



Designation: C361M – 12

Standard Specification for Reinforced Concrete Low-Head Pressure Pipe (Metric)¹

This standard is issued under the fixed designation C361M; 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 Department of Defense.

1. Scope

1.1 This specification covers reinforced concrete pipe intended to be used for the construction of pressure pipelines with low internal hydrostatic heads generally not exceeding 375 kPa.

1.2 This specification is the SI companion to Specification C361. It is compatible in technical content.

NOTE 1—Field tests on completed portions of the pipeline are not covered by this specification for the manufacture of the pipe but should be included in specifications for pipe laying.

2. Referenced Documents

2.1 ASTM Standards:²

- A27/A27M Specification for Steel Castings, Carbon, for General Application
- A36/A36M Specification for Carbon Structural Steel
- A82/A82M Specification for Steel Wire, Plain, for Concrete Reinforcement
- A185/A185M Specification for Steel Welded Wire Reinforcement, Plain, for Concrete
- A283/A283M Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
- A496/A496M Specification for Steel Wire, Deformed, for Concrete Reinforcement
- A497/A497M Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete
- A575 Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
- A576 Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality
- A615/A615M Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement

¹ This specification is under the jurisdiction of ASTM Committee C13 on Concrete Pipe and is the direct responsibility of Subcommittee C13.04 on Low Head Pressure 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.

- A675/A675M Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties
- A1008/A1008M Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
- A1011/A1011M Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field
- C33 Specification for Concrete Aggregates
- C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens
- C150 Specification for Portland Cement
- C260 Specification for Air-Entraining Admixtures for Concrete
- C309 Specification for Liquid Membrane-Forming Compounds for Curing Concrete
- C497M Test Methods for Concrete Pipe, Manhole Sections, or Tile [Metric]
- C595 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
- C1619 Specification for Elastomeric Seals for Joining Concrete Structures
- D698 Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))
- D4253 Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- D4254 Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density

2.2 Other Standard:

- ACI Code 318 Standard Building Code Requirements for Reinforced Concrete³

³ Available from American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, MI 48333-9094, <http://www.concrete.org>.

AISI-C1012⁴

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 for hydrostatic heads of 75, 150, 225, 300, and 375 kPa measured to the centerline of the pipe. Designs are provided in **Table 1** and **Table 2** for the above hydrostatic heads combined with external loadings of 1.5, 3.0, 4.5, and 6.0 m (designated A, B, C, and D in **Table 1** and **Table 2**) of earth cover over the top of the pipe under specific installation conditions. The specific installation conditions are covered in **Appendix X1**. Where the hydrostatic head, external loadings, and installation conditions vary from those given in **Table 1** and **Table 2** and **Appendix X1**, detailed design calculations shall be made. The design criteria for **Table 1** and **Table 2** are presented in **Appendix X2**.

5. Basis of Acceptance

5.1 Acceptability of the pipe in all diameters and classes shall be determined by the results of such material tests as are required in **6.2** through **6.9** by crushing tests on cured concrete cylinders, by hydrostatic pressure tests on units of the pipe, by joint leakage tests, and by inspection during or after manufacture to determine whether the pipe conforms to this specification as to design and freedom from defects.

5.2 *Age for Acceptance*—Pipe shall be considered ready for acceptance when they conform to the requirements, as indicated by the specified tests.

6. Materials

6.1 *Reinforced Concrete*—The reinforced concrete shall consist of portland cement, mineral aggregates, and water, in which steel has been embedded in such a manner that the steel and concrete act together. Fly ash or pozzolan is not prohibited when used as a partial cement replacement; see **9.1**.

6.2 Cementitious Materials:

6.2.1 Cement:

6.2.1.1 *Portland Cement*—Portland cement shall conform to the requirements of Specification **C150**.

6.2.1.2 *Blended Hydraulic Cement*—Blended cement shall conform to the requirements of Specification **C595** for Type IS portland blast furnace slag cement or Type IP portland pozzolan cement, except that the pozzolan constituent in the Type IP portland pozzolan cement shall not exceed 20 % by weight.

6.2.2 *Fly Ash or Pozzolan*—Fly ash or pozzolan shall conform to the requirements of Specification **C618**.

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

6.2.3.1 Portland cement only,

6.2.3.2 Portland blast furnace slag cement only,

6.2.3.3 Portland pozzolan cement only, or

6.2.3.4 A combination of portland cement and fly ash or pozzolan, wherein the proportion of fly ash or pozzolan is between 5 and 20 % by weight of total cementitious material (portland cement plus fly ash or pozzolan).

6.3 *Aggregates*—Aggregates shall conform to Specification **C33**, except that the requirements for grading are waived.

6.4 *Admixtures*—Admixtures, except for air-entraining agents, shall not be added to the concrete unless permitted by the owner. At the option of the manufacturer, or if specified by the owner, the concrete in precast concrete pipe placed by the cast-and-vibrated method shall contain an air-entraining agent conforming to Specification **C260**. The amount of air-entraining agent used shall be such as will affect the entrainment of not more than 3 % air by volume of concrete as discharged from the mixer.

6.5 *Steel Reinforcement*—Reinforcement shall consist of wire conforming to Specification **A82/A82M**, Specification **A496/A496M**, or of wire reinforcement conforming to Specification **A185/A185M** or Specification **A497/A497M**, or of bars of Grade 300 steel conforming to Specification **A615/A615M**.

6.6 Steel for Joint Rings:

6.6.1 Steel strips for bell rings less than 6 mm thick shall conform to Grade SS30 of Specification **A1011/A1011M** or Grade Designation 1012 of Specification **A575**. Steel that meets the requirements of AISI-C1012 for chemical components will be acceptable provided it conforms to Grade SS30 of Specification **A1011/A1011M** in other respects.

6.6.2 Steel plate for bell rings 6 mm or more in thickness and special shapes for spigot joint rings shall conform to Specification **A36/A36M**, or to Grade A of Specification **A283/A283M**, or to Grade Designation 1012 of Specification **A576**, or to Grade 50 of Specification **A675/A675M**. Steel that meets the requirements of AISI-C1012 for chemical components will be acceptable provided it conforms to Specification **A36/A36M** or to Specification **A283/A283M** in other respects.

6.7 *Steel Castings for Fittings*—Steel castings for fittings shall conform to Grade 70-36, Normalized, of Specification **A27/A27M**.

6.8 *Steel Plates and Sheets for Specials and Fittings*—Steel plates for specials and fittings shall conform to Specification **A36/A36M** or to Grade B or C of Specification **A283/A283M** or Grade SS30 or SS33 of Specification **A1011/A1011M** or Grade SS30 of Specification **A1008/A1008M**.

6.9 Rubber Gaskets:

6.9.1 *Composition and Properties*—All rubber gaskets shall comply with Specification **C1619** in terms of material and manufacture. The gaskets shall be of a solid circular cross section and shall be extruded or molded to the specified size within a diametrical tolerance of ± 0.4 mm or ± 1.5 % of the diameter, whichever is larger.

6.9.1.1 *Standard Gasket Requirements*—All rubber gaskets shall meet the dimensions, tolerances, and physical requirements of Specification **C1619**, Class A.

⁴ Available from the American Iron and Steel Institute (AISI), 1140 Connecticut Ave. NW, Suite 705, Washington D.C. 20036, <http://www.steel.org>.



TABLE 1 Design Requirements for Reinforced Concrete Low-Head Pressure Pipe [300 to 3650 mm Diameter], Concrete Design Strength 34.5 MPa (except as noted) Steel Reinforced Yield Strength 276 MPa

NOTE 1—See Appendix for specific installation conditions and design criteria conditions required in conjunction with the use of Table 1.

NOTE 2—Designations A, B, C, and D, for class of pipe, denote 1.5, 3.0, 4.5, and 6.0 m of earth cover over top of pipe. Figures 75, Figures 150, Figures 225, etc. for class of pipe, denote hydrostatic pressure heads in kilopascals measured to centerline of pipe.

NOTE 3—An “s” in place of a steel area indicates the pipe class is a special design requiring stirrup reinforcement. Stirrups may be eliminated by changing wall thickness, main reinforcement, concrete strength, or a combination thereof.

NOTE 4—The boldfaced value denotes 41.4 MPa concrete strength required.

Circumferential reinforcement, mm ² /linear m of pipe ^{A, B}																													
Internal Designated Dia., mm		300				375				450				525				600				675							
Type of Reinforcement	Circular		Circular		Elliptical		Circular		Elliptical		Circular		Elliptical		Circular		Elliptical		Circular								Elliptical		
	50	75	50	75	57	75	60	75	57	75	60	75	63	75	63	75	66	79	82	107	66	82	Single	Outer	Single	Single			
Wall Thickness, mm	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single			
Layers of Reinforcement	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single			
Class	A-75	140	120	200	170	250	220	250	250	320	280	320	290	390	350	390	350	460	410	290	200	230	160	460	370				
	B-75	210	170	310	240	390	320	390	320	500	420	500	420	610	540	610	540	740	650	440	280	340	210	740	440				
	C-75	280	220	420	310	540	430	540	430	690	570	690	570	870	730	870	730	1060	890	590	350	450	250	1060	590				
	D-75	360	270	540	390	700	540	700	540	910	730	910	730	1150	950	1150	950	1430	1170	750	440	560	300	1430	750				
	A-150	220	220	280	270	350	320	520	430	390	610	610	510	480	690	690	690	600	550	390	300	330	250	780	780				
	B-150	270	230	380	320	480	420	520	520	600	530	610	740	660	740	660	740	880	780	540	370	430	300	880	780				
	C-150	340	280	500	390	630	520	630	520	800	680	800	680	990	860	990	860	1190	1030	690	450	540	340	1190	780				
	D-150	420	330	620	470	790	640	790	640	1020	840	1020	840	1280	1070	1280	1070	1570	1310	850	530	650	390	1570	850				
	A-225	340	340	430	430	520	520	...	...	600	600	...	...	690	690	...	...	770	770	490	400	430	350	...	...				
	B-225	340	340	460	430	580	520	...	...	710	640	...	...	860	780	...	...	1020	920	640	470	520	390	...	...				
	C-225	400	340	570	470	720	620	...	...	910	790	...	...	1110	980	...	...	1330	1170	790	550	630	440	...	...				
	D-225	480	390	700	550	880	730	...	...	1130	950	...	...	1400	1200	...	...	1710	1440	940	630	730	480	...	...				
	A-300	490	490	610	610	730	730	...	...	860	860	...	...	980	980	...	...	1100	1100	590	500	590	510	...	...				
	B-300	490	490	610	610	730	730	...	...	860	860	...	...	980	980	...	...	1160	1100	740	570	620	480	...	...				
	C-300	490	490	650	610	820	730	...	...	1020	900	...	...	1240	1110	...	...	1470	1310	880	650	720	530	...	...				
	D-300	540	490	770	620	980	820	...	...	1240	1050	...	...	1530	1320	...	...	1850	1580	1040	730	820	570	...	...				
A-375	650	650	820	820	980	980	...	...	1140	1140	...	...	1310	1310	...	...	1470	1470	790	680	780	690	...	...					
B-375	650	650	820	820	980	980	...	...	1140	1140	...	...	1310	1310	...	...	1470	1470	830	670	810	660	...	...					
C-375	650	650	820	820	980	980	...	...	1140	1140	...	...	1360	1310	...	...	1610	1470	980	750	830	640	...	...					
D-375	650	650	850	820	1070	980	...	...	1350	1160	...	...	1650	1450	...	...	1990	1720	1140	830	910	670	...	...					

TABLE 1 Continued

Circumferential reinforcement, mm ² /linear m of pipe ^{A, B}																				
Internal Designated Dia, mm		750										825								
Type of Reinforcement	Circular								Elliptical		Circular								Elliptical	
Wall Thickness, mm	69	79	82	88		119		69	88	72	79	82		94		119		72	94	
Layers of Reinforcement	Single	Single	Inner	Outer	Inner	Outer	Inner	Outer	Single	Single	Single	Inner	Outer	Inner	Outer	Inner	Outer	Single	Single	
Class	530	490	340	230	320	220	250	170	530	410	610	570	400	270	350	240	290	610	450	
A-75	880	790	530	340	490	310	370	220	880	490	1020	950	630	400	540	340	440	1020	540	
B-75	1260	1110	720	440	660	400	490	280	1260	660	1490	1360	870	530	730	440	580	1490	730	
C-75	1750	1470	920	550	840	490	600	330	1750	840	1940	1850	1120	670	930	540	720	1940	930	
D-75	680	640	450	350	430	330	350	270	870	870	780	740	520	400	470	360	400	950	950	
A-150	1030	940	640	450	600	420	470	320	1030	870	1190	1120	750	520	660	460	550	1190	950	
B-150	1420	1260	830	550	770	500	580	370	1420	870	1660	1530	980	650	840	550	680	1660	950	
C-150	1900	1630	1030	650	940	600	700	430	1900	940	2110	2020	1230	780	1040	660	820	2110	1040	
D-150	860	860	560	460	530	440	470	390	...	...	950	950	640	520	580	470	520	...	...	
A-225	1180	1100	750	560	700	520	570	420	...	...	1360	1290	870	640	770	570	650	...	...	
B-225	1570	1410	940	660	870	610	680	470	...	...	1830	1700	1100	770	950	670	790	...	...	
C-225	2060	1780	1130	760	1040	700	800	520	...	...	2280	2190	1340	900	1150	770	930	...	...	
D-225	1220	1220	670	570	660	560	660	560	...	...	1340	1340	760	640	730	620	730	...	...	
A-300	1340	1250	860	670	810	630	690	540	...	...	1530	1460	990	760	890	690	760	...	...	
B-300	1730	1570	1040	760	980	720	780	570	...	...	2000	1870	1220	890	1070	780	900	...	...	
C-300	2210	1930	1240	870	1150	810	890	620	...	...	2450	2360	1460	1020	1260	880	1030	...	...	
D-300	1630	1630	870	760	870	760	870	760	...	...	1800	1800	960	830	960	840	960	...	...	
A-375	1630	1630	970	780	920	740	900	730	...	...	1800	1800	1110	890	1000	800	990	...	...	
B-375	1720	1720	1150	870	1080	820	930	710	...	...	2170	2040	1330	1010	1180	900	1020	...	...	
C-375	1880	1720	1340	980	1250	910	990	720	...	...	2620	2530	1570	1140	1370	990	1140	...	...	
D-375	2360	2090	1340	980	1250	910	990	720	...	...	2620	2530	1570	1140	1370	990	1140	...	...	



TABLE 1 Continued

Circumferential reinforcement, mm ² /linear m of pipe ^{A, B}																
Internal Designated Dia, mm	900						975 ^C						1050			
Type of Reinforcement	Circular						Circular						Elliptical			
	Elliptical						Elliptical						Elliptical			
Wall Thickness, mm	Circular						Circular						Elliptical			
Layers of Reinforcement	Circular						Circular						Elliptical			
	Elliptical						Elliptical						Elliptical			
Single	Circular						Circular						Elliptical			
	Elliptical						Elliptical						Elliptical			
Single	Circular						Circular						Elliptical			
	Elliptical						Elliptical						Elliptical			
Single	Circular						Circular						Elliptical			
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	Elliptical						Elliptical						Elliptical			
Single	Circular						Circular						Elliptical			
	Elliptical						Elliptical						Elliptical			
Single	Circular						Circular									



TABLE 1 Continued

Circumferential reinforcement, mm ² /linear m of pipe ^{A, B}																		
Internal Designated Dia, mm		1125 ^C								1200								
Type of Reinforcement	Circular				Elliptical				Circular				Elliptical					
	97		119		144		97		119		104		125		144			
Wall Thickness, mm	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer		
Layers of Reinforcement	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer		
Class	A-75	570	390	480	330	430	290	610	610	420	530	360	480	330	650	670	460	
	B-75	930	600	760	480	650	400	930	760	650	830	530	740	460	1010	1100	710	
	C-75	1280	790	1020	620	850	500	1280	1020	860	1110	680	970	580	1380	1510	940	
	D-75	1650	1000	1290	770	1060	610	1650	1290	1080	1410	840	1210	710	1790	1950	1190	
	A-150	720	550	630	480	570	430	1300	1300	590	690	520	640	480	1380	840	640	
	B-150	1080	750	910	630	790	540	1300	1300	810	990	680	890	610	1380	1270	880	
	C-150	1420	940	1160	760	990	640	1420	1300	1020	1260	830	1120	730	1540	1670	1100	
	D-150	1790	1150	1420	910	1190	750	1790	1420	1240	1550	990	1360	850	1930	2100	1350	
	A-225	880	710	780	630	710	580	...	...	950	850	680	790	640	...	1020	810	
	B-225	1230	900	1050	770	930	680	...	...	1330	1140	840	1040	760	...	1430	1050	
	C-225	1570	1090	1300	910	1130	780	...	...	1690	1180	990	1270	880	...	1830	1270	
	D-225	1930	1300	1560	1050	1330	880	...	...	2080	1390	1700	1140	1500	...	2260	1510	
	A-300	1040	860	1000	840	1000	840	...	...	1110	930	1070	890	1060	890	...	1190	990
	B-300	1380	1060	1200	920	1070	830	...	...	1490	1140	1300	1000	1190	920	...	1600	1220
	C-300	1720	1240	1440	1050	1270	920	...	...	1850	1340	1570	1140	1420	1030	...	1990	1440
	D-300	2070	1440	1700	1190	1470	1020	...	...	2230	1550	1850	1290	1650	1150	...	2410	1670
A-375	1320	1130	1320	1130	1310	1140	...	...	1410	1200	1410	1210	1400	1210	...	1500	1280	
B-375	1540	1210	1360	1090	1360	1090	...	...	1650	1300	1460	1160	1450	1160	...	1780	1400	
C-375	1860	1420	1590	1200	1410	1060	...	...	2010	1500	1720	1300	1570	1180	...	2160	1610	
D-375	2220	1590	1840	1330	1600	1160	...	...	2380	1710	2000	1450	1800	1300	...	2570	1840	



TABLE 1 Continued

Circumferential reinforcement, mm ² /linear m of pipe ^{A, B}																												
Internal Designated Dia, mm	1350								1425 ^C								1500											
Type of Reinforcement	Circular				Elliptical				Circular				Elliptical				Circular				Elliptical							
	113		138		157		113		138		119		163		119		144		125		150		169		125		150	
Wall Thickness, mm	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer
Layers of Reinforcement	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer	Inner	Outer
Class	710	480	610	410	560	380	740	480	610	410	560	380	740	480	610	410	560	380	740	480	610	410	560	380	740	480	610	410
A-75	1140	730	940	590	840	520	1140	730	940	590	840	520	1140	730	940	590	840	520	1140	730	940	590	840	520	1140	730	940	590
B-75	1580	980	1270	770	1120	670	1580	980	1270	770	1120	670	1580	980	1270	770	1120	670	1580	980	1270	770	1120	670	1580	980	1270	770
C-75	2030	1240	1590	950	1400	820	2030	1240	1590	950	1400	820	2030	1240	1590	950	1400	820	2030	1240	1590	950	1400	820	2030	1240	1590	950
D-75	890	670	780	590	730	550	890	670	780	590	730	550	890	670	780	590	730	550	890	670	780	590	730	550	890	670	780	590
A-150	1320	910	1110	760	1010	690	1320	910	1110	760	1010	690	1320	910	1110	760	1010	690	1320	910	1110	760	1010	690	1320	910	1110	760
B-150	1740	1150	1430	940	1280	840	1740	1150	1430	940	1280	840	1740	1150	1430	940	1280	840	1740	1150	1430	940	1280	840	1740	1150	1430	940
C-150	2190	1410	1760	1120	1560	980	2190	1410	1760	1120	1560	980	2190	1410	1760	1120	1560	980	2190	1410	1760	1120	1560	980	2190	1410	1760	1120
D-150	1070	850	950	760	900	720	1070	850	950	760	900	720	1070	850	950	760	900	720	1070	850	950	760	900	720	1070	850	950	760
A-225	1490	1090	1280	940	1170	860	1490	1090	1280	940	1170	860	1490	1090	1280	940	1170	860	1490	1090	1280	940	1170	860	1490	1090	1280	940
B-225	1910	1330	1600	1110	1450	1000	1910	1330	1600	1110	1450	1000	1910	1330	1600	1110	1450	1000	1910	1330	1600	1110	1450	1000	1910	1330	1600	1110
C-225	2350	1580	1920	1280	1720	1150	2350	1580	1920	1280	1720	1150	2350	1580	1920	1280	1720	1150	2350	1580	1920	1280	1720	1150	2350	1580	1920	1280
D-225	1250	1030	1200	1000	1200	1000	1250	1030	1200	1000	1200	1000	1250	1030	1200	1000	1200	1000	1250	1030	1200	1000	1200	1000	1250	1030	1200	1000
A-300	1670	1270	1450	1110	1340	1030	1670	1270	1450	1110	1340	1030	1670	1270	1450	1110	1340	1030	1670	1270	1450	1110	1340	1030	1670	1270	1450	1110
B-300	2080	1500	1760	1280	1610	1170	2080	1500	1760	1280	1610	1170	2080	1500	1760	1280	1610	1170	2080	1500	1760	1280	1610	1170	2080	1500	1760	1280
C-300	2520	1750	2080	1450	1880	1310	2520	1750	2080	1450	1880	1310	2520	1750	2080	1450	1880	1310	2520	1750	2080	1450	1880	1310	2520	1750	2080	1450
D-300	1590	1350	1580	1360	1580	1360	1590	1350	1580	1360	1580	1360	1590	1350	1580	1360	1580	1360	1590	1350	1580	1360	1580	1360	1590	1350	1580	1360
A-375	1850	1450	1640	1300	1640	1300	1850	1450	1640	1300	1640	1300	1850	1450	1640	1300	1640	1300	1850	1450	1640	1300	1640	1300	1850	1450	1640	1300
B-375	2260	1680	1930	1450	1780	1340	2260	1680	1930	1450	1780	1340	2260	1680	1930	1450	1780	1340	2260	1680	1930	1450	1780	1340	2260	1680	1930	1450
C-375	2680	1920	2250	1620	2040	1480	2680	1920	2250	1620	2040	1480	2680	1920	2250	1620	2040	1480	2680	1920	2250	1620	2040	1480	2680	1920	2250	1620
D-375	820	640	780	590	820	640	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640
A-150	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770
B-150	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930
C-150	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070
D-150	820	640	780	590	820	640	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640
A-225	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770
B-225	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930
C-225	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070
D-225	820	640	780	590	820	640	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640
A-300	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770
B-300	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930
C-300	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070
D-300	820	640	780	590	820	640	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640
A-375	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770	1040	770	1240	940	1040	770
B-375	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930	1420	930	1730	1240	1420	930
C-375	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070	1790	1070	2210	1590	1790	1070
D-375	820	640	780	590	820	640	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640	780	590	820	640

TABLE 1 Continued

Circumferential reinforcement, mm ² /linear m of pipe ^{A, B}																							
1575 ^C					1650					1725 ^C													
Internal Designated Dia. mm	Circular				Elliptical		Circular			Elliptical		Circular				Elliptical							
Type of Reinforcement	Circular				Elliptical		Circular			Elliptical		Circular				Elliptical							
Wall Thickness, mm	132		157		175		132	157	138		163	182	138	163	144		169	188	144	169			
Layers of Reinforcement	Inner	Outer	Inner	Outer	Inner	Outer	Single	Single	Inner	Outer	Inner	Outer	Single	Single	Inner	Outer	Inner	Outer	Single	Single			
Class																							
A-75	840	570	740	500	690	460	860	860	880	600	780	530	730	490	900	900	920	620	550	770	520	940	940
B-75	1310	840	1110	700	1010	630	1310	1110	1360	870	1160	740	1060	670	1360	1160	1410	910	1220	770	1120	700	1220
C-75	1840	1140	1520	930	1370	820	1840	1520	1910	1190	1610	980	1450	870	1910	1610	1990	1240	1690	1030	1530	920	1990
D-75	2350	1430	1920	1150	1700	1000	2350	1920	2450	1490	2020	1210	1800	1060	2450	2020	2540	1550	1270	1900	1120	2540	2120
A-150	1040	780	940	700	880	660	1820	1820	1090	810	990	730	930	690	1900	1900	1140	850	1040	770	980	730	1990
B-150	1510	1040	1300	900	1200	830	1820	1820	1560	1080	1370	940	1260	870	1900	1900	1620	1120	1430	990	1330	910	1990
C-150	2030	1340	1710	1120	1560	1020	2030	1820	2110	1390	1800	1180	1650	1070	2110	1900	2200	1450	1890	1240	1730	1130	2200
D-150	2530	1620	2100	1340	1890	1190	2530	2100	2630	1690	2210	1400	1990	1260	2630	2210	2740	1750	2310	1470	1330	2740	2310
A-225	1250	990	1140	900	1080	860	...	...	1300	1030	1190	940	1140	900	...	...	1360	1070	1250	990	1200	940	...
B-225	1710	1250	1500	1100	1390	1020	...	...	1770	1290	1570	1150	1460	1070	...	...	1840	1340	1640	1200	1540	1120	...
C-225	2220	1540	1900	1320	1750	1210	...	...	2310	1600	2000	1380	1840	1270	...	...	2400	1660	2100	1450	1940	1340	...
D-225	2720	1820	2280	1530	2070	1380	...	...	2820	1890	2400	1600	2190	1460	...	...	2930	1960	2510	1680	2300	1530	...
A-300	1460	1200	1410	1160	1400	1160	...	...	1520	1250	1470	1210	1470	1210	...	...	1580	1300	1540	1270	1540	1270	...
B-300	1910	1450	1700	1300	1590	1220	...	...	1980	1510	1770	1360	1670	1280	...	...	2050	1560	1850	1420	1750	1340	...
C-300	2410	1740	2100	1520	1940	1400	...	...	2510	1810	2200	1590	2040	1470	...	...	2610	1880	2300	1660	2140	1550	...
D-300	2900	2010	2470	1720	2260	1570	...	...	3010	2090	2590	1800	2380	1650	...	...	3130	2170	2710	1890	2500	1740	...
A-375	1860	1570	1860	1580	1850	1580	...	...	1950	1640	1950	1650	1940	1650	...	...	2040	1720	2040	1720	2030	1720	...
B-375	2110	1660	1920	1510	1910	1520	...	...	2190	1720	2010	1590	2000	1590	...	...	2270	1780	2100	1660	2100	1660	...
C-375	2610	1940	2290	1710	2130	1600	...	...	2710	2010	2400	1790	2240	1680	...	...	2820	2090	2510	1870	2350	1760	...
D-375	3090	2210	2660	1910	2450	1760	...	...	3210	2290	2790	2000	2570	1850	...	...	3330	2380	2920	2090	2370	1940	...