



Designation: C1941 – 24

Standard Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers for Jacking¹

This standard is issued under the fixed designation C1941; 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 precast reinforced concrete monolithic box sections that are intended to be installed using jacking techniques. The typical use of this type of product is for the construction of culverts and for the conveyance of storm water, industrial wastes and sewage.

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

NOTE 1—This specification is a manufacturing and purchase specification for precast reinforced concrete box sections installed using jacking techniques, to be utilized in conjunction with the designated precast reinforced concrete box section manufacturing standard. It is possible that such box sections will require a special design to withstand the anticipated longitudinal loading. Additional calculations and information beyond what are required for a non-jacked installed box section are required to establish maximum jacking forces. For calculating allowable jacking forces, ASCE 28 may be referenced.

NOTE 2—This standard may be used to supplement existing standards for precast reinforced concrete box sections when the box sections will be installed using trenchless methods. Such “designated precast reinforced concrete box section manufacturing standards” include, but are not limited, to ASTM C1433, ASTM C1577, and AASHTO M259.

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

1.4 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.5 *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:²

C822 Terminology Relating to Concrete Pipe and Related Products

C990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

C1433 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers

C1577 Specification for Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD

C1677 Specification for Joints for Concrete Box, Using Rubber Gaskets

2.2 AASHTO Standards:³

AASHTO M259 Standard Specification for Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers Designed According to AASHTO LRFD

2.3 ASCE Standards:⁴

ASCE 28 Standard Practice for Direct Design of Precast Concrete Box Sections for Jacking in Trenchless Construction

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 Available from American Association of State Highway and Transportation Officials (AASHTO), 555 12th St., NW, Suite 1000, Washington, DC 20004, <http://www.transportation.org>.

⁴ Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Dr., Reston, VA 20191, <http://www.asce.org>.

¹ This test method is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.07 on Acceptance Specifications and Precast Concrete Box Sections.

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3. Terminology

3.1 Definitions:

3.1.1 For Definitions of terms relating to concrete box sections not included in this standard, see Terminology C822.

3.1.2 *jacking box sections, n*—box sections installed using hydraulic jacking to push the box sections through soil or into or through an existing structure, behind a shield machine to form a continuous pipeline in the ground without needing to open-cut the area for typical installation techniques.

4. Ordering Information

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

4.1.1 Top slab thickness, bottom slab thickness, side wall thickness, haunch sizes, joint dimensions, lay length and outside corner details such as radius or fillet.

4.1.2 Design concrete compressive strength.

4.1.3 The jacking axial thrust capacity of the box section and the assumptions used to calculate it.

NOTE 3—The jacking axial thrust capacity of the box section is highly dependent upon the joint packing material supplied by the installer and the alignment of the box sections. 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/tongue face and the bell/groove face to be used for transfer of jacking forces, the length of the spigot/tongue and the bell/groove, 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 box section during construction and in the final installed condition. Joint details are critical to establish the available longitudinal jacking thrust capacity of the box section from which the installer establishes the means and methods of installation.

5. Materials and Manufacture

5.1 The precast reinforced concrete box sections shall be manufactured per any of the manufacturing standards listed under Section 2. In addition to meeting all the requirements of the chosen standard, the box section 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 precast reinforced concrete box section 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 Joint Reinforcements:

6.2.1 Joints shall be designated to meet ASTM C990, C1677, or as agreed to by the installer and manufacturer to meet the requirements of the installation method and equipment employed.

6.2.2 The joints shall be of such design and the ends of the concrete box sections so formed that the box sections can be laid together to make a continuous line compatible with the permissible variations given in Section 7.

6.2.3 Notwithstanding the requirements of the designated precast reinforced concrete box section manufacturing standard, the bell/groove and spigot/tongue of the box section shall contain embedded reinforcement as required by the design of the box section and joint for installation loads, vertical earth loads or joint sealing loads, or combination thereof. The minimum amount of reinforcement in the bell/groove shall be at least as much as is provided in the outer cage of the box section barrel. This reinforcement shall be an extension of the outer line of reinforcement.

NOTE 5—The joint reinforcement requirements of the designated precast reinforced concrete box section manufacturing standard should be followed as a minimum. However, concrete box sections used for trenchless installations often require 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 precast reinforced concrete box section manufacturing standard.

6.3 *Lubrication and Grout Injection Ports*—If lubrication or grouting ports are required, the owner/owner's engineer or installer shall specify the necessary properties of the ports. These properties may include, but are not necessarily limited to: size, material, physical detail, the need for any nonreturn valves, quantity, and location of the ports in the box section.

7. Permissible Variations

7.1 Test Samples:

7.1.1 All box sections from the production run shall be measured in accordance with 7.2 – 7.7 of this standard.

7.1.2 If any of the test samples fail to meet the requirements of 7.2 – 7.7, those samples are rejected.

7.2 *Internal Dimensions*—The internal dimensions shall not vary by more than 1 % of the design dimension. The haunch dimensions shall not vary more than ¼ in. from the design dimensions.

7.3 *External Dimensions*—The external dimensions shall not vary by more than ½ in. of the design dimensions.