerances applied. Minimum tolerances shall not be less than 10 % of the installed gasket height. The minimum off-center gasket deformation of the assembled joint at design closure shall not be less than 15 %. The joint design shall provide for the deflection of a pipe unit by opening one side of the outside joint surface of the joint ½ in. (13 mm) wider than the designed position without causing the deformation of the gasket to be less than 10 %. Where greater deflections are required than provided by the joint design, beveled joints or elbows must be provided.

6.1.6 The gasket shall be the sole sealing element depended upon to make the joint flexible and leak resistant. The gasket shall be a continuous shape which fits snugly into the annular space between the overlapping surfaces of the assembled pipe joint.

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

6.1.8 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 1—Joints in an assembled position are defined as joints in the position after assembly in accordance with the manufacturer's design.

6.2 *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 6. Design submissions shall include joint geometry, tolerances, gasket characteristics, gasket deformation, 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.

7. Permissible Variations in Dimensions

7.1 The planes formed by the ends of non-beveled pipe shall not vary from the perpendicular to the pipe axis by more than 3⁄16 in. (5 mm) for internal equivalent diameters 30 in. (750 mm) and smaller; or by more than ¼ in. (6 mm) for internal equivalent diameters 33 in. (825 mm) to 54 in. (1, 350 mm) inclusive; or not more than ⅜ in. (9 mm) for internal equivalent diameters 60 in. (1,500 mm) and larger.

8. Test Methods for Gaskets

8.1 In addition to Specification C1619, the physical properties of the gaskets shall be determined in accordance with the following methods:

8.1.1 *Profile Cross-Section Gasket Stretch Height*—Determine the stretch height of gasket sections in accordance to Test Method C497.

8.1.2 *Gasket Length*—Determine the stretch length of gasket sections in accordance to Test Method C497.

9. Performance Requirements for Joints

9.1 When required by the owner, assembled joints shall pass the following in plant performance test.

9.1.1 *Pipe in Straight Alignment*—Hydrostatic pressure tests on joints shall be made on an assembly of two sections of pipe, properly connected in accordance with the joint design. Suitable means shall be provided that allows pressure to be applied to the joint, either external or internal of the two joined pipe sections. No fillings or packings shall be placed prior to the tests. After the pipe sections are fitted together with the gasket or gaskets in place, the assembly shall be subjected to a hydrostatic pressure of 5 psi (35 kPa) for 10 min. Moisture or beads of water that drip from the joint that can be proven to seal and dry up on retesting are acceptable.

9.1.2 *Pipe in Maximum Deflected Position*—Upon completion of the test for pipe in straight alignment in 9.1.1, the test sections shall be deflected to create a position ½ in. (13 mm) 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 3 psi (21 kPa) for 10 min. Moisture or beads of water that drip from the joint that can be proven to seal and dry up on retesting are acceptable.

10. Storage

10.1 The gaskets shall be stored in as cool, clean, and shaded place as practicable, preferably at 70°F (21°C) or less.

10.2 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 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. Product 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, and

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