



Designation: C507 – 22

Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe¹

This standard is issued under the fixed designation C507; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This specification covers reinforced elliptically shaped concrete pipe to be used for the conveyance of sewage, industrial wastes, and storm water, and for the construction of culverts.

1.2 Pipe designed for placement with the major axis horizontal shall be designated as “Horizontal Elliptical Pipe.” Pipe designed for placement with the major axis vertical shall be designated as “Vertical Elliptical Pipe.”

1.3 This specification is the inch-pound companion to Specification C507M; therefore, no SI equivalents are presented in the specification. Reinforced concrete pipe that conforms to the requirements of C507M are acceptable under this Specification C507 unless prohibited by the owner.

NOTE 1—This specification is a manufacturing and purchase specification only, and does not include requirements for bedding, backfill, or the relationship between field load condition and the strength classification of pipe. However, experience has shown that the successful performance of this product depends upon the proper selection of the class of pipe, type of bedding and backfill, and care that the installation conforms to the construction specifications. The owner of the reinforced concrete pipe specified herein is cautioned that he must correlate the field requirements with the class of pipe specified and provide inspection at the construction site.

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.*

¹ This specification 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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2. Referenced Documents

2.1 ASTM Standards:²

- A36/A36M Specification for Carbon Structural Steel
- 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
- A1064/A1064M Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
- C33/C33M Specification for Concrete Aggregates
- 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
- C443 Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- C494/C494M Specification for Chemical Admixtures for Concrete
- C497 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
- C990 Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

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.

*A Summary of Changes section appears at the end of this standard

C1017/C1017M Specification for Chemical Admixtures for Use in Producing Flowing Concrete (Withdrawn 2022)³
C1116/C1116M Specification for Fiber-Reinforced Concrete
C1602/C1602M Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete

Horizontal Elliptical Pipe
 Class HE-A
 Class HE-I
 Class HE-II
 Class HE-III
 Class HE-IV

Vertical Elliptical Pipe
 Class VE-II
 Class VE-III
 Class VE-IV
 Class VE-V
 Class VE-VI

4.2 The strength requirements for horizontal elliptical pipe are prescribed in **Table 1** and for vertical elliptical pipe are prescribed in **Table 2**.

5. Basis of Acceptance

5.1 Unless otherwise designated by the owner at the time of, or before, placing an order, there are two separate and alternative bases of acceptance. Independent of the method of acceptance, the pipe shall be designed to meet both the 0.01-in. crack and ultimate strength requirements.

5.1.1 *Acceptance on Basis of Plant Load-Bearing Tests, Material Tests, and Inspection of Manufactured Pipe for Visual*

3. Terminology

3.1 *Definitions*—For definitions of terms relating to concrete pipe, see Terminology **C822**.

4. Classification

4.1 Pipe manufactured according to this specification shall be of five classes each for horizontal elliptical and vertical elliptical pipe with identification as follows:

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

TABLE 1 Design Requirements for Horizontal Elliptical (HE) Pipe^A

NOTE 1—The test load in pounds per linear foot equals D-load × inside span in feet.

NOTE 2—Single cage reinforcement, providing tension steel at the top, bottom, and springline, shall be permitted instead of double cage reinforcement. The area of such reinforcement shall be 112 % of the tabulated inner cage area.

NOTE 3—An inner and outer cage plus quadrant mats shall be permitted instead of double cage reinforcement. The area of such reinforcement shall be in accordance with **Fig. 1**.

NOTE 4—An inner and outer cage plus a middle cage shall be permitted instead of double cage reinforcement. The area of such reinforcement shall be in accordance with **Fig. 2**.

Designated Diameter, Equivalent Round Size, in.	Designated Rise, in. x Span, in.	Minimum Wall Thickness, in.	Reinforcement, in. ² /linear ft									
			Class HE-A		Class HE-I		Class HE-II		Class HE-III		Class HE-IV	
			D-Loads									
			0.01 = 600 Ult = 900		0.01 = 800 Ult = 1200		0.01 = 1000 Ult = 1500		0.01 = 1350 Ult = 2000		0.01 = 2000 Ult = 3000	
In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage	In Cage	Out Cage			
15	12 x 19	2½	0.07	...	0.07	...	0.07	...	0.09	...	0.16	...
18	14 x 23	2¾	0.08	...	0.11	...	0.14	...	0.19	...	0.27	...
24	19 x 30	3¼	0.11	...	0.15	...	0.19	...	0.26	...	0.39	...
27	22 x 34	3½	0.14	...	0.18	...	0.23	...	0.31	...	0.45	...
30	24 x 38	3¾	0.10	0.10	0.12	0.12	0.17	0.17	0.23	0.23	0.34	0.34
33	27 x 42	3¾	0.12	0.12	0.17	0.17	0.21	0.21	0.27	0.27	0.41	0.41
36	29 x 45	4½	0.11	0.11	0.15	0.15	0.19	0.19	0.26	0.26	0.39	0.39
39	32 x 49	4¾	0.12	0.12	0.17	0.17	0.21	0.21	0.29	0.29	0.44	0.44
42	34 x 53	5	0.15	0.15	0.20	0.20	0.24	0.24	0.33	0.33	0.50	0.50
48	38 x 60	5½	0.17	0.17	0.23	0.23	0.27	0.27	0.39	0.39	...	...
54	43 x 68	6	0.20	0.20	0.27	0.27	0.34	0.34	0.45	0.45	...	...
60	48 x 76	6½	0.24	0.24	0.32	0.32	0.40	0.40	0.53	0.53	...	...
66	53 x 83	7	0.27	0.27	0.36	0.36	0.45	0.45	0.60	0.60	...	...
72	58 x 91	7½	0.31	0.31	0.41	0.41	0.52	0.52	0.70	0.70	...	...
78	63 x 98	8	0.34	0.34	0.45	0.45	0.56	0.56	0.78	0.78	...	...
84	68 x 106	8½	0.38	0.38	0.50	0.50	0.63	0.63	0.88	0.88	...	...
90	72 x 113	9	...	...	...	...	...	...	...	...	...	...
96	77 x 121	9½	...	...	...	...	...	...	...	...	...	...
102	82 x 128	9¾	...	...	...	...	...	...	...	...	...	...
108	87 x 136	10	...	...	...	...	...	...	...	...	...	...
114	92 x 143	10½	...	...	...	...	...	...	...	...	...	...
120	97 x 151	11	...	...	...	...	...	...	...	...	...	...
132	106 x 166	12	...	...	...	...	...	...	...	...	...	...
144	116 x 180	13	...	...	...	...	...	...	...	...	...	...
Concrete strength ^B , psi			4000		4000		4000		15 to 66 in. 4000		4000	
									72 to 84 in. 5000			

^A For sizes and loads beyond those shown in this table, pipe designs are available that make use of one or a combination of the following: shear steel, multiple cages, or thicker walls in accordance with the provisions of **7.3**.

^B Concrete strength for designs with reinforcement tabulated. For modified or special designs, see **7.3**.