



Designation: C 1227 – 02b

## Standard Specification for Precast Concrete Septic Tanks<sup>1</sup>

This standard is issued under the fixed designation C 1227; 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 design requirements, manufacturing practices, and performance requirements for monolithic or sectional precast concrete septic tanks.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

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 limitations prior to use.*

### 2. Referenced Documents

#### 2.1 ASTM Standards:

- A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement<sup>2</sup>
- A 184/A 184M Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement<sup>2</sup>
- A 185 Specification for Steel Welded Wire Reinforcement, Plain, for Concrete<sup>2</sup>
- A 496 Specification for Steel Wire, Deformed, for Concrete Reinforcement<sup>2</sup>
- A 497 Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete<sup>2</sup>
- A 615/A 615M Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement<sup>2</sup>
- A 616/A 616M Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement<sup>2</sup>
- A 617/A 617M Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement<sup>2</sup>
- C 33 Specification for Concrete Aggregates<sup>3</sup>
- C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens<sup>3</sup>
- C 94 Specification for Ready-Mixed Concrete<sup>3</sup>
- C 125 Terminology Relating to Concrete and Concrete Aggregates<sup>3</sup>

- C 150 Specification for Portland Cement<sup>4</sup>
  - C 231 Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method<sup>3</sup>
  - C 260 Specification for Air-Entraining Admixtures for Concrete<sup>3</sup>
  - C 330 Specification for Lightweight Aggregates for Structural Concrete<sup>3</sup>
  - C 494 Specification for Chemical Admixtures for Concrete<sup>3</sup>
  - C 595 Specification for Blended Hydraulic Cements<sup>4</sup>
  - C 618 Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete<sup>3</sup>
  - C 685 Specification for Concrete Made by Volumetric Batching and Continuous Mixing<sup>3</sup>
  - C 890 Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures<sup>5</sup>
  - C 1116 Specification for Fiber Reinforced Concrete and Shotcrete<sup>3</sup>
- #### 2.2 ACI Standard:<sup>6</sup>
- ACI 318-89 Building Code Requirements for Reinforced Concrete

### 3. Terminology

3.1 For definitions of terms relating to concrete, see Terminology C 125.

#### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *access opening, n*—a hole in the top slab used to gain access to the inside of the tank for the purpose of cleaning and removing sludge without a person actually having to enter the tank.

3.2.2 *air scum volume, n*—the number of cubic inches (centimetres) in the space between the liquid surface and the underside of the top slab.

3.2.3 *inspection opening, n*—a hole in the top slab used for the purpose of observing conditions inside the tank.

3.2.4 *joint, n*—a physical separation where two pieces of precast concrete are in contact.

3.2.5 *non-sealed joint, n*—a joint where sealant is not used but where a machined fit will minimize the movement of liquid from one side of a precast concrete wall to the opposite side.

<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> *Annual Book of ASTM Standards*, Vol 01.04.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 04.02.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.01.

<sup>5</sup> *Annual Book of ASTM Standards*, Vol 04.05.

<sup>6</sup> American Concrete Institute (ACI), Box 9094, Farmington Hills, MI 48333.

3.2.6 *owner, n*—is by definition end user, customer, or purchaser.

3.2.7 *sealed joint, n*—a joint that is sealed to prevent liquid passing from one side of a precast concrete wall to the opposite side.

3.2.8 *septic tank system, n*—an anaerobic digestion chamber in which domestic sewage is received and retained, and from which the liquid effluent, which is comparatively free from settleable and floating solids, is then discharged.

#### 4. Ordering Information

4.1 The purchaser shall include the following information in bidding documents and on the purchase order, as applicable to the units being ordered:

4.1.1 Reference to this specification, and date of issue.

4.1.2 Quantity, that is, number of units ordered.

4.1.3 Capacity of tank in gallons or litres.

4.1.4 Special cement requirements including moderate sulfate-resisting cement, Specification C 150 Type II, or highly sulfate-resisting cement, Specification C 150, Type V. If the purchaser does not stipulate, the manufacturer shall use any cement meeting the requirements of Specification C 150 or C 595.

4.1.5 Acceptance will be based on a review of the calculations or on proof tests.

4.1.6 Design requirements such as depth of earth cover, live load applied at the surface, and ground water level.

4.1.7 Testing for water leakage shall not be required at the job site unless specifically required by the purchaser.

4.1.8 Manufacturer is permitted to require testing on site prior to backfill.

#### 5. Materials and Manufacture

5.1 *Cement*—Portland cement shall conform to the requirements of Specification C 150 or shall be portland blast-furnace slag cement or portland-pozzolan cement conforming to the requirements of Specification C 595.

5.2 *Aggregates*—Aggregates shall conform to Specification C 33 and lightweight aggregates shall conform to Specification C 330, except that the requirements for grading shall not apply.

5.3 *Water*—Water used in mixing concrete shall be clean and free of injurious amounts of oils, acids, alkalis, salts, organic materials, or other substances that will be incompatible with concrete or steel.

5.4 *Admixtures*—Admixtures, when used, shall conform to Specification C 494 or Specification C 618 and shall not be injurious to other products used in the concrete.

5.4.1 *Air-Entraining Admixtures*—Air-entraining admixtures conforming to Specification C 260 shall be used when there is a risk that the concrete will be exposed to freezing and thawing. Then the concrete mixture shall contain  $5.5 \pm 1.5$  % air by volume as determined by Test Method C 231.

5.5 *Steel Reinforcement*—Steel reinforcement shall conform to Specification A 82 or A 496 for wire; Specification A 185 or A 497 for wire fabric; or Specification A 184/A 184M, A 615/A 615M, A 616/A 616M, or A 617/A 617M for bars.

5.5.1 *Locating Reinforcement*—Reinforcement shall be placed in the forms as required by the design.

5.5.2 *Holding Reinforcement in Position During Pouring Placement*—Reinforcement must be securely tied in place to maintain position during concrete placing operations. Chairs, bolsters, braces, and spacers in contact with forms shall have a corrosion-resistant surface.

5.6 *Concrete Mixtures*—The aggregates, cement, and water shall be proportioned and mixed to produce a homogeneous concrete meeting the requirements of this specification, and in accordance with Specification C 94 or Specification C 685.

5.7 *Forms*—The forms used in manufacture shall be sufficiently rigid and accurate to maintain the dimensions of the structure within the stated tolerances. All casting surfaces shall be of smooth nonporous material. Form releasing agents used shall not be injurious to the concrete.

5.8 *Concrete Placement*—Concrete shall be placed in the forms at a rate to allow the concrete to consolidate in all parts of the form, and around all reinforcement steel and embedded fixtures without segregation of materials.

5.9 *Curing*—The precast concrete sections shall be cured by any method or combination of methods that will develop the specified compressive strength at 28 days or less.

5.10 *Concrete Quality*—The quality of the concrete shall be in accordance with the chapter on concrete quality in ACI 318-89, except for frequency of tests, which shall be specified by the purchaser. Concrete compressive strength tests shall be conducted in accordance with Test Method C 39.

5.11 *Fibers*—Polypropylene or polyolefin fibers are permitted, at the manufacturer's option, in precast concrete septic tanks as a nonstructural manufacturing material. Only Type III conforming to the requirements of Specification C 1116 shall be accepted.

#### 6. Structural Design Requirements

6.1 Structural design of septic tanks shall be by calculation or by performance.

6.1.1 Design by calculation shall be completed using the Strength Design Method (ultimate strength theory) or the Alternate Design Method (working stress theory) outlined in ACI 318-89. The Strength Design Method is outlined in Chapter 9 and the Alternate Design Method is in Appendix A.

6.1.2 Design by performance requires the manufacturer to demonstrate that failure will not occur by physically applying loads to the product. The load applied shall be 1.5 times the anticipated actual loads.

6.1.3 Tanks shall be designed so that they will not collapse or rupture when subjected to anticipated earth and hydrostatic pressures when the tanks are either full or empty.

6.1.4 After conditions are established, loads from Practice C 890 shall be used for design. Unless heavier live loads are expected, the minimum live load at the surface for design shall be 300 lbf/ft<sup>2</sup> (14 kPa).

6.1.5 The live loads imposed at lifting points shall be considered in the design of the structure.

6.1.6 Inserts embedded in the concrete shall be designed for an ultimate load that is four times the working load (Factor of Safety = 4).

6.2 *Concrete Strength*—The minimum compressive strength ( $f'c$ ) for designs shall be 4000 psi (28 MPa) at 28 days of age.