Designation: C877 – 16

Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections[1]

This standard is issued under the fixed designation C877; 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 external sealing bands to be used in conjunction with concrete pipe as defined in Terminology C822 and conforming to Specifications C14, C76, C412, C478, C506, C507, C655, C985, C1417, and C1433.

1.1.1 Type I, Rubber and Mastic Bands.

1.1.2 Type II, Plastic Film and Mesh Reinforced Mastic Bands.

1.1.3 Type III, Chemically-Bonded Adhesive Butyl Bands.

1.2 This specification is the inch-pound companion to Specification C877M; therefore, no SI equivalents are presented in the specification.

NOTE 1—This specification covers only the design and material of the sealing bands. Sealing bands covered by this specification are adequate, when properly installed, for external hydrostatic pressures up to 13 psi, (30 ft) without leakage. The amount of infiltration or exfiltration flow in an installed pipeline is dependent upon many factors other than the sealing bands; allowable quantities and suitable testing of the installed pipeline and system must be covered by other specifications.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014)[3]

C14 Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe

C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

C412 Specification for Concrete Drain Tile

C478 Specification for Circular Precast Reinforced Concrete Manhole Sections

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

C507 Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe

C655 Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe

C681 Test Method for Volatility of Oil- and Resin-Based, Knife-Grade, Channel Glazing Compounds

C822 Terminology Relating to Concrete Pipe and Related Products

C985 Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe

C1417 Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design

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

D36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)

D217 Test Methods for Cone Penetration of Lubricating Grease

D395 Test Methods for Rubber Property—Compression Set

D412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D471 Test Method for Rubber Property—Effect of Liquids

D570 Test Method for Water Absorption of Plastics

D573 Test Method for Rubber—Deterioration in an Air Oven

D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D882 Test Method for Tensile Properties of Thin Plastic Sheeting

D903 Test Method for Peel or Stripping Strength of Adhesive Bonds

D1171 Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors (Triangular Specimens)

D1278 Test Methods for Rubber from Natural Sources—Chemical Analysis

D1682 Test Method for Breaking Load and Elongation of Textile Fabric (Withdrawn 1992)[3]

[1] 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.

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[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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

D1963 Test Method for Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25°C (Withdrawn 2004)[3]
D2202 Test Method for Slump of Sealants
D2240 Test Method for Rubber Property—Durometer Hardness
D3407 Test Methods for Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements (Withdrawn 1996)[3]
D3953 Specification for Strapping, Flat Steel and Seals

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 sealing bands 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 sealing bands conform to this specification as to design and freedom from defects.

5. Materials and Manufacture for Sealing Bands

5.1 *Type I, Rubber and Mastic Bands:*

5.1.1 Sealing bands shall be composed of rubber, mastic, and protective film elements as schematically shown in Fig. 1 and with dimensions as required in the following:

5.1.1.1 *Length of Sealing Band*—For a given pipe size, the length of the sealing band as furnished shall be such that after being stretched longitudinally 8 to 12 % as part of the installation procedure, the sealing band will encircle the outside perimeter of the pipe and overlap by an amount equal to, but not less than, the width of the sealing band. Sealing bands may be furnished in the required length or multiples thereof.

5.1.1.2 *Width of Sealing Band*—The width of the sealing band shall conform to the requirements of Table 1.

5.1.2 *Rubber Element*—The rubber element shall be extruded or molded from a high-grade rubber compound and shall be cured in such a manner that any cross section will be dense, homogeneous, and free of porosity, blisters, pitting, and other imperfections. The basic polymer shall be natural, synthetic, or a blend of both and shall meet the physical requirements prescribed in Section 6. The rubber element shall have ribs with a height of 3⁄16 in., spaced 3⁄4 to 1 1⁄4 in. apart, and have a thickness between the ribs of 1⁄16 in. The thickness of the ribs is not prohibited from varying from 1⁄8 in. at the base to 1⁄32 in. at the top.

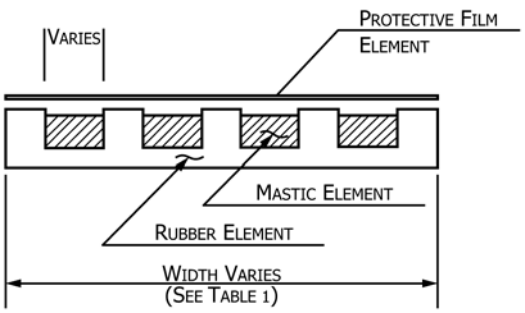

FIG. 1 Sealing Band Type I Schematic (Not to Scale)

TABLE 1 Required Sealing Band Width

Equivalent Circular Pipe Diameter, in.	Sealing Band Width, in.
18 to 33	7
36 to 78	9
84 to 108	11
114 to 144	13

5.1.3 *Mastic Element*—The mastic element shall contain rubber, reclaimed rubber and asphaltic derivatives, clay, and/or resin and shall meet the physical requirements prescribed in Section 6. The mastic element shall have a thickness of 1⁄8 in. and be free of porous areas, air pockets, and contamination by foreign matter.

5.1.4 *Protective Film*—The protective film shall be water soluble, have a 1-mil (0.001 in.) thickness, and meet the physical requirements prescribed in Section 6.

NOTE 2—The function of the film is to protect the mastic surface prior to installation. It is intended to dissolve away in the presence of moisture during installation and expose the mastic for sealing.

5.2 *Type II Plastic Film and Mesh Reinforced Mastic Bands:*

5.2.1 Sealing bands shall be composed of a plastic film, reinforced, rubberized, asphalt, mastic coating with steel straps as schematically shown in Fig. 2, with dimensions as required in the following:

5.2.1.1 *Length of Sealing Band for a Given Pipe Size*—The length of the sealing band shall be equal to the outside perimeter of the joint plus 8 in. to provide for overlap.

5.2.1.2 *Width of Sealing Band*—The width of the sealing band shall conform to the requirements of Table 1.

5.2.2 *Plastic Film Element*—The plastic film element shall be an extended polymer which provides external reinforcement and shall meet the physical requirements prescribed in Section 6.

5.2.3 *Mesh Reinforcement Element,* The mesh reinforcement shall consist of a woven plastic mesh and shall meet the physical requirements prescribed in Section 6.

5.2.4 *Rubberized Asphalt Mastic Element*—The rubberized, asphalt, mastic element shall be a self adhering composition and shall meet the requirements prescribed in Section 6.

5.2.5 *Tie Strap Element*—The tie strap element shall be steel straps with a minimum width of 5⁄8 in. and a minimum thickness of 0.020 in. and shall conform to Specification D3953. Steel straps shall be secured around the pipe with appropriate strapping tools as recommended by the sealing band manufacturer.

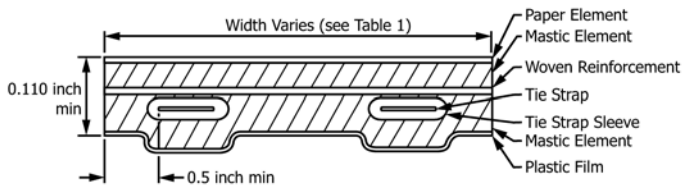

FIG. 2 Sealing Band Type II (Not to Scale)

5.2.6 *Tie Strap Sleeve Element*—The tie strap sleeve element shall consist of a minimum of 1 in. wide flat sleeve inside which the steel tie straps are not prohibited from sliding freely. The sleeve shall be made from woven or non-woven polypropylene fabric with nominal weight of 3.5 oz/yd^2.

5.2.7 *Release Sheet Element*—The disposable release sheet element shall consist of a silicone coated paper with a minimum basis weight of 50 lb/3000 ft^2.

5.3 *Type III, Chemically-Bonded Adhesive Butyl Bands:*

Type A (Plastic backing band)
Type B (Rubber backing band)

5.3.1 Sealing bands shall be composed of a backing band, an applied continuous butyl adhesive coating, and an *optional* release element (as schematically shown in Fig. 3), with width and overlap dimensions as required by 5.3.1.1 and 5.3.1.2. Purchaser specified clamping devices or tie straps are not prohibited to be used with these sealing bands.

5.3.1.1 *Length of Sealing Band for a Given Pipe Size*—The length of the sealing bands shall be equal to the outside perimeter of the joint plus a minimum distance equal to two times the width of the material used to provide for overlap. This requirement shall allow the sealing bands to be applied without stretching the product during application.

5.3.1.2 *Width of Sealing Band*—The minimum width of the sealing band shall conform to the requirements of Table 2.

5.3.2 *Backing Band Element:*

5.3.2.1 *Type A (Plastic Backing Band)*—The plastic backing band element shall be made from high density polyethylene plastic conforming to the physical requirements prescribed in Section 6

5.3.2.2 *Type B (Rubber Backing Band)*—The rubber used in the rubber backing band element shall conform to the physical property requirements of Section 6.

5.3.3 *Butyl Rubber Adhesive Element*—The butyl rubber adhesive element, conforming to the physical requirements prescribed in Section 6, shall be a self-adhering semi-solid and shall be applied evenly and homogeneously to the backing band with a minimum thickness of:

Type A (Plastic backing band)	0.03 in.
Type B (Rubber backing band)	0.03 in.

5.3.4 *Optional Primer Element*—When required, a primer shall be used as directed by the sealing band manufacturer and shall be spread in a continuous film at the intersection of the joint. The application width shall be sufficient to ensure that the entire band area will contact only primed surfaces.

TABLE 2 Required Sealing Band Width (Type III)

Equivalent Circular Pipe Diameter, in.	Minimum Sealing Band Width, in.	Equivalent Circular Manhole Diameter, in.	Minimum Sealing Band Width, in.
12 to 33	6	...	...
36 to 78	9	...	...
84 and larger	12	...	...
...	...	24 to 120	6

5.3.5 *Optional Tie Strap Element*—The *optional* tie strap element shall be steel straps with a minimum width of ⅝ in. and a minimum thickness of 0.20 in. and shall conform to Specification D3953. Steel straps shall be secured around the pipe with appropriate strapping tools as recommended by the sealing band manufacturer.

5.3.6 *Optional Clamping Devices*—Optional clamping devices shall be constructed of corrosion resistant materials meeting the physical properties and chemical composition requirements of Specification A167.

5.3.7 *Optional Release Element*—The *optional* release element shall consist of coated paper or plastic that has demonstrated its suitability for this use.

6. Requirements

6.1 *Type I, Rubber and Mastic Bands:*

6.1.1 The rubber element shall have the following physical properties when tested in accordance with 8.1.1:

Tensile strength, min, psi	1200
Elongation at break, min, %	300
Shore durometer hardness:	
min	60
max	70
Compression set, max, % of deflection	25
Accelerated aging:	
Decrease in tensile strength, max, % of original	15
Decrease in elongation, max, % of original	20
Water absorption by weight, max, %	10
Ozone resistance rating	0

6.1.2 The mastic element shall be capable of flowing, within the confines of the sealing band, to fill joint surface imperfections against which the sealing band is placed and shall have no

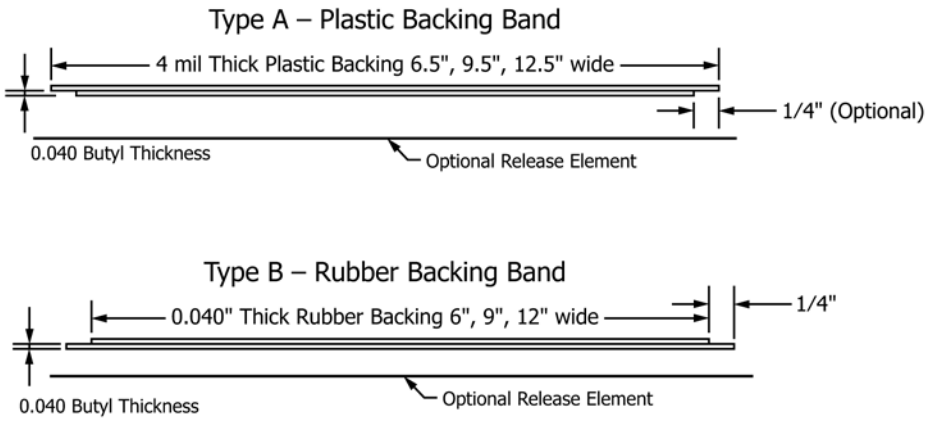

FIG. 3 Sealing Band Type III (Not to Scale)

deleterious effect on the rubber element. The mastic element shall have the following physical properties when tested in accordance with 8.1.2:

	Minimum	Maximum
Ash-inert matter	10 %	25 %
Volatiles	5 %	10 %
Specific gravity	1.20	1.35
Slump	0.01 in.	0.03 in.
Penetration	200	300

6.1.3 The protective film element shall have a maximum water solubility of 60 s/0.8 mil of thickness when tested in accordance with Section 8.

6.2 *Type II Plastic Film and Mesh Reinforced Mastic Bands:*

6.2.1 The plastic film element shall have the following physical properties when tested in accordance with 8.2.1:

Tensile strength, min, psi	4000
Elongation at break, min, %	100
Tear resistance, min, psi	1500
Water absorption, max, %	0.01

6.2.2 The reinforcing mesh element shall have the following physical properties when tested in accordance with 8.2.2:

Tensile Strength, min, lb/in.
warp 75
fill 75
Elongation at break, min, %
warp 20
fill 20

6.2.3 The rubberized asphalt mastic layer shall have the following physical properties when tested in accordance with 8.2.3:

	Minimum	Maximum
Ash-inert matter, %	8.0	15.0
Volatiles, %	0.1	2.0
Specific gravity	0.95	1.05
Softening temperature, min., °F	175	–
Penetration, dmm	60	90
Flow, mm	10	10

6.3 *Type III, Chemically-Bonded Adhesive Butyl Bands:*

6.3.1 The backing band element shall have the following physical properties when tested in accordance with 8.3.1 (plastic) and 8.3.2 (rubber):

Type A (Plastic Backing Band)	
Tensile strength, min, psi	4000
Elongation at break, min,%	100
Tear resistance, min, psi	1500
Water absorption, max, %	0.01
Type B (Rubber Backing Band)	
Tensile strength, min, psi	1200
Elongation at break, min, %	300
Shore durometer hardness:	
min	60
max	70
Compression set, max, % of deflection	25
Accelerated aging:	
Decrease in tensile strength, max, % of original	15
Decrease in elongation, max, % of original	20
Water absorption by weight, max, %	10
Ozone resistance rating	0

6.3.2 The butyl rubber adhesive element shall have the following physical properties when tested in accordance with 8.3.3:

	Minimum	Maximum
Ash-inert matter, %	30	50
Volatiles, %	0.1	2
Specific gravity	1.15	1.50
Adhesion after impact, %	50	100
Penetration at 77°F	50	100

7. Permissible Variations in Dimensions

7.1 *Type I, Rubber and Mastic Bands:*

7.1.1 The thickness of the rubber element between the ribs shall be a minimum of 1/16 in. and a maximum of 3/32 in.

7.1.2 The rubber element ribs shall have a minimum height of 3/16 in. and a maximum of 7/32 in.

7.1.3 No tolerances are required on the rib thickness.

7.1.4 The sealing band shall be manufactured to RMA (Rubber Manufacturers Association) commercial tolerances.[4]

7.1.5 The mastic element shall have a minimum thickness of 1/8 in.

7.2 *Type II Plastic Film and Mesh Reinforced Mastic Bands:*

7.2.1 The thickness of plastic film and mesh reinforced mastic bands shall be a minimum of 0.110 in. when measured away from the tie straps.

NOTE 3—Thickness shall be measured with the release sheet in place. The thickness of the release sheet shall also be determined and subtracted from the first measurement.

7.3 *Type III, Chemically-Bonded Adhesive Butyl Bands:*

Type A (Plastic backing band)
Type B (Rubber backing band)

7.3.1 *Type A:*

7.3.1.1 The bonded adhesive butyl material shall have a width equal to the nominal width of the material ±1/8 in. and the plastic backing shall have a minimum thickness of 0.004 in. and an actual nominal width equal to the width of the butyl material, but no more than 1/4 in. wider on each side of the butyl material.

7.3.2 *Type B:*

7.3.2.1 The bonded adhesive butyl material shall have a width equal to the nominal width of the material plus 0.4-0.7 in. The rubber backing element shall have a minimum thickness of 0.034 in. and actual nominal width equal to the nominal width of the material ±1/4 in.

7.3.3 *Types A and B:*

7.3.3.1 The bonded adhesive butyl material shall have a minimum thickness of 0.040 in.

8. Test Methods for Sealing Bands

8.1 The physical properties of the Type I sealing bands shall be determined in accordance with the following test methods:

8.1.1 *Rubber Element:*

8.1.1.1 *Tensile Strength and Elongation*—Test Methods D412.

8.1.1.2 *Hardness*—Test Method D2240, with the exception of the Significance and Use Section. The determination shall be taken directly on the band. The presser foot shall be applied on

[4] Available from the Rubber Manufacturers Assn., Inc., 444 Madison Ave., New York, NY 10022.

areas that are ¼ in. or greater in thickness. If ¼ in. or greater thickness is not available in the band, thinner samples shall be plied up to obtain this thickness.

8.1.1.3 *Compression Set*—Test Methods D395, the Compression Set Under Constant Deflection in Air Method. Test conditions shall be 22 h at 158°F. Specimens shall not be prepared from laboratory-prepared slabs or by direct molding.

8.1.1.4 *Accelerated Aging*—Test Method D573. Test conditions shall be 96 h at 158°F.

8.1.1.5 *Water Absorption*—Test Method D471. Use distilled water for the standard test liquid. When a 1-in. wide test specimen cannot be obtained, use the greatest width obtainable from the test sample. Test conditions shall be 48 h at 158°F.

8.1.1.6 *Ozone Resistance*—Test Method D1171. Test conditions shall be 70 h at 100 pphm.

8.1.2 *Mastic Element:*

8.1.2.1 *Ash-Inert Matter*—Test Methods D1278. Test conditions shall be 3 h at 1022 ± 77°F.

8.1.2.2 *Volatiles*—Test Method C681. Test conditions shall be 3 h at 220°F.

8.1.2.3 *Specific Gravity*—Test Method D1963. Test conditions shall be 77°F.

8.1.2.4 *Slump*—Test Method D2202. Test conditions shall be 30 min at 122°F.

8.1.2.5 *Penetration*—Test Methods D217. Test conditions shall be 3.5-oz cone for 5 s at 77°F.

8.1.3 *Protective Film*—The solubility of the protective film shall be determined by placing a 1-in.^{2} piece of film in a beaker containing 100 mL of water and stirring. The film must dissolve within 60 s at water temperatures between 33 and 120°F.

8.2 The physical properties of the Type 2 sealing bands shall be determined in accordance with the following test methods:

8.2.1 *Plastic Film Element:*

8.2.1.1 *Tensile Strength and Elongation*—Test Method D882, Method A.

8.2.1.2 *Tear Resistance*—Test Method D624, Die C.

8.2.1.3 *Water Absorption*—Test Method D570.

8.2.2 *Reinforcing Mesh Element:*

8.2.2.1 *Tensile Strength and Elongation*—Test Methods D1682.

8.2.3 *Rubberized Asphalt Mastic Layer:*

8.2.3.1 *Ash-Inert Matter*—Test Method D1278. Test conditions to be 3 h at 1022 ± 77°F.

8.2.3.2 *Volatiles*—Test Method C681. Test conditions to be 3 h at 220°F.

8.2.3.3 *Specific Gravity*—Test Method D1963. Test conditions to be 77°F.

8.2.3.4 *Softening Temperature*—Test Method D36.

8.2.3.5 *Penetration*—Test Methods D3407.

8.2.3.6 *Flow*—Test Methods D3407.

8.3 The physical properties of the Type III sealing bands shall be determined in accordance with the following methods:

8.3.1 Plastic Backing Bands:

8.3.1.1 *Tensile Strength and Elongation*—Test Method D882, Method A.

8.3.1.2 *Tear Resistance*—Test Method D624, Die C.

8.3.1.3 *Water Absorption*—Test Method D570.

8.3.2 *Rubber Backing Bands:*

8.3.2.1 *Tensile Strength and Elongation*—Test Methods D412.

8.3.2.2 *Hardness*—Test Method D2240, with the exception of the Significance and Use Section. The determination shall be taken directly on the band. The presser foot shall be applied on areas that are ¼ in. or greater in thickness. If ¼ in. or greater thickness is not available in the band, thinner samples may be plied up to obtain this thickness.

8.3.2.3 *Compression Set*—Test Methods D395, the Compression Set Under Constant Deflection in Air Method. Test conditions shall be 22 h at 158°F. Specimens shall not be prepared from laboratory-prepared slabs or by direct molding.

8.3.2.4 *Accelerated Aging*—Test Method D573. Test conditions shall be 96 h at 158°F.

8.3.2.5 *Water Absorption*—Test Method D471. Use distilled water for the standard test liquid. When a 1 in. wide test specimen cannot be obtained, use the greatest width obtainable from the test sample. Test conditions shall be 48 h at 158°F.

8.3.2.6 *Ozone Resistance*—Test Method D1171. Test conditions shall be 70 h at 100 pphm.

8.3.3 *Butyl Rubber Adhesive Element:*

8.3.3.1 *Ash-Inert Matter*—Test Method D1278. Test conditions to be 3 h at 1022 +77°F.

8.3.3.2 *Volatiles*—Test Method C681. Test conditions to be 3 h at 220°F.

8.3.3.3 *Specific Gravity*—Test Method D1963. Test conditions to be 77°F.

8.3.3.4 *Adhesion*—Test Method D903. Use 10 in. length of 1 in. diameter, 12 in. panel.

8.3.3.5 *Penetration*—Test Methods D217.

8.4 The manufacturer shall, if required, furnish certified copies of test reports under this specification.

9. Storage

9.1 The bands shall be stored in as cool, clean, and shaded a place as practicable, preferably 70°F or less.

10. Inspection

10.1 The quality of the materials and the finished band shall be subject to inspection and approval by the owner.

11. Rejection

11.1 Bands shall be subject to rejection upon failure to conform to any of the requirements of this specification.

11.2 The bands shall be subject to rejection whenever they show checking, weathering, or other deterioration prior to installation in the work.

12. Keywords

12.1 bands; external; concrete pipe; joints