



Designation: C877M – 21

Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections (Metric)¹

This standard is issued under the fixed designation C877M; 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 C14M, C76M, C412M, C478/C478M, C506M, C507M, C655M, C985M, C1417M, and C1433M.

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 metric counterpart of Specification C877.

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 90 kPa, (9.14 m) 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.

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

A167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (Withdrawn 2014)³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

Current edition approved Jan. 15, 2021. Published January 2021. Originally approved in 1980. Last previous edition approved in 2016 as C877M – 16. DOI: 10.1520/C0877M-21.

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.

C14M Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
C76M Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
C412M Specification for Concrete Drain Tile (Metric)
C478/C478M Specification for Circular Precast Reinforced Concrete Manhole Sections
C506M Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)
C507M Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric)
C655M Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe (Metric)
C681 Test Method for Volatility of Oil- and Resin-Based, Knife-Grade, Channel Glazing Compounds
C822 Terminology Relating to Concrete Pipe and Related Products
C985M Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe (Metric)
C1417M Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design (Metric)
C1433M Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers (Metric)
D36/D36M 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
- 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

TABLE 1 Required Minimum Sealing Band Width (Types I and II)

Equivalent Circular Pipe Diameter, mm	Sealing Band Width, mm
450 to 825	180
900 to 1950	230
2100 to 2700	280
2850 to 3600	330

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 4.8 mm, spaced 19 to 32 mm apart, and have a thickness between the ribs of 1.6 mm. The thickness of the ribs is not prohibited from varying from 3.2 mm at the base to 0.8 mm at the top.

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 3.2 mm 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 0.025-mm 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 200 mm 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 extruded 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.

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

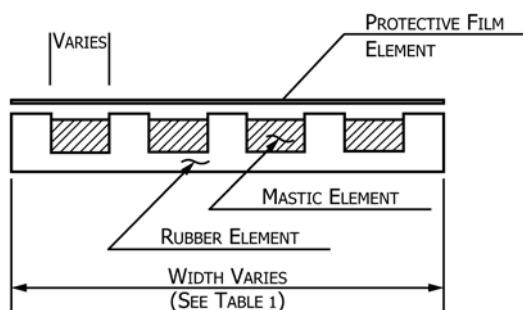


FIG. 1 Sealing Band Type I Schematic (Not to Scale)

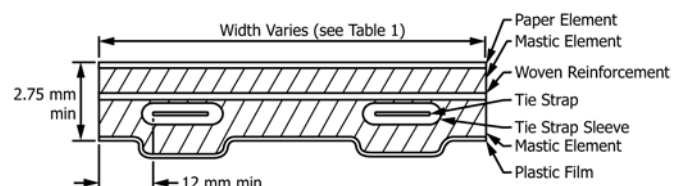


FIG. 2 Sealing Band Type II (Not to Scale)

5.2.5 *Tie Strap Element*—The tie strap element shall be steel straps with a minimum width of 15 mm and a minimum thickness of 0.50 mm 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.

5.2.6 *Tie Strap Sleeve Element*—The tie strap sleeve element shall consist of a minimum of 25 mm 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 mass of 0.12 kg/m².

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

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 will 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 prescribed in Section 6.

5.3.3 *Butyl Rubber Adhesive Element*—The butyl rubber adhesive element, conforming to the physical requirements

TABLE 2 Required Minimum Sealing Band Width (Type III)

Equivalent Circular Pipe Diameter, mm	Minimum Sealing Band Width, mm
300-900	152
901-2000	229
2001 and larger	305

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) 0.75-mm
- Type B (Rubber Backing Band) 0.75-mm

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.

5.3.5 *Optional Tie Strap*—The optional tie strap element shall be steel straps with a minimum width of 16 mm and a minimum thickness of 5 mm 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 material 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. Physical Requirements for Sealing Band Elements

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, MPa	8.27
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 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, mm	0.3	0.9
Penetration, dmm	200	300

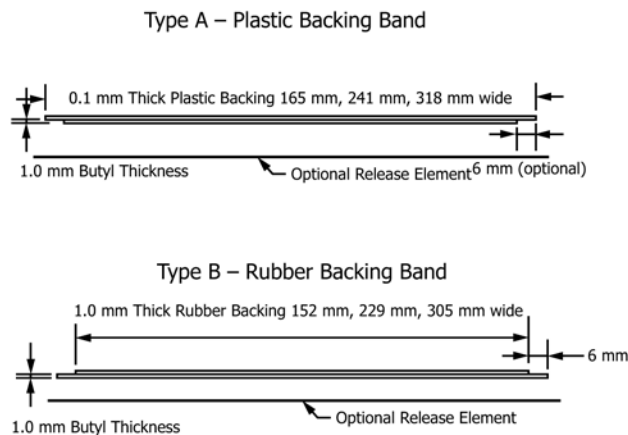


FIG. 3 Sealing Band Type III (Not to Scale)

6.1.3 The protective film element shall have a maximum water solubility of 60 s/0.020 mm of thickness when tested in accordance with 8.1.3.

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, MPa	27.6
Elongation at break, min, %	100
Tear resistance, min, MPa	10.4
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, N/mm	
warp 13	
fill 13	
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, °C	79.4	—
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, MPa	27.6
Elongation at break, min, %	100
Tear resistance, min, MPa	10.4
Water absorption, max, %	0.01

Type B (Rubber Backing Band)

Tensile strength, min, MPa	8.27
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, %	30	50
Volatiles, %	0.1	3.0
Specific gravity	1.15	1.50
Peel Strength, N/mm	0.35	—
Penetration at 25°C, dmm	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 1.6 mm and a maximum of 2.4 mm.

7.1.2 The rubber element ribs shall have a minimum height of 4.8 mm and a maximum of 5.6 mm.

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 3.2 mm.

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 2.75 mm when measured away from the tie straps.

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 ± 3 mm and the plastic backing shall have a minimum thickness of 0.08 mm and an actual nominal width equal to the width of the butyl material, but no more than 6.35 mm 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 10-18 mm. The rubber backing element shall have a minimum thickness of 0.8 mm and an actual nominal width equal to the nominal width of the material ± 5 mm.

7.3.3 *Types A and B:*

7.3.3.1 The bonded adhesive butyl material shall have a minimum thickness of 1.0 mm.

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.

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 areas that are 6.4 mm or greater in thickness. If 6.4 mm 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 70°C. 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 70°C.

8.1.1.5 *Water Absorption*—Test Method **D471**. Use distilled water for the standard test liquid. When a 25-mm wide test

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