



Designation: C506M – 22a

Standard Specification for Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)¹

This standard is issued under the fixed designation C506M; 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 arch-shaped concrete pipe to be used for the conveyance of sewage, industrial wastes, storm water, and for the construction of culverts.

1.2 This specification is the SI companion to Specification C506; therefore, no inch-pound equivalents are presented in this specification. Reinforced concrete pipe that conform to the requirements of Specification C506 are acceptable under this Specification C506M 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.

1.3 *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

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

C494/C494M Specification for Chemical Admixtures for Concrete

C497M Test Methods for Concrete Pipe, Concrete Box Sections, Manhole Sections, or Tile (Metric)

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

C990M Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants (Metric)

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

C1896 Specification for Joints for Concrete Arch Pipe Using Profile Rubber Gaskets

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 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*—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.

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

4. Classification

4.1 Pipe manufactured according to this specification shall be of three classes identified as Class A-II, A-III, and A-IV. The strength requirements are prescribed in [Table 1](#).

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 Defects and Imperfections*—Acceptability of the pipe in all diameters and classes produced in accordance with [7.1](#) or [7.2](#) shall be determined by the results of the three-edge-bearing tests as defined in [11.3.1](#); by such material tests as are required in accordance with [6.2](#), [6.3](#), [6.5](#), and [6.6](#), by an absorption test

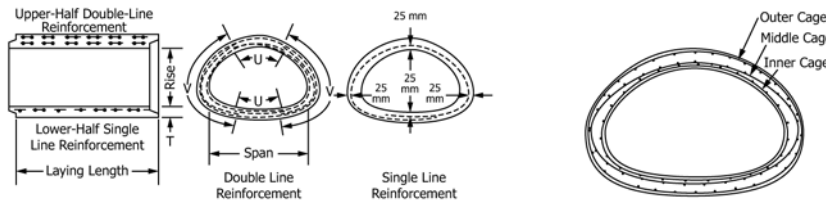
of the concrete from the wall of the pipe as required in [11.9](#); and by visual inspection of the finished pipe to determine its conformance with the accepted design and its freedom from defects.

5.1.2 *Acceptance on the Basis of Material Test and Inspection of Manufactured Pipe for Defects and Imperfections*—Acceptability of the pipe in all diameters and classes produced in accordance with [7.1](#) or [7.2](#) shall be determined by the results of such material tests as are required in accordance with [6.2](#), [6.3](#), [6.5](#), and [6.6](#); by crushing tests on concrete cores or cured concrete cylinders; by an absorption test of the concrete from the wall of the pipe for each mix design that is used on an order; and by inspection of the finished pipe, including amount and placement of reinforcement, to determine its conformance with the accepted design and its freedom from defects.

5.1.3 When agreed upon by the owner and the manufacturer, any portion or any combination of the tests itemized in [5.1.1](#) or [5.1.2](#) may form the basis of acceptance.

TABLE 1 Strength Requirements for Reinforced Concrete Pipe^A

Approximate Equivalent Round Size, mm	T, mm	Minimum Rise, mm	Minimum Span, mm	Double Line Reinforcement ^C																	Single Line Reinforcement		
				f_c^B MPa			Continuous Basic Reinforcement = A									Additional Reinforcement = A_s^D							
							s^D									"U" (Inner Cage)			"V" (Outer Cage)				
				Class			Inner Cage			Outer Cage													
				A-II	A-III	A-IV	A-II	A-III	A-IV	A-II	A-III	A-IV	Dimen- sion, mm	A-II	A-III	A-IV	Dimen- sion, mm	A-II	A-III	A-IV	A-II	A-III	A-IV
375	57	280	460	27.6	27.6	27.6	...	...	...	...	...	...	...	...	...	...	...	...	1.7	2.5	3.6		
450	63	345	560	27.6	27.6	27.6	...	...	...	...	...	...	...	...	...	...	...	...	2.3	3.0	5.5		
525	69	395	660	27.6	27.6	27.6	...	...	...	...	...	...	...	...	...	...	...	...	2.8	3.6	6.1		
600	75	460	725	27.6	27.6	27.6	...	...	...	...	...	...	660	...	...	735	...	...	3.4	4.6	6.8		
750	88	570	920	27.6	27.6	27.6	1.9	2.5	3.8	1.5	1.9	3.0	760	1.9	2.5	3.8	865	1.5	1.9	2.8	3.8	5.1	7.6
900	100	675	1110	27.6	27.6	27.6	2.3	3.2	4.6	1.9	2.5	3.6	865	2.3	3.2	4.6	990	1.9	2.5	3.4	4.6	6.3	9.3
1050	113	795	1300	27.6	27.6	27.6	2.8	3.8	5.7	2.1	3.0	4.4	1065	2.8	3.8	5.7	1090	2.1	3.0	4.6	5.5	7.6	11.4
1200	125	915	1485	27.6	27.6	...	3.2	4.6	...	2.5	3.6	...	1220	3.2	4.6	...	1245	2.5	3.6	...	6.3	9.3	...
1350	138	1015	1650	27.6	27.6	...	3.8	5.1	...	3.0	4.0	...	1320	3.8	5.1	...	1395	3.0	4.0	...	7.6	10.2	...
1500	150	1145	1855	27.6	27.6	...	4.4	5.9	...	3.6	4.6	...	1525	4.4	5.9	...	1700	3.6	4.6	...	8.9	11.8	...
1800	175	1370	2235	27.6	34.5	...	5.5	7.6	...	4.2	5.9	...	1725	5.5	7.6	...	1955	4.2	5.9	...	11.0	15.2	...
2100	200	1575	2590	27.6	34.5	...	6.8	9.3	...	5.1	7.2	...	...	6.8	9.3	...	...	5.1	7.2	...	13.5	18.6	...
2250	213	1830	2920	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2400	225	1960	3100	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
2700	250	2215	3505	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3000	275	2460	3910	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3300	250	2705	4285	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...



D-Loads for 3-Edge-Bearing Method		
Class	0.3-mm Crack	Ultimate
A-II	50.0	75.0
A-III	65.0	100.0
A-IV	100.0	150.0

Note—Test load in newtons per linear metre equals D-load × inside span in millimetres.

^A For modified or special designs, see [7.3](#).

^B f_c = minimum compressive strength of concrete in megapascals.

^C As an alternative to designs requiring double line reinforcement, the reinforcement may be positioned and proportioned so that the total reinforcement of the inner cage plus the middle cage shall not be less than that specified for the inner cage continuous basic reinforcement, and the additional reinforcement “U” and the total reinforcement of the outer cage plus the middle cage shall not be less than that specified for the outer cage continuous basic reinforcement and the additional reinforcement “V.”

^D A_s = circumferential steel area in square millimetres per longitudinal centimetre of pipe barrel in each continuous basic cage and additional cages in area denoted “U” and “V.” Dimensions “U” and “V” are measured on the center line of the culvert wall.