



Designation: C 990 – 03

Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants¹

This standard is issued under the fixed designation C 990; 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 reappraisal. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reappraisal.

1. Scope

1.1 This specification covers joints for precast concrete pipe and box, and other sections using preformed flexible joint sealants for use in storm sewers and culverts which are not intended to operate under internal pressure, or are not subject to infiltration or exfiltration limits. Joint material used in horizontal applications is intended to prevent the flow of solids through the joint.

1.2 For precast concrete manhole sections and other vertical structures, which are subject to internal or external pressure, infiltration or exfiltration limits are not prohibited from being specified. Joints in vertical structures covered by this specification are intended mainly to prevent the flow of solids or fluids through the joint.

1.3 This specification is to be used with pipe and structures conforming in all respects to Specifications C 14, C 76, C 478, C 506, C 507, C 655, C 985, and C 1433, provided that if there is a conflict in permissible variations in dimensions, the requirements of this specification shall govern.

1.4 This specification is the companion to SI specification C 990M; therefore, no SI equivalents are shown in this specification.

1.5 *This standard does not purport to address all of the safety problems, 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.*

NOTE 1—This specification covers the material and performance of the joint and sealant only. Infiltration and exfiltration quantities for installed sections are dependent on factors other than the joints which must be covered by other specifications and suitable testing of the installed pipeline.

2. Referenced Documents

2.1 ASTM Standards:

- C 14 Specification for Concrete Sewer, Storm Drain, and Culvert Pipe²
- C 76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe²
- C 478 Specification for Precast Reinforced Concrete Manhole Sections²
- C 506 Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe²
- C 507 Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe²
- C 655 Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe²
- C 822 Terminology Relating to Concrete Pipe and Related Products²
- C 969 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines²
- C 972 Test Method for Compression—Recovery of Tape Sealant³
- C 985 Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe²
- C 1433 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers²
- D 4 Test Method for Bitumen Content⁴
- D 6 Test Method for Loss on Heating of Oil and Asphaltic Compounds⁴
- D 36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)⁴
- D 71 Test Method for Relative Density of Solid Pitch and Asphalt (Displacement Method)⁴
- D 92 Test Method for Flash Fire Points by Cleveland Open Cup⁴
- D 113 Test Method for Ductility of Bituminous Materials⁵
- D 217 Test Method for Cone Penetration of Lubricating Grease⁶
- D 482 Test Method for Ash from Petroleum Products⁶

¹ This specification is under the jurisdiction of ASTM Committee C13 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 04.07.

⁴ *Annual Book of ASTM Standards*, Vol 04.04.

⁵ *Annual Book of ASTM Standards*, Vol 04.03.

⁶ *Annual Book of ASTM Standards*, Vol 05.01.



2.2 AASHTO Standards:⁷

- T47 Test for Loss of Heating of Oil and Asphaltic Compounds
- T48 Test for Flash and Fire Points by Cleveland Open Cup
- T51 Test for Ductility of Bituminous Material
- T111 Test for Inorganic Matter or Ash
- T229 Test for Specific Gravity of Asphalts and Tar Pitches Sufficiently Solid to be Handled in Fragments

Ash-Inert Mineral Matter, % by weight	30 % min
Volatile Matter, % by weight	3 % max
Specific Gravity at 77°F	1.20 min
	1.35 max
Ductility at 77°F, cm	5.0 min
Flash Point, C.O.C.	350°F min
Fire Point, C.O.C.	375°F min
Softening Point	320°F min
Penetration at 77°F, 150 gm, 5 s	50 min
	120 max
Chemical Resistance	No deterioration, no cracking, no swelling

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 joint and sealant 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 joint and the sealant conform to this specification as to design and freedom from defects.

5. Materials and Manufacture for Sealants

5.1 Bitumen sealants shall be produced from asphalts, hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents. Butyl rubber sealants shall be produced from blends of butyl rubber and refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler and shall contain no solvents.

5.2 Blends of material used in the manufacture of flexible joint sealants shall be approved by the owner and meet the composition and physical requirements prescribed in Section 6. The joint sealant shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength and shall be supplied preformed and of suitable cross section and size to seal the joint annular space when the sections are joined. For a given joint size, the sealing material, as furnished, shall be such so as to encircle the outside circumference of the spigot or tongue of the joint or the inside circumference of the bell or groove and shall not be stretched when seated in the joint. Sealant material shall be furnished in the required length and cross-dimensions, and the dimensions shall be clearly marked. Sealant material shall be preformed to the following specified tolerances:

	Tolerance
Length, %	+ 10, - 0
Cross sectional area, %	+ 10, - 5
Volume (in. ³ /linear ft (mm ³ /linear m)), %	+ 5, - 5
Cross-sectional dimensions (inches), %	+ 10, - 5 ^A

^ADimensions in the field may vary from preformed dimensions

6. Physical Requirements for Sealants

6.1 *Bitumen Sealants:*

6.1.1 Bitumen sealants shall comply with the following composition and physical requirements. Testing shall be in accordance with the methods prescribed in Section 9.

Bitumen (hydrocarbon blends), % by weight	50 % min
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6.2 *Butyl Rubber Sealant:*

6.2.1 Butyl rubber sealants (elastomeric polymer shall be butyl rubber only) shall comply with the following composition and physical requirements. Testing shall be in accordance with the methods prescribed in Section 9.

Butyl Rubber (hydrocarbon blends), % by weight	50 % min
Ash-Inert Mineral Matter, % by weight	30 % min
Volatile Matter, % by weight	3 % max
Specific Gravity at 77°F	1.15 min
	1.40 max
Ductility at 77°F, cm	5.0 min
Flash Point, C.O.C.	350°F min
Fire Point, C.O.C.	375°F min
Compression Test at 77°F, lbf/in. ³	100 max
at 32°F, lbf/in. ³	200 max
Cone Penetration at 77°F, dmm	50 to 120
at 32°F, dmm	30 min
Chemical Resistance	No deterioration, no cracking, no swelling

7. Design of Joints

7.1 The pipe manufacturer shall furnish the owner with the detailed design of the joint. The sealant manufacturer shall furnish a complete list of joint sizes showing the minimum size of material to be used with each size joint, along with complete instructions on recommended installation procedures.

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

7.1.2 All surfaces of the joint upon or against which the sealant will bear shall be free of spalls, cracks or fractures, and imperfections that would adversely affect the function of the joint.

7.1.3 The joints of the sections shall be of such design that they will withstand the forces caused by the compression of the sealant when joined, without cracking or fracturing when tested, in accordance with Section 10.

7.1.4 For horizontal installations, 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 sealant seats shall be not more than 10° measured from the pipe axis. Alternate tapers are permitted if proven adequate by the plant tests specified in Section 10 and approved by the owner.

7.1.5 The annular space measured perpendicular to the sealant bearing surfaces of the assembled and centered joint shall not exceed ½ in. at any point or the maximum specified by the sealant manufacturer, whichever is the lesser. The joint design shall provide for the deflection of a section by opening one side of the outside perimeter of the joint ½ in. wider than the assembled position. Where greater deflections are required than provided by the joint design, beveled joints or elbows may be acceptable if approved by owner.

⁷ Available from American Association of State Highway and Transportation Officials, 444 N. Capitol, Washington, DC 20001.