



# Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections (Metric)<sup>1</sup>

This standard is issued under the fixed designation C 877M; 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.

<sup>e1</sup> NOTE—Editorial corrections were made to 5.1.3 in March 2005.

## 1. Scope

1.1 This specification covers external sealing bands to be used in conjunction with concrete pipe as defined in Terminology C 822 and conforming to Specifications C 14M, C 76M, C 412M, C 478M, C 506M, C 507M, C 655M, C 985M, C 1417M, and C 1433M.

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 C 877.

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.

## 2. Referenced Documents

2.1 *ASTM Standards*:<sup>2</sup>

A 167 Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

C 14M Specification for Concrete Sewer, Storm Drain, and Culvert Pipe [Metric]

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

C 412M Specification for Concrete Drain Tile [Metric]

C 478M Specification for Precast Reinforced Concrete Manhole Sections [Metric]

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

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

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

C 681 Test Method for Volatility of Oil- and Resin-Based, Knife-Grade, Channel Glazing Compounds

C 766 Test Method for Adhesion After Impact of Preformed Tape Sealants<sup>3</sup>

C 822 Terminology Relating to Concrete Pipe and Related Products

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

C 1417M Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design [Metric]

C 1433M Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers [Metric]

D 36 Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)

D 217 Test Methods for Cone Penetration of Lubricating Grease

D 395 Test Methods for Rubber Property—Compression Set

D 412 Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension

D 471 Test Method for Rubber Property—Effect of Liquids

D 570 Test Method for Water Absorption of Plastics

D 573 Test Method for Rubber—Deterioration in an Air Oven

D 624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers

D 882 Test Method for Tensile Properties of Thin Plastic Sheeting

<sup>3</sup> Withdrawn.

<sup>1</sup> 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

- D 1171 Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
- D 1278 Test Methods for Rubber from Natural Sources—Chemical Analysis
- D 1682 Test Methods for Breaking Load and Elongation of Textile Fabrics<sup>3</sup>
- D 1963 Test Method for Specific Gravity of Drying Oils, Varnishes, Resins, and Related Materials at 25/25°C
- D 2202 Test Method for Slump of Sealants
- D 2240 Test Method for Rubber Property—Durometer Hardness
- D 3407 Test Methods of Testing for Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements<sup>3</sup>
- D 3953 Specification for Strapping, Flat Steel and Seals

**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 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

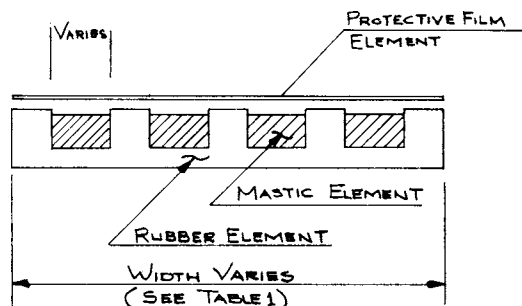


FIG. 1 Sealing Band Type I Schematic (Not to Scale)

**TABLE 1 Required Sealing Band Width**

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 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 15 mm and a minimum thickness of 0.50 mm and shall conform to Specification

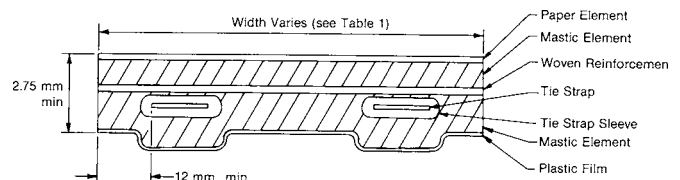


FIG. 2 Sealing Band Type II (Not to Scale)

**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 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/m<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 mass of 0.1 kg/m<sup>2</sup>.

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

- Type A (Plastic backing band)
- Type B (Rubber backing band)
- A semi-liquid paintable butyl rubber-based adhesive primer

**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 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:

**TABLE 2 Required 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

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

**5.3.4 Primer Element**—The primer element shall be a semi-liquid homogeneous mixture of butyl rubber and vehicle, conforming to the physical requirements prescribed in Section 6, 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 D 3953. 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 A 167.

**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:**

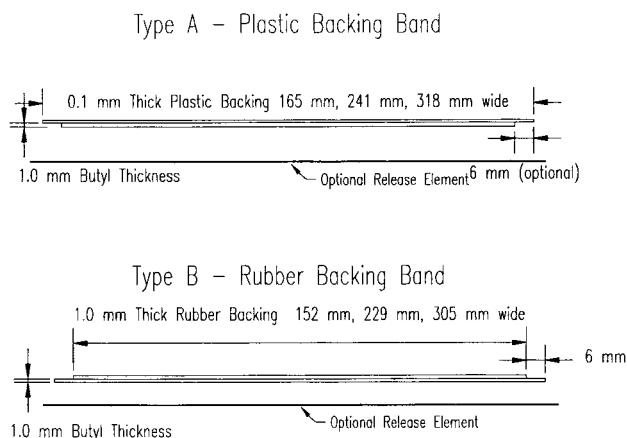
**6.1.1** The rubber element shall have the following physical properties when tested in accordance with 8.1.1:

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	0.3 mm	0.9 mm
Penetration	200	300

**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.



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

## 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	2
Specific gravity	1.15	1.50
Adhesion after impact, %	50	100
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.<sup>4</sup>

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  $\pm 3$  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.

#### 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  $\pm 5$  mm.

#### 7.3.3 Types and B:

7.3.3.1 The bonded adhesive butyl material shall have a thickness of 1.0 mm  $\pm 0.25$  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 **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 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 **D 395**, 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 **D 573**. Test conditions shall be 96 h at 70°C.

8.1.1.5 *Water Absorption*—Test Method **D 471**. Use distilled water for the standard test liquid. When a 25-mm wide test specimen cannot be obtained, use the greatest width obtainable from the test sample. Test conditions shall be 48 h at 70°C.

8.1.1.6 *Ozone Resistance*—Test Method **D 1171**. Test conditions shall be 70 h at 100 pphm.

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

### 8.1.2 Mastic Element:

8.1.2.1 *Ash-Inert Matter*—Test Methods **D 1278**. Test conditions shall be 3 h at 550 ± 25°C.

8.1.2.2 *Volatiles*—Test Method **C 681**. Test conditions shall be 3 h at 104°C.

8.1.2.3 *Specific Gravity*—Test Method **D 1963**. Test conditions shall be 25°C.

8.1.2.4 *Slump*—Test Method **D 2202**. Test conditions shall be 30 min at 50°C.

8.1.2.5 *Penetration*—Test Methods **D 217**. Test conditions shall be 100-g cone for 5 s at 25°C.

8.1.3 *Protective Film*—The solubility of the protective film shall be determined by placing a 6.5-cm<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 1 and 50°C.

8.2 The physical properties of the Type II 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 Method **D 1682**.

#### 8.2.3 Rubberized Asphalt Mastic Layer:

8.2.3.1 *Ash-Inert Matter*—Test Method **D 1278**. Test conditions to be 3 h at 550 ± 25°C.

8.2.3.2 *Volatiles*—Test Method **C 681**. Test conditions to be 3 h at 104°C.

8.2.3.3 *Specific Gravity*—Test Method **D 1963**. Test conditions to be 25°C.

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 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 Methods **D 882**, Method A.

8.3.1.2 *Tear Resistance*—Test Method **D 624**, Die C.

8.3.1.3 *Water Absorption*—Test Method **D 570**.

#### 8.3.2 Rubber Backing Bands:

8.3.2.1 *Tensile Strength and Elongation*—Test Methods **D 412**.

8.3.2.2 *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 6.4 mm or greater in thickness. If 6.4 mm 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 **D 395**, 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.

8.3.2.4 *Accelerated Aging*—Test Method **D 573**. Test conditions shall be 96 h at 70°C.

8.3.2.5 *Water Absorption*—Test Method **D 471**. Use distilled water for the standard test liquid. When a 25 mm wide test specimen cannot be obtained, use the greatest width obtainable from the test sample. Test conditions shall be 48 h at 70°C.

8.3.2.6 *Ozone Resistance*—Test Method **D 1171**. Test conditions shall be 70 h at 100 ppm.

#### 8.3.3 Butyl Rubber Adhesive Element:

8.3.3.1 *Ash-Inert Matter*—Test Method **D 1278**. Test conditions to be 3 h at 550 +25°C.

8.3.3.2 *Volatiles*—Test Method **C 681**. Test conditions to be 3 h at 104°C.

8.3.3.3 *Specific Gravity*—Test Method **D 1963**. Test conditions to be 25°C.

8.3.3.4 *Adhesion*—Test Method **C 766**. Use 250 mm length diameter, 300 mm panel.

8.3.3.5 *Penetration*—Test Method **D 217**.

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 21°C 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 surface checking, weathering, or other deterioration prior to installation in the work.

## 12. Keywords

12.1 bands; external; concrete pipe; joints

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