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Standard Specification for Circular Precast Concrete Culvert, Storm Drain, and Sewer Pipe for Pipe Jacking[1]

This standard is issued under the fixed designation C1885; 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 manufacturing requirements for circular concrete pipe that is intended to be installed using pipe jacking techniques. The typical use of this type of pipe is for the conveyance of sewage, industrial wastes, storm water, utilities, or personnel.

1.2 The requirements of this specification are intended to supplement the existing manufacturing standards for precast concrete pipe and provide the additional manufacturing details required for pipe that will be installed using jacking techniques. The parent manufacturing standard for the concrete pipe is denoted as the "designated concrete pipe manufacturing standard" throughout this document. The requirements included within shall supplement the designated concrete pipe manufacturing standard when the concrete pipe is to be used for jacking.

NOTE 1—This specification is a manufacturing and purchase specification for concrete pipe installed using jacking techniques, to be utilized in conjunction with the designated concrete pipe manufacturing standard. It is possible that such pipe will require a special design to withstand the anticipated longitudinal loading. Additional calculations and information beyond what is required for a direct bury pipe are required to establish maximum jacking forces. For calculating allowable jacking forces, ASCE 27 may be referenced.

NOTE 2—This standard may be used to supplement existing standards for precast concrete pipe when the pipe will be installed using trenchless methods. Such "designated concrete pipe standards" include, but are not limited to: C14, C76, C361, C655, C985, C1417, C1765, and C1846/C1846M.

1.3 There are many forms of pipe jacking. The most advanced of these, and in a category all its own, is microtunneling pipe. With the highly accurate guidance systems used in microtunneling, the pipes are utilized in longer push lengths and more challenging configurations and soil conditions. This standard does not address concrete pipe used for microtunneling. For concrete pipe used in microtunneling, the engineer, producer, and installer are encouraged to work together in establishing the specific needs of each project.

1.4 There are applications where concrete pipe is utilized as a carrier pipe and is pushed through a casing after the soil has already been removed. These applications are not specifically addressed by this standard since the requirements for these types of installations differ from those for a typical jacking installation.

1.5 *Units*—The values stated in inch-pound units are to be regarded as standard. No other units of measurement are included in this standard.

[1] This test method is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.02 on Reinforced Sewer and Culvert Pipe.

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1.6 *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:*

C14 Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe
C76 Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C361 Specification for Reinforced Concrete Low-Head Pressure Pipe
C443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
C655 Specification for Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
C822 Terminology Relating to Concrete Pipe and Related Products
C985 Specification for Nonreinforced Concrete Specified Strength Culvert, Storm Drain, and Sewer Pipe
C990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
C1417 Specification for Manufacture of Reinforced Concrete Sewer, Storm Drain, and Culvert Pipe for Direct Design
C1628 Specification for Joints for Concrete Gravity Flow Sewer Pipe, Using Rubber Gaskets
C1765 Specification for Steel Fiber Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
C1846/C1846M Specification for Performance Based Manufacture of Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

2.2 *ASCE Standards:*

ASCE 27 Standard Practice for Direct Design of Precast Concrete Pipe for Jacking in Trenchless Construction

3. Terminology

3.1 *Definitions*—For Definitions of terms relating to concrete pipe not included in this standard, see Terminology C822.

3.2 *jacking pipe, n*—pipe installed using hydraulic jacking to push the pipes behind a shield machine so that they form a continuous pipeline in the ground.

4. Ordering Information

4.1 In addition to the requirements of the designated concrete pipe manufacturing standard, the manufacturer shall submit the following manufacturing data for the concrete pipe to the owner/owner's engineer for approval if requested by the owner/owner's engineer.

4.1.1 Outside diameter of the pipe

4.1.2 Pipe wall thickness

4.1.3 Concrete strength

4.1.4 The jacking capacity of the pipe and the assumptions used to calculate it.

NOTE 3—The jacking capacity of the pipe is highly dependent upon the joint packing material supplied by the installer and the alignment of the pipe. The packing should have sufficient material properties to appropriately distribute the jacking force. Packing material needs to be thick enough to distribute jacking forces in both the straight and angular positions, while not being so thick that it impedes the hydraulic or joint sealing performance of the joint.

4.2 *Joint Details for Jacking Force*—The minimum compressive strength of the concrete at the time of delivery, the surface area of the spigot/groove face and the bell/tongue face to be used for transfer of jacking forces, the length of the spigot/groove and the bell/tongue, and the applicable face for jacking, shall be reported in the manufacturer's submittal details provided to the installer and/or owner/owner's engineer before production.

NOTE 4—Circumferential strength design is based on the vertical loads on the pipe during construction and in the final installed condition. Joint details are critical for the Engineer to establish the available longitudinal jacking thrust capacity of the pipe from which the installer establishes the means and methods of installation.

5. Materials and Manufacture

5.1 The concrete pipe shall be manufactured per any of the concrete pipe manufacturing standards listed under 2.1. In addition to meeting all of the requirements of the designated concrete pipe manufacturing standard, the pipe shall meet all the requirements of this standard, and shall be labeled according to the parent standard and as amended by this standard.

6. Physical Requirements

6.1 *Concrete:*

6.1.1 *Compression Testing Cylinders*—The number of cylinders, preparation, and testing shall be as required in the designated manufacturing standard. However, all cylinder tests shall have concrete strengths that meet or exceed the required concrete strength. The averaging of cylinder strengths is not permitted.

6.1.2 *Compression Testing of Cores*—The number of cores, preparation, and testing shall be as required in the designated manufacturing standard. However, all core tests shall meet or exceed 85 % of the required concrete strength. The averaging of core strengths is not permitted. Verification of concrete strength through core testing shall only be performed when concrete cylinders are not available.

6.2 *Reinforcement:*

6.2.1 Elliptical reinforcement and quadrant reinforcement are not permitted in circular pipe produced to this standard, unless approved in writing by the owner/owner's engineer and/or installer.

6.3 *Joint Requirements:*

6.3.1 Joints shall be designated to meet ASTM C361, C443, C990, C1628, or as agreed to by the installer and manufacturer to meet the requirements of the installation method and equipment employed. The hydrostatic requirements include, but are not limited to; maximum internal hydrostatic pressure, maximum external hydrostatic pressure, and maximum external grouting pressure.

6.3.2 The joints shall be of such design and the ends of the concrete pipe sections so formed that the pipe can be laid together to make a continuous line of pipe compatible with the permissible variations given in Section 7. Expanded or modified bells extending beyond the outside diameter of the pipe wall shall not be used.

6.4 *Joint Reinforcement for Bells:*

6.4.1 Notwithstanding the requirements of the designated concrete pipe manufacturing standard, the bell of the pipe shall contain reinforcement meeting one of the following options:

6.4.1.1 Embedded reinforcement as required by the design of the pipe and joint for installation loads, vertical earth loads or joint sealing loads, or combination thereof. The minimum amount of reinforcement in the bell shall be at least as much as is provided in the outer cage of the pipe barrel. This reinforcement shall be an extension of the outer line of reinforcement, or may be a separate cage of at least the area per foot of that specified for a single line of reinforcement if only one line of reinforcement is used.

6.4.1.2 Steel bell band in composite with a concrete bell or a separate steel bell collar. If a steel bell band embedded in the wall of the pipe is used, the concrete portion of the bell shall also contain circumferential reinforcement. This reinforcement shall be an extension of the outer line of reinforcement, or may be a separate cage of at least the area per foot of that specified for a single line of reinforcement if only one line of reinforcement is used.

NOTE 5—The joint reinforcement requirements of the designated concrete pipe manufacturing standard should be followed as a minimum. However, concrete pipe used for trenchless installations often requires joint designs that exceed the requirements for direct bury installations. Details and quantity of circumferential and longitudinal reinforcing for trenchless installations may require additional analysis or considerations based on installer installation techniques. Manufacturer submittal documents should clearly indicate any additional requirements for joint reinforcing over and above that required by the designated costandard.