Designation: C 990 – 01

Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants[1]

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 reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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 may be operated with internal or external pressure, infiltration or exfiltration limits may be 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 789, C 850 and C 985, 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 Pipe[2]

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

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

C 506 Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe[2]

C 507 Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe[2]

C 655 Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe[2]

C 765 Test Method for Low-Temperature Flexibility of Preformed Tape Sealants[3]

C 766 Test Method for Adhesion After Impact of Preformed Tape Sealants[3]

C 789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers[2]

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

C 850 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less than 2 ft of Cover Subjected to Highway Loadings[2]

C 969 Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines[2]

C 972 Test Method for Compression—Recovery of Tape Sealant[3]

C 985 Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe[2]

D 4 Test Method for Bitumen Content[4]

D 6 Test Method for Loss on Heating of Oil and Asphaltic Compounds[4]

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 Cup[4]

D 113 Test Method for Ductility of Bituminous Materials[5]

D 217 Test Method for Cone Penetration of Lubricating Grease[6]

D 482 Test Method for Ash from Petroleum Products[6]

[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.

Current edition approved June 10, 2001. Published October 2001. Originally published as C 990–91. Last previous edition C 990–00.

[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

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 blends of refined 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 in extruded rope form of suitable cross section and size to fill 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 may be furnished in the required length or multiples thereof. Sealant material shall be extruded or molded to the following specified tolerances:

	Tolerance
Length, %	+ 5, − 0
Cross sectional area, %	+ 5, − 5
Volume (in.^{3}/linear ft (mm^3/linear m)), %	+ 5, − 5

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
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

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	2 % max
Specific Gravity at 77°F	1.15 min
	1.50 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
Rebound Test at 77°F	3 % to 15 %
at 32°F	3 % to 20 %
Compression Test at 77°F, lbf/in.^{3}	100 max
at 32°F, lbf/in.^{3}	200 max
Low Temperature Flexibility at − 10°F	180° bend no cracking nor loss of adhesion
Elevated Temperature Flow 14 days at 158°F	No sag, nor change in extruded shape
Adhesion after Impact	No greater loss than 50 % of adhesion
Cone Penetration at 77°F, dmm	50 to 100
at 32°F, dmm	40 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 may 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 may be used 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

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