



Designation: C1932 – 23

Standard Specification for Manufacture of Reinforced Precast Concrete End Sections for Pipe¹

This standard is issued under the fixed designation C1932; 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 manufacture and acceptance of reinforced precast concrete end sections for pipe, herein referred to as “end section(s),” to conform to the owner’s requirements.

NOTE 1—End sections include but are not limited to; flared end sections; sloped end sections; parallel end sections, precast end walls; precast headwalls; etc. (see Fig. 1 for examples); or as designated by the owner.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

NOTE 2—This specification is a purchasing, manufacturing and acceptance specification and does not include requirements for bedding, backfill or installation. Care should be taken in assuring that the installation conforms to the project construction specifications.

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

1.4 *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

[A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement](#)

[A706/A706M Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement](#)
[A820/A820M Specification for Steel Fibers for Fiber-Reinforced Concrete](#)
[A1064/A1064M Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete](#)
[C33/C33M Specification for Concrete Aggregates](#)
[C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens](#)
[C150/C150M Specification for Portland Cement](#)
[C260/C260M Specification for Air-Entraining Admixtures for Concrete](#)
[C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete](#)
[C494/C494M Specification for Chemical Admixtures for Concrete](#)
[C497/C497M Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile](#)
[C595/C595M Specification for Blended Hydraulic Cements](#)
[C618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete](#)
[C822 Terminology Relating to Concrete Pipe and Related Products](#)
[C989/C989M Specification for Slag Cement for Use in Concrete and Mortars](#)
[C1017/C1017M Specification for Chemical Admixtures for Use in Producing Flowing Concrete \(Withdrawn 2022\)³](#)
[C1602/C1602M Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete](#)
[C1837 Specification for Production of Dry Cast Concrete Used for Manufacturing Pipe, Box, and Precast Structures](#)
[D7508/D7508M Specification for Polyolefin Chopped Strands for Use in Concrete](#)

¹ This test method is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.05 on Special Projects.

Current edition approved Feb. 1, 2023. Published February 2023. DOI: 10.1520/C1932-23.

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. Terminology

3.1 Definitions:

3.1.1 For definitions of terms relating to concrete pipe, see Terminology [C822](#).

³ The last approved version of this historical standard is referenced on www.astm.org.

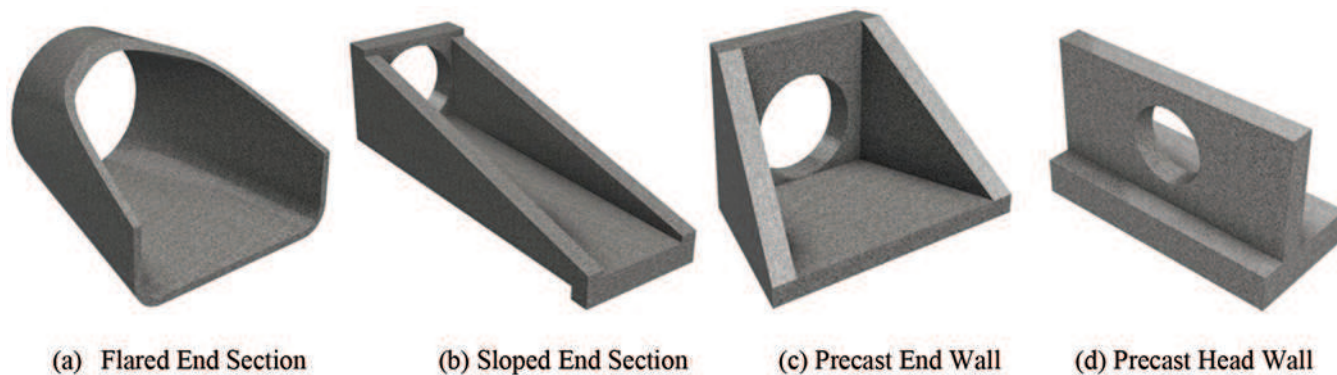


FIG. 1 Examples of Various Precast End Sections for Pipe

3.1.2 *precast concrete end section, n*—a reinforced precast concrete structure utilized at the inlet or outlet end of an installed pipe through the face of the slope. Reinforcement shall be comprised of any combination of steel wire, welded wire reinforcement, bars, and/or fibers of known strength.

3.1.3 *group of precast end sections, n*—each day’s production run of precast end sections of a single concrete strength.

4. Basis of Acceptance of Design

4.1 *Manufacturing Design Data*—The manufacturer shall submit the following manufacturing data to the owner for approval as required.

4.1.1 End section geometry, dimensions (that is, length, width, height), weight and wall thickness.

4.1.2 Concrete strength.

4.1.3 *Steel Reinforcement*:

4.1.3.1 Applicable steel reinforcement specification(s),

4.1.3.2 Design yield strength(s),

4.1.3.3 Placement and design concrete cover,

4.1.3.4 Cross-sectional diameters,

4.1.3.5 Spacing,

4.1.3.6 Cross-sectional area,

4.1.3.7 Description of longitudinal members.

4.1.4 *Fiber Reinforcement*:

4.1.4.1 Type,

4.1.4.2 Applicable reinforcement specification(s),

4.1.4.3 Grade

4.1.4.4 Amount of fiber used in pounds per cubic yard.

4.1.5 Joint information if provided.

4.1.6 Manufacturing and curing process.

4.2 *Minimum End Section Requirements*:

(a) Minimum concrete compressive strength, $f'_c = 4,000$ psi. (27.6 MPa).

(b) Minimum reinforcement for temperature and shrinkage.

(c) Minimum reinforcement to safely handle at least 2 times the end section weight.

5. Basis of Acceptance of Precast Concrete End Sections

5.1 Acceptance of end sections shall be on the basis of concrete compression tests, materials tests, conformance to the manufacturing design data, conformance to this specification, owner’s requirements and visual inspection of manufactured end sections for defects and imperfections.

5.2 When mutually agreed in writing by the owner and the manufacturer, a certification may be made on the basis of acceptance of the end section. This certification shall consist of a statement by the manufacturer that the end section conforms to the manufacturing design data and to this specification, and that the concrete and materials have been sampled and tested and conform to this specification.

5.3 *Age for Acceptance*—End sections shall be considered ready for acceptance when they conform to the requirements of this specification.

6. Material

6.1 *Reinforced Concrete*—The reinforced concrete shall consist of cementitious materials; mineral aggregates; admixtures, if used; and water in which steel reinforcement and/or fiber reinforcement has been embedded in such a manner that the reinforcement and concrete act together.

6.2 *Cementitious Material*:

6.2.1 *Cement*—Cement shall conform to the requirements for portland cement of Specification C150/C150M or shall be Portland-blast-furnace slag cement, Portland-limestone cement, or Portland-pozzolan cement conforming to the requirements of Specification C595/C595M, except that the pozzolan constituent in the Type IP Portland-pozzolan cement shall be fly ash.

6.2.2 *Slag Cement*—Slag cement shall conform to the requirements of Grade 100 or 120 of Specification C989/C989M.

6.2.3 *Fly Ash*—Fly ash shall conform to the requirements of Specification C618, Class F or Class C.

6.2.4 *Allowable Combinations of Cementitious Materials*—The combination of cementitious materials used in the concrete shall be one of the following:

6.2.4.1 Portland cement only.

6.2.4.2 Portland blast-furnace slag cement only.

6.2.4.3 Portland-pozzolan cement only.

6.2.4.4 Portland-limestone cement only,

6.2.4.5 A combination of Portland cement or Portland-limestone cement and slag cement.

6.2.4.6 A combination of Portland cement or Portland-limestone cement and fly ash.

6.2.4.7 A combination of Portland cement or Portland-limestone cement, slag cement, and fly ash, or

6.2.4.8 A combination of Portland-pozzolan cement and fly ash.

6.3 *Aggregates*—Aggregates shall conform to the requirements of Specification **C33/C33M**, except that the requirement for gradation shall not apply.

6.4 *Admixtures*—The following admixtures and blends are allowable:

6.4.1 Air-entraining admixture conforming to Specification **C260/C260M**;

6.4.2 Chemical admixture conforming to Specification **C494/C494M**;

6.4.3 Chemical admixture for use in producing flowing concrete conforming to Specification **C1017/C1017M**; and

6.4.4 Chemical admixture or blend approved by the owner.

6.5 *Steel Reinforcement*—Steel reinforcement shall consist of wire and welded wire conforming to Specification **A1064/A1064M**; or of bars conforming to Specifications **A615/A615M**, Grade 40 [280] or 60 [420], or **A706/A706M**, Grade 60 [420]; or combination thereof.

6.6 *Fiber Reinforcement*—Fiber reinforcement shall consist of synthetic fibers conforming to **D7508/D7508M**; or non-synthetic fiber conforming to **A820/A820M**; or combination thereof.

6.7 *Water*—Water used in the production of concrete shall be potable or non-potable water that meets the requirements of Specification **C1602/C1602M**.

7. Joints and Connections

7.1 The joint or connection of the end section shall be compatible with the pipe system. The joint or connection of the end section shall be designed and formed within the permissible variation given in Section 11 so that the end section can be installed or connected to the pipe.

8. Manufacture

8.1 *Mixture*—The aggregates shall be sized, graded, proportioned, and mixed with such proportions of cementitious material, water, admixtures, if any, and fibers, if any, to produce a thoroughly mixed concrete of such quality that the end sections will conform to the test and design requirements of this specification. All concrete shall have a water-cementitious materials ratio not exceeding 0.53 by weight.

8.2 *Curing*—End sections shall be subjected to any one of the curing methods described in 8.2.1 to 8.2.3 or to any other method or combination of methods approved by the owner, that will give satisfactory results. The end section shall be cured for a sufficient length of time so that the concrete will develop the required compressive strength at the time of delivery when tested in accordance with Section 10.

8.2.1 *Steam Curing*—End sections may be placed in a curing chamber, free of outside drafts, and cured in a moist atmosphere maintained by the injection of steam for such a time and such temperature as may be needed to enable the end section to meet the strength requirements. The curing chamber shall be so constructed as to allow full circulation of steam around the pipe end section.

8.2.2 *Water Curing*—End sections may be water-cured by covering with water saturated material or by a system of perforated pipes, mechanical sprinklers, porous hose, or by any other approved method that will keep the end sections moist during the specified curing period.

8.2.3 *Membrane Curing*—A sealing membrane conforming to the requirements of Specification **C309** may be applied and should be left intact until the required concrete compressive strength is obtained. The concrete at the time of application shall be within 10°F (−12.2°C) of the atmospheric temperature. All surfaces shall be kept moist prior to the application of the compounds and shall be damp when the membrane is applied.

8.2.4 The manufacturer is not prohibited from combining the methods described in 8.2.1 and 8.2.3 provided the specified strength is attained.

8.3 *Forms*—The forms used in manufacture shall be sufficiently rigid and accurate to maintain the end section dimensions within the permissible variations given in Section 11. All casting surfaces shall be smooth and nonporous.

8.4 *Handling*—Handling devices, inserts, anchors or holes are permitted in each precast section for the purpose of handling and installing.

9. Reinforcement

9.1 Reinforcement for end sections shall consist of steel reinforcement or fiber reinforcement or combination thereof.

9.2 Steel Reinforcement:

9.2.1 This section presents requirements for reinforcement cover, continuity, laps, welds and splices. Other reinforcement requirements are presented in Section 6.

9.2.2 *Cover*—The exposure of the ends of reinforcement, ties, chairs or spacers used to position the steel reinforcement during placement of the concrete shall not be a cause of rejection.

9.2.3 Reinforcement placement and concrete cover from the inner or outer surface shall conform to the approved manufacturing data. The nominal concrete cover over the steel reinforcement shall not be less than 1 in. (25 mm) in end sections having a wall thickness of 2½ in. (63 mm) or greater, and shall not be less than ¾ in. (19 mm) in end sections having a wall thickness of less than 2½ in. (63 mm). The location of the reinforcement shall be subject to the permissible variations in dimensions given in Section 11.

9.2.4 *Continuity*—The continuity of the reinforcing steel shall be maintained during the manufacture of the end section, except when, as agreed upon by the owner, lift eyes or holes are provided in each end section.

9.2.5 Laps, Welds, and Splices:

9.2.5.1 If splices are not welded, the reinforcement shall be lapped not less than 20 diameters for deformed bars and deformed cold-worked wire, and 40 diameters for plain bars and cold-worked wire. In addition, where lapped cages of welded wire reinforcement are used without welding, the lap shall contain a longitudinal wire.

9.2.5.2 When splices are welded and are not lapped to the minimum requirements in 9.2.5.1, there shall be a minimum lap of 2 in. and a weld of sufficient length such that pull test of