



## Designation: ~~C1677 – 11a~~ **C1677 – 11a (Reapproved 2017)**

# Standard Specification for Joints for Concrete Box, Using Rubber Gaskets<sup>1</sup>

This standard is issued under the fixed designation C1677; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

## 1. Scope

1.1 This specification covers flexible joints for concrete box sections, 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 boxes conforming in all other respects to Specification C1433 or C1577, 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:*<sup>2</sup>

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

C822 Terminology Relating to Concrete Pipe and Related Products

C1433 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers

C1577 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD

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 box 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 box 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 *Circular Cross-Section Gaskets:*

5.2.1 Circular cross-section gaskets shall be extruded or molded to the specified size within a tolerance of  $\pm 1/64$  in. ( $\pm 0.4$  mm) or  $\pm 1.5$  % of the cord diameter, whichever is larger.

<sup>1</sup> 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.

Current edition approved Sept. 1, 2011/Sept. 1, 2017. Published September 2011/September 2017. Originally approved in 2009. Last previous edition approved in 2011 as C1677 – 11. C1677 – 11a. DOI: 10.1520/C1677-11A-10.1520/C1677-11AR17.

<sup>2</sup> 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.

5.2.2 Circular cross-section gaskets shall have the nominal design cut length tolerance of  $\pm 3\%$  for extruded and spliced gaskets.

### 5.3 Non-Circular Cross-Section Gaskets:

5.3.1 Non-circular cross-section gaskets shall be extruded or molded to the design size within a tolerance of  $\pm \frac{1}{64}$  in. ( $\pm 0.4$  mm) or  $\pm 3.0\%$  on any dimension, measured at any cross section, whichever is larger.

5.3.2 Non-circular cross-section gaskets shall have the nominal design cut length tolerance of  $\pm 3\%$  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 box, and a spigot or tongue on the adjacent end of the joining box.

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 box 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 where the gasket seats shall be not more than  $3.5^\circ$  measured from the pipe axis, except that tapers up to  $5^\circ$  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 box unit by opening one side of the outside joint surface of the joint  $\frac{1}{2}$  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 box joint.

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

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 box shall not vary from the perpendicular to the box axis by more than  $\frac{1}{8}$  in./ft (10 mm/m) of internal span with a maximum of  $\frac{5}{8}$  in. (16 mm) for all sizes through 7 ft (2100 mm) internal span, and a maximum of  $\frac{3}{4}$  in. (19 mm) for internal spans greater than 7 ft (2100 mm), except where beveled ends for laying on curves are specified by the purchaser.

## 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 *Gasket Volume Determination*—Determine the volume of gasket sections in accordance to Test Method C497.

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

8.1.3 *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 *Boxes in Straight Alignment*—Hydrostatic pressure tests on joints shall be made on an assembly of two sections of box, properly connected in accordance with the joint design. At the option of the owner a second such test shall be required. Suitable