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Standard Specification for Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes, and Laterals (Metric)[1]

This standard is issued under the fixed designation C1478M; 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 the minimum performance and material requirements for resilient connectors used for connections between precast reinforced concrete storm sewer structures conforming to Specification C478 and pipes, and between precast reinforced concrete pipe and laterals for storm drainage systems.

1.1.1 These connectors are designed to prevent soil migration between the pipe and storm sewer structure, and between the pipe and lateral.

1.2 This specification is the SI companion to C1478.

NOTE 1—This specification covers the design, material, and performance of the resilient connection only. Connections covered by this specification are adequate for hydrostatic pressures up to 41 kPa (4.3 m) without leakage when tested in accordance with Section 7. Infiltration quantities for an installed system are dependent upon many factors other than the connections between storm sewer structures and pipe, and allowable quantities must be covered by other specifications and suitable testing of the installed pipeline and system.

1.3 *This standard does not purport to address all of the safety concerns, 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 requirements prior to use.* For a specific warning statement, see 7.2.4.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A493 Specification for Stainless Steel Wire and Wire Rods for Cold Heading and Cold Forging

A666 Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar

C478 Specification for Circular Precast Reinforced Concrete Manhole Sections

C822 Terminology Relating to Concrete Pipe and Related Products

C913 Specification for Precast Concrete Water and Wastewater Structures

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

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D573 Test Method for Rubber—Deterioration in an Air Oven

F624 Guide for Evaluation of Thermoplastic Polyurethane Solids and Solutions for Biomedical Applications

D883 Terminology Relating to Plastics

D1149 Test Methods for Rubber Deterioration—Cracking in an Ozone Controlled Environment

D1566 Terminology Relating to Rubber

D2137 Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics

D2240 Test Method for Rubber Property—Durometer Hardness

NOTE 2—For more information about wastewater structures, see Specification C913.

3. Terminology

3.1 *Definitions:*

3.1.1 Terms relating to plastics and rubber shall be as defined in Terminologies D883 and D1566, respectively.

3.1.2 Terms relating to precast concrete pipe, manholes, and related products shall be as defined in Terminology C822.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *connector*—the entire assembly, including resilient seals and metallic or nonmetallic mechanical devices, if any, used therein.

3.2.2 *lateral*—the small diameter pipe connected to the main line pipe.

[1] This specification is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.06 on Manholes and Specials.

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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.

3.2.3 *pipe*—the inlet or outlet pipe connected to the manhole.

3.2.4 *pipe stub*—a short section of pipe installed in the structure as an inlet or outlet pipe, for future connection.

4. Materials and Manufacture

4.1 All materials shall conform to the following requirements:

4.1.1 Resilient materials for connectors and filler rings shall be manufactured from natural or synthetic rubber and shall conform to the requirements prescribed in Table 1. If a splice is used in the manufacture of the seal, its strength shall be such that the seal shall withstand a 180° bend with no visible separation.

4.2 *Mechanical Devices*—Expansion rings, tension bands, and take-up devices used for mechanically compressing the resilient portion of the connector against the pipe or storm sewer structure shall be made from a material or materials in combination that will ensure durability, strength, resistance to corrosion, and have properties that will ensure continued resistance to leakage. All metallic mechanical devices, including castings and bolt assemblies used to mechanically deform resilient materials, shall be constructed of corrosion resistant materials meeting the physical properties and chemical composition requirements of Specifications A493 and A666, Type 302 through Type 316.

NOTE 3—Experience has shown that successful performance of this product depends on the type of bedding and backfill and the care in the field installation of the manhole storm sewer structure and connecting pipes. The owner is cautioned to require inspection at the construction site.

5. Principles of Design

5.1 The design of the connector shall be such that positive seal is accomplished at two locations: *(1)* between the connector and the storm sewer structure wall and *(2)* between the connector and the pipe. The seal between the connector and the storm sewer structure wall shall be made by either mechanical means, compression of the resilient material between the outside surface of the pipe and the pipe opening in the storm sewer structure wall, or by casting the connector integrally with the storm sewer structure wall. The seal between the connector and the pipe shall be made by mechanical means or by compression of the resilient material against the outside of the pipe. Resilient filler rings are not prohibited from being used between the pipe and the connector to provide a seal. Whichever design is used, it shall be capable of maintaining a resilient, hydrostatic seal under the performance conditions in accordance with Section 7. Devices used to effect mechanical seals shall conform to the requirements specified in Section 4.

5.2 For lateral to pipe connectors, the design of the connector shall be such that a positive seal is accomplished at two locations: *(1)* between the connector and the pipe wall and *(2)* between the connector and the lateral. The seal between the connector and the pipe wall shall be made by either mechanical means, compression, or by casting the connector integrally with the pipe wall. The seal between the connector and the lateral shall be made by either mechanical means or by compression of the resilient material against the outside of the pipe. Resilient filler rings are not prohibited from being used between the lateral and the connector to provide a seal. Connector design must not allow either lateral or connector to extend past the cylindrical plane of the pipe inside diameter. The connector shall be capable of maintaining a resilient hydrostatic seal under the performance conditions in accordance with Section 7. Devices used to effect mechanical seals shall conform to the requirements specified in Section 4.

5.3 *Pipe Stubs*—Owners shall require that all pipe stubs installed to allow for future connections to storm sewer structures be mechanically restrained from movement by means other than, and in addition to, the resilient connectors.

6. Basis of Acceptance

6.1 For diameter 900 mm and smaller, at least one connector shall be tested for each 150 mm increment in diameter. For diameters larger than 900 mm, at least one connector shall be tested for each 300 mm increment in diameter.

6.2 The acceptability of the resilient connector shall be determined by the results of the physical tests prescribed in this specification, if and where required, and by inspection, to determine whether the connector conforms to the specification with regards to design and freedom from defects.

TABLE 1 Resilient Material Tests

Test	Test Requirements[A]	ASTM Test Method
Chemical resistance:		D543, at 22°C for 48 h
1 *N* sulfuric acid	no weight loss	
1 *N* hydrochloric acid	no weight loss	
Tensile strength	8 MPa, min	D412
Elongation at break	350 %, min	
Hardness[B]	± 5 from the connector manufacturer's specified hardness	D2240 (Shore A Durometer)
Accelerated oven-aging	decrease of 15 %, max, of original tensile strength decrease of 20 %, max, of elongation	D573, 70 ± 1°C for 7 days
Compression set	decrease of 25 %, max, of original deflection	D395, Method B, at 70°C for 22 h
Water absorption	increase of 10 %, max, of original by weight	D471, immerse 19 by 25-mm specimen in distilled water at 70°C for 48 h
Ozone resistance	rating 0	D1149
Low-temperature brittle point	no fracture at -40°C	D2137
Tear resistance	34 kN/m	F624, Die B

[A] Specimens shall be prepared from connector specimens and shall not be prepared from laboratory slabs or by direct molding.
[B] The connector manufacturer shall select the hardness appropriate for each component of the connector. Thereafter, the hardness shall comply within the tolerances in Table 1.

6.3 When requested, a current certification shall be furnished as the basis of acceptance. The certification shall consist of the connector manufacturer's test report, or statement by the manufacturer, accompanied by a copy of the test results, that the resilient connector has been tested and inspected in accordance with the provisions of Sections 4 and 7. Each certification so furnished shall be signed by the connector manufacturer or an authorized agent.

NOTE 4—Certification shall be deemed current if it represents present design and bears a date that is no more than five years older than the current date.

7. Test Methods and Requirements

7.1 Install a pipe and the resilient connector to be tested in the manhole base 1200 mm inside diameter or smaller. Subject the assembly to a hydrostatic pressure of 41 kPa (4.3 m) at the centerline of the connector for a period of 10 min. Restrain the pipe against axial movement during the tests.

7.1.1 Install a lateral and resilient connector to be tested into the pipe. Subject the assembly to a hydrostatic pressure of 41 kPa (4.3 m) at the centerline of the connector for a period of 10 min. Restrain the lateral against axial movement during the tests.

7.2 There shall be no leakage under any of the following conditions, when subjected to a hydrostatic pressure of 41 kPa (4.3 m) for 10 min:

7.2.1 Straight alignment of the pipe/lateral.

7.2.2 Axial deflection of the pipe/lateral of at least 7° in any direction.

7.2.3 When the pipe is loaded in shear in accordance with the requirements shown in Fig. 1.

7.2.4 When the lateral is loaded in shear in accordance with the loading requirements of Fig. 1 and does not exceed 25 mm of axial movement at the connector. (Note: Pressure is not prohibited from being relieved while deflecting or loading test section.)

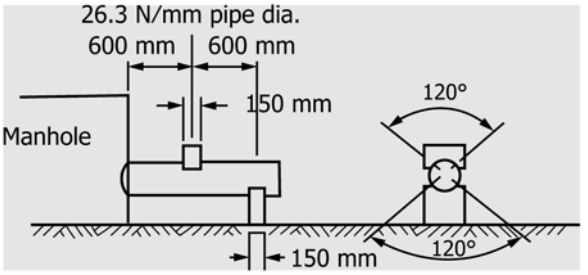

FIG. 1 Shear Test Requirements

7.3 Leakage shall be construed to mean freely dripping water emanating at the interface between the connector and either the manhole base, the pipe, or the lateral; between the connector and the filler rings; or through the body of the connector and the filler rings; or through the body of the connector itself.

7.4 Moisture appearing at random locations on the base of the outlet in the form of patches or beads adhering to the surfaces shall not be considered leakage.

7.5 A delay of up to 24 h is not prohibited prior to making observations of leakage.

8. Product Marking

8.1 Each connector shall be marked legibly by the connector manufacturer with the trade name and the size designation or part number.

9. Keywords

9.1 design test method; marking; material requirements acceptance criteria; product marking; resilient connector