



# Standard Specification for Resilient Connectors Between Reinforced Concrete On-Site Wastewater Tanks and Pipes<sup>1</sup>

This standard is issued under the fixed designation C1644; 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 the minimum performance and material requirements for resilient connectors used for connections between reinforced concrete tanks used for septic effluent treatment/detention, including those referenced in Specifications C913 and C1227.

1.1.1 These connectors are designed to eliminate leakage between the pipe(s) and tank.

1.2 A complete metric companion to Specification C1644 has been developed—C1644M; therefore, no metric equivalents are presented in this specification.

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 5 psi (11.5 ft) without leakage when tested in accordance with Section 7. Infiltration or exfiltration quantities for an installed system are dependent upon many factors other than the connectors between tanks and pipes, and allowable quantities must be covered by other specifications and suitable testing of the installed pipe and system.

1.3 The following precautionary caveat pertains only to the test methods portion, Section 7, of this specification. *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 limitations prior to use.*

## 2. Referenced Documents

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

- A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications
- C822 Terminology Relating to Concrete Pipe and Related Products

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee C27 on Precast Concrete Products and is the direct responsibility of Subcommittee C27.30 on Water and Wastewater Containers.

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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.

C913 Specification for Precast Concrete Water and Wastewater Structures

C1227 Specification for Precast Concrete Septic Tanks

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

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

D746 Test Method for Brittleness Temperature of Plastics and Elastomers by Impact

D883 Terminology Relating to Plastics

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

D1566 Terminology Relating to Rubber

D2240 Test Method for Rubber Property—Durometer Hardness

## 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 tanks, and related products shall be as defined in Terminology C822 and as modified in 3.1.3 – 3.1.5.

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

3.1.4 *pipe*—the inlet or outlet pipe connected to the tank.

3.1.5 *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 be suitable for use in sanitary sewage applications.

4.1.1 *Resilient Materials*—Resilient materials for connectors shall be manufactured from natural or synthetic materials and shall conform to the requirements prescribed in Table 1

**TABLE 1 Resilient Material Tests**

Test	Test Requirements <sup>A</sup>	ASTM Test Method
Chemical Resistance		
1 N sulfuric acid	No weight loss	D543, at 22°C for 48 h
1 N hydrochloric acid	No weight loss	
Tensile strength	1000 psi, min	D412
Elongation at break	350 %, min	
Hardness <sup>B</sup>	±5 from manufacturer's specified hardness	D2240 (Type A Durometer)
Accelerated oven-aging	Decrease of 15 %, max, of original tensile strength, Decrease of 20 %, max, of original 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 0.75 by 2 in. specimen in distilled water at 70°C for 48 h
Ozone resistance	Rating 0	D1149
Low-temperature brittle point	No fracture at –40°C	D746
Tear resistance	150 lbf/in., min.	D624, Die B

<sup>A</sup> Specimens shall be prepared from connector specimens, and shall not be prepared from laboratory slabs or by direct molding.

<sup>B</sup> 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.

and 4.1. If a splice is used in the manufacture of the seal, its strength shall be such that the splice can withstand a 180° bend with no visible separation.

4.1.2 *Mechanical Devices*—Expansion rings, tension bands, and take-up devices used for mechanically compressing the resilient portion of the connector against the pipe, or tank 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 in or with the connector shall be constructed of series 300 stainless steel in accordance with Specification A240/A240M.

NOTE 2—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 tank 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 tank and (2) between the connector and the pipe. The seal between the connector and the tank, and between the connector and the pipe, may be made by any suitable and durable means, provided that it meets the requirements of Table 1 and Section 7.

5.2 Purchaser shall require that all pipe stubs installed, to allow for future connection to the structure, be mechanically restrained from movement by means of, and in addition to, the resilient connectors.

## 6. Basis of Acceptance

6.1 Each connector design shall be tested in accordance with the requirements of Section 7. For connectors into which more than one pipe size may be installed, each pipe size shall be tested independently.

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

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 Table 1 and Section 7.

NOTE 3—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 The intent of these tests is to demonstrate resistance of the tank/connector/pipe interface to hydrostatic infiltration and exfiltration. The test report shall clearly define the specific methods used in testing so that these may be readily understood.

7.2 Install the connector(s) to be tested into a tank or into a precast wall test section. Install the pipe(s) according to the directions of the connector manufacturer. Seal the test tank or section so that test pressure can be applied to the entire area around the section, connector, and pipe. Testing shall be performed either by installing two connectors oriented in opposite directions (bi-directional) and testing both simultaneously under each condition below, or by applying infiltration and exfiltration test pressure in series to a single connector/pipe/wall section under each condition below. Hydrostatic pressure shall be 5 psi at the pipe centerline of the highest connector. Each condition below shall be tested for a period of 5 min with infiltration and 5 min with exfiltration test pressure. In simultaneous bi-directional testing, only one 5-min test shall be required. Gages used for this testing shall be in current calibration traceable to NIST and have a maximum limit of no more than 15 psi. If a water column is used, it shall measure no less than 11.5 ft in height to the centerline of the highest connector. If the connector permits more than one pipe size, O.D., or type to be installed, each pipe size, O.D., or type shall be individually tested and certified to the requirements of Section 7.

### 7.3 Required Tests:

7.3.1 *Straight Alignment of the Pipe(s)*—With the pipe(s) aligned to the test wall section at 90°, the connector(s) shall be

subjected to infiltration and exfiltration test pressures for a period of 5 min in each condition.

**7.3.2 Axial Deflection of the Pipe(s)**—The pipe(s) shall be axially deflected at least 7° in any direction and the connector(s) shall be subjected to infiltration and exfiltration test pressures for a period of 5 min in each condition.

**7.3.3 Shear Loading of the Pipe(s)**—A constant vertical load of 50 lb/in. pipe diameter shall be applied at a point 12-in. from the structure wall. The end of the pipe shall be supported at a point 24-in. from the structure wall. Both the load and the support shall utilize a radiused form at least 2-in. wide and closely fitting the outside diameter of the test pipe section for at least 120° of its circumference to prevent collapse of the pipe section. After application of the constant load, the connector(s) shall be subjected to infiltration and exfiltration test pressures for a period of 5 min in each condition.

NOTE 4—**Fig. 1** shows one method of performing these tests. Any suitable method may be used, provided that all required tests are performed.

**7.3.4 Warning**—It is suggested that hydrostatic pressure be relieved while changes are made between different test conditions.

**7.4 Leakage** shall be construed to mean freely dripping water emanating at the interface between the connector and the structure or the pipe, or through the body of the connector itself.

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

**7.6** 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 permanently and legibly by the connector manufacturer with his trade name and the size designation or part number.

## **9. Keywords**

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



Restrain sections against pressure as necessary

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