



# Standard Specification for External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe<sup>1</sup>

This standard is issued under the fixed designation C 877; 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 external sealing bands to be used in conjunction with noncircular concrete pipe as defined in Terminology C 822 and conforming to Specifications C 506, C 507, C 789, and C 850.

1.1.1 Type I, Rubber and Mastic Bands.

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

1.2 A complete metric companion to Specification C 877 has been developed—C 877M; therefore, no metric equivalents are presented in this specification.

NOTE 1—This specification covers only the design and material of the sealing bands. Sealing bands covered by this specification should be 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:

C 506 Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe<sup>2</sup>

C 507 Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe<sup>2</sup>

C 681 Test Method for Volatility of Oil- and Resin-Based, Knife-Grade, Channel Glazing Compounds<sup>3</sup>

C 789 Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers<sup>2</sup>

C 822 Terminology Relating to Concrete Pipe and Related Products<sup>2</sup>

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<sup>2</sup>

D 5 Test Method for Penetration of Bituminous Materials<sup>4</sup>

D 36 Test Method for Softening Point of Bitumen (Ring and Ball Apparatus)<sup>5</sup>

D 217 Test Method for Cone Penetration of Lubricating Grease<sup>6</sup>

D 395 Test Methods for Rubber Property—Compression Set<sup>7</sup>

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers—Tension<sup>7</sup>

D 471 Test Method for Rubber Property—Effect of Liquids<sup>7</sup>

D 570 Test Method for Water Absorption of Plastics<sup>8</sup>

D 573 Test Method for Rubber—Deterioration in an Air Oven<sup>7</sup>

D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers<sup>7</sup>

D 882 Test Methods for Tensile Properties of Thin Plastic Sheet<sup>8</sup>

D 1171 Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)<sup>7</sup>

D 1278 Test Methods for Rubber from Natural Sources—Chemical Analysis<sup>7</sup>

D 1682 Test Methods for Breaking Load and Elongation of Textile Fabrics<sup>9</sup>

D 1963 Test Method for Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25 C<sup>10</sup>

D 2202 Test Method for Slump of Sealants<sup>3</sup>

D 2240 Test Method for Rubber Property—Durometer Hardness<sup>7</sup>

D 3407 Methods of Testing for Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements<sup>4</sup>

D 3953 Specification for Strapping, Flat Steel and Seals<sup>11</sup>

## 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 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.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C-13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.08 on Rubber Gaskets.

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<sup>2</sup> *Annual Book of ASTM Standards*, Vol 04.05.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.07.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.03.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 04.04.

<sup>6</sup> *Annual Book of ASTM Standards*, Vol 05.01.

<sup>7</sup> *Annual Book of ASTM Standards*, Vol 09.01.

<sup>8</sup> *Annual Book of ASTM Standards*, Vol 08.01.

<sup>9</sup> *Annual Book of ASTM Standards*, Vol 07.01.

<sup>10</sup> *Annual Book of ASTM Standards*, Vol 06.03.

<sup>11</sup> *Annual Book of ASTM Standards*, Vol 15.09.

cation 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 circumference 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 may 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 may 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  $\frac{3}{16}$  in., spaced  $\frac{3}{4}$  to  $1\frac{1}{4}$  in. apart, and have a thickness between the ribs of  $\frac{1}{16}$  in. The thickness of the ribs may vary from  $\frac{1}{8}$  in. at the base to  $\frac{1}{32}$  in. at the top.

5.1.3 *Mastic Element*—The mastic element may contain rubber, reclaimed rubber and asphaltic derivatives, clay, asbestos, and resin and shall meet the physical requirements prescribed in Section 6. The mastic element shall have a thickness of  $\frac{1}{8}$  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

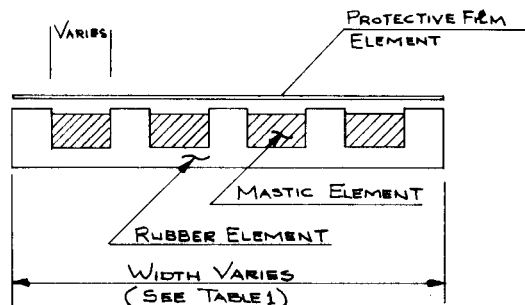


FIG. 1 Sealing Band Type I Schematic (Not to Scale)

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

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 circumference 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  $\frac{5}{8}$  in. and a minimum thickness of 0.020 in. and shall conform to Specification D 3953. 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 1 in. wide flat sleeve inside which the steel tie straps may slide freely. The sleeve may be made from woven or non-woven polypropylene fabric with nominal weight of 3.5 oz./yd<sup>2</sup>.

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<sup>2</sup>.

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

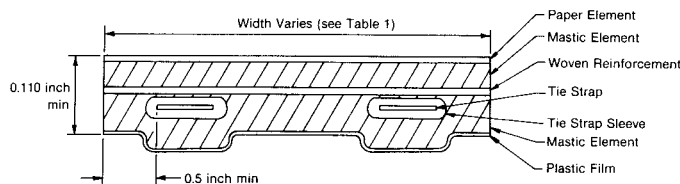


FIG. 2 Sealing Band Type II (Not to Scale)

	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

#### 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  $\frac{1}{16}$  in. and a maximum of  $\frac{3}{32}$  in.

7.1.2 The rubber element ribs shall have a minimum height of  $\frac{3}{16}$  in. and a maximum of  $\frac{7}{32}$  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.<sup>12</sup>

7.1.5 The mastic element shall have a minimum thickness of  $\frac{1}{8}$  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.

#### 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 D 412.

8.1.1.2 Hardness—Test Method D 2240, 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  $\frac{1}{4}$  in. or greater in thickness. If  $\frac{1}{4}$  in. or greater thickness is not available in the band, thinner samples may be plied up to obtain this thickness.

8.1.1.3 Compression Set—Test Methods D 395, 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 D 573. Test conditions shall be 96 h at 158°F.

8.1.1.5 Water Absorption—Test Method D 471. 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 D 1171. Test conditions shall be 70 h at 100 pphm.

##### 8.1.2 Mastic Element:

8.1.2.1 Ash-Inert Matter—Test Methods D 1278. Test conditions shall be 3 h at  $1022 \pm 77^\circ\text{F}$ .

8.1.2.2 Volatiles—Test Method C 681. Test conditions shall be 3 h at 220°F.

8.1.2.3 Specific Gravity—Test Method D 1963. Test conditions shall be 77°F.

8.1.2.4 Slump—Test Method D 2202. Test conditions shall be 30 min at 122°F.

8.1.2.5 Penetration—Test Method D 217. 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.<sup>2</sup> 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 D 882, Method A.

8.2.1.2 Tear Resistance—Test Method D 624, Die C.

8.2.1.3 Water Absorption—Test Method D 570.

##### 8.2.2 Reinforcing Mesh Element:

8.2.2.1 Tensile Strength and Elongation—Test Methods D 1682.

##### 8.2.3 Rubberized Asphalt Mastic Layer:

<sup>12</sup> Available from the Rubber Manufacturers Assn., Inc., 444 Madison Ave., New York, NY 10022.

8.2.3.1 *Ash-Inert Matter*—Test Method D 1278. Test conditions to be 3 h at  $1022 \pm 77^{\circ}\text{F}$ .

8.2.3.2 *Volatiles*—Test Method C 681. Test conditions to be 3 h at  $220^{\circ}\text{F}$ .

8.2.3.3 *Specific Gravity*—Test Method D 1963. Test conditions to be  $77^{\circ}\text{F}$ .

8.2.3.4 *Softening Temperature*—Test Method D 36.

8.2.3.5 *Penetration*—Methods D 3407.

8.2.3.6 *Flow*—Methods D 3407.

8.3 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  $70^{\circ}\text{F}$  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

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