Specification for Line Pipe

API SPECIFICATION 5L
FORTY-FIRST EDITION, APRIL 1, 1995

American Petroleum Institute
1220 L Street, Northwest
Washington, D.C. 20005

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Exploration and Production Department

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Institute

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FOREWORD

Specification 5L covers seamless and welded steel line pipe. It includes standard-weight and extra-strong threaded line pipe; standard-weight plain-end, regular-weight plain-end, special plain-end, extra-strong plain-end, and double-extra-strong plain-end pipe; and bell and spigot and through-the-flow line (TFL) pipe.

The purpose of this specification is to provide standards for pipe suitable for use in conveying gas, water, and oil in both the oil and natural gas industries.

This specification is under the jurisdiction of the Committee on Standardization of Tubular Goods and includes changes to the previous edition approved by letter ballot through December 1993. Specifications 5LS and 5LX have been incorporated into this edition of Specification 5L. The last editions of Specifications 5LS and 5LX published in March 1982 have been withdrawn.

The bar notations identify parts of this standard that have been changed from the previous API edition.

This standard shall become effective on the date printed on the cover but may be used voluntarily from the date of distribution.

Specification for Line Pipe

1 Scope

1.1 This specification covers seamless and welded steel line pipe. It includes standard-weight and extra-strong threaded line pipe; and standard-weight plain-end, regular-weight plain-end, special plain-end, extra-strong plain-end, and double-extra-strong plain-end pipe; as well as bell and spigot and through-the-flowline (TFL) pipe.

The purpose of this specification is to provide standards for pipe suitable for use in conveying gas, water, and oil in both the oil and natural gas industries.

1.2 Dimensional requirements on threads and thread gauges, stipulations on gauging practice, gauge specifications and certification, as well as instruments and methods for inspection of threads are given in API Standard 5B and are applicable to products covered by this specification.

Grades covered by this specification are A25, A, B, X42, X46, X52, X56, X60, X65, X70, and X80 and grades intermediate to the Grades X42 and higher listed (see note). The chemical composition and mechanical properties of intermediate grades that are subject to agreement between the purchaser and the manufacturer must be consistent with the corresponding requirements for the grades to which the material is intermediate.

Note: The grade designations used herein for Grades A and B do not include reference to the specified minimum yield strength. Other grade designations used herein comprise the letter A or X followed by the first two digits of the specified minimum yield strength.

1.3 Pipe manufactured as Grade X60 or higher shall not be substituted for pipe ordered for Grade X52 or lower without purchaser approval.

1.4 Although plain-end line pipe meeting this specification is primarily intended for field makeup by circumferential welding, the manufacturer will not assume responsibility for field welding.

1.5 For regular-weight and special plain-end pipe (special weight) shown in Tables 6A, 6B, and 6C and for standard-weight threaded pipe larger than nominal size 12, the size designations used herein are outside diameter sizes. For all other pipe, the size designations are nominal pipe sizes. In the text of this specification, pipe size limits (or size ranges) are outside diameter sizes except where stated to be nominal. These outside diameter size limits and ranges also apply to the corresponding nominal sizes.

1.6 Class II steel is rephosphorized and probably has better threading properties than Class I. Because Class II has higher chemical properties than Class I, it may be somewhat more difficult to bend.

1.7 U.S. customary units are used in this specification; metric (SI) units are shown in parentheses in the text and in many tables. See Appendix J for specific information about rounding procedures and conversion factors.

2 References

2.1 This specification includes by reference, either in total or in part, the latest editions of the following API and industry standards:

API

RP 5L3	*Recommended Practice for Conducting Drop-Weight Tear Tests on Line Pipe*
Std 5B	*Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing, and Line Pipe Threads*
Std 1104	*Welding Pipelines and Related Facilities*

ASME[1]

Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"

ASTM[2]

A370	*Mechanical Testing of Steel Products*, Annex II—Steel Tubular Products
A751	*Methods, Practices, and Definitions for Chemical Analysis of Steel Products*
E 4	*Practices for Load Verification of Testing Machines*
E 8	*Test Methods for Tension Testing of Metallic Materials*
E 29	*Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications*
E 83	*Practice for Verification and Classification of Extensometers*

2.2 Requirements of other standards included by reference in this specification are essential to the safety and interchangeability of the equipment produced.

2.3 Other nationally or internationally recognized standards shall be submitted to and approved by API for inclusion in this specification prior to their use as equivalent standards.

[1]American Society of Mechanical Engineers, 22 Law Drive, Box 2300, Fairfield, New Jersey 07007-2300.

[2]ASTM, 1916 Race Street, Philadelphia, Pennsylvania 19103-1187.

[redacted]

b. Without filler metal:	
1. As-rolled (nonexpanded)	Seam welding and sizing, if applicable, seam heat treatment, repair welding.
2. As-rolled (expanded)	Expansion and seam welding. If applicable, seam heat treatment, repair welding.
3. Heat treated	Seam welding and full body heat treatment. If applicable, repair welding.

Alternative bevel, plain-end pipe in sizes 2 percent and larger	Paragraph 7.9.3
Special coupling pipe ends	Paragraph 7.9.5
Power-tight makeup	Paragraph 7.9.2
Bare pipe—special coatings	Paragraph 11.1
Special nondestructive inspection for laminations	Paragraph 7.8.9
Defect repair procedures	Appendix B
Markings in metric units	Paragraph 10.1.3
Method of welding jointers	Appendix A
Purchaser inspection	Appendix H
Monogram marking (see Note 2)	Paragraph I.1 of Appendix I

4.3 The following stipulations are subject to agreement between the purchaser and the manufacturer:

Information	Reference
Skelp end welds	Paragraph 5.5
Chemical composition	Paragraph 6.1.1
Intermediate grades	Paragraphs 1.1, 6.1.1, 6.2.1, Table C-1
Flattening test orientation	Paragraph 9.3.2
Intermediate diameters	Paragraph 7.2
Intermediate wall thickness	Paragraph 7.3
Supplementary requirements	Appendix F
Supplementary hydrostatic test	Paragraph 9.4.4
Hydrostatic test pressure	Paragraph 9.4.3
Lengths applied to carloads	Table 11
Nonstandard length and length tolerances	Paragraph 7.5
Welded couplings	Paragraph 8.1
Thread protectors	Paragraph 11.2
Repair of welds of electric welded pipe	Paragraph B.3
Marking requirements	Paragraphs 10.1, 10.4, and 10.6 and Appendix I

Notes:

1. Nothing in this specification should be interpreted as indicating a preference by the committee for any material or process or as indicating equality among the various materials or processes. In the selection of materials and processes, the purchaser must be guided by his experience and by the service for which the pipe is intended.

2. Users of this specification should note that there is no longer a requirement for marking a product with the API monogram. API continues to license use of the monogram on products covered by this specification, but it is administered by the staff of the Institute separately from the specification. The policy describing use of the monogram is contained in Appendix I. No other use of the monogram is permitted. Licensees may mark products in conformance with Appendix I or Section 10, and nonlicensees may mark products in conformance with Section 10.

5 Process of Manufacture and Material

5.1 PROCESS OF MANUFACTURE

Pipe furnished to this specification shall be either seamless or welded as defined in 5.1.1 and 5.1.2 and limited to the grades, types, and minimum diameter limitations specified in Table 1.

5.1.1 Seamless Process

The seamless process is a method of hot working steel to form a tubular product without a welded seam. If necessary, the hot worked tubular product may be subsequently cold finished to produce the desired shape, dimensions, and properties.

5.1.2 Welding Processes

5.1.2.1 Without Filler Metal

5.1.2.1.1 Continuous Welding

Continuous welding is a process of forming a seam by heating the skelp in a furnace and mechanically pressing the formed edges together wherein successive coils of skelp have been joined together to provide a continuous flow of steel for the welding mill. (This process is a type of butt welding.)

5.1.2.1.2 Electric Welding

Electric welding is a process of forming a seam by electric-resistance or electric-induction welding wherein the edges to be welded are mechanically pressed together and the heat for welding is generated by the resistance to flow of the electric current.

5.1.2.2 With Filler Metal

5.1.2.2.1 Submerged-Arc Welding

Submerged-arc welding is a welding process that produces coalescence of metals by heating them with an arc or

Table 1—Process of Manufacture

(1)	(2)	(3)
	Grade	
Type of Pipe	A25	A Through X80
Seamless	X	X
Continuous welded	X	
Electric welded	X	X
Longitudinal seam submerged-arc welded		X
Gas metal-arc welded		X
Combination gas metal-arc and submerged-arc welded		X
Double seam submerged-arc welded[a]		X
Double seam gas metal-arc welded[a]		X
Double seam combination gas metal-arc and submerged-arc welded[a]		X
Helical seam submerged-arc welded[b]		X

[a]Double seam pipe is limited to size 36 and larger.
[b]Helical seam pipe is limited to size $4^1/_2$ and larger.

arcs between a bare metal consumable electrode or electrodes and the work. The arc and molten metal are shielded by a blanket of granular, fusible material on the work. Pressure is not used, and part or all of the filler metal is obtained from the electrode or electrodes.

5.1.2.2.2 Gas Metal-Arc Welding

Gas metal-arc welding is a welding process that produces coalescence of metals by heating them with an arc or arcs between a continuous consumable electrode and the work. Shielding is obtained entirely from an externally supplied gas or gas mixture. Pressure is not used, and the filler metal is obtained from the electrode.

5.1.3 Types of Pipe

5.1.3.1 Seamless Pipe

Seamless pipe is produced by the seamless process defined in 5.1.1.

5.1.3.2 Continuous Welded Pipe

Continuous welded pipe is pipe that has one longitudinal seam produced by the continuous welding process defined in 5.1.2.1.1. (This is a type of butt-welded pipe.)

5.1.3.3 Electric-Welded Pipe

Electric-welded pipe is pipe that has one longitudinal seam produced by the electric-welding process defined in 5.1.2.1.2. For grades higher than X42, the weld seam and the entire heat affected zone shall be heat treated so as to simulate a normalizing heat treatment (see note), except that by agreement between the purchaser and the manufacturer alternative heat treatments or combinations of heat treatment and chemical composition may be substituted. Where such substitutions are made, the manufacturer shall demonstrate the effectiveness of the method selected using a procedure that is mutually agreed upon. This procedure may include, but is not necessarily limited to, hardness testing, microstructural evaluation, or mechanical testing. For Grades X42 and lower, the weld seam shall be similarly heat treated or the pipe shall be processed in such a manner that no untempered martensite remains.

Note: During the manufacture of electric-welded pipe, the product is in motion through the surrounding air. Normalizing is usually defined as "cooling in still air"; hence the phrase "to simulate a normalizing heat treatment" is used here.

5.1.3.4 Longitudinal Seam Submerged-Arc Welded Pipe

Longitudinal seam submerged-arc welded pipe is pipe that has one longitudinal seam produced by the automatic submerged-arc welding process defined in 5.1.2.2.1. At least one pass shall be on the inside, and at least one pass shall be on the outside. (This type of pipe is also known as submerged-arc welded pipe.)

5.1.3.5 Gas Metal-Arc Welded Pipe

Gas metal-arc welded pipe is defined as pipe that has one longitudinal seam produced by the continuous gas metal-arc welding process defined in 5.1.2.2.2. At least one pass shall be on the inside, and at least one pass shall be on the outside.

5.1.3.6 Combination Gas Metal-Arc and Submerged-Arc Welded Pipe

Combination gas metal-arc and submerged-arc welded pipe is pipe with one longitudinal seam produced by a combination of the welding processes defined in 5.1.2.2.1 and 5.1.2.2.2. The gas metal-arc welding process shall be continuous and first, and followed by the automatic submerged-arc welding process with at least one pass on the inside and at least one pass on the outside.

5.1.3.7 Double Seam Submerged-Arc Welded Pipe

Double seam submerged-arc welded pipe is pipe with two longitudinal seams produced by the automatic submerged-arc welding process defined in 5.1.2.2.1. The seams shall be approximately 180 degrees apart. For each seam, at least one pass shall be on the inside, and at least one pass shall be on the outside. All weld tests shall be performed after forming and welding.

5.1.3.8 Double Seam Gas Metal-Arc Welded Pipe

Double seam gas metal-arc welded pipe is pipe that has two longitudinal seams produced by the gas metal-arc welding process defined in 5.1.2.2.2. The seams shall be approximately 180 degrees apart. For each seam, at least one pass shall be on the inside, and at least one pass shall be on the outside. All weld tests shall be performed after forming and welding.

5.1.3.9 Double Seam Combination Gas Metal-Arc and Submerged-Arc Welded Pipe

Double seam combination gas metal-arc and submerged-arc welded pipe is pipe with two longitudinal seams produced by a combination of the welding processes defined in 5.1.2.2.1 and 5.1.2.2.2. The seams shall be approximately 180 degrees apart. For each seam, the gas metal-arc welding shall be continuous and first and followed by the automatic submerged-arc welding process with at least one pass on the inside and at least one pass on the outside. All weld tests shall be performed after forming and welding.

5.1.3.10 Helical Seam Submerged-Arc Welded Pipe

Helical seam submerged-arc welded pipe is pipe that has one helical seam produced by the automatic submerged-arc welding process defined in 5.1.2.2.1. At least one pass shall be on the inside, and at least one pass shall be on the outside. (This type of pipe is also known as spiral weld pipe.)

5.1.4 Types of Seam Welds

5.1.4.1 Electric Weld

An electric weld is a longitudinal seam weld produced by the electric-welding process defined in 5.1.2.1.2.

5.1.4.2 Submerged-Arc Weld

A submerged-arc weld is a longitudinal or helical seam weld produced by the submerged-arc welding process defined in 5.1.2.2.1.

5.1.4.3 Gas Metal-Arc Weld

A gas metal-arc weld is a longitudinal seam weld produced in whole or in part by the continuous gas metal-arc welding process defined in 5.1.2.2.2.

5.1.4.4 Skelp End Weld

A skelp end weld is a seam weld that joins plate or skelp ends together in helical seam pipe.

5.1.4.5 Jointer Weld

A jointer weld is a circumferential seam weld that joins two pieces of pipe together.

5.1.4.6 Tack Weld

A tack weld is a seam weld used to align the abutting edges until the final seam welds are produced. Tack welds shall be made by the following: (a) manual or semi-automatic submerged-arc welding, (b) electric welding, (c) gas metal-arc welding, (d) flux cored arc welding, or (e) shielded metal-arc welding using low-hydrogen electrodes. Tack welds shall be removed by machining or remelting during subsequent welding of the seam.

5.2 COLD EXPANSION

Pipe furnished to this specification, except continuous welded pipe, shall be either nonexpanded or cold expanded at the option of the manufacturer, unless otherwise specified on the purchase order. Suitable provision shall be incorporated to protect the weld from contact with the internal expander during mechanical expansion.

5.3 MATERIAL

The width of plate or skelp used to manufacture helical seam pipe shall be not less than 0.8 or more than 3.0 times the outside diameter of the pipe.

5.4 HEAT TREATMENT

The heat treating process shall be performed in accordance with a documented procedure. Pipe furnished to this specification may be as-rolled, normalized, normalized and tempered, subcritically stress relieved, or subcritically age hardened; and X grades may be quenched and tempered. Grade B pipe that is quenched and tempered shall be seamless, meet the requirements of Supplementary Requirement 4 (SR4 of Appendix F), and be by agreement between the purchaser and the manufacturer. See Section 10 for applicable marking requirements.

5.5 SKELP END WELDS—HELICAL SEAM PIPE

Junctions of skelp end welds and helical seam welds in finished pipe shall be permitted only at distances greater than 12 in. (304.8 mm) from the pipe ends. By agreement between the purchaser and the manufacturer, skelp end welds shall be permitted at the pipe ends, provided there is a circumferential separation of at least 6 in. (152.4 mm) between the skelp end weld and the helical seam weld at the applicable pipe ends. Skelp end welds in finished pipe shall be properly prepared for welding and shall be made by automatic submerged-arc welding, automatic gas metal-arc welding, or a combination of both procedures.

5.6 TRACEABILITY

The manufacturer shall establish and follow procedures for maintaining heat and/or lot identity until all required heat and/or lot tests are performed and conformance with specification requirements is shown.

6 Material Requirements

6.1 CHEMICAL PROPERTIES

6.1.1 Chemical Composition

The composition of pipe furnished to this specification, as determined by heat analysis for pipe other than Grade X80, shall conform to the chemical requirements specified in Table 2, except that by agreement between the purchaser and the manufacturer carbon contents higher than those specified may be used. The composition of intermediate grades (higher than X42) shall conform to chemical requirements agreed upon between the manufacturer and the purchaser,

Table 2—Chemical Requirements for Heat Analyses by Percentage of Weight

(1)	(2)	(3)	(4)		(5)		(6)
		Carbon	Manganese		Phosphorus		Sulphur
Type of Pipe	Grade & Class	Max.[a]	Min	Max.[a]	Min.	Max.	Max.
		Seamless					
Nonexpanded or cold expanded	A25, CI I	0.21	0.30	0.60	—	0.030	0.030b
Nonexpanded or cold expanded	A25, CI II[b]	0.21	0.30	0.60	0.045	0.080	0.030
Nonexpanded or cold expanded	A	0.22	—	0.90	—	0.030	0.030
Nonexpanded or cold expanded	B[c]	0.27	—	1.15	—	0.030	0.030
Nonexpanded	X42[e]	0.29	—	1.25	—	0.030	0.030
Nonexpanded	X46[d], X52[d]	0.31	—	1.35	—	0.030	0.030
Cold expanded	X42[d], X46[d], X52[d]	0.29[e]	—	1.25	—	0.030	0.030
Nonexpanded or cold expanded	X56[d,f], X60[d,f]	0.26	—	1.35	—	0.030	0.030
Nonexpanded or cold expanded	X65, X70, X80	(By agreement between the purchaser and the manufacturer)					
		Welded					
Electric-welded or continuous-welded only	A25 CI I	0.21	0.30	0.60	—	0.030	0.030
Electric-welded or continuous-welded only	A25 CI II[b]	0.21	0.30	0.60	0.045	0.080	0.030
Nonexpanded or cold expanded	A	0.21	—	0.90	—	0.030	0.030
Nonexpanded or cold expanded	B[c]	0.26	—	1.15	—	0.030	0.030
Nonexpanded or cold expanded	X42[d]	0.28	—	1.25	—	0.030	0.030
Nonexpanded	X46[d], X52[d]	0.30	—	1.35	—	0.030	0.030
Cold expanded	X46[d], X52[d]	0.28	—	1.25	—	0.030	0.030
Nonexpanded or cold expanded	X56[d,f], X60[d,f]	0.26	—	1.35	—	0.030	0.030
Nonexpanded or cold expanded	X65[d,g]	0.26	—	1.40	—	0.030	0.030[b]
Nonexpanded or cold expanded	X70[f]	0.23[h]	—	1.60[h]	—	0.030	0.030
Nonexpanded or cold expanded	X80[f]	0.18[h,i]	—	1.80[h,i]	—	0.030[i]	0.018[i]

[a]For Grades X42 through X65, for each reduction of 0.01 percent below the specified maximum carbon content, an increase of 0.05 percent above the specified maximum manganese content is permissible, up to a maximum of 1.45 percent for X52 and lower and up to a maximum of 1.60 percent for grades higher than X52.

[b]Class II steel is rephosphorized. (See 1.2 for note on bending and threading properties.)

[c]Columbium, vanadium, titanium, or combinations thereof may be used by agreement between the purchaser and the manufacturer.

[d]Columbium, vanadium, titanium, or combinations thereof may be used at the discretion of the manufacturer.

[e]For cold-expanded seamless pipe size 20 or larger, the maximum carbon content shall be 0.28 percent.

[f]Other chemical compositions may be furnished by agreement between purchaser and manufacturer.

[g]For Grade X65 welded pipe size 16 or larger with a wall thickness of 0.500 in. (12.7 mm) or less, the chemical composition shall be as shown or as agreed upon between the purchaser and the manufacturer; for all other sizes and wall thicknesses of such pipe, the chemical composition shall be as agreed upon between the purchaser and the manufacturer.

[h]For each reduction of 0.01 percent below the specified maximum carbon content, an increase of 0.05 percent above the specified maximum manganese content is permissible, up to a maximum of 2.0 percent.

[i]For Grade X80, limits are for product analysis only, thereby eliminating the need for product analysis tolerances in 9.2.2.

and such requirements shall be consistent with the requirements specified in Table 2 for the applicable type of pipe. For Grades X42 and higher, by agreement between the purchaser and the manufacturer, elements other than columbium, vanadium, and titanium may be used; however, caution should be exercised in determining the quantity that may be present for any particular size and thickness of pipe because the addition of such otherwise desirable elements may alter the weldability of the pipe.

6.1.2 Elements Analyzed

As a minimum, each required analysis shall determine the following:

a. Carbon, manganese, phosphorus, sulphur, and silicon.

b. Columbium, vanadium, titanium, or combinations thereof, if added during steelmaking.

c. Any other alloying element added during steelmaking for other than deoxidation purpose.

6.1.3 Product Analysis Variation

Product analyses shall conform to the chemical requirements shown in Table 2, within the following permissible variations for product analyses, except for Grade X80 pipe where the requirements in Table 2 are for product analysis:

Element	Percent of Variation
a. Carbon:	
Seamless pipe—all nonexpanded and cold expanded smaller than size 20	+0.03

Seamless pipe—cold expanded size	
20 and larger in Grades X42 and higher	+0.04
Welded pipe	+0.04
b. Manganese:	
All grades through B	+0.05
Where minimum is specified	–0.05
Grade X42 and higher	+0.10
c. Phosphorus:	+0.01
Where minimum is specified	–0.01
d. Sulfur	+0.01

6.2 MECHANICAL PROPERTIES

6.2.1 Tensile Properties

Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70, and X80 shall conform to the tensile requirements specified in Table 3. Other grades intermediate to the listed grades between X42 and X80 shall conform to tensile requirements agreed upon between the purchaser and the manufacturer, and the requirements shall be consistent with those specified in Table 3. For cold expanded pipe, the ratio of body yield strength and body ultimate strength of each test pipe on which body yield strength and body ultimate strength are determined shall not exceed 0.93. The yield strength shall be the tensile stress required to produce a total elongation of 0.5 percent of the gauge length as determined by an extensometer. When elongation is recorded or reported, the record or report shall show the nominal width of the test specimen when strip specimens are used and the diameter and gauge length when round bar specimens are used, or shall state when full section specimens are used. For Grade A25 pipe, the manufacturer may certify that the material furnished has been tested and meets the mechanical requirements of Grade A25.

6.2.2 Flattening Test Acceptance Criteria

Acceptable criteria for flattening tests shall be as follows:

a. Electric welded pipe in grades higher than A25. For all pipe diameter-to-thickness ratios (D/t), flatten to two-thirds of the original outside diameter (OD) without weld opening. For pipe with a D/t greater than 10, continue flattening to one-third of the original OD without cracks or breaks other than in the weld. For all pipe D/t, continue flattening until opposite walls of the pipe meet; no evidence of lamination or burnt metal shall develop during the entire test.

Table 3—Tensile Requirements

(1)	(2)		(3)		(4)		(5)
	Yield Strength, Minimum		Ultimate Tensile Strength, Minimum		Ultimate Tensile Strength, Maximum		Elongation, Minimum Percent in 2 in. (50.80 mm)[a]
Grade	PSI	MPa	PSI	MPa	PSI	MPa	
A25	25,000	(172)	45,000	(310)			
A	30,000	(207)	48,000	(331)			
B	35,000	(241)	60,000	(413)			
X42	42,000	(289)	60,000	(413)			
X46	46,000	(317)	63,000	(434)			
X52	52,000	(358)	66,000	(455)			
X56	56,000	(386)	71,000	(489)			
X60	60,000	(413)	75,000	(517)			
X65	65,000	(448)	77,000	(530)			
X70	70,000	(482)	82,000	(565)			
X80	80,000	(551)	90,000	(620)	120,000	(827)	

[a]The minimum elongation in 2 in. (50.80 mm) shall be that determined by the following equation:

U.S. Customary Equation	Metric Equation
$e = 625{,}000 \frac{A^{0.2}}{U^{0.9}}$	$e = 1942.57 \frac{A^{0.2}}{U^{0.9}}$

Where: e = minimum elongation in 2 in. (50.80 mm) in percent to nearest $^1/_2$ percent.

A = cross-sectional area of the tensile test specimen in sq. in. (mm) based or. specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 0.01 sq. in. (6.5 mm^2) or 0.75 sq. in. (484 mm^2), whichever is smaller.

U = specified minimum ultimate tensile strength, psi, (MPa).

See Appendix D for minimum elongation values for various size tensile specimens and grades. The minimum elongations for both round bar tensile specimens [0.350 in. (8.9 mm) diameter with 1.4 in. (35 mm) gauge length, and 0.500 in. (12.5 mm) diameter with 2.00 in. (50.8 mm) gauge length] shall be that shown in the Area A line of 0.20 sq. in. in Table D-1, Appendix D.

b. Grade A25 welded pipe. Flatten to three-fourths of the original OD without weld fracture. Continue flattening to 60 percent of the original OD without cracks or breaks other than in the weld.

6.2.3 Bend Tests

Welded Grade A25 pipe of nominal size 2 and smaller shall be tested according to 9.3.3.

6.2.4 Manipulation Tests for Submerged-Arc and Gas Metal-Arc Welds

Submerged-arc and gas metal-arc welds shall be tested by the guided-bend test (see 9.3.4).

6.2.5 Weld Ductility Test

For electric welded pipe, the weld ductility shall be determined by tests on full-section specimens of 2 in. (50.8 mm) minimum length. The specimens shall be flattened cold between parallel plates. The weld shall be placed 90 degrees from the direction of applied force (point of maximum bending). No crack or breaks exceeding $^1/_8$ in. (3.18 mm) in any direction in the weld or the parent metal shall occur on the outside surface until the distance between the plate is less than the value of S calculated by the following equations:

a. Grades less than X52:

$$S = \frac{3.07t}{.07 + 3t/D}$$

b. Grades X52 or higher:

$$S = \frac{3.05t}{.05 + 3t/D}$$

Where:

S = distance between flattening plates, in. (mm).
t = specified wall thickness of the pipe, in. (mm).
D = specified outside diameter of the pipe, in. (mm).

Cracks that originate at the edge of the specimen and that are less than 0.025 in. (6.35 mm) long shall not be cause for rejection. One test shall be made on a length of pipe from each lot size as follows:

Grade	Size Designation	Lot Size, No. of Lengths
A25, A and B	$2^3/_8$ through $5^9/_{16}$	400 or less
A25, A and B	$6^5/_8$ through $12^3/_4$	200 or less
X42 and higher	$2^3/_8$ through $12^3/_4$	200 or less
All grades	14 and over	100 or less

For multiple-length pipe, a length shall be considered as each section cut from a particular multiple length. The weld ductility test may also serve as one of the flattening tests of 9.3.2 by compliance with appropriate amounts of flattening.

6.2.6 Fracture Toughness Tests

When so specified on the purchase order, the manufacturer shall conduct fracture toughness tests in accordance with SR5 or SR6 (Appendix F) or any combination of these, as specified by the purchaser, and shall furnish a report of results showing compliance with the supplementary requirement specified. The testing temperature for SR5 and SR6 shall be selected by the purchaser and shall be shown on the purchase order. Both testing temperature and the Charpy V-notch energy value for SR5B shall be selected by the purchaser and shown on the purchase order. For Grade X80, the manufacturer shall conduct fracture toughness tests in accordance with SR5. The following requirements are mandatory for all diameters:

Minimum Energy at 32°F (0°C) (See Notes 1 and 2)				Minimum Shear Area at 32°F (0°C) (See Note 3)	
Average of Three Specimens				Average of Three Specimens	
All Heat Average		From One Heat		All Heat Average	From One Heat
Ft-lbs	(J)	Ft-lbs	(J)	Percent	Percent
50	(68)	20	(27)	70	40

Optional SR5B and SR6 mandatory toughness requirements based on Charpy V-notch and drop weight tear tests are as follows:

Minimum Charpy Energy at 32°F (0°C) (See Notes 1 and 2)				Minimum DWTT Shear Area at 32°F (0°C) (See Note 3)	
Average of Three Specimens				Average of Three Specimens	
All Heat Average		From One Heat		All Heat Average	From One Heat
Ft-lbs	(J)	Ft-lbs	(J)	Percent	Percent
50	(68)	20	(27)	60	40

Notes:
1. Three 10 mm by 10 mm Charpy V-notch specimens shall be used if obtainable from the pipe diameter and wall thickness. Otherwise, appropriate specimen thicknesses shall be used with the required energy levels reduced in proportion to the thickness. For pipe size $6^5/_8$ and smaller, longitudinal specimens shall be used.
2. If the all-heat average of the order does not meet 50 ft-lbs, the manufacturer shall be responsible for the replacement of heats as may be necessary to bring the average up to 50 ft-lbs.
3. If the all-heat average of the order does not meet the required percentage of shear area, the manufacturer shall be responsible for replacement of such heats as may be necessary to bring the average to the required value.

6.2.7 Metallographic Examination

For grades higher than X42, full-body normalized pipe excluded, compliance with the requirement in 5.1.3.3 to heat treat the entire heat affected zone shall be demonstrated by metallographic examination of a weld cross section. Such examinations shall be performed at least once per working shift or more frequently where grade, diameter, or wall thickness changes are made or where significant excursions from operating heat treatment conditions are encountered.

7 Dimensions, Weights, Lengths, Defects, and End Finishes

7.1 GENERAL—DIMENSIONS AND WEIGHTS

Line pipe shall be furnished in the outside diameters, wall thicknesses, and weights specified in Tables 4, 5, 6A, 6B, 6C, and 7, as specified on the purchase order. (See Tables E-1, E-2, and E-3 of Appendix E for the metric equivalents of U.S. customary values given in Tables 6A, 6B, and 6C.)

7.2 DIAMETER

The outside diameter shall be within the tolerances specified in Tables 7 and 8. Pipe with outside diameters intermediate to those listed in Tables 6A, 6B, and 6C is available in sizes 20 and larger by agreement between the purchaser and the manufacturer. For threaded pipe, the outside diameter at the threaded ends shall be such that the thread length, L, and the number of full-crest threads in that length are within the applicable dimensions and tolerances specified in in API Standard 5B.

Pipe sizes 20 and smaller shall permit the passage over the ends, for a distance of 4 in. (101.6 mm), of a ring gauge that has a bore diameter not larger than the pipe's specified outside diameter plus the applicable plus tolerance shown in Table 8. For submerged-arc welded pipe, ring gauges may be slotted or notched to permit passage of the gauge over the weld reinforcement. Ring gauge measurements shall be made at least three times on each working shift (12 hours maximum).

Diameter measurements of pipe larger than size 20 shall be made with a diameter tape. Diameter measurements of pipe sizes 20 and smaller shall be made with a snap gauge, caliper, or other device that measures actual diameter across a single plane, except that the manufacturer shall have the option of using a diameter tape. Diameter measurements shall be made at least three times on each operating shift (12 hours maximum).

Any pipe found to be out of tolerance is cause for individual diameter measurement of all pipe back to the last, and up to the next, two sequential pipes measured and found to be within tolerance.

By agreement between the purchaser and the manufacturer, the tolerances on the outside diameter at the pipe ends may be applied instead to the inside diameter at the pipe ends.

7.3 WALL THICKNESS

Each length of pipe shall be measured for conformance to the specified wall thickness requirements. The wall thickness at any location shall be within the tolerances specified in Table 9, except that the weld area shall not be limited by the plus tolerance. Pipe with wall thicknesses intermediate to those listed in Tables 6A, 6B, and 6C may be furnished by agreement between the purchaser and the manufacturer. Wall thickness measurements shall be made with a mechanical caliper or with a properly calibrated nondestructive inspection device of appropriate accuracy. In case of dispute, the measurement determined by use of the mechanical caliper shall govern. The mechanical caliper shall be fitted with contact pins having circular cross sections of $^1/_4$ in. (6.35 mm) diameter. The end of the pin contacting the inside surface of the pipe shall be rounded to a maximum radius of $1^1/_2$ in. (38.10 mm) for pipe size 6 or larger, and to a maximum radius of d/4 for pipe less than size 6, with a minimum radius of $^1/_8$ in. (3.2 mm). The end of the pin contacting the outside surface of the pipe shall be either flat or rounded to a radius of not less than $1^1/_2$ in. (38.10 mm).

7.4 WEIGHT

Each length of pipe size 5 or larger shall be weighed separately and the carload weights determined. Lengths of pipe size 4 or smaller shall be weighed either individually or in convenient lots at the option of the manufacturer and the carload weights determined. A carload is considered to be a minimum of 40,000 pounds (18,144 kilograms). Threaded-and-coupled pipe shall be weighed with the couplings screwed on but without thread protectors, except for carload weighings for which proper allowance shall be made for the weight of the thread protectors. Threaded-and-coupled pipe may be weighed before the couplings are attached provided that allowance is made for the weight of the couplings.

The weights determined as described above shall conform to the specified weights or calculated weights for plain-end pipe or to the specified calculated weights (or adjusted calculated weights) for threaded-and-coupled pipe, within the tolerances specified in Table 10.

Full length calculated weights shall be determined in accordance with the following equation:

$$W_L = (w_{pe} \times L) + e_w$$

Where:

W_L = calculated weight of a piece of pipe of length L, lb (kg).

w_{pe} = plain-end weight per unit length rounded to the nearest 0.01 lb/ft (0.01 kg/m).

L = length of pipe, including end finish, as defined in 7.5, ft (m).

e_w = weight gain or loss due to end finish, lb (kg). For plain-end pipe, e_w equals 0.

The plain-end weight per unit length, w_{pe}, shall be calculated using the following equation and rounded to the nearest 0.01 lb/ft (0.01 kg/m):

U.S. customary unit equation (lb/ft) = $w_{pe} = 10.68\ (D - t)t$

SI unit equation (kg/m) = $w_{pe} = 0.02466(D - t)t$

Where:

D = specified outside diameter, in. (mm).
t = specified wall thickness, in. (mm).

7.5 LENGTH

Unless otherwise agreed between the purchaser and the manufacturer, pipe shall be furnished in the nominal lengths and within the length tolerances shown in Table 11, as specified on the purchase order. For threaded-and-coupled pipe, the length shall be measured to the outer face of the coupling. The length of threaded-and-coupled pipe may be determined before the couplings are attached provided proper allowance is made for the length of the couplings. Each length of pipe shall be measured, except that pipe made in lengths that are uniform within 0.1 ft (0.03 m) need not be individually measured, provided the accuracy of the length is verified at least three times per operating shift (12 hours maximum). Any pipe found to be out of tolerance is cause for individual measurement of all pipe back to the last, and up to the next, two sequential pipes measured and found to be within tolerance.

The accuracy of length measuring devices for lengths of pipe less than 100 ft (30 m) shall be ±0.1 ft (0.03 m).

7.6 STRAIGHTNESS

Pipe smaller than $4^1/_2$ in. OD in Grades A25, A, or B shall be reasonably straight. All other pipe shall be randomly checked for straightness; deviation from a straight line shall not exceed 0.2 percent of the length. Measurement may be made using a taut string or wire from end to end along the side of the pipe, measuring the greatest deviation.

7.7 JOINTERS

When specified on the purchase order, jointers (two lengths of pipe coupled together by the manufacturer or two lengths of pipe welded together by the manufacturer in accordance with the requirements of Appendix A) may be furnished; however, no length used in making a jointer shall be less than 5.0 ft (1.52 m).

For helical seam submerged-arc welded pipe, the junctions of skelp end welds and helical seam welds shall be permitted only at distances greater than 12 in. (304.8 mm) from jointer welds. By agreement between the purchaser and the manufacturer, skelp end welds in finished pipe shall be permitted at jointer welds, provided there is a circumferential separation of at least 6 in. (152.4 mm) between the junction of the skelp end weld and the jointer weld and the junction of the helical seam and the jointer weld.

Double joints are not within the purview of API Specification 5L. Double joints are defined as lengths of pipe welded together by parties other than the manufacturer or lengths welded together by the manufacturer in accordance with requirements other than those in Appendix A.

7.8 WORKMANSHIP AND DEFECTS

Imperfections of the types described in 7.8.1–7.8.12 that exceed the specified criteria shall be considered defects. The manufacturer shall take all reasonable precautions to minimize recurring imperfections, damage, and defects.

7.8.1 Dents

The pipe shall contain no dents greater than $^1/_4$ in. (6.35 mm), measured as the gap between the lowest point of the dent and a prolongation of the original contour of the pipe. The length of the dent in any direction shall not exceed one-half the diameter of the pipe. All cold-formed dents deeper than $^1/_8$ in. (3.18 mm) with a sharp bottom gouge shall be considered a defect. The gouge may be removed by grinding.

7.8.2 Offset of Plate Edges

For pipe with filler metal welds having wall thicknesses of 0.500 in. (12.7 mm) and less, the radial offset (misalignment) of plate edges in the weld seams shall not be greater than $^1/_{16}$ in. (1.59 mm). For pipe with filler metal welds having wall thicknesses over 0.500 in. (12.7 mm), the radial offset shall not be greater than $0.125t$ or $^1/_8$ in. (3.18 mm), whichever is smaller. For electric-welded pipe, the radial offset of plate edges plus flash trim shall be no greater than 0.060 in. (1.52 mm).

7.8.3 Out-of-Line Weld Bead for Pipe With Filler Metal Welds

Out-of-line weld bead (off-seam weld) shall not be cause for rejection, provided complete penetration and complete fusion have been achieved as indicated by nondestructive examination.

7.8.4 Height of Outside and Inside Weld Beads—Submerged-Arc Welds

The weld bead shall not extend above the prolongation of the original surface of the pipe by more than the following:

Wall Thickness	Maximum Height of Weld Bead
$^1/_2$ in. (12.70 mm) and under	$^1/_8$ in. (3.18 mm)
Over $^1/_2$ in. (12.70 mm)	$^3/_{16}$ in. (4.76 mm)

Weld beads higher than permitted by the requirements of this paragraph may be ground to acceptable limits at the option of the manufacturer.

The height of the weld bead shall in no case come below a prolongation of the surface of the pipe (outside or inside the weld bead) except that contouring by grinding, otherwise covered in this specification, shall be permitted.

7.8.5 Height of Flash of Electric-Welded Pipe

The outside flash of electric-welded pipe shall be trimmed to an essentially flush condition.

The inside flash of electric-welded pipe shall not extend above the prolongation of the original inside surface of the pipe more than 0.060 in. (1.52 mm).

7.8.6 Trim of Inside Flash of Electric-Welded Pipe

The depth of groove resulting from removal of the internal flash of electric-welded pipe shall not be greater than that listed below for the various wall thicknesses. Depth of groove is defined as the difference between the wall thickness measured approximately 1 in. (25.4 mm) from the weld line and the remaining wall under the groove.

Specified Wall Thickness (t)	Maximum Depth of Trim
0.150 in. (3.8 mm) and less	0.10t
0.151 in. (3.8 mm) to 0.301 in. (7.6 mm)	0.015 in. (0.38 mm)
0.301 in. (7.6 mm) and greater	0.05t

7.8.7 Hard Spots

Any hard spot having a minimum dimension greater than 2 in. (50.8 mm) in any direction and a hardness greater than or equal to 35 HRC (327 Brinell) shall be rejected. The section of pipe containing the hard spot shall be removed as a cylinder.

The surface of cold-formed welded pipe shall be examined visually to detect irregularities in the curvature of the pipe. When this examination fails to disclose mechanical damage as the cause of the irregular surface but indicates that the irregular surface may be attributed to a hard spot, the hardness and dimensions of the area shall be determined. If hardness and dimensions exceed the aforementioned rejection criteria, the hard spot shall be removed.

7.8.8 Cracks and Leaks

All cracks, sweats, and leaks shall be considered defects.

7.8.9 Laminations (See Note)

Any lamination or inclusion extending into the face or bevel of the pipe and having a visually determined transverse dimension exceeding $^1/_4$ in. (6.35 mm) is considered a defect. Pipe containing such defects shall be cut back until no lamination or inclusion is greater than $^1/_4$ in. (6.35 mm).

Any lamination in the body of the pipe exceeding both of the following is considered a defect:

a. Greater than or equal to $^3/_4$ in. (19.0 mm) in the minor dimension.

b. Greater than or equal to 12 square inches (7,742 mm^2) in area.

Disposition of such defects shall be in accordance with 9.7.5.4, Item a or b. No specific inspection by the manufacturer is required unless the purchaser specifies special nondestructive inspection on the purchase order.

Note: A lamination is an internal metal separation creating layers generally parallel to the surface.

7.8.10 Arc Burns

Arc burns are localized points of surface melting caused by arcing between electrode or ground and pipe surface and shall be considered defects (see note).

Disposition of pipe containing arc burns shall be in accordance with 9.7.5.4, except that removal of defects by grinding shall be subject to the following additional conditions:

a. Arc burns may be removed by grinding, chipping, or machining. The resulting cavity shall be thoroughly cleaned and checked for complete removal of damaged material by etching with a 10 percent solution of ammonium persulfate or a 5 percent solution of nital.

b. If removal of damaged material is complete, the cavity may be merged smoothly into the original contour of the pipe by grinding, provided the remaining wall thickness is within specified limits.

Note: Contact marks, defined as intermittent marks adjacent to the weld line, resulting from the electrical contact between the electrodes supplying the welding current and the pipe surface, are not defects.

7.8.11 Undercuts

Undercutting of submerged-arc or gas metal-arc welded pipe is the reduction in thickness of the pipe wall adjacent to the weld where it is fused to the surface of the pipe. Undercutting can best be located and measured visually.

Minor undercutting on either the inside or the outside of the pipe is defined as follows and is acceptable without repair or grinding:

a. Maximum depth of $^1/_{32}$ in. (0.79 mm) and not exceeding $2^1/_2$ percent of the wall thickness with a maximum length of one-half the wall thickness and not more than two such undercuts in any 1 ft (0.30 m) of the weld length.

b. Maximum depth of $^1/_{64}$ in. (0.40 mm) any length.

Undercutting in excess of Item a above shall be considered a defect. Disposition shall be as follows:

a. Undercut defects not exceeding $^1/_{32}$ in. (0.79 mm) in depth and not exceeding $12^1/_2$ percent of the specified wall thickness shall be removed by grinding in accordance with 9.7.5.4, Item a.

b. Disposition of undercuts greater in depth than $^1/_{32}$ in. (0.79 mm) or $12^1/_2$ percent of the specified wall thickness shall be in accordance with 9.7.5.4, Item b, c, or d.

7.8.12 Other Defects

Any imperfection having a depth greater than $12^1/_2$ percent of the specified wall thickness, measured from the surface of the pipe, shall be considered a defect.

7.9 PIPE ENDS

7.9.1 General

Pipe shall be furnished threaded or plain end as set forth in Tables 4, 5, 6A, 6B, and 6C or with bell and spigot ends in accordance with 7.10.4. Extra-strong line pipe shall be furnished with plain ends, except that the ends shall be threaded and coupled if so specified on the purchase order. Spiral weld may not be threaded. The inside and outside edges of the ends of all pipe shall be free of burrs.

7.9.2 Threaded Ends

Threaded ends shall conform to the threading, thread inspection, and gauging requirements specified in API Standard 5B. One end of each length of threaded pipe shall be provided with a coupling conforming to the requirements of Section 8, in effect at the date of manufacture of each coupling (see Note 1), and the other end with thread protection conforming to the requirements of 11.2. Couplings shall be screwed onto the pipe handling-tight (see Note 2), except that they shall be applied power-tight if so specified on the purchase order. A thread compound shall be applied to cover the full surface of either the coupling or pipe engaged thread before making up the joint. All exposed threads shall be coated with the thread compound. Unless otherwise specified on the purchase order, the manufacturer may use any thread compound that meets the performance objectives set forth in API Bulletin 5A2. A storage compound of distinct color may be substituted for this thread compound on all exposed threads. Whichever compound is used shall be applied to a surface that is clean and reasonably free of moisture and cutting fluids.

Notes:

1. Unless otherwise specified on the purchase order, it is not mandatory that both the pipe and coupling of each threaded-and-coupled product be manufactured to the same edition of this specification.
2. Handling-tight shall be defined as sufficiently tight that the coupling cannot be removed except by using a wrench. The purpose of making up couplings handling-tight is to facilitate removal of the couplings for cleaning and inspecting threads and applying fresh thread compound before laying the pipe. This procedure has been found necessary to prevent thread leakage, especially in gas lines, because manufacturer-applied couplings made up power-tight, although leak-proof at the time of makeup, may not always remain so after transportation, handling, and laying.

7.9.3 Plain Ends

Unless otherwise orde red, plain-end pipe (other than double-extra-strong pipe) in sizes $2^3/_8$ and larger shall be furnished with ends beveled to an angle of 30 degrees (+5 degrees, –0 degrees) measured from a line drawn perpendicular to the axis of the pipe, and with a root face of $^1/_{16}$ in., $\pm^1/_{32}$ in. (1.59 mm, ±0.79 mm) (see note). Double-extra strong plain-end pipe sizes $2^3/_8$ and larger shall be furnished with square-cut ends, unless beveled ends (as above) are specified on the purchase order. For seamless pipe where internal machining is required to maintain the root face tolerance, the angle of the internal taper, measured from the longitudinal axis, shall be no larger than the following:

Specified Wall Thickness (in.)	Maximum Angle of Taper (degrees)
Less than 0.418 (10.6 mm)	7
0.418 thru 0.555 (10.6 thru 14.1 mm)	$9^1/_2$
0.556 thru 0.666 (14.1 thru 16.9 mm)	11
Over 0.666 (16.9)	14

For the removal of an internal burr on welded pipe larger than size $4^1/_2$, the internal taper, measured from the longitudinal axis, shall be no larger than 7 degrees.

The end finish of pipe sizes smaller than $2^3/_8$ shall be specified on the purchase order. For pipe sizes $2^3/_8$ and larger, the pipe ends shall be cut square within $^1/_{16}$ in. (1.59 mm). Pipe ends from each end-finishing machine shall be checked for compliance at least three times per 8-hour working shift.

Both ends of pipe with filler metal welds shall have the inside reinforcement removed for a distance of approximately 4 in. (101.6 mm) from the end of the pipe.

Note: The purchaser is directed to the applicable code for the recommended angle of pipe bevel.

7.9.4 Belled Ends

When so specified on the purchase order, pipe with wall thicknesses 0.141 in. (3.58 mm) and less shall be furnished with one end belled for bell and spigot joints in accordance with Figure 1. The belled end shall be visually inspected for workmanship and injurious defects.

7.9.5 Plain Ends for Special Couplings

When so specified on the purchase order, pipe shall be furnished with ends suitable for use with special couplings such as Dresser, Victaulic, or other equivalent special couplings. Such pipe shall be sufficiently free from indentations, projections, or roll marks for a distance of 8 in. (203 mm) from the end of the pipe to permit proper makeup of coupling.

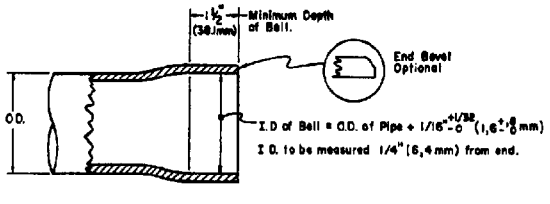


Figure 1—Belled End for Bell and Spigot Joint

Table 4—Standard-Weight Threaded Line Pipe Dimensions, Weights, and Test Pressures

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)	
								Calculated Weight				Test Pressure					
Nominal Size Designation	Nominal Weight Designation Threads and Coupling[a]	Outside Diameter, D		Wall Thickness, t		Inside Diameter, d		Plain End, w_{pe}		Threads and Coupling,[b] e_w		Grade A25		Grade A		Grade B	
		in.	mm	in.	mm	in.	mm	lb/ft	kg/m	lb	kg	psi	100 kPa	psi	100 kPa	psi	100 kPa
1/8	0.25	0.405	(10.3)	0.068	(1.7)	0.269	(6.9)	0.24	(0.36)	0.20	(0.09)	700	(48)	700	(48)	700	(48)
1/4	0.43	0.540	(13.7)	0.088	(2.2)	0.364	(9.3)	0.42	(0.62)	0.20	(0.09)	700	(48)	700	(48)	700	(48)
3/8	0.57	0.675	(17.1)	0.091	(2.3)	0.493	(12.5)	0.57	(0.84)	0.00	(0.00)	700	(48)	700	(48)	700	(48)
1/2	0.86	0.840	(21.3)	0.109	(2.8)	0.622	(15.7)	0.85	(1.28)	0.20	(0.09)	700	(48)	700	(48)	700	(48)
3/4	1.14	1.050	(26.7)	0.113	(2.9)	0.824	(20.9)	1.13	(1.70)	0.20	(0.09)	700	(48)	700	(48)	700	(48)
1	1.70	1.315	(33.4)	0.133	(3.4)	1.049	(26.6)	1.68	(2.52)	0.20	(0.09)	700	(48)	700	(48)	700	(48)
1 1/4	2.30	1.660	(42.2)	0.140	(3.6)	1.380	(35.0)	2.27	(3.43)	0.60	(0.27)	1000	(69)	1000	(69)	1100	(76)
1 1/2	2.75	1.900	(48.3)	0.145	(3.7)	1.610	(40.9)	2.72	(4.07)	0.40	(0.18)	1000	(69)	1000	(69)	1100	(76)
2	3.75	2.375	(60.3)	0.154	(3.9)	2.067	(52.5)	3.65	(5.42)	1.20	(0.54)	1000	(69)	1000	(69)	1100	(76)
2 1/2	5.90	2.875	(73.0)	0.203	(5.2)	2.469	(62.6)	5.79	(8.69)	1.80	(0.82)	1000	(69)	1000	(69)	1100	(76)
3	7.70	3.500	(88.9)	0.216	(5.5)	3.068	(77.9)	7.58	(11.31)	1.80	(0.82)	1000	(69)	1000	(69)	1100	(76)
3 1/2	9.25	4.000	(101.6)	0.226	(5.7)	3.548	(90.2)	9.11	(13.48)	3.20	(1.45)	1200	(83)	1200	(83)	1300	(90)
4	11.00	4.500	(114.3)	0.237	(6.0)	4.026	(102.3)	10.79	(16.02)	4.40	(2.00)	1200	(83)	1200	(83)	1300	(90)
5	15.00	5.563	(141.3)	0.258	(6.6)	5.047	(128.1)	14.62	(21.92)	5.60	(2.54)	1200	(83)	1200	(83)	1300	(90)
6	19.45	6.625	(168.3)	0.280	(7.1)	6.065	(154.1)	18.97	(28.22)	7.20	(3.27)	—	—	1200	(83)	1300	(90)
8	25.55	8.625	(219.1)	0.277	(7.0)	8.071	(205.1)	24.70	(36.61)	14.80	(6.72)	—	—	1160	(80)	1350	(93)
8	29.35	8.625	(219.1)	0.322	(8.2)	7.981	(202.7)	28.55	(42.65)	14.00	(6.36)	—	—	1340	(92)	1570	(108)
10	32.75	10.750	(273.0)	0.279	(7.1)	10.192	(258.9)	31.20	(46.57)	20.00	(9.08)	—	—	930	(64)	1090	(75)
10	35.75	10.750	(273.0)	0.307	(7.8)	10.136	(257.5)	34.24	(51.03)	19.20	(8.72)	—	—	1030	(71)	1200	(83)
10	41.85	10.750	(273.0)	0.365	(9.3)	10.020	(254.5)	40.48	(60.50)	17.40	(7.90)	—	—	1220	(84)	1430	(99)
12	45.45	12.750	(323.8)	0.330	(8.4)	12.090	(307.1)	43.77	(65.35)	32.60	(14.80)	—	—	960	(64)	1090	(75)
12	51.15	12.750	(323.8)	0.375	(9.5)	12.000	(304.9)	49.56	(73.65)	30.80	(13.98)	—	—	1060	(73)	1240	(85)
14D	57.00	14.000	(355.6)	0.375	(9.5)	13.250	(336.6)	54.57	(81.08)	24.60	(11.17)	—	—	960	(66)	1120	(77)
16D	65.30	16.000	(406.4)	0.375	(9.5)	15.250	(387.4)	62.58	(92.98)	30.00	(13.62)	—	—	840	(58)	980	(68)
18D	73.00	18.000	(457.0)	0.375	(9.5)	17.250	(438.0)	70.59	(104.84)	35.60	(16.16)	—	—	750	(52)	880	(61)
20D	81.00	20.000	(508.0)	0.375	(9.5)	19.250	(489.0)	78.60	(116.78)	42.00	(19.07)	—	—	680	(47)	790	(54)

Note: See Figure 2.
[a]Nominal weight, threads and coupling (column 2) are shown for the purpose of identification in ordering.
[b]Weight gain due to end finishing. See 7.4.

Table 5—Extra-Strong Threaded Line Pipe Dimensions, Weights, and Test Pressures

(1)	(2)	(3)		(4)		(5)		(6)		(7)	
						Test Pressure					
Nominal Size Designation	Nominal Weight Designation Threads and Coupling[a]	Outside Diameter, *D*		Wall Thickness, *t*		Grade A25		Grade A		Grade B	
		in.	mm	in.	mm	psi	100 kPa	psi	100 kPa	psi	100 kPa
1/8	0.31	0.405	(10.3)	0.095	(2.4)	850	(59)	850	(59)	850	(59)
1/4	0.54	0.540	(13.7)	0.119	(3.0)	850	(59)	850	(59)	850	(59)
3/8	0.74	0.675	(17.1)	0.126	(3.2)	850	(59)	850	(59)	850	(59)
1/2	1.09	0.840	(21.3)	0.147	(3.7)	850	(59)	850	(59)	850	(59)
3/4	1.48	1.050	(26.7)	0.154	(3.9)	850	(59)	850	(59)	850	(59)
1	2.18	1.315	(33.4)	0.179	(4.5)	850	(59)	850	(59)	850	(59)
1 1/4	3.02	1.660	(42.2)	0.191	(4.9)	1300	(90)	1500	(103)	1600	(110)
1 1/2	3.66	1.900	(48.3)	0.200	(5.1)	1300	(90)	1500	(103)	1600	(110)
2	5.07	2.375	(60.3)	0.218	(5.5)	1300	(90)	2500	(172)	2500	(172)
2 1/2	7.73	2.875	(73.0)	0.276	(7.0)	1300	(90)	2500	(172)	2500	(172)
3	10.33	3.500	(88.9)	0.300	(7.6)	1300	(90)	2500	(172)	2500	(172)
3 1/2	12.63	4.000	(101.6)	0.318	(8.1)	1700	(117)	2800	(193)	2800	(193)
4	15.17	4.500	(114.3)	0.337	(8.6)	1700	(117)	2700	(186)	2800	(193)
5	21.09	5.563	(141.3)	0.375	(9.5)	1700	(117)	2400	(165)	2800	(193)
6	28.89	6.625	(168.3)	0.432	(11.0)	—	—	2300	(159)	2700	(186)
8	43.90	8.625	(219.1)	0.500	(12.7)	—	—	2100	(145)	2400	(165)
10	55.82	10.750	(273.0)	0.500	(12.7)	—	—	1700	(117)	2000	(138)
12	66.71	12.750	(323.8)	0.500	(12.7)	—	—	1400	(97)	1600	(110)

[a]Nominal weights, threads, and coupling (column 2) are shown for the purpose of identification in ordering.

Table 6A—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Nominal Sizes 1/8 Through 1 1/2

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Designation							Minimum Test Pressure (psi)[b]				
Nominal Size	Wall	Weight	Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Grade A25 Alt.	Grade A		Grade B	
								Std.	Alt.	Std.	Alt.
1/8	Std.	0.24	0.405	0.068	0.24	0.269	700	700	—	700	—
1/8	XS	0.31	0.405	0.095	0.31	0.215	850	850	—	850	—
1/4	Std.	0.42	0.540	0.088	0.42	0.364	700	700	—	700	—
1/4	XS	0.54	0.540	0.119	0.54	0.302	850	850	—	850	—
3/8	Std.	0.57	0.675	0.091	0.57	0.493	700	700	—	700	—
3/8	XS	0.74	0.675	0.126	0.74	0.423	850	850	—	850	—
1/2	Std.	0.85	0.840	0.109	0.85	0.622	700	700	—	700	—
1/2	XS	1.09	0.840	0.147	1.09	0.546	850	850	—	850	—
1/2	XXS	1.71	0.840	0.294	1.71	0.252	1000	1000	—	1000	—
3/4	Std.	1.13	1.050	0.113	1.13	0.824	700	700	—	700	—
3/4	XS	1.47	1.050	0.154	1.47	0.742	850	850	—	850	—
3/4	XXS	2.44	1.050	0.308	2.44	0.434	1000	1000	—	1000	—
1	Std.	1.68	1.315	0.133	1.68	1.049	700	700	—	700	—
1	XS	2.17	1.315	0.179	2.17	0.957	850	850	—	850	—
1	XXS	3.66	1.315	0.358	3.66	0.599	1000	1000	—	1000	—
1 1/4	Std.	2.27	1.660	0.140	2.27	1.380	1000	1200	—	1300	—
1 1/4	XS	3.00	1.660	0.191	3.00	1.278	1300	1800	—	1900	—
1 1/4	XXS	5.21	1.660	0.382	5.21	0.896	1400	2200	—	2300	—
1 1/2	Std.	2.72	1.900	0.145	2.72	1.610	1000	1200	—	1300	—
1 1/2	XS	3.63	1.900	0.200	3.63	1.500	1300	1800	—	1900	—
1 1/2	XXS	6.41	1.900	0.400	6.41	1.100	1400	2200	—	2300	—

Note: See Appendix E, Tables E-1A, E-1B, and E-1C, for metric unit equivalents of the U.S. customary values shown in this table.
[a]Outside diameter and wall thickness dimensions shown are subject to tolerances described in Table 7. Inside diameters are nominal and are given here for information (see 7.2).
[b]The test pressures given in Tables 6A, 6B, and 6C apply to Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70, and X80 only. See 9.4.3 for pressures applicable to other grades.

Table 6B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16

(1)			(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)		Minimum Test Pressure (psi)[b]										
Nominal Size	Wall	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
2 3/8[c]		2.03	2.375	0.083	2.03	2.209	Std.	600	1260	1470	1760	1930	2180	2350	2520	2730	2940	3000
							Alt.	—	1570	1830	2200	2410	2730	2940	3000	3000	3000	3000
2 3/8[c]		2.64	2.375	0.109	2.64	2.157	Std.	800	1650	1930	2310	2530	2860	3000	3000	3000	3000	3000
							Alt.	—	2070	2410	2890	3000	3000	3000	3000	3000	3000	3000
2 3/8[c]		3.00	2.375	0.125	3.00	2.125	Std.	1000	1890	2210	2650	2910	3000	3000	3000	3000	3000	3000
							Alt.	—	2370	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8[c]		3.36	2.375	0.141	3.36	2.093	Std.	1000	2140	2490	2990	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8	Std.	3.65	2.375	0.154	3.65	2.067	Std.	1000	2330	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8		4.05	2.375	0.172	4.05	2.031	Std.	1100	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8		4.39	2.375	0.188	4.39	1.999	Std.	1200	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8	XS	5.02	2.375	0.218	5.02	1.939	Std.	1300	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8		5.67	2.375	0.250	5.67	1.875	Std.	1400	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8		6.28	2.375	0.281	6.28	1.813	Std.	1400	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 3/8	XXS	9.03	2.375	0.436	9.03	1.503	Std.	1400	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8[c]		2.47	2.875	0.083	2.47	2.709	Std.	600	1040	1210	1460	1590	1800	1940	2030	2250	2430	2770
							Alt.	—	1300	1520	1820	1990	2250	2430	2600	2310	3000	3000
2 7/8[c]		3.22	2.875	0.109	3.22	2.657	Std.	800	1360	1590	1910	2090	2370	2550	2730	2960	3000	3000
							Alt.	—	1710	1990	2390	2620	2960	3000	3000	3000	3000	3000
2 7/8[c]		3.67	2.875	0.125	3.67	2.625	Std.	1000	1570	1830	2190	2400	2710	2920	3000	3000	3000	3000
							Alt.	—	1960	2280	2740	3000	3000	3000	3000	3000	3000	3000
2 7/8[c]		4.12	2.875	0.141	4.12	2.593	Std.	1000	1770	2060	2470	2710	3000	3000	3000	3000	3000	3000
							Alt.	—	2210	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8		4.53	2.875	0.156	4.53	2.563	Std.	1000	1950	2280	2730	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2440	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8		4.97	2.875	0.172	4.97	2.531	Std.	1000	2150	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8		5.40	2.875	0.188	5.40	2.499	Std.	1000	2350	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8	Std.	5.79	2.875	0.203	5.79	2.469	Std.	1000	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8		6.13	2.875	0.216	6.13	2.443	Std.	1100	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8		7.01	2.875	0.250	7.01	2.375	Std.	1200	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
2 7/8	XS	7.66	2.875	0.276	7.66	2.323	Std.	1300	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000

Table 6B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16—Continued

(1)			(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)		Minimum Test Pressure (psi)[b]										
Nominal Size	Wall	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
2 7/8	XXS	13.69	2.875	0.552	13.69	1.771	Std.	1400	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 1/2[c]		3.03	3.500	0.083	3.03	3.334	Std.	600	850	1000	1200	1310	1480	1590	1710	1850	1990	2280
							Alt.	—	1070	1250	1490	1640	1850	1990	2130	2310	2490	2850
3 1/2[c]		3.95	3.500	0.109	3.95	3.282	Std.	800	1120	1310	1570	1720	1940	2090	2240	2430	2620	2990
							Alt.	—	1400	1640	1960	2150	2430	2620	2800	3000	3000	3000
3 1/2[c]		4.51	3.500	0.125	4.51	3.250	Std.	1000	1290	1500	1800	1970	2230	2400	2570	2790	3000	3000
							Alt.	—	1610	1880	2250	2460	2790	3000	3000	3000	3000	3000
3 1/2[c]		5.06	3.500	0.141	5.06	3.218	Std.	1000	1450	1690	2030	2220	2510	2710	2900	3000	3000	3000
							Alt.	—	1810	2120	2540	2780	3000	3000	3000	3000	3000	3000
3 1/2[c]		5.57	3.500	0.156	5.57	3.188	Std.	1000	1600	1870	2250	2460	2780	3000	3000	3000	3000	3000
							Alt.	—	2010	2340	2810	3000	3000	3000	3000	3000	3000	3000
3 1/2		6.11	3.500	0.172	6.11	3.156	Std.	1000	1770	2060	2480	2710	3000	3000	3000	3000	3000	3000
							Alt.	—	2210	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 1/2		6.65	3.500	0.188	6.65	3.124	Std.	1000	1930	2260	2710	2970	3000	3000	3000	3000	3000	3000
							Alt.	—	2420	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 1/2	Std.	7.58	3.500	0.216	7.58	3.068	Std.	1000	2220	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 1/2		8.68	3.500	0.250	8.68	3.000	Std.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 1/2		9.66	3.500	0.281	9.66	2.938	Std.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 1/2	XS	10.25	3.500	0.300	10.25	2.900	Std.	1300	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
3 1/2	XXS	18.58	3.500	0.600	18.58	2.300	Std.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
4[c]		3.47	4.000	0.083	3.47	3.834	Std.	—	750	870	1050	1150	1290	1390	1490	1620	1740	1990
							Alt.	—	930	1090	1310	1430	1620	1740	1870	2020	2180	2490
4[c]		4.53	4.000	0.109	4.53	3.782	Std.	600	980	1140	1370	1500	1700	1830	1960	2130	2290	2620
							Alt.	—	1230	1430	1720	1880	2130	2290	2450	2660	2860	3000
4[c]		5.17	4.000	0.125	5.17	3.750	Std.	—	1130	1310	1580	1730	1950	2100	2250	2440	2630	3000
							Alt.	—	1410	1640	1970	2160	2440	2630	2810	3000	3000	3000
4[c]		5.81	4.000	0.141	5.81	3.718	Std.	800	1270	1480	1780	1950	2200	2370	2540	2750	2960	3000
							Alt.	—	1590	1850	2220	2430	2750	2960	3000	3000	3000	3000
4[c]		6.40	4.000	0.156	6.40	3.688	Std.	—	1400	1640	1970	2150	2430	2620	2810	3000	3000	3000
							Alt.	—	1760	2050	2460	2690	3000	3000	3000	3000	3000	3000
4		7.03	4.000	0.172	7.03	3.656	Std.	1000	1550	1810	2170	2370	2680	2890	3000	3000	3000	3000
							Alt.	—	1940	2260	2710	2970	3000	3000	3000	3000	3000	3000
4		7.65	4.000	0.188	7.65	3.624	Std.	1200	1690	1970	2370	2590	2930	3000	3000	3000	3000	3000
							Alt.	—	2120	2470	2960	3000	3000	3000	3000	3000	3000	3000
4	Std.	9.11	4.000	0.226	9.11	3.548	Std.	1200	2930	2370	2850	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2540	2800	3000	3000	3000	3000	3000	3000	3000	3000
4		10.01	4.000	0.250	10.01	3.500	Std.	—	2250	2630	3000	3000	3000	3000	3000	3000	3000	3000

Table 6B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16—Continued

(1)			(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)		Minimum Test Pressure (psi)[b]										
Nominal Size	Wall	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4		11.16	4.000	0.281	11.16	3.438	Std.	—	2530	2800	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4	XS	12.50	4.000	0.318	12.50	3.364	Std.	1700	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2[c]		3.92	4.500	0.083	3.92	4.334	Std.	—	660	770	930	1020	1150	1240	1330	1440	1550	1770
							Alt.	—	830	970	1160	1270	1440	1550	1660	1800	1940	2210
4 1/2[c]		5.84	4.500	0.125	5.84	4.250	Std.	800	1000	1170	1400	1530	1730	1870	2000	2170	2330	2670
							Alt.	—	1250	1460	1750	1920	2170	2330	2500	2710	2920	3000
4 1/2[c]		6.56	4.500	0.141	6.56	4.218	Std.	—	1130	1320	1580	1730	1960	2110	2260	2440	2630	3000
							Alt.	—	1410	1650	1970	2160	2440	2630	2820	3000	3000	3000
4 1/2[c]		7.24	4.500	0.156	7.24	4.188	Std.	1000	1250	1460	1750	1910	2160	2330	2500	2700	2910	3000
							Alt.	—	1560	1820	2180	2390	2700	2910	3000	3000	3000	3000
4 1/2		7.95	4.500	0.172	7.95	4.156	Std.	—	1380	1610	1930	2110	2390	2570	2750	2980	3000	3000
							Alt.	—	1720	2010	2410	2640	2980	3000	3000	3000	3000	3000
4 1/2		8.66	4.500	0.188	8.66	4.124	Std.	1200	1500	1750	2110	2310	2610	2810	3000	3000	3000	3000
							Alt.	—	1880	2190	2630	2880	3000	3000	3000	3000	3000	3000
4 1/2		9.32	4.500	0.203	9.32	4.094	Std.	—	1620	1890	2270	2490	2810	3000	3000	3000	3000	3000
							Alt.	—	2030	2370	2840	3000	3000	3000	3000	3000	3000	3000
4 1/2		10.01	4.500	0.219	10.01	4.062	Std.	1200	1750	2040	2450	2690	3000	3000	3000	3000	3000	3000
							Alt.	—	2190	2560	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2	Std.	10.79	4.500	0.237	10.79	4.026	Std.	1200	1900	2210	2650	2910	3000	3000	3000	3000	3000	3000
							Alt.	—	2370	2770	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2		11.35	4.500	0.250	11.35	4.000	Std.	—	2000	2330	2800	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2500	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2		12.66	4.500	0.281	12.66	3.938	Std.	—	2250	2620	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2		13.96	4.500	0.312	13.96	3.876	Std.	—	2500	2800	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2	XS	14.98	4.500	0.337	14.98	3.826	Std.	1700	2700	2800	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2		19.00	4.500	0.438	19.00	3.624	Std.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2		22.51	4.500	0.531	22.51	3.438	Std.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
4 1/2	XXS	27.54	4.500	0.674	27.54	3.152	Std.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
							Alt.	—	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
5 9/16[c]		4.86	5.563	0.083	4.86	5.397	Std.	—	540	630	750	820	930	1000	1040	1160	1250	1430
5 9/16[c]		7.26	5.563	0.125	7.26	5.313	Std.	670	810	940	1130	1240	1400	1500	1630	1750	1890	2160
5 9/16[c]		9.01	5.563	0.156	9.01	5.251	Std.	840	1010	1180	1410	1550	1750	1910	2020	2120	2360	2690
5 9/16		10.79	5.563	0.188	10.79	5.187	Std.	1010	1220	1420	1700	1870	2110	2270	2430	2640	2840	3000
5 9/16		12.50	5.563	0.219	12.50	5.125	Std.	1180	1420	1650	1990	2170	2460	2650	2830	3000	3000	3000
5 9/16	Std.	14.62	5.563	0.258	14.62	5.047	Std.	1200	1670	1950	2340	2560	2890	3000	3000	3000	3000	3000

Table 6B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16—Continued

(1)			(2)	(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)		Minimum Test Pressure (psi)[b]										
Nominal Size	Wall	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
5 9/16		15.85	5.563	0.281	15.85	5.001	Std.	1520	1820	2120	2550	2790	3000	3000	3000	3000	3000	3000
5 9/16		17.50	5.563	0.312	17.50	4.939	Std.	1680	2020	2360	3000	3000	3000	3000	3000	3000	3000	3000
5 9/16		19.17	5.563	0.344	19.17	4.875	Std.	1860	2230	2600	3000	3000	3000	3000	3000	3000	3000	3000
5 9/16	XS	20.78	5.563	0.375	20.78	4.813	Std.	2020	2430	2800	3000	3000	3000	3000	3000	3000	3000	3000
5 9/16		27.04	5.563	0.500	27.04	4.563	Std.	2700	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
5 9/16		32.96	5.563	0.625	32.96	4.313	Std.	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
5 9/16	XXS	38.55	5.563	0.750	38.55	4.063	Std.	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000

Note: See Appendix E, Tables E-1A, E-1B, and E-1C for metric unit equivalents of the U.S. customary values shown in this table.

[a]Outside diameter and wall thickness dimensions shown are subject to tolerances described in Table 7. Inside diameters are nominal, and are given here for information (see Par. 7.2).

[b]The test pressures given in Tables 6A, 6B, and 6C apply to Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70, and X80 only. See 9.4.3 for pressures applicable to other grades.

[c]These sizes are special plain-end weights. All other sizes are regular weight. See Table 7 for applicable weight tolerances. For Grades X42 and higher, weights intermediate to regular weights shall be considered regular weight; weights intermediate to special plain-end weights shall be considered special plain-end weights; and weights intermediate to the heaviest tabulated special plain-end weight and the lightest regular weight shall be considered special plain-end weights.

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
6⅝[c]		5.80	6.625	0.083	5.80	6.459	450	560	530	660	790	860	980	1050	1130	1220	1320	1500
6⅝[c]		7.59	6.625	0.109	7.59	6.407	590	740	690	860	1040	1140	1280	1380	1480	1600	1730	1970
6⅝[c]		8.68	6.625	0.125	8.68	6.375	680	850	790	990	1190	1300	1470	1580	1700	1840	1980	2260
6⅝[c]		9.76	6.625	0.141	9.76	6.343	770	960	890	1120	1340	1470	1660	1790	1920	2080	2230	2550
6⅝[c]		10.78	6.625	0.156	10.78	6.313	850	1060	990	1240	1480	1620	1840	1980	2120	2300	2470	2830
6⅝		11.85	6.625	0.172	11.85	6.281	930	1170	1090	1360	1640	1790	2030	2180	2340	2530	2730	3000
6⅝		12.92	6.625	0.188	12.92	6.249	1020	1280	1190	1490	1790	1960	2210	2380	2550	2770	2980	3000
6⅝		13.92	6.625	0.203	13.92	6.219	1100	1380	1290	1610	1930	2110	2390	2570	2760	2990	3000	3000
6⅝		14.98	6.625	0.219	14.98	6.187	1190	1490	1390	1740	2080	2280	2580	2780	2980	3000	3000	3000
6⅝		17.02	6.625	0.250	17.02	6.125	1360	1700	1580	1980	2380	2600	2940	3000	3000	3000	3000	3000
6⅝	Std.	18.97	6.625	0.280	18.97	6.065	1520	1900	1780	2220	2660	2920	3000	3000	3000	3000	3000	3000
6⅝		21.04	6.625	0.312	21.04	6.001	1700	2120	1980	2470	2970	3000	3000	3000	3000	3000	3000	3000
6⅝		23.08	6.625	0.344	23.08	5.937	1870	2340	2180	2500	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		25.03	6.625	0.375	25.03	5.875	2040	2550	2380	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝	XS	28.57	6.625	0.432	28.57	5.761	2350	2800	2740	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		32.71	6.625	0.500	32.71	5.625	2720	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		36.39	6.625	0.562	36.39	5.501	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		40.05	6.625	0.625	40.05	5.375	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		45.35	6.625	0.719	45.35	5.187	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		47.06	6.625	0.750	47.06	5.125	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝[d]	XXS	53.16	6.625	0.864	53.16	4.897	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
6⅝		53.73	6.625	0.875	53.73	4.875	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝[c]		11.35	8.625	0.125	11.35	8.375	520	650	610	760	910	1000	1130	1220	1300	1410	1520	1740
8⅝[c]		14.11	8.625	0.156	14.11	8.313	650	810	760	950	1140	1250	1410	1520	1630	1760	1900	2170
8⅝		16.94	8.625	0.188	16.94	8.249	780	980	920	1140	1370	1500	1700	1830	1960	2130	2290	2620
8⅝		18.26	8.625	0.203	18.26	8.219	850	1060	990	1240	1480	1620	1840	2000	2120	2290	2470	2820
8⅝		19.66	8.625	0.219	19.66	8.187	910	1140	1070	1330	1600	1750	1980	2130	2290	2480	2670	3000
8⅝		22.36	8.625	0.250	22.36	8.125	1040	1300	1220	1520	1830	2000	2260	2430	2610	2830	3000	3000
8⅝		24.70	8.625	0.277	24.70	8.071	1160	1450	1350	1690	2020	2220	2510	2700	2890	3000	3000	3000
8⅝		27.70	8.625	0.312	27.70	8.001	1300	1630	1520	1900	2280	2500	2820	3000	3000	3000	3000	3000
8⅝	Std.	28.55	8.625	0.322	28.55	7.981	1340	1680	1570	1960	2350	2580	2910	3000	3000	3000	3000	3000
8⅝		30.42	8.625	0.344	30.42	7.937	1440	1790	1680	2090	2510	2750	3000	3000	3000	3000	3000	3000
8⅝		33.04	8.625	0.375	33.04	7.875	1570	1960	1830	2280	2740	3000	3000	3000	3000	3000	3000	3000
8⅝		38.30	8.625	0.438	38.30	7.749	1830	2290	2130	2670	3000	3000	3000	3000	3000	3000	3000	3000
8⅝	XS	43.39	8.625	0.500	43.39	7.625	2090	2610	2430	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		48.40	8.625	0.562	48.40	7.501	2350	2800	2740	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		53.40	8.625	0.625	53.40	7.375	2610	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		60.71	8.625	0.719	60.71	7.187	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		63.08	8.625	0.750	63.08	7.125	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		67.76	8.625	0.812	67.76	7.001	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝	XXS	72.42	8.625	0.875	72.42	6.875	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
8⅝		81.44	8.625	1.000	81.44	6.625	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
10 3/4[c]		17.65	10.750	0.156	17.65	10.438	520	650	610	760	1040	1130	1280	1380	1480	1600	1730	1970
10 3/4[c]		21.21	10.750	0.188	21.21	10.374	630	790	730	920	1250	1370	1550	1660	1780	1930	2080	2380
10 3/4[c]		22.87	10.750	0.203	22.87	10.344	680	850	790	990	1350	1480	1670	1800	1930	2090	2250	2570
10 3/4		24.63	10.750	0.219	24.63	10.312	730	920	860	1070	1450	1590	1800	1940	2080	2250	2420	2770
10 3/4		28.04	10.750	0.250	28.04	10.250	840	1050	980	1220	1660	1820	2060	2210	2370	2570	2770	3000
10 3/4		31.20	10.750	0.279	31.20	10.192	930	1170	1090	1360	1850	2030	2290	2470	2650	2870	3000	3000
10 3/4		34.24	10.750	0.307	34.24	10.136	1030	1290	1200	1500	2040	2230	2520	2720	2910	3000	3000	3000
10 3/4		38.23	10.750	0.344	38.23	10.062	1150	1440	1340	1680	2280	2500	2830	3000	3000	3000	3000	3000
10 3/4	Std.	40.48	10.750	0.365	40.48	10.020	1220	1530	1430	1780	2420	2660	3000	3000	3000	3000	3000	3000
10 3/4		48.24	10.750	0.438	48.24	9.874	1470	1830	1710	2140	2910	3000	3000	3000	3000	3000	3000	3000
10 3/4	XS	54.74	10.750	0.500	54.74	9.750	1670	2090	1950	2440	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		61.15	10.750	0.562	61.15	9.626	1880	2350	2200	2740	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		67.58	10.750	0.625	67.58	9.500	2090	2620	2440	2800	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		77.03	10.750	0.719	77.03	9.312	2410	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		86.18	10.750	0.812	86.18	9.126	2720	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		92.28	10.750	0.875	92.28	9.000	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		98.30	10.750	0.938	98.30	8.874	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4	XXS	104.13	10.750	1.000	104.13	8.750	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
10 3/4		126.83	10.750	1.250	126.83	8.250	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4[c]		23.11	12.750	0.172	23.11	12.406	490	610	570	710	960	1050	1190	1280	1380	1490	1610	1830
12 3/4[c]		25.22	12.750	0.188	25.22	12.374	530	660	620	770	1050	1150	1300	1400	1500	1630	1750	2010
12 3/4[c]		27.20	12.750	0.203	27.20	12.344	570	720	670	840	1140	1250	1410	1520	1620	1760	1890	2170
12 3/4[c]		29.31	12.750	0.219	29.31	12.312	620	770	720	900	1230	1340	1520	1640	1750	1900	2040	2340
12 3/4		33.38	12.750	0.250	33.38	12.250	710	880	820	1030	1400	1530	1730	1870	2000	2170	2330	2670
12 3/4		37.42	12.750	0.281	37.42	12.188	790	990	930	1160	1570	1720	1950	2100	2250	2440	2620	3000
12 3/4		41.45	12.750	0.312	41.45	12.126	880	1100	1030	1280	1750	1910	2160	2330	2500	2700	2910	3000
12 3/4		43.77	12.750	0.330	43.77	12.090	930	1160	1090	1360	1850	2020	2290	2460	2640	2860	3000	3000
12 3/4		45.58	12.750	0.344	45.58	12.062	970	1210	1130	1420	1930	2110	2390	2570	2750	2980	3000	3000
12 3/4	Std.	49.56	12.750	0.375	49.56	12.000	1060	1320	1240	1540	2100	2300	2600	2800	3000	3000	3000	3000
12 3/4		53.52	12.750	0.406	53.52	11.938	1150	1430	1340	1670	2270	2490	2810	3000	3000	3000	3000	3000
12 3/4		57.59	12.750	0.438	57.59	11.874	1240	1550	1440	1800	2450	2690	3000	3000	3000	3000	3000	3000
12 3/4	XS	65.42	12.750	0.500	65.42	11.750	1410	1760	1650	2060	2800	3000	3000	3000	3000	3000	3000	3000
12 3/4		73.15	12.750	0.562	73.15	11.626	1590	1980	1850	2310	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		80.93	12.750	0.625	80.93	11.500	1760	2210	2060	2570	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		88.63	12.750	0.688	88.63	11.374	1940	2430	2270	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		96.12	12.750	0.750	96.12	11.250	2120	2650	2470	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		103.53	12.750	0.812	103.53	11.126	2290	2800	2670	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		110.97	12.750	0.875	110.97	11.000	2470	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		118.33	12.750	0.938	118.33	10.874	2650	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4	XXS	125.49	12.750	1.000	125.49	10.750	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		132.57	12.750	1.062	132.57	10.626	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		139.67	12.750	1.125	139.67	10.500	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
12 3/4		153.53	12.750	1.250	153.53	10.250	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
14[c]		27.73	14.000	0.188	27.73	13.624	480	600	560	700	960	1050	1190	1280	1370	1480	1600	1830
14[c]		29.91	14.000	0.203	29.91	13.594	520	650	610	760	—	—	—	—	—	—	—	1970
14[c]		30.93	14.000	0.210	30.93	13.580	540	680	630	790	1070	1170	1330	1430	1530	1660	1790	2040
14[c]		32.23	14.000	0.219	32.23	13.562	560	700	660	820	1120	1220	1380	1490	1600	1730	1860	2130
14[c]		36.71	14.000	0.250	36.71	13.500	640	800	750	940	1280	1400	1580	1700	1820	1970	2130	2430
14[c]		41.17	14.000	0.281	41.17	13.438	720	900	840	1050	1430	1570	1770	1910	2050	2220	2390	2730
14		45.61	14.000	0.312	45.61	13.376	800	1000	940	1170	1590	1740	1970	2120	2270	2460	2650	3000
14		50.17	14.000	0.344	50.17	13.312	880	1110	1030	1290	1750	1920	2170	2340	2510	2720	2920	3000
14	Std.	54.57	14.000	0.375	54.57	13.250	960	1210	1120	1410	1910	2090	2370	2550	2730	2960	3000	3000
14		58.94	14.000	0.406	58.94	13.188	1040	1310	1220	1520	2070	2270	2560	2760	2960	3000	3000	3000
14		63.44	14.000	0.438	63.44	13.124	1130	1410	1310	1640	2230	2450	2770	2980	3000	3000	3000	3000
14		67.78	14.000	0.469	67.78	13.062	1210	1510	1410	1760	2390	2620	2960	3000	3000	3000	3000	3000
14	XS	72.09	14.000	0.500	72.09	13.000	1290	1610	1500	1880	2550	2790	3000	3000	3000	3000	3000	3000
14		80.66	14.000	0.562	80.66	12.876	1450	1810	1690	2110	2870	3000	3000	3000	3000	3000	3000	3000
14		89.28	14.000	0.625	89.28	12.750	1610	2010	1880	2340	3000	3000	3000	3000	3000	3000	3000	3000
14		97.81	14.000	0.688	97.81	12.624	1770	2210	2060	2580	3000	3000	3000	3000	3000	3000	3000	3000
14		106.13	14.000	0.750	106.13	12.500	1930	2410	2250	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		114.37	14.000	0.812	114.37	12.376	2090	2610	2440	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		122.65	14.000	0.875	122.65	12.250	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		130.85	14.000	0.938	130.85	12.124	2412	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		138.84	14.000	1.000	138.84	12.000	2570	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		146.74	14.000	1.062	146.74	11.876	2730	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		154.69	14.000	1.125	154.69	11.750	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
14		170.21	14.000	1.250	170.21	11.500	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
16[c]		31.75	16.000	0.188	31.75	15.624	420	530	490	620	840	920	1040	1120	1200	1300	1400	1600
16[c]		34.25	16.000	0.203	34.25	15.594	460	570	530	670	910	990	1120	1210	1290	1400	1510	1730
16[c]		36.91	16.000	0.219	36.91	15.562	490	620	570	720	980	1070	1210	1300	1400	1510	1630	1860
16[c]		42.05	16.000	0.250	42.05	15.500	560	700	660	820	1120	1220	1380	1490	1590	1730	1860	2130
16[c]		47.17	16.000	0.281	47.17	15.438	630	790	740	920	1250	1370	1550	1670	1790	1940	2090	2390
16		52.27	16.000	0.312	52.27	15.376	700	880	820	1020	1390	1520	1720	1860	1990	2150	2320	2650
16		57.52	16.000	0.344	57.52	15.312	770	970	900	1130	1540	1680	1900	2050	2190	2380	2560	2920
16	Std.	62.58	16.000	0.375	62.58	15.250	840	1050	980	1230	1670	1830	2070	2230	2390	2590	2790	3000
16		67.62	16.000	0.406	67.62	15.188	910	1110	1070	1330	1810	1980	2240	2420	2590	2800	3000	3000
16		72.80	16.000	0.438	72.80	15.124	990	1230	1150	1440	1950	2140	2420	2610	2790	3000	3000	3000
16		77.79	16.000	0.469	77.79	15.062	1060	1320	1230	1540	2090	2290	2590	2790	2990	3000	3000	3000
16	XS	82.77	16.000	0.500	82.77	15.000	1120	1410	1310	1640	2230	2440	2760	2980	3000	3000	3000	3000
16		92.66	16.000	0.562	92.66	14.876	1260	1580	1480	1840	2510	2750	3000	3000	3000	3000	3000	3000
16		102.63	16.000	0.625	102.63	14.750	1410	1760	1640	2050	2790	3000	3000	3000	3000	3000	3000	3000
16		112.51	16.000	0.688	112.51	14.624	1550	1940	1810	2260	3000	3000	3000	3000	3000	3000	3000	3000
16		122.15	16.000	0.750	122.15	14.500	1690	2110	1970	2460	3000	3000	3000	3000	3000	3000	3000	3000
16		131.71	16.000	0.812	131.71	14.376	1830	2280	2130	2660	3000	3000	3000	3000	3000	3000	3000	3000
16		141.34	16.000	0.875	141.34	14.250	1970	2460	2300	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		150.89	16.000	0.938	150.89	14.124	2110	2640	2460	2800	3000	3000	3000	3000	3000	3000	3000	3000

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
16		160.20	16.000	1.000	160.20	14.000	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		169.43	16.000	1.062	169.43	13.876	2390	2800	2790	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		178.72	16.000	1.125	178.72	13.750	2530	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		187.93	16.000	1.188	187.93	13.624	2670	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
16		196.91	16.000	1.250	196.91	13.500	2800	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
18[c]		35.76	18.000	0.188	35.76	17.624	380	470	440	550	750	820	920	990	1070	1150	1240	1420
18[c]		41.59	18.000	0.219	41.59	17.562	440	550	510	640	870	950	1080	1160	1240	1340	1450	1650
18[c]		47.39	18.000	0.250	47.39	17.500	500	620	580	730	990	1090	1230	1320	1420	1530	1650	1890
18[c]		53.18	18.000	0.281	53.18	17.438	560	700	660	820	1110	1220	1380	1490	1590	1730	1860	2120
18		58.94	18.000	0.312	58.94	17.376	620	780	730	910	1240	1360	1530	1650	1770	1920	2060	2360
18		64.87	18.000	0.344	64.87	17.312	690	860	800	1000	1360	1490	1690	1820	1950	2110	2270	2600
18	Std.	70.59	18.000	0.375	70.59	17.250	750	940	880	1090	1490	1630	1840	1980	2120	2300	2480	2830
18		76.29	18.000	0.406	76.29	17.188	810	1020	950	1180	1610	1760	1990	2150	2300	2490	2680	3000
18		82.15	18.000	0.438	82.15	17.124	880	1100	1020	1280	1740	1900	2150	2320	2480	2690	2900	3000
18		87.81	18.000	0.469	87.81	17.062	940	1170	1090	1370	1860	2040	2300	2480	2660	2880	3000	3000
18	XS	93.45	18.000	0.500	93.45	17.000	1000	1250	1170	1460	1980	2170	2460	2640	2830	3000	3000	3000
18		104.67	18.000	0.562	104.67	16.876	1120	1400	1310	1640	2230	2440	2760	2970	3000	3000	3000	3000
18		115.98	18.000	0.625	115.98	16.750	1250	1560	1460	1820	2480	2720	3000	3000	3000	3000	3000	3000
18		127.21	18.000	0.688	127.21	16.624	1380	1720	1610	2010	2730	2990	3000	3000	3000	3000	3000	3000
18		138.17	18.000	0.750	138.17	16.500	1500	1880	1750	2190	2980	3000	3000	3000	3000	3000	3000	3000
18		149.06	18.000	0.812	149.06	16.376	1620	2030	1890	2370	3000	3000	3000	3000	3000	3000	3000	3000
18		160.03	18.000	0.875	160.03	16.250	1750	2190	2040	2550	3000	3000	3000	3000	3000	3000	3000	3000
18		170.92	18.000	0.938	170.92	16.124	1880	2340	2190	2740	3000	3000	3000	3000	3000	3000	3000	3000
18		181.56	18.000	1.000	181.56	16.000	2000	2500	2330	2800	3000	3000	3000	3000	3000	3000	3000	3000
18		192.11	18.000	1.062	192.11	15.876	2120	2660	2480	2800	3000	3000	3000	3000	3000	3000	3000	3000
18		202.75	18.000	1.125	202.75	15.750	2250	2800	2620	2800	3000	3000	3000	3000	3000	3000	3000	3000
18		213.31	18.000	1.188	213.31	15.626	2370	2800	2770	2800	3000	3000	3000	3000	3000	3000	3000	3000
18		223.61	18.000	1.250	223.61	15.500	2500	2800	2800	2800	3000	3000	3000	3000	3000	3000	3000	3000
20[c]		46.27	20.000	0.219	46.27	19.562	390	490	460	570	830	910	1020	1100	1180	1280	1380	1580
20[c]		52.73	20.000	0.250	52.73	19.500	450	560	520	660	950	1040	1170	1260	1350	1460	1580	1800
20[c]		59.18	20.000	0.281	59.18	19.438	510	630	590	740	1060	1160	1320	1420	1520	1640	1770	2020
20		65.60	20.000	0.312	65.60	19.376	560	700	660	820	1180	1290	1460	1570	1680	1830	1970	2250
20		72.21	20.000	0.344	72.21	19.312	620	770	720	900	1300	1420	1610	1730	1860	2010	2170	2480
20	Std.	78.60	20.000	0.375	78.60	19.250	680	840	790	980	1420	1550	1760	1890	2030	2190	2360	2700
20		84.96	20.000	0.406	84.96	19.188	730	910	850	1070	1530	1680	1900	2050	2190	2380	2560	2920
20		91.51	20.000	0.438	91.51	19.124	790	990	920	1150	1660	1810	2050	2210	2370	2560	2760	3000
20		97.83	20.000	0.469	97.83	19.062	840	1060	980	1230	1770	1940	2190	2360	2530	2740	2950	3000
20	XS	104.13	20.000	0.500	104.13	19.000	900	1120	1050	1310	1890	2070	2340	2520	2700	2930	3000	3000
20		116.67	20.000	0.562	116.67	18.876	1010	1260	1180	1480	2120	2330	2630	2830	3000	3000	3000	3000
20		129.33	20.000	0.625	129.33	18.750	1120	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
20		141.90	20.000	0.688	141.90	18.624	1240	1550	1440	1810	2600	2850	3000	3000	3000	3000	3000	3000
20		154.19	20.000	0.750	154.19	18.500	1350	1690	1580	1970	2840	3000	3000	3000	3000	3000	3000	3000
20		166.40	20.000	0.812	166.40	18.376	1460	1830	1710	2130	3000	3000	3000	3000	3000	3000	3000	3000

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
20		178.72	20.000	0.875	178.72	18.250	1580	1970	1840	2300	3000	3000	3000	3000	3000	3000	3000	3000
20		190.96	20.000	0.938	190.96	18.124	1690	2110	1970	2460	3000	3000	3000	3000	3000	3000	3000	3000
20		202.92	20.000	1.000	202.92	18.000	1800	2250	2100	2620	3000	3000	3000	3000	3000	3000	3000	3000
20		214.80	20.000	1.062	214.80	17.876	1910	2390	2230	2750	3000	3000	3000	3000	3000	3000	3000	3000
20		226.78	20.000	1.125	226.78	17.750	2020	2530	2360	2750	3000	3000	3000	3000	3000	3000	3000	3000
20		238.68	20.000	1.188	238.68	17.626	2140	2670	2490	2750	3000	3000	3000	3000	3000	3000	3000	3000
20		250.31	20.000	1.250	250.31	17.500	2250	2750	2620	2750	3000	3000	3000	3000	3000	3000	3000	3000
20		261.86	20.000	1.312	261.86	17.376	2360	2750	2750	2750	3000	3000	3000	3000	3000	3000	3000	3000
20		273.51	20.000	1.375	273.51	17.250	2480	2750	2750	2750	3000	3000	3000	3000	3000	3000	3000	3000
22[c]		50.94	22.000	0.219	50.94	21.562	360	450	420	520	750	820	930	1000	1080	1160	1250	1430
22[c]		58.07	22.000	0.250	58.07	21.500	410	510	480	600	860	940	1060	1150	1230	1330	1430	1640
22[c]		65.18	22.000	0.281	65.18	21.438	460	570	540	670	970	1060	1200	1290	1380	1490	1610	1840
22		72.27	22.000	0.312	72.27	21.376	510	640	600	740	1070	1170	1330	1430	1530	1660	1790	2040
22		79.56	22.000	0.344	79.56	21.312	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
22	Std.	86.61	22.000	0.375	86.61	21.250	610	770	720	890	1290	1410	1600	1720	1840	1990	2150	2450
22		93.63	22.000	0.406	93.63	21.188	660	830	780	970	1400	1530	1730	1860	1990	2160	2330	2660
22		100.86	22.000	0.438	100.86	21.124	720	900	840	1050	1510	1650	1860	2010	2150	2330	2510	2870
22		107.85	22.000	0.469	107.85	21.062	770	960	900	1120	1610	1770	2000	2150	2300	2490	2690	3000
22	XS	114.81	22.000	0.500	114.81	21.000	820	1020	950	1190	1720	1880	2130	2290	2450	2660	2860	3000
22		128.67	22.000	0.562	128.67	20.876	920	1150	1070	1340	1930	2120	2390	2570	2760	2990	3000	3000
22		142.68	22.000	0.625	142.68	20.750	1020	1280	1190	1490	2150	2350	2660	2860	3000	3000	3000	3000
22		156.60	22.000	0.688	156.60	20.624	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
22		170.21	22.000	0.750	170.21	20.500	1230	1530	1430	1790	2580	2820	3000	3000	3000	3000	3000	3000
22		183.75	22.000	0.812	183.75	20.376	1330	1660	1550	1940	2790	3000	3000	3000	3000	3000	3000	3000
22		197.41	22.000	0.875	197.41	20.250	1430	1790	1670	2090	3000	3000	3000	3000	3000	3000	3000	3000
22		211.00	22.000	0.938	211.00	20.124	1530	1920	1790	2240	3000	3000	3000	3000	3000	3000	3000	3000
22		224.28	22.000	1.000	224.28	20.000	1640	2050	1910	2390	3000	3000	3000	3000	3000	3000	3000	3000
22		237.48	22.000	1.062	237.48	19.876	1740	2170	2030	2500	3000	3000	3000	3000	3000	3000	3000	3000
22		250.81	22.000	1.125	250.81	19.750	1840	2300	2150	2500	3000	3000	3000	3000	3000	3000	3000	3000
22		264.06	22.000	1.188	264.06	19.626	1940	2430	2270	2500	3000	3000	3000	3000	3000	3000	3000	3000
22		277.01	22.000	1.250	277.01	19.500	2050	2500	2390	2500	3000	3000	3000	3000	3000	3000	3000	3000
22		289.88	22.000	1.312	289.88	19.376	2150	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
22		302.88	22.000	1.375	302.88	19.250	2250	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
22		315.79	22.000	1.438	315.79	19.126	2350	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
22		328.41	22.000	1.500	328.41	19.000	2450	2500	2500	2500	3000	3000	3000	3000	3000	3000	3000	3000
24[c]		63.41	24.000	0.250	63.41	23.500	380	470	440	550	790	860	980	1050	1130	1220	1310	1500
24[c]		71.18	24.000	0.281	71.18	23.438	420	530	490	610	890	970	1100	1180	1260	1370	1480	1690
24		78.93	24.000	0.312	78.93	23.376	470	580	550	680	980	1080	1220	1310	1400	1520	1640	1870
24		86.91	24.000	0.344	86.91	23.312	520	640	600	750	1080	1190	1340	1440	1550	1680	1810	2060
24	Std.	94.62	24.000	0.375	94.62	23.250	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
24		102.31	24.000	0.406	102.31	23.188	610	760	710	890	1280	1400	1580	1710	1830	1980	2130	2440
24		110.22	24.000	0.438	110.22	23.124	660	820	770	960	1380	1510	1710	1840	1970	2140	2300	2630
24		117.86	24.000	0.469	117.86	23.062	700	880	820	1030	1480	1620	1830	1970	2110	2290	2460	2810

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
24	XS	125.49	24.000	0.500	125.49	23.000	750	940	880	1090	1580	1730	1950	2100	2250	2440	2630	3000
24		140.68	24.000	0.562	140.68	22.876	840	1050	980	1230	1770	1940	2190	2360	2530	2740	2950	3000
24		156.03	24.000	0.625	156.03	22.750	940	1170	1090	1370	1970	2160	2440	2630	2810	3000	3000	3000
24		171.29	24.000	0.688	171.29	22.624	1030	1290	1200	1500	2170	2370	2680	2890	3000	3000	3000	3000
24		186.23	24.000	0.750	186.23	22.500	1120	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
24		201.09	24.000	0.812	201.09	22.376	1220	1520	1420	1780	2560	2800	2930	3000	3000	3000	3000	3000
24		216.10	24.000	0.875	216.10	22.250	1310	1640	1530	1910	2760	3000	3000	3000	3000	3000	3000	3000
24		231.03	24.000	0.938	231.03	22.124	1410	1760	1640	2050	2950	3000	3000	3000	3000	3000	3000	3000
24		245.64	24.000	1.000	245.64	22.000	1500	1880	1750	2190	3000	3000	3000	3000	3000	3000	3000	3000
24		260.17	24.000	1.062	260.17	21.876	1590	1990	1860	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		274.84	24.000	1.125	274.84	21.750	1690	2110	1970	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		289.44	24.000	1.188	289.44	21.626	1780	2230	2080	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		303.71	24.000	1.250	303.71	21.500	1880	2300	2190	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		317.91	24.000	1.312	317.91	21.376	1970	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		332.25	24.000	1.375	332.25	21.250	2060	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		346.50	24.000	1.438	346.50	21.126	2160	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		360.45	24.000	1.500	360.45	21.000	2250	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
24		374.31	24.000	1.562	374.31	20.876	2300	2300	2300	2300	3000	3000	3000	3000	3000	3000	3000	3000
26[c]		68.75	26.000	0.250	68.75	25.500	350	430	400	500	730	800	900	970	1040	1130	1210	1380
26[c]		77.18	26.000	0.281	77.18	25.438	390	490	450	570	820	890	1010	1090	1170	1260	1360	1560
26		85.60	26.000	0.312	85.60	25.376	430	540	500	630	910	990	1120	1210	1300	1400	1510	1730
26		94.26	26.000	0.344	94.26	25.312	480	600	560	690	1000	1100	1240	1330	1430	1550	1670	1910
26	Std.	102.63	26.000	0.375	102.63	25.250	520	650	610	760	1090	1190	1350	1450	1560	1690	1820	2080
26		110.98	26.000	0.406	110.98	25.188	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250
26		119.57	26.000	0.438	119.57	25.124	610	760	710	880	1270	1390	1580	1700	1820	1970	2120	2430
26		127.88	26.000	0.469	127.88	25.062	650	810	760	950	1360	1490	1690	1820	1950	2110	2270	2600
26	XS	136.17	26.000	0.500	136.17	25.000	690	870	810	1010	1450	1590	1800	1940	2080	2250	2420	2770
26		152.68	26.000	0.562	152.68	24.876	780	970	910	1130	1630	1790	2020	2180	2330	2530	2720	3000
26		169.38	26.000	0.625	169.38	24.750	870	1080	1010	1260	1820	1990	2250	2420	2600	2810	3000	3000
26		185.99	26.000	0.688	185.99	24.624	950	1190	1110	1390	2000	2190	2480	2670	2860	3000	3000	3000
26		202.25	26.000	0.750	202.25	24.500	1040	1300	1210	1510	2180	2390	2700	2910	3000	3000	3000	3000
26		218.43	26.000	0.812	218.43	24.376	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
26		234.79	26.000	0.875	234.79	24.250	1210	1510	1410	1770	2540	2790	3000	3000	3000	3000	3000	3000
26		251.07	26.000	0.938	251.07	24.124	1300	1620	1520	1890	2730	2990	3000	3000	3000	3000	3000	3000
26		267.00	26.000	1.000	267.00	24.000	1380	1730	1620	2000	2910	3000	3000	3000	3000	3000	3000	3000
28[c]		74.09	28.000	0.250	74.09	27.500	320	400	370	470	680	740	840	900	960	1040	1130	1290
28[c]		83.19	28.000	0.281	83.19	27.438	360	450	420	530	760	830	940	1010	1080	1170	1260	1450
28		92.26	28.000	0.312	92.26	27.376	400	500	470	580	840	920	1040	1120	1200	1300	1400	1600
28		101.61	28.000	0.344	101.61	27.312	440	550	520	650	930	1020	1150	1240	1330	1440	1550	1770
28	Std.	110.64	28.000	0.375	110.64	27.250	480	600	560	700	1010	1110	1250	1350	1450	1570	1690	1930
28		119.65	28.000	0.406	119.65	27.188	520	650	610	760	1100	1200	1360	1460	1570	1700	1830	2090
28		128.93	28.000	0.438	128.93	27.124	560	700	660	820	1180	1300	1460	1580	1690	1830	1970	2250
28		137.90	28.000	0.469	137.90	27.062	600	750	700	880	1270	1390	1570	1690	1810	1960	2110	2410

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
28	XS	146.85	28.000	0.500	146.85	27.000	640	800	750	940	1350	1480	1670	1800	1930	2090	2250	2570
28		164.69	28.000	0.562	164.69	26.876	720	900	840	1050	1520	1660	1880	2020	2170	2350	2530	2890
28		182.73	28.000	0.625	182.73	26.750	800	1000	940	1170	1690	1850	2090	2250	2410	2610	2810	3000
28		200.68	28.000	0.688	200.68	26.624	880	1110	1030	1290	1860	2030	2300	2480	2650	2870	3000	3000
28		218.27	28.000	0.750	218.27	26.500	960	1210	1120	1410	2020	2220	2510	2700	2890	3000	3000	3000
28		235.78	28.000	0.812	235.78	26.376	1040	1300	1220	1520	2190	2400	2710	2920	3000	3000	3000	3000
28		253.48	28.000	0.875	253.48	26.250	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
28		271.10	28.000	0.938	271.10	26.124	1210	1510	1410	1760	2530	2770	3000	3000	3000	3000	3000	3000
28		288.36	28.000	1.000	288.36	26.000	1290	1610	1500	1880	2700	2960	3000	3000	3000	3000	3000	3000
30[c]		79.43	30.000	0.250	79.43	29.500	300	370	350	440	630	690	780	840	900	980	1050	1200
30[c]		89.19	30.000	0.281	89.19	29.438	340	420	390	490	710	780	880	940	1010	1100	1180	1350
30		98.93	30.000	0.312	98.93	29.376	370	470	440	550	790	860	970	1050	1120	1220	1310	1500
30		108.95	30.000	0.344	108.95	29.312	410	520	480	600	870	950	1070	1160	1240	1340	1440	1650
30	Std.	118.65	30.000	0.375	118.65	29.250	450	560	520	660	940	1040	1170	1260	1350	1460	1580	1800
30		128.32	30.000	0.406	128.32	29.188	490	610	590	710	1020	1120	1270	1360	1460	1580	1710	1950
30		138.29	30.000	0.438	138.29	29.124	530	660	610	770	1100	1210	1370	1470	1580	1710	1840	2100
30		147.92	30.000	0.469	147.92	29.062	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
30	XS	157.53	30.000	0.500	157.53	29.000	600	750	700	880	1260	1380	1560	1680	1800	1950	2100	2400
30		176.69	30.000	0.562	176.69	28.876	670	840	790	980	1420	1550	1750	1890	2020	2190	2360	2700
30		196.08	30.000	0.625	196.08	28.750	750	940	880	1090	1580	1720	1950	2100	2250	2440	2630	3000
30		215.38	30.000	0.688	215.38	28.624	830	1030	960	1200	1730	1900	2150	2310	2480	2680	2890	3000
30		234.29	30.000	0.750	234.29	28.500	900	1120	1050	1310	1890	2070	2340	2520	2700	2920	3000	3000
30		253.12	30.000	0.812	253.12	28.376	970	1220	1140	1420	2050	2240	2530	2730	2920	3000	3000	3000
30		272.17	30.000	0.875	272.17	28.250	1050	1310	1220	1530	2200	2420	2730	2940	3000	3000	3000	3000
30		291.14	30.000	0.938	291.14	28.124	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
30		309.72	30.000	1.000	309.72	28.000	1200	1500	1400	1750	2520	2760	3000	3000	3000	3000	3000	3000
30		328.22	30.000	1.062	328.22	27.876	1270	1590	1490	1860	2680	2930	3000	3000	3000	3000	3000	3000
30		346.93	30.000	1.125	346.93	27.750	1350	1690	1580	1970	2840	3000	3000	3000	3000	3000	3000	3000
30		365.56	30.000	1.188	365.56	27.624	1430	1780	1660	2080	2990	3000	3000	3000	3000	3000	3000	3000
30		383.81	30.000	1.250	383.81	27.500	1500	1880	1750	2190	3000	3000	3000	3000	3000	3000	3000	3000
32[c]		84.77	32.000	0.250	84.77	31.500	280	350	330	410	590	650	730	790	840	910	980	1130
32[c]		95.19	32.000	0.281	95.19	31.438	320	400	370	460	660	730	820	890	950	1030	1110	1260
32		105.59	32.000	0.312	105.59	31.376	350	440	410	510	740	810	910	980	1050	1140	1230	1400
32		116.30	32.000	0.344	116.30	31.312	390	480	450	560	810	890	1010	1080	1160	1260	1350	1550
32	Std.	126.66	32.000	0.375	126.66	31.250	420	530	490	620	890	970	1100	1180	1270	1370	1480	1690
32		136.99	32.000	0.406	136.99	31.188	460	570	530	670	960	1050	1190	1280	1370	1480	1600	1830
32		147.64	32.000	0.438	147.64	31.124	490	620	570	720	1030	1130	1280	1380	1480	1600	1720	1970
32		157.94	32.000	0.469	157.94	31.062	530	660	620	770	1110	1210	1370	1480	1580	1710	1850	2110
32	XS	168.21	32.000	0.500	168.21	31.000	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
32		188.70	32.000	0.562	188.70	30.876	630	790	740	920	1330	1450	1640	1770	1900	2050	2210	2530
32		209.43	32.000	0.625	209.43	30.750	700	880	820	1030	1480	1620	1830	1970	2110	2290	2460	2810
32		230.08	32.000	0.688	230.08	30.624	770	970	900	1130	1630	1780	2010	2170	2320	2520	2710	3000
32		250.31	32.000	0.750	250.31	30.500	840	1050	980	1230	1770	1940	2190	2360	2530	2740	2950	3000

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
32		270.47	32.000	0.812	270.47	30.376	910	1140	1070	1330	1920	2100	2380	2560	2740	2970	3000	3000
32		290.86	32.000	0.875	290.86	30.250	980	1230	1150	1440	2070	2260	2560	2760	2950	3000	3000	3000
32		311.17	32.000	0.938	311.17	30.124	1060	1320	1230	1540	2220	2430	2740	2950	3000	3000	3000	3000
32		331.08	32.000	1.000	331.08	30.000	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
32		350.90	32.000	1.062	350.90	29.876	1190	1490	1390	1740	2510	2750	3000	3000	3000	3000	3000	3000
32		370.96	32.000	1.125	370.96	29.750	1270	1580	1480	1850	2660	2910	3000	3000	3000	3000	3000	3000
32		390.94	32.000	1.188	390.94	29.624	1340	1670	1560	1950	2810	3000	3000	3000	3000	3000	3000	3000
32		410.51	32.000	1.250	410.51	29.500	1410	1760	1640	2050	2950	3000	3000	3000	3000	3000	3000	3000
34[c]		90.11	34.000	0.250	90.11	33.500	260	330	310	390	560	610	690	740	790	860	930	1060
34[c]		101.19	34.000	0.281	101.19	33.438	300	370	350	430	620	680	770	830	890	970	1040	1190
34		112.25	34.000	0.312	112.25	33.376	330	410	390	480	690	760	860	920	990	1070	1160	1320
34		123.65	34.000	0.344	123.65	33.312	360	460	420	530	760	840	950	1020	1090	1180	1270	1460
34	Std.	134.67	34.000	0.375	134.67	33.250	400	500	460	580	830	910	1030	1110	1190	1290	1390	1590
34		145.67	34.000	0.406	145.67	33.188	430	540	500	630	900	990	1120	1200	1290	1400	1500	1720
34		157.00	34.000	0.438	157.00	33.124	460	580	540	680	970	1070	1210	1300	1390	1510	1620	1860
34		167.95	34.000	0.469	167.95	33.062	500	620	580	720	1040	1140	1290	1390	1490	1610	1740	1990
34	XS	178.89	34.000	0.500	178.89	33.000	530	660	620	770	1110	1220	1380	1480	1590	1720	1850	2120
34		200.70	34.000	0.562	200.70	32.876	600	740	690	870	1250	1370	1550	1670	1790	1930	2080	2380
34		222.78	34.000	0.625	222.78	32.750	660	830	770	970	1390	1520	1720	1850	1990	2150	2320	2650
34		244.77	34.000	0.688	244.77	32.624	730	910	850	1060	1530	1680	1890	2040	2190	2370	2550	2910
34		266.33	34.000	0.750	266.33	32.500	790	990	930	1160	1670	1830	2060	2220	2380	2580	2780	3000
34		287.81	34.000	0.812	287.81	32.376	860	1070	1000	1250	1810	1980	2240	2410	2580	2790	3000	3000
34		309.55	34.000	0.875	309.55	32.250	930	1160	1080	1350	1950	2130	2410	2590	2780	3000	3000	3000
34		331.21	34.000	0.938	331.21	32.124	990	1240	1160	1450	2090	2280	2580	2780	2980	3000	3000	3000
34		352.44	34.000	1.000	352.44	32.000	1060	1320	1240	1540	2220	2440	2750	2960	3000	3000	3000	3000
34		373.59	34.000	1.062	373.59	31.876	1120	1410	1310	1640	2360	2590	2920	3000	3000	3000	3000	3000
34		394.99	34.000	1.125	394.99	31.750	1190	1490	1390	1740	2500	2740	3000	3000	3000	3000	3000	3000
34		416.31	34.000	1.188	416.31	31.624	1260	1570	1470	1830	2640	2890	3000	3000	3000	3000	3000	3000
34		437.21	34.000	1.250	437.21	31.500	1320	1650	1540	1930	2780	3000	3000	3000	3000	3000	3000	3000
36[c]		95.45	36.000	0.250	95.45	35.500	250	310	290	360	520	580	650	700	750	810	880	1000
36[c]		107.20	36.000	0.281	107.20	35.438	280	350	330	410	590	650	730	790	840	910	980	1120
36		118.92	36.000	0.312	118.92	35.376	310	390	360	450	660	720	810	870	940	1010	1090	1250
36		131.00	36.000	0.344	131.00	35.312	340	430	400	500	720	790	890	960	1030	1120	1200	1380
36	Std.	142.68	36.000	0.375	142.68	35.250	380	470	440	550	790	860	980	1050	1120	1220	1310	1500
36		154.34	36.000	0.406	154.34	35.188	410	510	470	590	850	930	1060	1140	1220	1320	1420	1620
36		166.35	36.000	0.438	166.35	35.124	440	550	510	640	920	1010	1140	1230	1310	1420	1530	1750
36		177.97	36.000	0.469	177.97	35.062	770	590	550	680	980	1080	1220	1310	1410	1520	1640	1880
36	XS	189.57	36.000	0.500	189.57	35.000	500	620	580	730	1050	1150	1300	1400	1500	1620	1750	2000
36		212.70	36.000	0.562	212.70	34.876	560	700	660	820	1180	1290	1460	1570	1690	1820	1970	2250
36		236.13	36.000	0.625	236.13	34.750	620	780	730	910	1310	1440	1620	1750	1880	2030	2190	2500
36		259.47	36.000	0.688	259.47	34.624	690	860	800	1000	1440	1580	1790	1930	2060	2240	2410	2750
36		282.35	36.000	0.750	282.35	34.500	750	940	880	1090	1580	1720	1950	2100	2250	2440	2630	3000
36		305.16	36.000	0.812	305.16	34.376	810	1020	950	1180	1710	1870	2110	2270	2440	2640	2840	3000

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
36		328.24	36.000	0.875	328.24	34.250	880	1090	1020	1280	1840	2010	2280	2450	2620	2840	3000	3000
36		351.25	36.000	0.938	351.25	34.124	940	1170	1090	1370	1970	2160	2440	2630	2810	3000	3000	3000
36		373.80	36.000	1.000	373.80	34.000	1000	1250	1170	1460	2100	2300	2600	2800	3000	3000	3000	3000
36		396.27	36.000	1.062	396.27	33.876	1060	1330	1240	1550	2230	2440	2760	2970	3000	3000	3000	3000
36		419.02	36.000	1.125	419.02	33.750	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
36		441.69	36.000	1.188	441.69	33.624	1190	1480	1390	1730	2490	2730	3000	3000	3000	3000	3000	3000
36		463.91	36.000	1.250	463.91	33.500	1250	1560	1460	1820	2630	2870	3000	3000	3000	3000	3000	3000
38		125.58	38.000	0.312	125.58	37.376	300	370	340	430	620	680	770	830	890	960	1030	1180
38		138.35	38.000	0.344	138.35	37.312	330	410	380	480	680	750	850	910	980	1060	1140	1300
38	Std.	150.69	38.000	0.375	150.69	37.250	360	440	410	520	750	820	920	990	1070	1150	1240	1420
38		163.01	38.000	0.406	163.01	37.188	380	480	450	560	810	880	1000	1080	1150	1250	1350	1540
38		175.71	38.000	0.438	175.71	37.124	410	520	480	610	870	950	1080	1160	1240	1350	1450	1660
38		187.99	38.000	0.469	187.99	37.062	440	560	520	650	930	1020	1160	1240	1330	1440	1560	1780
38	XS	200.25	38.000	0.500	200.25	37.000	470	590	550	690	990	1090	1230	1330	1420	1540	1660	1890
38		224.71	38.000	0.562	224.71	36.876	530	670	620	780	1120	1220	1380	1490	1600	1730	1860	2130
38		249.48	38.000	0.625	249.48	36.750	590	740	690	860	1240	1360	1540	1560	1780	1920	2070	2370
38		274.16	38.000	0.688	274.16	36.624	650	810	760	950	1370	1500	1690	1830	1960	2120	2280	2610
38		298.37	38.000	0.750	298.37	36.500	710	890	830	1040	1490	1630	1850	1990	2130	2310	2490	2840
38		322.50	38.000	0.812	322.50	36.376	770	960	900	1120	1620	1770	2000	2150	2310	2500	2690	3000
38		346.93	38.000	0.875	346.93	36.250	830	1040	970	1210	1740	1910	2160	2320	2490	2690	2900	3000
38		371.28	38.000	0.938	371.28	36.124	890	1110	1040	1300	1870	2040	2310	2490	2670	2890	3000	3000
38		395.16	38.000	1.000	395.16	36.000	950	1180	1110	1380	1990	2180	2460	2650	2840	3000	3000	3000
38		418.96	38.000	1.062	418.96	35.876	1010	1260	1170	1470	2110	2310	2620	2820	3000	3000	3000	3000
38		443.05	38.000	1.125	443.05	35.750	1070	1330	1240	1550	2240	2450	2770	2980	3000	3000	3000	3000
38		467.06	38.000	1.188	467.06	35.624	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
38		490.61	38.000	1.250	490.61	35.500	1180	1480	1380	1730	2490	2720	3000	3000	3000	3000	3000	3000
40		132.25	40.000	0.312	132.25	39.376	280	350	330	410	590	650	730	790	840	910	980	1120
40		145.69	40.000	0.344	145.69	39.312	310	390	360	450	650	710	800	870	930	1010	1080	1240
40	Std.	158.70	40.000	0.375	158.70	39.250	340	420	390	490	710	780	880	940	1010	1100	1180	1350
40		171.68	40.000	0.406	171.68	39.188	370	460	430	530	770	840	950	1020	1100	1190	1280	1460
40		185.06	40.000	0.438	185.06	39.124	390	490	460	570	830	910	1020	1100	1180	1280	1380	1580
40		198.01	40.000	0.469	198.01	39.062	420	530	490	620	890	970	1100	1180	1270	1370	1480	1690
40	XS	210.93	40.000	0.500	210.93	39.000	450	560	520	660	940	1040	1170	1260	1350	1460	1580	1800
40		236.71	40.000	0.562	236.71	38.876	510	630	590	740	1060	1160	1320	1420	1520	1640	1770	2020
40		262.83	40.000	0.625	262.83	38.750	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
40		288.86	40.000	0.688	288.86	38.624	620	770	720	900	1300	1420	1610	1730	1860	2010	2170	2480
40		314.39	40.000	0.750	314.39	38.500	680	840	790	980	1420	1550	1760	1890	2020	2190	2360	2700
40		339.84	40.000	0.812	339.84	38.376	730	910	850	1070	1530	1680	1900	2050	2190	2380	2560	2920
40		365.62	40.000	0.875	365.62	38.250	790	980	920	1150	1650	1810	2050	2200	2360	2560	2760	3000
40		391.32	40.000	0.938	391.32	38.124	840	1060	980	1230	1770	1940	2190	2360	2530	2740	2950	3000
40		416.52	40.000	1.000	416.52	38.000	900	1120	1050	1310	1890	2070	2340	2520	2700	2920	3000	3000
40		441.64	40.000	1.062	441.64	37.876	960	1190	1120	1390	2010	2200	2490	2680	2870	3000	3000	3000
40		467.08	40.000	1.125	467.08	37.750	1010	1270	1180	1480	2130	2330	2630	2830	3000	3000	3000	3000
40		492.44	40.000	1.188	492.44	37.624	1070	1340	1250	1560	2250	2460	2780	2990	3000	3000	3000	3000

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
40		517.31	40.000	1.250	517.31	37.500	1130	1410	1310	1640	2360	2590	2930	3000	3000	3000	3000	3000
42		153.04	42.000	0.344	153.04	41.312	290	370	340	430	620	680	770	830	880	960	1030	1180
42	Std.	166.71	42.000	0.375	166.71	41.250	320	400	380	470	680	740	840	900	960	1040	1130	1290
42		180.35	42.000	0.406	180.35	41.188	350	430	410	510	730	800	900	970	1040	1130	1220	1390
42		194.42	42.000	0.438	194.42	41.124	380	470	440	550	790	860	980	1050	1130	1220	1310	1500
42		208.03	42.000	0.469	208.03	41.062	400	500	470	590	840	920	1050	1130	1210	1310	1410	1610
42	XS	221.61	42.000	0.500	221.61	41.000	430	540	500	620	900	990	1110	1200	1290	1390	1500	1710
42		248.72	42.000	0.562	248.72	40.876	480	600	560	700	1010	1110	1250	1350	1450	1570	1690	1930
42		276.18	42.000	0.625	276.18	40.750	540	670	620	780	1120	1230	1390	1500	1610	1740	1880	2140
42		303.55	42.000	0.688	303.55	40.624	590	740	690	860	1240	1360	1530	1650	1770	1920	2060	2360
42		330.41	42.000	0.750	330.41	40.500	640	800	750	940	1350	1480	1670	1800	1930	2090	2250	2570
42		357.19	42.000	0.812	357.19	40.376	700	870	810	1020	1460	1600	1810	1950	2090	2260	2440	2780
42		384.31	42.000	0.875	384.31	40.250	750	940	880	1090	1580	1720	1950	2100	2250	2440	2630	3000
42		411.35	42.000	0.938	411.35	40.124	800	1000	940	1170	1690	1850	2090	2250	2410	2610	2810	3000
42		437.88	42.000	1.000	437.88	40.000	860	1070	1000	1250	1800	1970	2330	2400	2570	2790	3000	3000
42		464.32	42.000	1.062	464.32	39.876	910	1140	1060	1330	1910	2090	2370	2550	2730	2960	3000	3000
42		491.11	42.000	1.125	491.11	39.750	960	1210	1130	1410	2030	2220	2510	2700	2890	3000	3000	3000
42		517.82	42.000	1.188	517.82	39.624	1020	1270	1190	1480	2140	2340	2650	2850	3000	3000	3000	3000
42		554.01	42.000	1.250	554.01	39.500	1070	1340	1250	1560	2250	2460	2790	3000	3000	3000	3000	3000
44		160.39	44.000	0.344	160.39	43.312	280	350	330	410	590	650	730	790	840	910	990	1130
44	Std.	174.72	44.000	0.375	174.72	43.250	310	380	360	450	640	710	800	860	920	1000	1070	1230
44		189.03	44.000	0.406	189.03	43.188	330	420	390	480	700	760	860	930	1000	1080	1160	1330
44		203.78	44.000	0.438	203.78	43.124	360	450	420	520	750	820	930	1000	1080	1160	1250	1430
44		218.04	44.000	0.469	218.04	43.062	380	480	450	560	810	880	1000	1070	1150	1250	1340	1530
44	XS	232.29	44.000	0.500	232.29	43.000	410	510	480	600	860	940	1060	1150	1230	1330	1430	1640
44		260.72	44.000	0.562	260.72	42.876	460	570	540	670	970	1060	1200	1290	1380	1490	1610	1840
44		289.53	44.000	0.625	289.53	42.750	510	640	600	750	1070	1180	1330	1430	1530	1660	1790	2050
44		318.25	44.000	0.688	318.25	42.624	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
44		346.43	44.000	0.750	346.43	42.500	610	770	720	890	1290	1410	1600	1720	1840	1990	2150	2450
44		374.53	44.000	0.812	374.53	42.376	660	830	780	970	1400	1530	1730	1860	1990	2160	2330	2600
44		403.00	44.000	0.875	403.00	42.250	720	890	840	1040	1500	1650	1860	2000	2150	2330	2510	2860
44		431.39	44.000	0.938	431.39	42.124	770	960	900	1120	1610	1770	2000	2150	2300	2490	2690	3000
44		459.24	44.000	1.000	459.24	42.000	820	1020	950	1190	1720	1880	2130	2290	2450	2660	2860	3000
44		487.01	44.000	1.062	487.01	41.876	870	1090	1010	1270	1820	2000	2260	2430	2610	2820	3000	3000
44		515.14	44.000	1.125	515.14	41.750	920	1150	1070	1340	1930	2120	2390	2580	2760	2990	3000	3000
44		543.19	44.000	1.188	543.19	41.624	970	1210	1130	1420	2040	2240	2530	2720	2920	3000	3000	3000
44		570.71	44.000	1.250	570.71	41.500	1020	1280	1190	1490	2150	2350	2660	2860	3000	3000	3000	3000
46		167.74	46.000	0.344	167.74	45.312	270	340	310	390	570	620	700	750	810	870	940	1080
46	Std.	182.73	46.000	0.375	182.73	45.250	290	370	340	430	620	680	760	820	880	950	1030	1170
46		197.70	46.000	0.406	197.70	45.188	320	400	370	460	670	730	830	890	950	1030	1110	1270
46		213.13	46.000	0.438	213.13	45.124	340	430	400	500	720	790	890	960	1030	1110	1200	1370
46		228.06	46.000	0.469	228.06	45.062	370	460	430	540	770	840	950	1030	1100	1190	1280	1470

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
46	XS	242.97	46.000	0.500	242.97	45.000	390	490	460	570	820	900	1020	1100	1170	1270	1370	1570
46		272.73	46.000	0.562	272.73	44.876	440	550	510	640	920	1010	1140	1230	1320	1430	1540	1760
46		302.88	46.000	0.625	302.88	44.750	490	610	570	710	1030	1120	1270	1370	1470	1590	1710	1960
46		332.95	46.000	0.688	332.95	44.624	540	670	630	790	1130	1240	1400	1510	1620	1750	1880	2150
46		362.45	46.000	0.750	362.45	44.500	590	730	680	860	1230	1350	1530	1640	1760	1910	2050	2350
46		391.88	46.000	0.812	391.88	44.376	640	790	740	930	1330	1460	1650	1780	1910	2070	2220	2540
46		421.69	46.000	0.875	421.69	44.250	680	860	800	1000	1440	1580	1780	1920	2050	2230	2400	2740
46		451.42	46.000	0.938	451.42	44.124	730	920	860	1070	1540	1690	1910	2060	2200	2390	2570	2940
46		480.60	46.000	1.000	480.60	44.000	780	980	910	1140	1640	1800	2030	2190	2350	2540	2740	3000
46		509.69	46.000	1.062	509.69	43.876	830	1040	970	1210	1750	1910	2160	2330	2490	2700	2910	3000
46		539.17	46.000	1.125	539.17	43.750	880	1100	1030	1280	1850	2020	2290	2470	2640	2860	3000	3000
46		568.57	46.000	1.188	568.57	43.624	930	1160	1080	1360	1950	2140	2420	2600	2790	3000	3000	3000
46		597.41	46.000	1.250	597.41	43.500	980	1220	1140	1430	2050	2250	2540	2740	2930	3000	3000	3000
48		175.08	48.000	0.344	175.08	47.312	260	320	300	380	540	590	670	720	770	840	900	1030
48	Std.	190.74	48.000	0.375	190.74	47.250	280	350	330	410	590	650	730	790	840	910	980	1130
48		206.37	48.000	0.406	206.37	47.188	300	380	360	440	640	700	790	850	910	990	1070	1220
48		222.49	48.000	0.438	222.49	47.124	330	410	380	480	690	760	850	920	990	1070	1150	1310
48		238.08	48.000	0.469	238.08	47.062	350	440	410	510	740	810	910	980	1060	1140	1230	1410
48	XS	253.65	48.000	0.500	253.65	47.000	380	470	440	550	790	860	980	1050	1120	1220	1310	1500
48		284.73	48.000	0.562	284.73	46.876	420	530	490	610	890	970	1100	1180	1260	1370	1480	1690
48		316.23	48.000	0.625	316.23	46.750	470	590	550	680	980	1080	1220	1310	1410	1520	1640	1880
48		347.64	48.000	0.688	347.64	46.624	520	640	600	750	1080	1190	1340	1440	1550	1680	1810	2060
48		378.47	48.000	0.750	378.47	46.500	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
48		409.22	48.000	0.812	409.22	46.376	610	760	710	890	1280	1400	1580	1710	1830	1980	2130	2440
48		440.38	48.000	0.875	440.38	46.250	660	820	770	960	1380	1510	1710	1840	1970	2130	2300	2630
48		471.46	48.000	0.938	471.46	46.124	700	880	820	1030	1480	1620	1830	1970	2110	2290	2460	2810
48		501.96	48.000	1.000	501.96	46.000	750	940	880	1090	1580	1720	1950	2100	2250	2440	2630	3000
48		532.38	48.000	1.062	532.38	45.876	800	1000	930	1160	1670	1830	2070	2230	2390	2590	2790	3000
48		563.20	48.000	1.125	563.20	45.750	840	1050	980	1230	1770	1940	2190	2360	2530	2740	2950	3000
48		593.94	48.000	1.188	593.94	45.624	890	1110	1040	1300	1870	2050	2320	2490	2670	2900	3000	3000
48		624.11	48.000	1.250	624.11	45.500	940	1170	1090	1370	1970	2160	2440	2620	2810	3000	3000	3000
52	Std.	206.76	52.000	0.375	206.76	51.250	260	320	300	380	550	600	680	730	780	840	910	1040
52		223.72	52.000	0.406	223.72	51.188	280	350	330	410	590	650	730	790	840	910	980	1120
52		241.20	52.000	0.438	241.20	51.124	300	380	350	440	640	700	790	850	910	990	1060	1210
52		258.11	52.000	0.469	258.11	51.062	320	410	380	470	680	750	840	910	970	1060	1140	1300
52	XS	275.01	52.000	0.500	275.01	51.000	350	430	400	500	730	800	900	970	1040	1130	1210	1380
52		308.74	52.000	0.562	308.74	50.876	390	490	450	570	820	890	1010	1090	1170	1260	1360	1560
52		342.93	52.000	0.625	342.93	50.750	430	540	500	630	910	1000	1130	1210	1300	1410	1510	1730
52		377.03	52.000	0.688	377.03	50.624	480	600	560	690	1000	1100	1240	1330	1430	1550	1670	1910
52		410.51	52.000	0.750	410.51	50.500	520	650	610	760	1090	1190	1350	1450	1560	1690	1820	2080
52		443.91	52.000	0.812	443.91	50.376	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250
52		477.76	52.000	0.875	477.76	50.250	610	760	710	880	1270	1390	1580	1700	1820	1970	2120	2420
52		511.53	52.000	0.938	511.53	50.124	650	810	760	950	1360	1490	1690	1820	1950	2110	2270	2600

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
52		544.68	52.000	1.000	544.68	50.000	690	870	810	1010	1450	1590	1800	1940	2080	2250	2420	2770
52		577.75	52.000	1.062	577.75	49.876	740	920	860	1070	1540	1690	1910	2060	2210	2390	2570	2940
52		611.26	52.000	1.125	611.26	49.750	780	970	910	1140	1640	1790	2030	2180	2340	2530	2730	3000
52		644.69	52.000	1.188	644.69	49.624	820	1030	960	1200	1730	1890	2140	2300	2470	2670	2880	3000
52		677.51	52.000	1.250	677.51	49.500	870	1080	1010	1260	1820	1990	2250	2420	2600	2810	3000	3000
56		222.78	56.000	0.375	222.78	55.250	240	300	280	350	510	550	630	670	720	780	840	960
56		241.06	56.000	0.406	241.06	55.188	260	330	300	380	550	600	680	730	780	850	910	1040
56		259.91	56.000	0.438	259.91	55.124	280	350	330	410	590	650	730	790	840	920	990	1130
56		278.15	56.000	0.469	278.15	55.062	300	380	350	440	630	690	780	840	900	980	1060	1210
56		296.37	56.000	0.500	296.37	55.000	320	400	380	470	680	740	840	900	960	1040	1130	1290
56		332.75	56.000	0.562	332.75	54.876	360	450	420	530	760	830	940	1010	1080	1170	1260	1450
56		369.63	56.000	0.625	369.63	54.750	400	500	470	590	840	920	1040	1120	1210	1310	1410	1610
56		406.42	56.000	0.688	406.42	54.624	440	550	520	650	930	1020	1150	1240	1330	1440	1550	1770
56		442.55	56.000	0.750	442.55	54.500	480	600	560	700	1010	1110	1250	1350	1450	1570	1690	1930
56		478.60	56.000	0.812	478.60	54.376	520	650	610	760	1100	1200	1360	1460	1570	1700	1830	2090
56		515.14	56.000	0.875	515.14	54.250	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250
56		551.60	56.000	0.938	551.60	54.124	600	750	700	880	1270	1390	1570	1690	1810	1960	2110	2410
56		587.40	56.000	1.000	587.40	54.000	640	800	750	940	1350	1480	1670	1800	1930	2090	2250	2570
56		623.12	56.000	1.062	623.12	53.876	680	850	800	1000	1430	1570	1780	1910	2050	2220	2390	2730
56		659.32	56.000	1.125	659.32	53.750	720	900	840	1050	1520	1660	1880	2020	2170	2350	2530	2890
56		695.45	56.000	1.188	695.45	53.624	760	950	890	1110	1600	1760	1990	2140	2290	2480	2670	3000
56		730.91	56.000	1.250	730.91	53.500	800	1000	940	1170	1690	1850	2090	2250	2410	2610	2810	3000
60		238.80	60.000	0.375	238.80	59.250	230	280	260	330	470	520	590	630	680	730	790	900
60		258.40	60.000	0.406	258.40	59.188	240	300	280	360	510	560	630	680	730	790	850	970
60		278.62	60.000	0.438	278.62	59.124	260	330	310	380	550	600	680	740	790	850	920	1050
60		298.19	60.000	0.469	298.19	59.062	280	350	330	410	590	650	730	790	840	910	980	1130
60		317.73	60.000	0.500	317.73	59.000	300	380	350	440	630	690	780	840	900	980	1050	1200
60		356.76	60.000	0.562	356.76	58.876	340	420	390	490	710	780	880	940	1010	1100	1180	1350
60		396.33	60.000	0.625	396.33	58.750	380	470	440	550	790	860	980	1050	1130	1220	1310	1500
60		435.81	60.000	0.688	435.81	58.624	410	520	480	600	870	950	1070	1160	1240	1340	1440	1650
60		474.59	60.000	0.750	474.59	58.500	450	560	530	660	950	1030	1170	1260	1350	1460	1580	1800
60		513.29	60.000	0.812	513.29	58.376	490	610	570	710	1020	1120	1270	1360	1460	1580	1710	1950
60		552.52	60.000	0.875	552.52	58.250	530	660	610	770	1100	1210	1370	1470	1580	1710	1840	2100
60		591.67	60.000	0.938	591.67	58.124	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
60		630.12	60.000	1.000	630.12	58.000	600	750	700	880	1260	1380	1560	1680	1800	1950	2100	2400
60		668.48	60.000	1.062	668.48	57.876	640	800	740	930	1340	1470	1660	1780	1910	2070	2230	2550
60		707.38	60.000	1.125	707.38	57.750	680	840	790	980	1420	1550	1760	1890	2030	2190	2360	2700
60		746.20	60.000	1.188	746.20	57.624	710	890	830	1040	1500	1640	1850	2000	2140	2320	2490	2850
60		784.31	60.000	1.250	784.31	57.500	750	940	880	1090	1580	1720	1950	2100	2250	2440	2630	3000
64		254.82	64.000	0.375	254.82	63.250	210	260	250	310	440	490	550	590	630	690	740	840
64		275.75	64.000	0.406	275.75	63.188	230	290	270	330	480	530	590	640	690	740	800	910
64		297.33	64.000	0.438	297.33	63.124	250	310	290	360	520	570	640	690	740	800	860	990

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
64		318.22	64.000	0.469	318.22	63.062	260	330	310	380	550	610	690	740	790	860	920	1060
64		339.09	64.000	0.500	339.09	63.000	280	350	330	410	590	650	730	790	840	910	980	1130
64		380.76	64.000	0.562	380.76	62.876	320	400	370	460	660	730	820	890	950	1030	1110	1260
64		423.03	64.000	0.625	423.03	62.750	350	440	410	510	740	810	910	980	1050	1140	1230	1410
64		465.21	64.000	0.688	465.21	62.624	390	480	450	560	810	890	1010	1080	1160	1260	1350	1550
64		506.63	64.000	0.750	506.63	62.500	420	530	490	620	890	970	1100	1180	1270	1370	1480	1690
64		547.98	64.000	0.812	547.98	62.376	460	570	530	670	960	1050	1190	1280	1370	1480	1600	1830
64		589.90	64.000	0.875	589.90	62.250	490	620	570	720	1030	1130	1280	1380	1480	1600	1720	1970
64		631.74	64.000	0.938	631.74	62.124	530	660	620	770	1110	1210	1370	1480	1580	1710	1850	2110
64		672.84	64.000	1.000	672.84	62.000	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250
64		713.85	64.000	1.062	713.85	61.876	600	750	700	870	1250	1370	1550	1670	1790	1940	2090	2390
64		755.44	64.000	1.125	755.44	61.750	630	790	740	920	1330	1460	1650	1770	1900	2060	2210	2530
64		796.95	64.000	1.188	796.95	61.624	670	840	780	970	1400	1540	1740	1870	2000	2170	2340	2670
64		837.71	64.000	1.250	837.71	61.500	700	880	820	1030	1480	1620	1830	1970	2110	2290	2460	2810
68		338.26	68.000	0.469	338.26	67.062	250	310	290	360	520	570	650	700	740	810	870	990
68		360.45	68.000	0.500	360.45	67.000	260	330	310	390	560	610	690	740	790	860	930	1060
68		404.77	68.000	0.562	404.77	66.876	300	370	350	430	620	680	770	830	890	970	1040	1190
68		449.73	68.000	0.625	449.73	66.750	330	410	390	480	690	760	860	930	990	1080	1160	1320
68		494.60	68.000	0.688	494.60	66.624	360	460	420	530	760	840	950	1020	1090	1180	1270	1460
68		538.67	68.000	0.750	538.67	66.500	400	500	460	580	830	910	1030	1110	1190	1290	1390	1590
68		582.66	68.000	0.812	582.66	66.375	430	540	500	630	900	990	1120	1200	1290	1400	1500	1720
68		627.28	68.000	0.875	627.28	66.250	460	580	540	680	970	1070	1200	1300	1390	1510	1620	1850
68		671.82	68.000	0.938	671.82	66.124	500	620	580	720	1040	1140	1290	1390	1490	1610	1740	1990
68		715.56	68.000	1.000	715.56	66.000	530	660	620	770	1110	1220	1380	1480	1590	1720	1850	2120
68		759.22	68.000	1.062	759.22	65.875	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250
68		803.50	68.000	1.125	803.50	65.750	600	740	690	870	1250	1370	1550	1670	1790	1940	2080	2380
68		847.70	68.000	1.188	847.70	65.624	630	790	730	920	1320	1450	1640	1760	1890	2040	2200	2520
68		891.11	68.000	1.250	891.11	65.500	660	830	770	970	1390	1520	1720	1850	1990	2150	2320	2650
72		381.81	72.000	0.500	381.81	71.000	250	310	290	360	530	570	650	700	750	810	880	1000
72		428.78	72.000	0.562	428.78	70.876	280	350	330	410	590	650	730	790	840	910	980	1120
72		476.43	72.000	0.625	476.43	70.750	310	390	360	460	660	720	810	870	940	1020	1090	1250
72		523.99	72.000	0.688	523.99	70.624	340	430	400	500	720	790	890	960	1030	1120	1200	1380
72		570.71	72.000	0.750	570.71	70.500	380	470	440	550	790	860	980	1050	1130	1220	1310	1500
72		617.35	72.000	0.812	617.35	70.375	410	510	470	590	850	930	1060	1140	1220	1320	1420	1620
72		664.66	72.000	0.875	664.66	70.250	440	550	510	640	920	1010	1140	1220	1310	1420	1530	1750
72		711.89	72.000	0.938	711.89	70.124	470	590	550	680	980	1080	1220	1310	1410	1520	1640	1880
72		758.28	72.000	1.000	758.28	70.000	500	630	580	730	1050	1150	1300	1400	1500	1630	1750	2000
72		804.59	72.000	1.062	804.59	69.875	530	660	620	770	1120	1220	1380	1490	1590	1730	1860	2120
72		851.56	72.000	1.125	851.56	69.750	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250
72		898.45	72.000	1.188	898.45	69.624	590	740	690	870	1250	1370	1540	1660	1780	1930	2080	2380
72		944.51	72.000	1.250	944.51	69.500	630	780	730	910	1310	1440	1630	1750	1880	2030	2190	2500
76		403.17	76.000	0.500	403.17	75.000	240	300	280	350	500	540	620	660	710	770	830	950

Table 6C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80—Continued

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation			Outside Diameter, D (in.)[a]	Wall Thickness, t (in.)[a]	Plain-End Weight, w_{pe} (lb/ft)	Inside Diameter, d (in.)	Minimum Test Pressure (psi)[b]											
							Grade A		Grade B									
Nominal Size	Wall	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
76		452.79	76.000	0.562	452.79	74.876	270	330	310	390	560	610	690	750	800	870	930	1060
76		503.13	76.000	0.625	503.13	74.750	300	370	350	430	620	680	770	830	890	960	1040	1180
76		553.38	76.000	0.688	553.38	74.624	330	410	380	480	680	750	850	910	980	1060	1140	1300
76		602.75	76.000	0.750	602.75	74.500	360	440	410	520	750	820	920	990	1070	1150	1240	1420
76		652.04	76.000	0.812	652.04	74.375	380	480	450	560	810	880	1000	1080	1150	1250	1350	1540
76		702.04	76.000	0.875	702.04	74.250	410	520	480	600	870	950	1080	1160	1240	1350	1450	1660
76		751.96	76.000	0.938	751.96	74.124	440	560	520	650	930	1020	1160	1240	1330	1440	1560	1780
76		801.00	76.000	1.000	801.00	74.000	470	590	550	690	990	1090	1230	1330	1420	1540	1660	1890
76		849.96	76.000	1.062	849.96	73.875	500	630	590	730	1060	1160	1310	1410	1510	1630	1760	2010
76		899.62	76.000	1.125	899.62	73.750	530	670	620	780	1120	1230	1390	1490	1600	1730	1870	2130
76		949.20	76.000	1.188	949.20	73.624	560	700	660	820	1180	1290	1460	1580	1690	1830	1970	2250
76		997.91	76.000	1.250	997.91	73.500	590	740	690	860	1240	1360	1540	1660	1780	1920	2070	2370
80		476.80	80.000	0.562	476.80	78.876	250	320	300	370	530	580	660	710	760	820	890	1010
80		529.83	80.000	0.625	529.83	78.750	280	350	330	410	590	650	730	790	840	910	980	1130
80		582.77	80.000	0.688	582.77	78.624	310	390	360	450	650	710	800	870	930	1010	1080	1240
80		634.79	80.000	0.750	634.79	78.500	340	420	390	490	710	780	880	940	1010	1100	1180	1350
80		686.73	80.000	0.812	686.73	78.375	370	460	430	530	770	840	950	1020	1100	1190	1280	1460
80		739.42	80.000	0.875	739.42	78.250	390	490	460	570	830	910	1020	1100	1180	1280	1380	1580
80		792.03	80.000	0.938	792.03	78.124	420	530	490	620	890	970	1100	1180	1270	1370	1480	1690
80		843.72	80.000	1.000	843.72	78.000	450	560	530	660	950	1030	1170	1260	1350	1460	1580	1800
80		895.33	80.000	1.062	895.33	77.875	480	600	560	700	1000	1100	1240	1340	1430	1550	1670	1910
80		947.68	80.000	1.125	947.68	77.750	510	630	590	740	1060	1160	1320	1420	1520	1650	1770	2030
80		999.95	80.000	1.188	999.95	77.624	530	670	620	780	1120	1230	1390	1500	1600	1740	1870	2140
80		1051.31	80.000	1.250	1051.31	77.500	560	700	660	820	1180	1290	1460	1570	1690	1830	1970	2250

Note: See Appendix E, Tables E-1A, E-1B, and E-1C, for metric unit equivalents of the U.S. customary unit values shown in this table.

[a]Outside diameter and wall thickness dimensions shown are subject to tolerances described in Table 7. Inside diameters are nominal and are given here for information (see 7.2).

[b]The test pressures given in Tables 6A, 6B, and 6C apply to Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70 and X80 only. See 9.4.3 for pressures applicable to other grades.

[c]These sizes are special plain-end weights. All other sizes are regular weight. See Table 7 for applicable weight tolerances. For Grades X42 and higher, weights intermediate to regular weights shall be considered regular weight; weights intermediate to special plain-end weights shall be considered special plain-end weights; and weights intermediate to the heaviest tabulated special plain-end weight and the lightest regular weight shall be considered special plain-end weights.

[d]For information only—available by agreement per 7.3.

Table 7—Tolerances for Diameter of Pipe Body

Size Designation	Tolerance
$< 2^3/_8$	+0.016, –0.031 in. (+0.41, –0.79 mm)
$\geq 2^3/_8$ and $\leq 4^1/_2$ Continuous welded	±1.00%
$\geq 2^3/_8$ and < 20	±0.75%
≥ 20 and ≤ 36	
Nonexpanded	±1.00%
Cold-expanded	+0.75%, −0.25%
Larger than 36	
Nonexpanded	±1.00%
Cold-expanded[a]	$+^1/_4$ in., $-^1/_8$ in. (+6.35, −3.20 mm)

[a]In the case of pipe hydrostatically tested to pressures in excess of standard test pressures, other tolerances may be agreed upon between the manufacturer and the purchaser.

Table 8—Tolerances for Diameter at Pipe Ends [Within 4 in. (101.6 mm) of the Pipe End]

Size Designation	Minus Tolerance	Plus Tolerance	End-to-End Tolerance	Out-of-Roundness Tolerance[a]
$\leq 10^3/_4$	$^1/_{64}$ in. (0.40 mm)	$^1/_{16}$ in. (1.59 mm)	—	—
$> 10^3/_4$ and ≤ 20	$^1/_{32}$ in. (0.79 mm)	$^3/_{32}$ in. (2.38 mm)	—	—
> 20	$^1/_{32}$ in. (0.79 mm)	$^3/_{32}$ in. (2.38 mm)	[b]	±1%

[a]Out-of-roundness tolerance applies to major axis (+1 percent of specified OD) and minor axis (−1 percent of specified OD) as measured with a bar gauge, caliper, or other device measuring actual major and minor axes.
[b]On welded expanded pipe, the diameter (as measured with a diameter tape) of one end of the pipe shall not differ by more than $^3/_{32}$ in. (2.38 mm) from that of the other end.

Table 9—Tolerances for Wall Thickness

Size Designation	Type of Pipe	Tolerance[a] (percent of specified wall thickness)	
		Grade B or Lower	Grade X42 or Higher
≤ 2.875	All	+20.0, −12.5	+15.0, −12.5
> 2.875 and < 20	All	+15.0, −12.5	+15.0, −12.5
≥ 20	Welded	+17.5, −12.5	+19.5, −8.0
≥ 20	Seamless	+15.0, −12.5	+17.5, −10.0

[a]Where negative tolerances smaller than those listed are specified by the purchaser, the positive tolerance shall be increased to the applicable total tolerance range in percent less the wall thickness negative tolerance.

Table 10—Tolerances for Weight (See Note)

Quantity	Tolerance (percent)
Single lengths, special plain-end pipe or A25 pipe	+10, −5.0
Single lengths, other pipe	+10, −3.5
Carload lots, Grade A25	−2.5
Carload lots, all other grades	−1.75

Note: Weight tolerance applies to the calculated weight for threaded-and-coupled pipe and to the tabulated or calculated weights for plain-end pipe. Where negative wall thickness tolerances smaller than those listed in Table 9 are specified by the purchaser, the plus weight tolerance for single lengths shall be increased to 22.5 percent less the wall thickness negative tolerance.

Table 11—Tolerences on Lengths

(1) Nominal Length [a]		(2) Minimum Length		(3) Minimum Average Length for Each Order Item[b]		(4) Maximum Length	
Threaded-and-Coupled Pipe							
20 ft	(6 m)	16.0 ft	(4.88 m)	17.5 ft	(5.33 m)	22.5 ft	(6.86 m)
40 ft	(12 m)	22.0 ft	(6.71 m)	35.0 ft	(10.67 m)	45.0 ft	(13.72 m)
Plain-End Pipe							
20 ft	(6 m)	9.0 ft	(2.74 m)	17.5 ft	(5.33 m)	22.5 ft	(6.86 m)
40 ft	(12 m)	14.0 ft	(4.27 m)	35.0 ft	(10.67 m)	45.0 ft	(13.72 m)
50 ft	(15 m)	17.5 ft	(5.33 m)	43.8 ft	(13.35 m)	55.0 ft	(16.76 m)
60 ft	(18 m)	21.0 ft	(6.40 m)	52.5 ft	(16.00 m)	65.0 ft	(19.81 m)
80 ft	(24 m)	28.0 ft	(8.53 m)	70.0 ft	(21.34 m)	85.0 ft	(25.91 m)

[a]Nominal lengths of 20 ft (6 m) were formerly designated "single random lengths" and those of 40 ft (12 m) "double random lengths."
[b]By agreement between the purchaser and the manufacturer, these tolerances shall apply to each carload.

8 Couplings

8.1 MATERIAL

Couplings for Grades A and B pipe shall be seamless and shall be made of a grade of material at least equal in mechanical properties to that of the pipe. Couplings for Grade A25 pipe shall be seamless or welded and shall be made of steel. By agreement between the purchaser and the manufacturer, welded couplings may be supplied on nominal pipe sizes 14 and larger, if the couplings are properly marked.

8.2 TENSILE TESTS

A tensile test shall be made on each heat of steel from which couplings are produced, and the coupling manufacturer shall maintain a record of such tests. This record shall be open to inspection by the purchaser. If such a test is made on finished couplings, either round specimens proportioned as specified in ASTM E 8, *Test Method for Tension Testing of Metallic Materials*, or strip specimens shall be used at the option of the manufacturer.

8.3 DIMENSIONS

Couplings shall conform to the dimensions and tolerances shown in Table 12 (see note) and Figure 2.

Note: Couplings covered by Table 12 are applicable to either standard-weight or extra-strong pipe.

8.4 THREADING

Coupling threads, gauging practice, and thread inspection shall conform to the requirements of API Standard 5B. Couplings shall not be expanded to provide the required taper for threads.

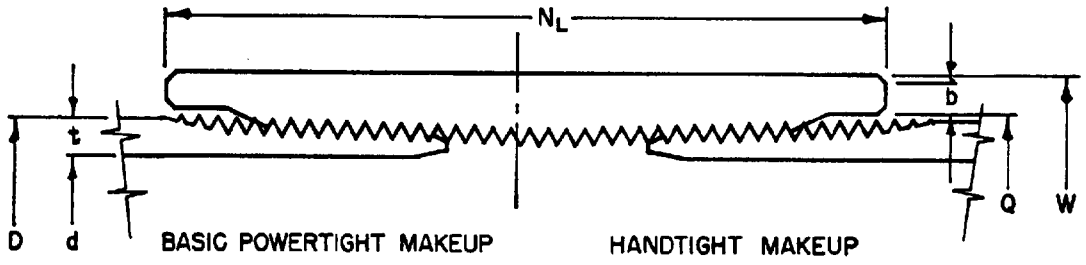
8.5 INSPECTION

Couplings shall be free from blisters, pits, cinder marks, and other defects that would impair the efficiency of the coupling or break the continuity of the thread.

Table 12—Coupling Dimensions, Weights, and Tolerances

(1)	(2)		(3)		(4)		(5)		(6)	
Nominal Size Designation	Outside Diameter of Coupling,[a] W		Minimum Length, N_L		Diameter of Recess, Q		Width of Bearing Face, b		Calculated Coupling Weight	
	in.	mm	in.	mm	in.	mm	in.	mm	lb	kg
1/8	0.563	(14.3)	1 1/16	(27.0)	0.468	(11.9)	1/32	(0.8)	0.04	(0.02)
1/4	0.719	(18.3)	1 5/8	(41.3)	0.603	(15.3)	1/32	(0.8)	0.09	(0.04)
3/8	0.875	(22.2)	1 5/8	(41.3)	0.738	(18.8)	1/32	(0.8)	0.13	(0.06)
1/2	1.063	(27.0)	2 1/8	(54.0)	0.903	(22.9)	1/16	(1.6)	0.24	(0.11)
3/4	1.313	(33.4)	2 1/8	(54.0)	1.113	(28.3)	1/16	(1.6)	0.34	(0.15)
1	1.576	(40.0)	2 5/8	(66.7)	1.378	(35.0)	3/32	(2.4)	0.54	(0.25)
1 1/4	2.054	(52.2)	2 3/4	(69.8)	1.723	(43.8)	3/32	(2.4)	1.03	(0.47)
1 1/2	2.200	(55.9)	2 3/4	(69.8)	1.963	(49.9)	3/32	(2.4)	0.90	(0.41)
2	2.875	(73.0)	2 7/8	(73.0)	2.469	(62.7)	1/8	(3.2)	1.86	(0.84)
2 1/2	3.375	(85.7)	4 1/8	(104.8)	2.969	(75.4)	3/16	(4.8)	3.27	(1.48)
3	4.000	(101.6)	4 1/4	(108.0)	3.594	(91.3)	3/16	(4.8)	4.09	(1.86)
3 1/2	4.625	(117.5)	4 3/8	(111.1)	4.094	(104.0)	3/16	(4.8)	5.92	(2.69)
4	5.200	(132.1)	4 1/2	(114.3)	4.594	(116.7)	1/4	(6.4)	7.59	(3.45)
5	6.296	(159.9)	4 5/8	(117.5)	5.657	(143.7)	1/4	(6.4)	9.98	(4.53)
6	7.390	(187.7)	4 7/8	(123.8)	6.719	(170.7)	1/4	(6.4)	12.92	(5.87)
8	9.625	(244.5)	5 1/4	(133.4)	8.719	(221.5)	1/4	(6.4)	23.18	(10.52)
10	11.750	(298.4)	5 3/4	(146.0)	10.844	(275.4)	3/8	(9.5)	31.55	(14.32)
12	14.000	(355.6)	6 1/8	(155.6)	12.844	(326.2)	3/8	(9.5)	49.27	(22.37)
14D	15.000	(381.0)	6 3/8	(161.9)	14.094	(358.0)	3/8	(9.5)	45.83	(20.81)
16D	17.000	(431.8)	6 3/4	(171.4)	16.094	(408.8)	3/8	(9.5)	55.83	(23.35)
18D	19.000	(482.6)	7 1/8	(181.0)	18.094	(459.6)	3/8	(9.5)	66.53	(30.20)
20D	21.000	(533.4)	7 5/8	(193.7)	20.094	(510.4)	3/8	(9.5)	79.37	(36.03)

Note: See Figure 2.
[a]Tolerance on outside diameter, W, is ±1 percent.



Note: See Table 4 for pipe dimensions, Table 12 for coupling dimensions, and API Standard 5B for thread details.

Figure 2—Line Pipe and Coupling

9 Inspection and Testing

9.1 TEST EQUIPMENT

If test equipment, whose calibration or verification is required under the provisions of the specification, is subjected to unusual or severe conditions sufficient to make its accuracy questionable, recalibration or reverification shall be performed before further use of the equipment.

9.2 TESTING OF CHEMICAL COMPOSITION

9.2.1 Heat Analyses

The steel manufacturer shall determine the analysis of each heat of steel used in the manufacture of pipe specified on the purchase order. The analysis so determined shall conform to the requirements of 6.1.1.

For Grade X80, heat analysis limits have not been defined, only product analysis limits.

9.2.2 Product Analyses

9.2.2.1 Sampling Frequency

The manufacturer shall determine the analysis of two samples representing each heat of steel used for the production of pipe under this specification.

9.2.2.2 Sampling Methods

9.2.2.2.1 Seamless Pipe

At the option of the manufacturer, samples used for product analyses shall be taken either from tensile test specimens or from the finished pipe.

9.2.2.2.2 Welded Pipe

At the option of the manufacturer, samples used for product analyses shall be taken from either finished pipe, plate, skelp, tensile test specimens, or flattening test specimens. The location of the samples shall be a minimum of 90 degrees from the weld of longitudinally welded pipe. For spiral weld, the sample location shall be at a position not less than one quarter of the distance between adjacent weld convolutions as measured from either edge of the weld. For pipe manufactured from plate or skelp, the product analyses may be made by the supplier of the plate or skelp providing the analyses are made in accordance with the frequency requirement of this specification.

9.2.3 Test Reports

The results of all specified chemical analyses shall be available to the purchaser upon request. When SR15 is specified by the purchaser (see Appendix F), the manufacturer shall furnish a report of all chemical analyses required by this specification.

For Grade A25, in lieu of furnishing a test report, the manufacturer may certify that the pipe furnished was produced in conformance with the requirements for chemical properties and tests of API Specification 5L.

9.3 TESTING OF MECHANICAL PROPERTIES

9.3.1 Tensile Tests

9.3.1.1 Tensile Testing Specimens

Tensile test orientation shall be as shown in Figure 3. At the option of the manufacturer for longitudinal seam welded pipe, the longitudinal specimens may be taken from the skelp parallel to the rolling direction and approximately midway between edge and center. At the option of the manufacturer, the specimen may be either full section, strip specimen, or round bar specimens as specified in 9.3.1.3, 9.3.1.4, and Figure 4. The type, size, and orientation of the specimens shall be reported. Strip specimens shall be approximately $1^1/_2$ in. (38.1 mm) wide in gauge length if suitable curved face testing grips are used or if the ends of the specimens are machined to reduce the curvatures in the grip area; otherwise they shall be approximately $^3/_4$ in. (19.0 mm) wide for pipe sizes $3^1/_2$ and smaller, approximately 1 in. (25.4 mm) wide for pipe sizes 4 through $6^5/_8$, and approximately $1^1/_2$ in. (25.4 mm) wide for pipe sizes $8^5/_8$ and larger. Alternatively, when grips with curved faces are not available, the ends of the specimens may be flattened without heating.

9.3.1.2 Tensile Testing Frequency

Tensile tests shall be made at the frequency shown in Table 13.

9.3.1.3 Longitudinal Tensile Tests

At the option of the manufacturer, longitudinal tests may utilize a full section specimen (see Figure 4, subfigure B); a strip specimen (see Figure 4, subfigure C); or for pipe with wall thickness greater than 0.750 in. (19.1 mm), a 0.500-in. (12.7-mm) diameter round bar specimen (see Figure 4, subfigure D). The strip specimen shall be tested without flattening.

9.3.1.4 Transverse Tensile Tests

The transverse tensile properties shall be determined, at the option of the manufacturer, by one of the following methods:

a. The yield strength, ultimate strength, and elongation values shall be determined on either a flattened rectangular specimen (see Figure 4, subfigure E) or on a 0.500-in. (12.7-mm) or 0.350-in. (8.9-mm) round bar specimen (see Figure 4, subfigure G).
b. The yield strength shall be determined by the ring expansion method (see Figure 4, subfigure A) with the ultimate strength and elongation values determined from a flattened rectangular specimen.

The same method of testing must be employed for all lots in an order item. All transverse tensile specimens shall be as shown in Figure 4. All specimens shall represent the full wall thickness of the pipe from which the specimen was cut, except for round bar tensile specimens.

Transverse round bar specimens are to be secured from nonflattened pipe sections. The 0.500 in. (12.7 mm) diameter round bar specimens shall be used when the pipe size allows, and the 0.350 in. (8.9 mm) diameter round bar specimen shall be used for other sizes. For pipe sizes too small to allow a 0.350 in. (8.9 mm) specimen, round bar tensile specimens are not permitted.

9.3.1.5 Weld Tensile Tests

Weld tensile test specimens shall be taken at 90 degrees to the weld with the weld at the center as shown in Figures 3 and 4 and shall represent the full wall thickness of the pipe from which the specimen was cut. Weld reinforcement may be removed at the manufacturer's option. Weld tensile tests need not include determination of yield strength and elongation.

9.3.1.6 Control Tensile Tests

For pipe other than Grade A25, one tensile test per heat shall be made as a control, and a record of such tests shall be available to the purchaser. For longitudinal seam welded pipe, such tensile tests shall be made using samples taken from either plate, skelp, or finished pipe at the option of the manufacturer.

9.3.2 Flattening Tests

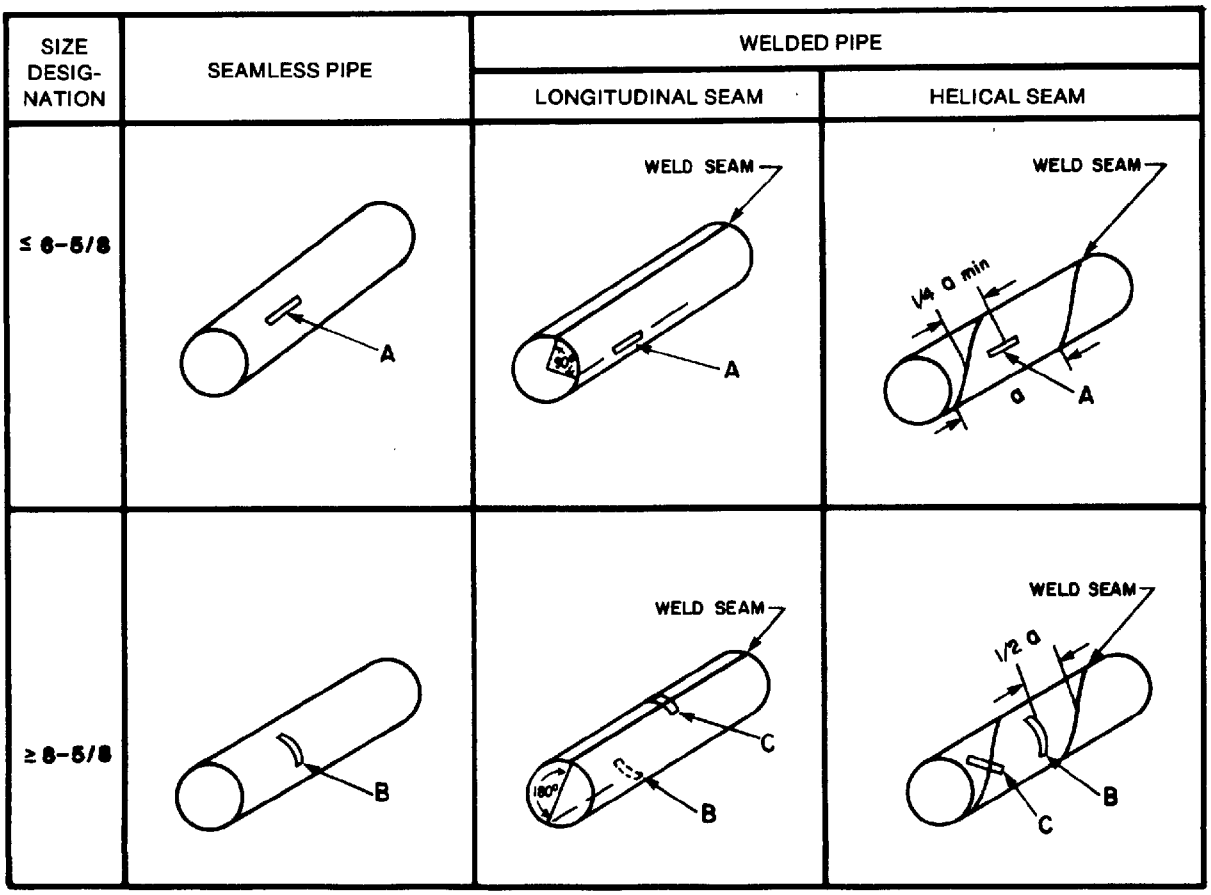
Flattening tests shall be performed for electric-welded and continuous welded pipe. Frequency of testing, sample location, and test orientation are shown in Figure 5. When a weld stop condition occurs during production of a multiple length, flattening tests with the weld at 90 degrees shall be made from the crop ends resulting from each side of the weld stop and may be substituted for the intermediate flattening tests (see note).

Note: Flattening tests with the weld at the 0 degrees orientation may be conducted at 180 degrees and the 90 degrees orientation at 270 degrees upon agreement between the purchaser and manufacturer.

Table 13—Frequency of Tensile Testing

(1) Size Designation	(2) Tensile Tests	(3) Weld Tensile Tests	(4) Control Tensile Tests
≦ 1 1/2 nom. A25 welded	1 per 25 tons or fraction thereof	—	—
≧ 2 nom. A25 welded	1 per 50 tons or fraction thereof	—	—
≦ 5 9/16 except A25 welded	1 per 400 lengths	—	—
≧ 6 5/8 thru 12 3/4	1 per 200 lengths	—	One per heat on all sizes except for Grade A25
> 12 3/4	1 per 100 lengths per cold expansion amount[b]	—	—
8 5/8 thru 12 3/4	—	1 per 200 length	—
> 12 3/4	—	1 per 100 lengths[a] per cold expansion amount[b]	—

[a]Each weld for two-seam pipe.
[b]Pipe manufactured with the same nominal amount of cold expansion, ±0.2 percent, shall be considered to have the same cold expansion amount.



Note: A = Strip specimen (any circumferential location for seamless).
B = Transverse specimen (any circumferential location for seamless). For double seam pipe, the specimen shall be taken from a location midway between the welds.
C = Transverse weld specimen.

Figure 3—Orientation of Tensile Test Specimens

9.3.3 Bend Tests

One full section specimen of appropriate length, cut from a length of pipe from each lot of 25 tons, or fraction thereof, for pipe of nominal sizes $1\,^1/_2$ and smaller, and from each lot of 50 tons, or fraction thereof, for pipe of nominal size 2, shall be bent cold through 90 degrees, around a mandrel having a diameter not greater than twelve times the outside diameter of the pipe being tested, with the weld located approximately 45 degrees from the point of contact of the specimen with the mandrel. No cracks shall occur in any portion of the pipe, and no opening shall occur in the weld.

Note: For the purpose of mechanical testing of the weld of electric-welded pipe of nominal sizes 2 and larger, the weld extends to a distance of $^1/_2$ in. (12.7 mm) on either side of the fusion line. For pipe smaller than nominal size 2, the weld extends to a distance of $^1/_4$ in. (6.35 millimeters) on either side of the fusion line.

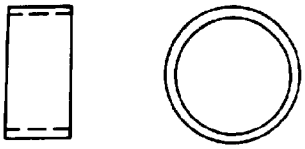
9.3.4 Guided-Bend Tests

The test specimens shall be taken from the helical or each longitudinal seam weld in a length of pipe from each lot of 50 lengths or less of each combination of outside diameter, wall thickness, and grade; and from a skelp end weld in a length of pipe from each lot of 50 lengths or less of each combination of outside diameter, wall thickness, and grade of finished helical seam pipe containing skelp end welds. The test specimens shall not contain repair welds.

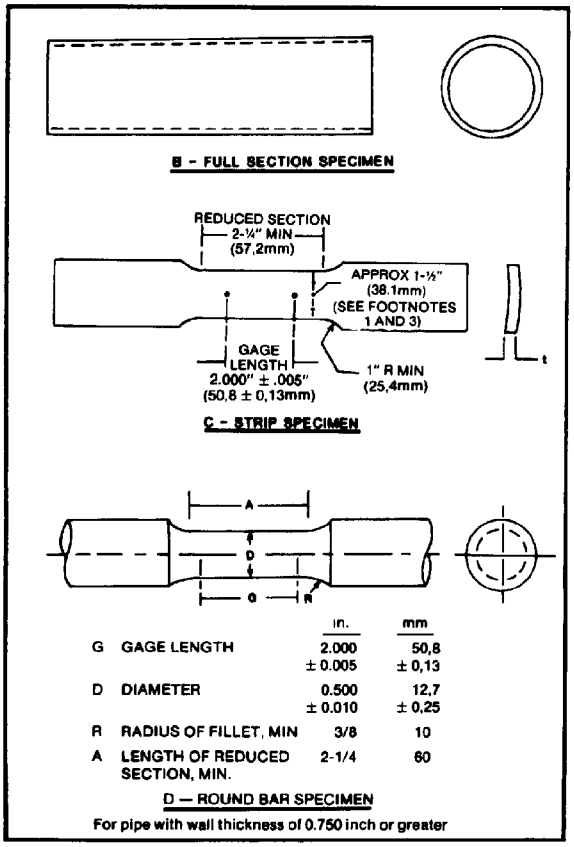
9.4 HYDROSTATIC TESTS

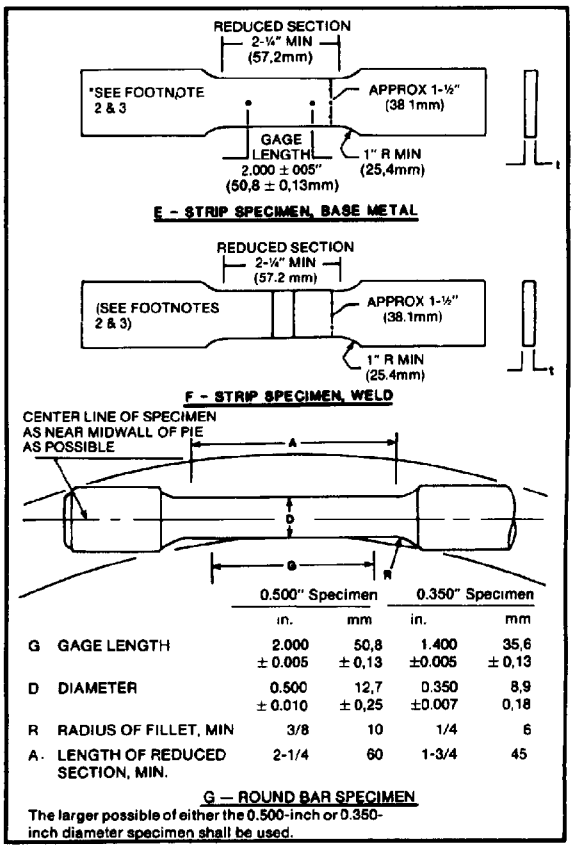
9.4.1 Hydrostatic Test Requirements

Each length of pipe shall withstand, without leakage, an inspection hydrostatic test to at least the pressure specified



A - RING EXPANSION SPECIMEN





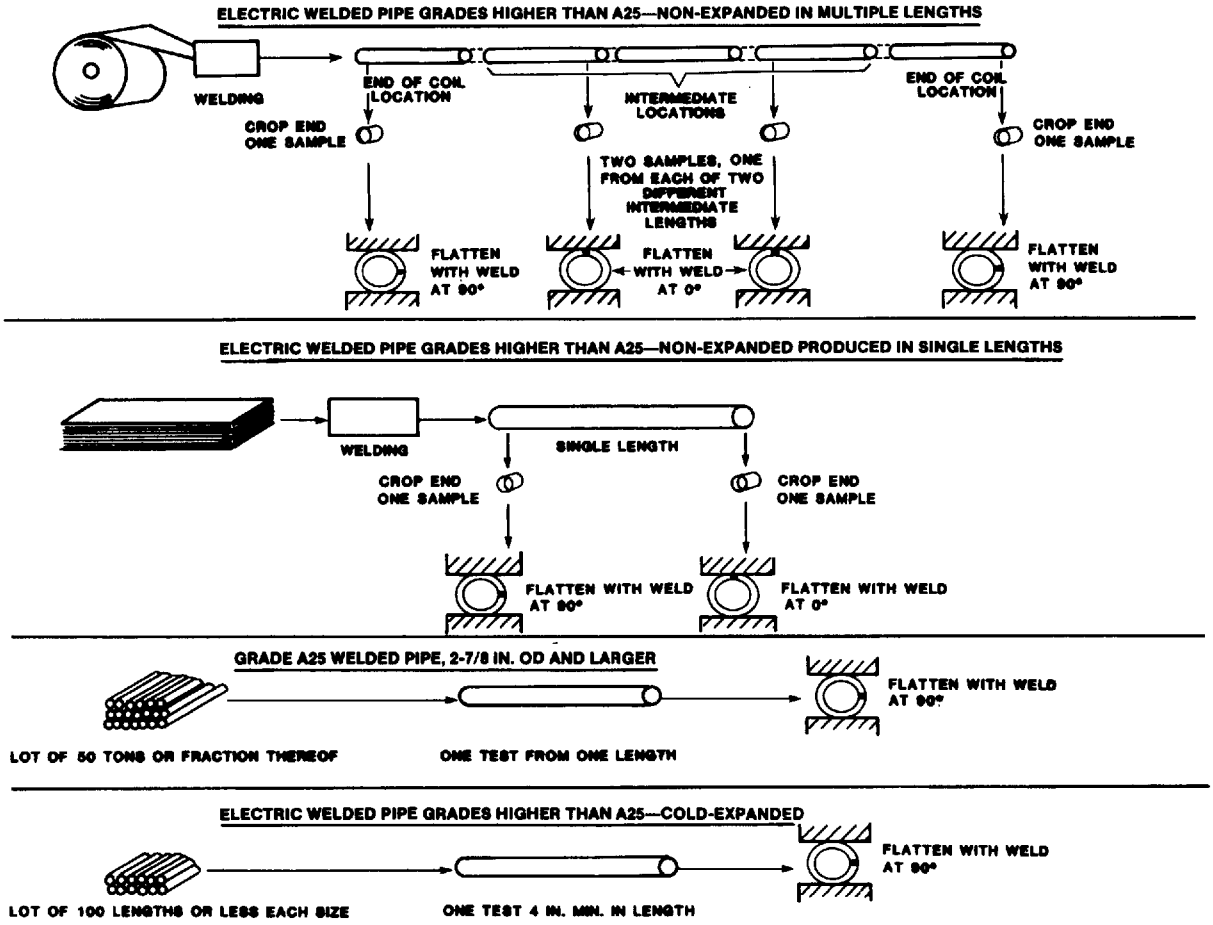
Notes:
1. See 9.3.1.1 for gauge width if testing is not done with properly curved grips.
2. Flattening of transverse and weld specimens shall be performed at room temperature.
3. Hot flattening, artificial aging, or heat treatment of tensile specimens is not permitted.

Figure 4—Tensile Test Specimens

in 9.4.3. Test pressures for all sizes of seamless pipe and for welded pipe in sizes 18 and smaller, shall be held for not less than 5 seconds. Test pressures for welded pipe in sizes 20 and larger shall be held for not less than 10 seconds. For threaded-and-coupled pipe, the test shall be applied with the couplings made up power-tight, if power-tight makeup is specified on the purchase order, except that pipe sizes larger than $12^3/_4$ may be tested in the plain-end condition. For threaded pipe furnished with couplings made up handling-tight, the hydrostatic test shall be made on the pipe in the plain-end or threads-only condition or with couplings applied, unless otherwise agreed by the purchaser and the manufacturer.

9.4.2 Verification of Hydrostatic Test

In order to ensure that every length of pipe is tested to the required test pressure, each tester (except those on which continuous welded pipe is tested) shall be equipped with a recording gauge that will record the test pressure and duration of time the pressure is applied to each length of pipe, or



Note: See 9.3.2

Figure 5—Flattening Tests

shall be equipped with some positive and automatic or interlocking device to prevent pipe from being classified as tested until the test requirements (pressure and time) have been complied with. Such records or charts shall be available for examination at the manufacturer's facility by the purchaser's inspectors at the manufacturer's facility. The test pressure measuring device shall be calibrated by means of a dead weight tester, or equivalent, within the 4 months prior to each use. Calibration records retention shall be as specified in 12.2.

9.4.3 Test Pressures

The minimum test pressure shall be the standard test pressure or alternate test pressure listed in Tables 4, 5, 6A, 6B, and 6C; an intermediate or higher pressure at the discretion of the manufacturer unless specifically limited by the purchaser; or a higher pressure as agreed between the purchaser and the manufacturer (see Note 1). The minimum test pressures for grades, outside diameters, and wall thicknesses not listed shall be computed by the equation given in Note 2 below. For all sizes of Grade A25 pipe smaller than $5^{9}/_{16}$ and all sizes of Grade A and Grade B pipe smaller than $2^{3}/_{8}$, the test pressure has been arbitrarily assigned. Where the unlisted wall thickness is intermediate to wall thicknesses whose test pressures have been arbitrarily assigned, the test pressure for the intermediate wall thickness shall be equal to the test pressure specified for the next heavier wall thickness. When computed pressures are not an exact multiple of 100 kPa (10 psi), they shall be rounded to the nearest 100 kPa (10 psi).

When the purchase order specifies a hydrostatic test that will produce a hoop stress greater than 90 percent of the specified minimum yield strength and when SR14 (see Appendix F) is specified on the purchase order, the test pressure shall be determined in accordance with SR14 (see Note 3).

Note 1: The hydrostatic test pressures given herein are inspection test pressures, are not intended as a basis for design, and do not necessarily have any direct relationship to working pressures.

Note 2: The test pressures given in Tables 4, 5, 6A, 6B,and 6C were computed by the following equation and rounded to the nearest 100 kPa (10 psi):

US Customary Formula

$$P = \frac{2St}{D}$$

Metric Formula

$$P = \frac{2000St}{D}$$

Where:

P = hydrostatic test pressure, psi (kPa).
S = fiber stress, psi (MPa), equal to a percentage of the specified minimum yield strength for the various sizes as shown in the tabulation below.
t = specified wall thickness, in. (mm).
D = specified outside diameter, in. (mm).

Grade	Size Designation	Percent of Specified Minimum Yield Strength: Standard Test Pressure	Percent of Specified Minimum Yield Strength: Alternate Test Pressure
A25	$5^{9}/_{16}$[a]	60	—
A	$2^{3}/_{8}$ and larger[b]	60	75
B	$2^{3}/_{8}$ and larger[b]	60	75
X42 thru X80[c]	$5^{9}/_{16}$ and smaller	60	75
	$6^{5}/_{8}$ and $8^{5}/_{8}$	75	—
	$10^{3}/_{4}$ to 18 incl.	85	—
	20 and larger	90	—

[a]Test pressures for other sizes are established arbitrarily.
[b]Test pressures were limited to 2,500 psi (17,200 kPa) for sizes $3^{1}/_{2}$ and smaller, and to 2,800 psi (19,300 kPa) for sizes larger than size $3^{1}/_{2}$. Test pressures for other sizes are established arbitrarily.
[c]Test pressures for Grades X42 through X80 were limited to 3,000 psi (20,700 kPa) to accommodate hydrostatic tester limitations.

Note 3: When hydrostatic testing in excess of 90 percent of specified minimum yield strength using the equation in Note 2, the applied forces for end sealing produce a compressive longitudinal stress that should be considered.

9.4.4 Supplementary Hydrostatic Tests

By agreement between the purchaser and the manufacturer, for Grades X42 and higher, the manufacturer shall make additional internal pressure tests, which may involve one or more of the following methods. In all supplementary hydrostatic tests, the equation shown in 9.4.3 shall be used for stress calculations. The conditions of testing shall be as agreed upon.

a. Hydrostatic destructive tests in which the minimum length of the specimen is ten times the outside diameter of the pipe, but need not exceed 40 ft.
b. Full-length destructive tests made by the hydrostatic pressure water column method.
c. Hydrostatic transverse yield strength tests using accurate strain gauges (see note).

Note: Acceptable gauges are the roller-chain ring-expansion gauge, the SR4 strain gauge, or other suitable gauges of similar accuracy.

9.5 DIMENSIONAL TESTING

The accuracy of all measuring instruments used for acceptance or rejection, except ring and plug thread gauges and weighing devices, shall be verified at least every operating shift.

Verifying the accuracy of measuring devices such as snap gauges and drift mandrels shall consist of inspection for wear and conformance to specified dimensions. Verifying the accuracy of rules, length measuring tapes, and other nonadjustable measuring devices shall consist of a visual check for legibility of markings and general wear of fixed reference points. The adjustable and nonadjustable designation of measuring devices used by the manufacturer shall be documented.

The verification procedure for working ring and plug thread gauges shall be documented. The accuracy of all weighing devices shall be verified at periods not to exceed those required by the manufacturer's documented procedure in accordance with National Institute of Standards and Technology (NIST) standards or equivalent regulations in the country of manufacture of products made to this specification.

If measuring equipment, whose calibration or verification is required under the provisions of the specification, is subjected to unusual or severe conditions sufficient to make its accuracy questionable, recalibration or reverification shall be performed before using the equipment.

9.6 VISUAL INSPECTION

All pipe shall be visually examined and shall be free of defects in the finished condition.

9.7 NONDESTRUCTIVE INSPECTION

9.7.1 Purchaser Inspection

When inspection by the purchaser is stated on the purchase order, the provisions of Appendix H shall apply.

9.7.2 Methods of Inspection

Except for Grade A25 pipe, the weld seams of welded pipe sizes $2^{3}/_{8}$ and larger shall be inspected full length (100 percent) in accordance with the methods specified below. In addition, the skelp end weld in finished helical seam pipe shall be so inspected. The location of equipment in the manufacturer's facility shall be at the discretion of the manufacturer.

9.7.2.1 Submerged-arc welds shall be inspected by radiological methods in accordance with 9.7.3.1 through 9.7.3.12. Such inspection shall be full length or, for a minimum distance of 8 in. (203 mm) from each end if the balance of the weld length is inspected by ultrasonic methods in accordance with 9.7.4.1 through 9.7.4.4.

9.7.2.2 Electric welds shall be inspected by ultrasonic or electromagnetic methods in accordance with 9.7.4.1 through 9.7.4.4. If necessary to meet the full length (100 percent) inspection requirements of 9.7.2, pipe ends shall be inspected by using hand-held ultrasonic shear wave equipment or other

NDT method agreed to by the manufacturer and the purchaser.

By agreement between the purchaser and the manufacturer and when specified on the purchase order, electric welds shall be nondestructively inspected in accordance with SR17 (see Appendix F).

9.7.2.3 Gas metal-arc welds shall be inspected full length by ultrasonic methods in accordance with 9.7.4.1 through 9.7.4.4. In addition, the welds shall be inspected by radiological methods in accordance with 9.7.3.1 through 9.7.3.12 for a minimum distance of 8 in. (203 mm) from each end.

9.7.2.4 Skelp end welds in finished helical seam pipe shall have been inspected in accordance with one or more of the methods specified above for the weld type. Radiological inspection shall include the junction of the skelp end weld with the helical seam weld. For cold expanded pipe, radiological inspection shall be performed after expansion.

9.7.2.5 By agreement between the purchaser and the manufacturer and when specified on the purchase order, seamless pipe shall be nondestructively inspected in accordance with SR4 (see Appendix F).

9.7.3 Radiological Inspection

9.7.3.1 Radiological Inspection Equipment

The homogeneity of weld seams examined by radiological methods shall be determined by means of X-rays directed through the weld material onto a suitable radiographic film or fluorescent screen or onto a television screen, provided adequate sensitivity can be obtained.

9.7.3.2 Fluoroscopic Operator Qualification

Operators of fluoroscopic equipment shall be trained, tested, and certified by the pipe manufacturer.

Details of such training, testing, and certification programs shall be available to the purchaser. This program shall include the following:

a. Classroom instruction in the fundamentals of radiological inspection techniques.
b. On-the-job training designed to familiarize the operator with specific installations, including the appearance and interpretation of weld imperfections and defects. The duration of such training shall be sufficient to assure adequate assimilation of the knowledge required for conducting the inspection.
c. Knowledge of the appropriate requirements of this specification.
d. A physical examination at least once per year to determine the operator's optical capability to perform the required inspection.
e. Upon completion of Items a and b above, an examination shall be given by the manufacturer to determine if the operator is qualified to properly perform fluoroscopic examinations.

9.7.3.3 Operator Certification

Certified operators whose work has not included fluoroscopic inspection for a period of one year or more shall be recertified by successfully completing the examination (Item e above) and also passing the physical examination (Item d above). Substantial changes in procedure or equipment shall require recertification of the operators.

9.7.3.4 NDT Reference Standards

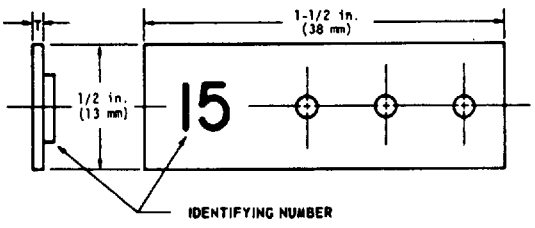
Unless otherwise specified, the reference standard shall be the API standard penetrameter described in 9.7.3.5, or at the option of the manufacturer the ISO wire penetrameter described in 9.7.3.6. By agreement between the purchaser and the manufacturer, other standard penetrameters may be used.

9.7.3.5 API Standard Penetrameter

The API standard penetrameter shall be as shown in Figure 6 and made of a material with the same radiological characteristics as the pipe. The thickness of the penetrameter shall be a maximum of 4 percent of the specified wall thickness. Either 2 percent or 4 percent penetrameters may be used (see Tables 14 and 15 for sizes).

9.7.3.6 ISO Wire Penetrameter

The ISO wire penetrameter shall be Fe $^{1}/_{7}$, Fe $^{6}/_{12}$, or Fe $^{10}/_{16}$ in accordance with Tables 16 and 17 for the appropriate wall thickness. When the wire penetrameter is placed across the weld, the diameter of the wire employed shall be based



Notes:
1. The diameter of each hole shall be $^{1}/_{16}$ in. (1.6 mm).
2. Holes shall be round and drilled perpendicular to the surface.
3. Holes shall be free of burrs, but edges shall not be chamfered.
4. Each penetrameter shall carry a lead identification number as given in Tables 14 and 15.

Figure 6—API Standard Penetrameter

Table 14—API Standard 4 Percent Penetrameters

(1)			(2)			(3)		(4)
Wall Thickness						Maximum Penetrameter Thickness		
Over			Through					Identifying
in.		mm	in.		mm	in.	mm	Number
3/16	or 0.188	(4.8)	1/4	or 0.250	(6.4)	0.010	(0.25)	10
1/4	or 0.250	(6.4)	3/16	or 0.313	(7.9)	0.0125	(0.32)	12
5/16	or 0.313	(7.9)	3/8	or 0.375	(9.5)	0.015	(0.38)	15
3/8	or 0.375	(9.5)	7/16	or 0.438	(11.1)	0.0175	(0.45)	17
7/16	or 0.438	(11.1)	1/2	or 0.500	(12.7)	0.020	(0.51)	20
1/2	or 0.500	(12.7)	5/8	or 0.625	(15.9)	0.025	(0.64)	25
5/8	or 0.625	(15.9)	3/4	or 0.750	(19.1)	0.030	(0.76)	30
3/4	or 0.750	(19.1)	1	or 1.000	(25.4)	0.040	(1.02)	40
1	or 1.000	(25.4)	1 1/4	or 1.250	(31.8)	0.050	(1.27)	50
1 1/4	or 1.250	(31.8)	1 1/2	or 1.500	(38.1)	0.060	(1.52)	60

Table 15—API Standard 2 Percent Penetrameters

(1)			(2)			(3)		(4)
Wall Thickness						Maximum Penetrameter Thickness		
Over			Through					Identifying
in.		mm	in.		mm	in.	mm	Number
7/32	or 0.219	(5.1)	1/4	or 0.250	(6.4)	0.005	(0.13)	5
1/4	or 0.250	(6.4)	5/16	or 0.313	(7.9)	0.006	(0.15)	6
5/16	or 0.313	(7.9)	3/8	or 0.375	(9.5)	0.0075	(0.19)	7
3/8	or 0.375	(9.5)	1/2	or 0.500	(12.7)	0.010	(0.25)	10
1/2	or 0.500	(12.7)	5/8	or 0.625	(15.9)	0.0125	(0.32)	12
5/8	or 0.625	(15.9)	3/4	or 0.750	(19.1)	0.015	(0.38)	15
3/4	or 0.750	(19.1)	7/8	or 0.875	(22.2)	0.0175	(0.45)	17
7/8	or 0.875	(22.2)	1	or 1.000	(25.4)	0.020	(0.51)	20
1	or 1.000	(25.4)	1 1/4	or 1.250	(31.8)	0.025	(0.64)	25
1 1/4	or 1.250	(31.8)	1 1/2	or 1.500	(38.1)	0.030	(0.76)	30

on the specified wall thickness plus the estimated thickness of the weld reinforcement (not to exceed the maximum allowed) at the penetrameter location. When the penetrameter is placed on the base metal, the diameter of the wire employed shall be based on the specified wall thickness.

9.7.3.7 Frequency of Calibration

When the fluoroscopic method is used full length and on each film when film is used, the penetrameter shall be used to check the sensitivity and adequacy of the radiographic technique on one pipe in every lot of 50 pipe, but not less than twice per 8-hour working shift. When film is used full length, one penetrameter shall be used for each length of pipe. The pipe shall be held in a stationary position during the adjustment of the radiographic technique by use of the penetrameter. Proper definition and sensitivity is attained when all three holes of the API standard penetrameter or individual wires of the ISO penetrameter are clearly discernible.

9.7.3.8 Procedure for Evaluating In-Motion Operation of a Fluoroscope

To evaluate the definition of defects at operational speeds, a pipe section having a minimum wall thickness of 0.375 in. (9.5 mm) shall be used. Series of 1/32 in. (0.79 mm) holes, as shown in Example 6 of Figure 7 shall be drilled into the center of the weld to a depth of 100 percent of the total thickness. At least four such series shall be used, spaced 1 foot apart. As an alternative to using the pipe section described above, a penetrameter as described in 9.7.3.4, 9.7.3.5, and 9.7.3.6 may be used at the option of the manufacturer. The speed of operation shall be adjusted so that the holes in the pipe section or API penetrameter, or individual wires in the ISO penetrameter, are clearly visible to the operator.

Table 16—ISO Wire 4 Percent Penetrameters

(1)	(2)		(3)		(4)	
	Wall Thickness					
	Over		Through		Wire Diameter	
Wire Number	in.	mm	in.	mm	in.	mm
			Fe 1/7			
1	2.50	(63.5)	3.25	(82.6)	.13	(3.20)
2	2.00	(50.8)	2.50	(63.5)	.10	(2.50)
3	1.62	(41.1)	2.00	(50.8)	.08	(2.00)
4	1.25	(31.8)	1.62	(41.1)	.065	(1.60)
5	1.00	(25.4)	1.25	(31.8)	.050	(1.25)
6	0.80	(20.3)	1.00	(25.4)	.040	(1.00)
7	0.63	(15.9)	0.80	(20.3)	.032	(0.80)
			Fe 6/12			
6	0.800	(20.3)	1.000	(25.4)	.040	(1.00)
7	0.625	(15.9)	0.800	(20.3)	.032	(0.80)
8	0.500	(12.7)	0.625	(15.9)	.025	(0.63)
9	0.400	(10.2)	0.500	(12.7)	.020	(0.50)
10	0.325	(8.3)	0.400	(10.2)	.016	(0.40)
11	0.250	(6.4)	0.325	(8.3)	.013	(0.32)
12	0.200	(5.1)	0.250	(6.4)	.010	(0.25)
			Fe 10/16			
10	0.325	(8.3)	0.400	(10.2)	.016	(0.40)
11	0.250	(6.4)	0.325	(8.3)	.013	(0.32)
12	0.200	(5.1)	0.250	(6.4)	.010	(0.25)
13	0.162	(4.1)	0.200	(5.1)	.008	(0.20)
14	0.125	(3.2)	0.162	(4.1)	.006	(0.16)
15	0.100	(2.5)	0.125	(3.2)	.005	(0.13)
16	0.080	(2.0)	0.100	(2.5)	.004	(0.10)

Table 17—ISO Wire 2 Percent Penetrameters

(1)	(2)		(3)		(4)	
	Wall Thickness					
	Over		Through		Wire Diameter	
Wire Number	in.	mm	in.	mm	in.	mm
			Fe 1/7			
1	5.00	(127.0)	6.50	(165.2)	.13	(3.20)
2	4.00	(101.6)	5.00	(127.0)	.10	(2.50)
3	3.25	(82.6)	4.00	(101.6)	.08	(2.00)
4	2.50	(63.5)	3.25	(82.6)	.065	(1.60)
5	2.00	(50.8)	2.50	(63.5)	.050	(1.25)
6	1.60	(40.6)	2.00	(50.8)	.040	(1.00)
7	1.25	(31.8)	1.60	(40.6)	.032	(0.80)
			Fe 6/12			
6	1.600	(40.6)	2.00	(50.8)	.040	(1.00)
7	1.250	(31.8)	1.60	(40.6)	.032	(0.80)
8	1.000	(25.4)	1.250	(31.8)	.025	(0.63)
9	0.800	(20.3)	1.000	(25.4)	.020	(0.50)
10	0.650	(16.5)	0.800	(20.3)	.016	(0.40)
11	0.500	(12.7)	0.650	(16.5)	.013	(0.32)
12	0.400	(10.1)	0.500	(12.7)	.010	(0.25)
			Fe 10/16			
10	0.625	(16.2)	0.800	(20.3)	.016	(0.40)
11	0.500	(12.7)	0.650	(16.2)	.013	(0.32)
12	0.400	(10.1)	0.500	(12.7)	.010	(0.25)
13	0.325	(8.3)	0.400	(10.1)	.008	(0.20)
14	0.250	(6.4)	0.325	(8.3)	.006	(0.16)
15	0.200	(5.1)	0.250	(6.4)	.005	(0.13)
16	0.160	(4.1)	0.200	(5.1)	.004	(0.10)

9.7.3.9 Acceptance Limits for Radiological Inspection

Radiological examination shall be capable of detecting weld imperfections and defects as described in 9.7.3.10 and 9.7.3.11.

9.7.3.10 Imperfections Observed During Radiological Inspection

The maximum acceptable size and distribution of slag inclusion and/or gas pocket discontinuities are shown in Tables 18 and 19 and Figures 7 and 8 (see note).

The important factors to be considered in determining rejection or acceptance limits are size and spacing of discontinuities and the sum of the diameters in an established distance. For simplicity, the distance is established as any 6 in. (152.4 mm) length. Discontinuities of this type usually occur in an aligned pattern, but no distinction is made between aligned or scattered patterns. Also, the distribution pattern may be of assorted sizes.

Note: Unless the discontinuities are elongated, it cannot be determined with assurance whether the radiological indications represent slag inclusions or gas pockets. Therefore, the same limits apply to all circular-type discontinuities.

9.7.3.11 Defects Observed During Radiological Inspection

Cracks, lack of complete penetration or of complete fusion, and discontinuities greater in size and/or distribution than shown in Tables 18 and 19 and Figures 7 and 8, as indicated by radiological examination, shall be considered defects. See 9.7.5.4 for disposition of pipe containing defects.

9.7.3.12 Disposition of Defects Observed During Radiological Inspection

Any weld defect detected as a result of radiological examination shall be rejected. Disposition of the pipe containing the defect shall be in accordance with 9.7.5.4.

Table 18—Elongated Slag-Inclusion-Type Discontinuities[a]

(1)		(2)		(3)
Maximum Dimensions		Minimum Separation		Maximum Number in any 6 in. (152.4 mm)
in.	mm	in.	mm	
$^1/_{16} \times ^1/_2$	(1.6 × 12.7)	6	(152.4)	1
$^1/_{16} \times ^1/_4$	(1.6 × 6.4)	3	(76.2)	2
$^1/_{16} \times ^1/_8$	(1.6 × 3.2)	2	(50.8)	3

Note: See Figure 8.
[a]Maximum accumulated length of discontinuities in any 6 in. (152.4 mm) shall not exceed $^1/_2$ in. (12.7 mm).

Table 19—Circular Slag-Inclusion and Gas-Pocket-Type Discontinuities[a]

(1)		(2)		(3)		(4)
Size		Adjacent Size		Minimum Separation		Maximum Number in any 6 in. (152.4 mm)
in.	mm	in.	mm	in.	mm	
$^1/_8$[b]	(3.2)	$^1/_8$[b]	(3.2)	2	(50.8)	2
$^1/_8$[b]	(3.2)	$^1/_{16}$	(1.6)	1	(25.4)	Varies
$^1/_8$[b]	(3.2)	$^1/_{32}$	(0.8)	$^1/_2$	(12.7)	Varies
$^1/_8$[b]	(3.2)	$^1/_{64}$	(0.4)	$^3/_8$	(9.5)	Varies
$^1/_{16}$	(1.6)	$^1/_{16}$	(1.6)	$^1/_2$	(12.7)	4
$^1/_{16}$	(1.6)	$^1/_{32}$	(0.8)	$^3/_8$	(9.5)	Varies
$^1/_{16}$	(1.6)	$^1/_{64}$	(0.4)	$^1/_4$	(6.4)	Varies
$^1/_{32}$	(0.8)	$^1/_{32}$	(0.8)	$^1/_4$[c]	(6.4)	8
$^1/_{32}$	(0.8)	$^1/_{64}$	(0.4)	$^3/_{16}$	(4.8)	Varies
$^1/_{64}$	(0.4)	$^1/_{64}$	(0.4)	$^1/_8$	(3.2)	16

Note: See Figure 7.
[a]The sum of the diameters of all discontinuities in any 6 in. (152.4 mm) not to exceed $^1/_4$ in. (6.4 mm).
[b]Maximum size discontinuity for 0.250 in. (6.4 mm) wall and lighter shall be $^3/_{32}$ in. (2.4 mm).
[c]Two discontinuities $^1/_{32}$ in. (0.8 mm) or smaller may be as close as one diameter apart provided they are separated from any other discontinuity by at least $^1/_2$ in. (12.7 mm).

9.7.4 Ultrasonic and Electromagnetic Inspection

9.7.4.1 Equipment

Any equipment utilizing the ultrasonic or electromagnetic principles and capable of continuous and uninterrupted inspection of the weld seam shall be used. The equipment shall be checked with an applicable reference standard as described in 9.7.4.2 at least once every working shift to demonstrate its effectiveness and the inspection procedures. The equipment shall be adjusted to produce well-defined indications when the reference standard used by the manufacturer is scanned by the inspection unit in a manner simulating the inspection of the product and shall be capable of inspecting $^1/_{16}$ in. (1.6 mm) on either side of the weld line for the entire wall thickness.

9.7.4.2 NDT Reference Standards

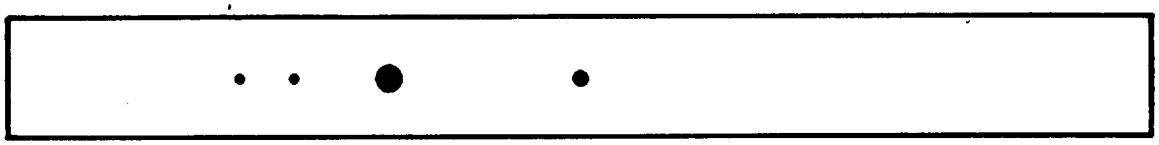
Reference standards shall have the same specified diameter and thickness as the product being inspected and may be of any convenient length as determined by the manufacturer. Reference standards shall contain machined notches, one on the inside surface and one on the outside surface, or a drilled hole as shown in Figure 9, at the option of the manufacturer. The notches shall be parallel to the weld seam and shall be separated by a distance sufficient to produce two separate and distinguishable signals. The $^1/_{16}$-in. (1.6-mm) or $^1/_8$-in. (3.2-mm) hole shall be drilled through the wall and perpendicular to the surface of the reference standard as shown in Figure 9 (see note).

Note: The reference standards defined above are convenient standards for calibration of nondestructive testing equipment. The dimensions of these standards should not be construed as the minimum size imperfection detectable by such equipment.

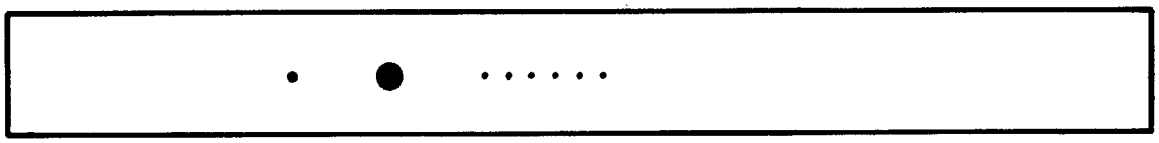
9.7.4.3 Acceptance Limits

Table 20 gives the height of acceptance limit signals produced by reference standards. An imperfection that produces a signal greater than the acceptance limit signal given in Table 20 shall be considered a defect unless it can be demonstrated by the manufacturer that the imperfection does not

EXAMPLE 1: TWO 1/8″ (3.2 mm) DISCONTINUITIES

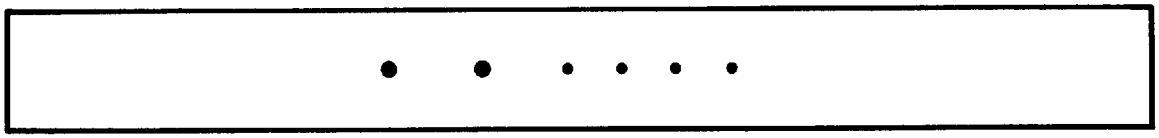


EXAMPLE 2: ONE 1/8″ (3,2 mm), ONE 1/16″ (1,6 mm), TWO 1/32″ (0,8 mm) DISCONTINUITIES

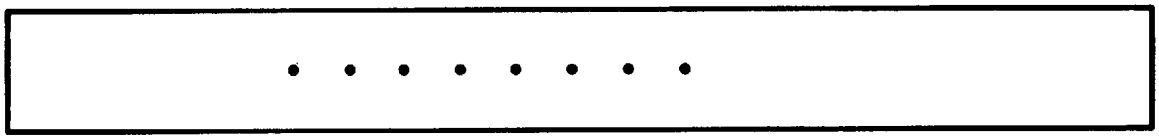


EXAMPLE 3: ONE 1/8″ (3.2 mm), ONE 1/32″ (0.8 mm), SIX 1/64″ (0.4 mm) DISCONTINUITIES

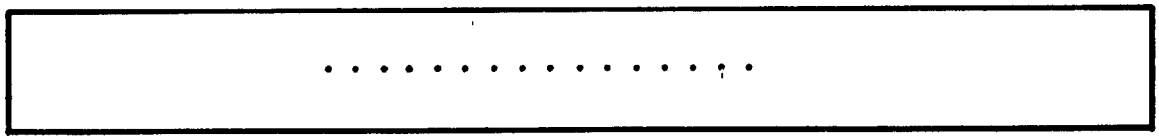
EXAMPLE 4: FOUR 1/16″ (1.6 mm) DISCONTINUITIES



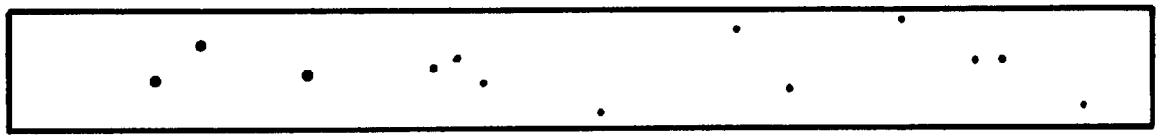
EXAMPLE 5: TWO 1/16″ (1.6 mm), FOUR 1/32″ (0.8 mm) DISCONTINUITIES



EXAMPLE 6: EIGHT 1/32″ (0.8 mm) DISCONTINUITIES



EXAMPLE 7: SIXTEEN 1/64″ (0.4 mm) DISCONTINUITIES



EXAMPLE 8: SCATTERED, THREE 1/32″ (0.8 mm), TEN 1/64″ (0.4 mm) DISCONTINUITIES

Figure 7—Examples of Maximum Distribution Patterns of Indicated Circular Slag-Inclusion and Gas-Pocket-Type Discontinuities

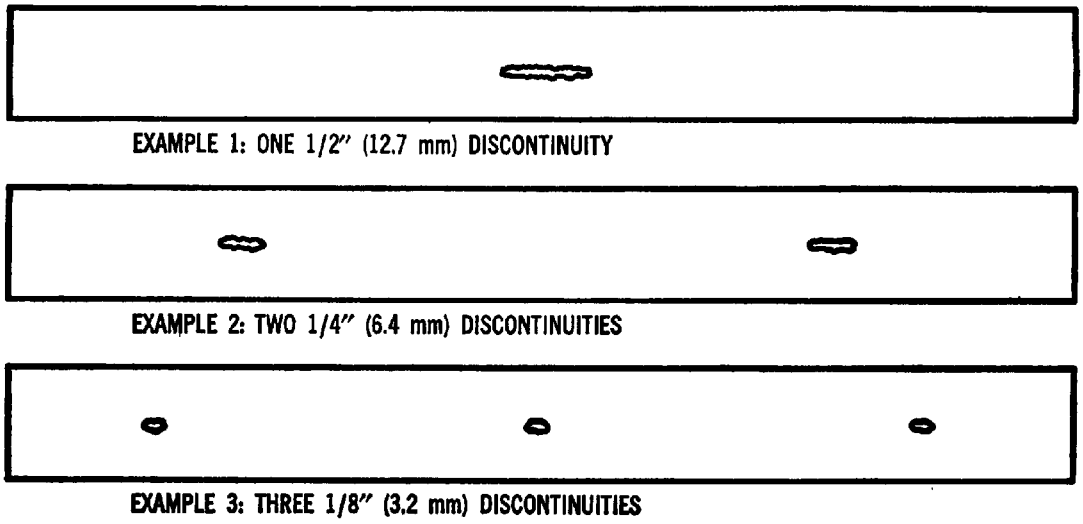


Figure 8—Examples of Maximum Distribution Patterns of Indicated Elongated Slag-Inclusive-Type Discontinuities

exceed the provisions of 7.8. Alternatively, indicated imperfections in submerged-arc welds may be reinspected by film radiological methods using 2 percent penetrameters in accordance with 9.7.3.1 through 9.7.3.12.

In addition, for gas metal-arc welds, continuous flaw signals greater than 1 in. in length, regardless of signal height, but greater than the background signal (noise) shall be reinspected by radiological methods using 2 percent penetrameters in accordance with 9.7.3.1 through 9.7.3.12 or by other techniques as agreed upon between the purchaser and the manufacturer.

9.7.4.4 Weld Repair

Defects in the weld found by ultrasonic or electromagnetic methods of inspection may be repaired by welding then reexamined nondestructively in accordance with Appendix B.

Table 20—Acceptance Limits

(1)	(2)	(3)		(4)
		Size Hole		Acceptance Limit Signal
Weld Type	Notch Type	in.	mm	(percent)
Submerged-arc, gas-metal arc and repair welds	N5	1/16	(1.6)	100
	All other	1/8	(3.2)	33 1/3
Electric weld	N10, V10	1/8	(3.2)	100
	B, P	—	—	80

9.7.4.5 Reinspection of Pipe Ends

For cold expanded welded pipe nondestructively inspected only prior to cold expansion, the weld at each end of each length shall be nondestructively reinspected subsequent to cold expansion for a distance of at least 6 in. (152.4 mm) by any of the methods specified in 9.7.2 or by the magnetic particle method in accordance with 9.7.5.1 through 9.7.5.3.

9.7.5 Magnetic Particle Inspection (See Note)

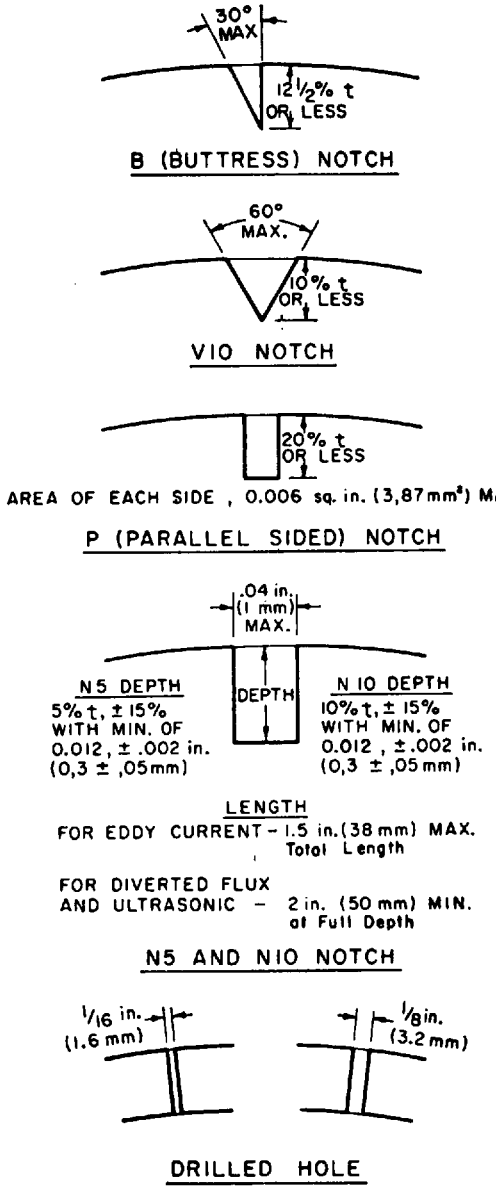
Note: For pipe ends per 9.7.4.5 and for weld repairs to the pipe body.

9.7.5.1 Equipment

The equipment used for magnetic particle inspection shall produce a magnetic field, transverse to the weld, of sufficient intensity to indicate weld area defects of the following character in the external surface of the pipe: open welds, partial or incomplete welds, intermittent welds, cracks, seams, and slivers.

9.7.5.2 Reference Standard

If requested by the purchaser, arrangements shall be made by the manufacturer to perform a demonstration for the purchaser or his representative during production of his order. Such demonstration shall be based on pipe in process or sample lengths of similar pipe retained by the manufacturer for that purpose that exhibit natural or artificially produced defects of the character stated in 9.7.5.1.



Note: See 9.7.4.2.

Figure 9—Reference Standards

9.7.5.3 Acceptance Limits

The manufacturer shall mark each magnetic particle indication and subsequently explore each indication with respect to the depth of the imperfection. Imperfections that require grinding or chipping to determine their depth shall be completely removed by grinding, or by cutting off, or may be repaired by welding in accordance with Appendix B and reexamined nondestructively.

9.7.5.4 Disposition of Defects

Pipe containing a defect must be given one of the following dispositions:

a. The defect shall be removed by grinding provided the remaining wall thickness is within specified limits. Grinding shall be done in a workmanlike manner.
b. The defect shall be repaired by welding in accordance with Appendix B.
c. The section of pipe containing the defect shall be cut off within the limits of requirements on length.
d. The entire pipe shall be rejected.

9.8 TEST METHODS

9.8.1 Methods of Chemical Analysis

Methods and practices relating to chemical analysis shall be performed in accordance with ASTM A 751, *Methods, Practices, and Definitions for Chemical Analysis of Steel Products*. Calibrations performed shall be traceable to established standards.

9.8.1.1 Test Method

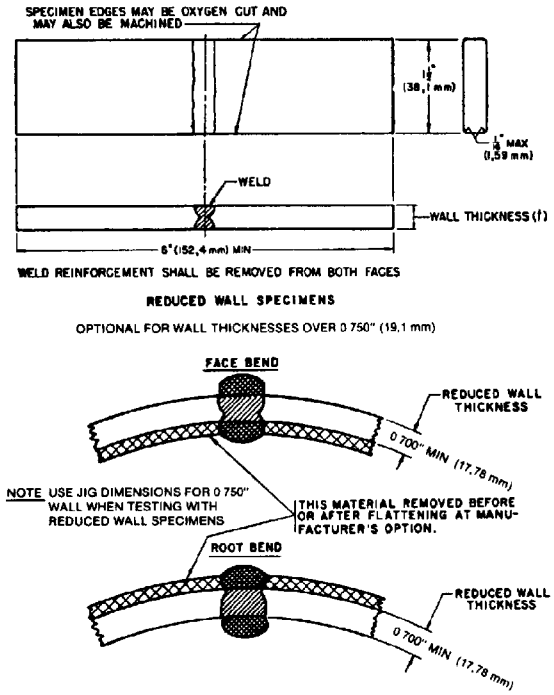
The tensile testing procedure shall conform to the requirements of the latest edition of ASTM A 370, *Mechanical Testing of Steel Products*, Annex II—Steel Tubular Products. All tensile tests, except transverse weld and ring tests, shall include yield strength, ultimate tensile strength, and elongation determinations and shall be performed with the specimens at room temperature. The strain rate shall be in accordance with the requirements of ASTM A 370.

9.8.1.2 Equipment

Tensile test machines shall have been calibrated within 15 months preceding any test in accordance with the procedures of ASTM E 4, *Practices for Load Verification of Testing Machines*. Where yield strength is determined by using extensometers, such extensometers shall be calibrated within the preceding 15 months in accordance with the procedures of ASTM E 83, *Method of Verification and Classification of Extensometers*.

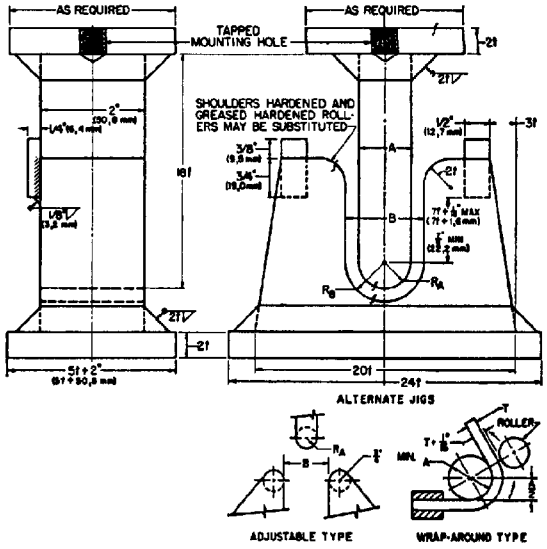
9.8.2 Guided-Bend Test

One face-bend and one root-bend specimen, both conforming to Figure 10, shall be bent approximately 180 degrees in a jig substantially in accordance with Figure 11. For any combination of outside diameter, wall thickness, and grade, the maximum value for jig dimension A in Figure 11 may be calculated using the equation shown. The manufacturer shall use a jig based on this dimension or a smaller dimension at his option; however, to minimize the number of jigs required, standard values for dimension A have been selected for pipe sizes $12^3/_4$ and larger. These values are listed for each diameter, wall thickness, and grade in Appendix G. For intermediate grades or wall thicknesses, the next smaller standard value for dimension A shall be used. When dimension A is greater than 9 in. (228.6 mm), the length of the



See 9.8.2.

Figure 10—Guided-Bend Test Specimen



$$A = \frac{1.15\,(D - 2t)}{\left(e\,\frac{D}{t} - 2e - 1\right)} - t$$

Where:

1.15 = peaking factor.
D = specified OD, in. (mm).
t = specified wall thickness, in. (mm).
e = strain.

	in./in.	(mm/mm)
for Grade A =	0.1675	(167.5)
for Grade B =	0.1375	(137.5)
for Grade X42 =	0.1375	(137.5)
for Grade X46 =	0.1325	(132.5)
for Grade X52 =	0.1250	(125.0)
for Grade X56 =	0.1175	(117.5)
for Grade X60 =	0.1125	(112.5)
for Grade X65 =	0.1100	(110.0)
for Grade X70 =	0.1025	(102.5)
for Grade X80 =	0.0900	(90.0)

$R_A = {}^1/_2\,A$

$B = A + 2t + {}^1/_8$ in. $(A + 2t + 3.2$ mm$)$

$R_B = {}^1/_2\,B$

Note: See 9.8.2.

Figure 11—Jig for Guided-Bend Test

specimen required to contact the male die need not exceed 9 in. (228.6 mm). For pipe with wall thicknesses over 0.750 in. (19.1 mm), a reduced wall specimen as shown in Figure 10 may be used at the option of the manufacturer. Reduced wall specimens shall be tested in a jig with the A dimension calculated for 0.750 in. (19.1 mm) wall pipe of the appropriate size and grade. The specimens (a) shall not fracture completely; (b) shall not reveal any cracks or ruptures in the weld metal greater than $^1/_8$ in. (3.18 mm) in length regardless of depth; and (c) shall not reveal any cracks or ruptures in the parent metal, heat affected zone, or fusion line longer than $^1/_8$ in. (3.18 mm) and deeper than $12^1/_2$ percent of the specified wall thickness, except cracks that occur at the edges of the specimen and that are less than $^1/_4$ in. (6.35 mm) long shall not be cause for rejection in (b) or (c) above regardless of depth.

scratches marked on the specimen before testing, a retest shall be allowed.

9.9 INVALIDATION OF TESTS

9.9.1 Defective Tensile Test Specimens

When the elongation of any tensile test specimen is less than that specified and if any part of the fracture is outside the middle third of the gauge length as indicated by scribe

9.9.2 Defective Mechanical Test Specimens

For any of the mechanical tests in Section 6, any test specimen that shows defective preparation or material imperfections unrelated to the intent of the particular mechanical test, whether observed before or after testing, may be discarded and replaced by another specimen from the same length of pipe.

9.10 RETESTS

9.10.1 Recheck Analyses

If the product analyses of both samples representing the heat fail to conform to the specified requirements, at the manufacturer's option either the heat shall be rejected or the remainder of the heat shall be tested individually for conformance to the specified requirements. If the product analysis of only one of the samples representing the heat fails to conform to the specified requirements, at the manufacturer's option either the heat shall be rejected or two recheck analyses shall be made using two additional samples from the heat. If both recheck analyses conform to the specified requirements, the heat shall be accepted, except for the pipe, plate, or skelp from which the initial sample that failed was taken. If one or both recheck analyses fail to conform to the specified requirements, at the manufacturer's option either the heat shall be rejected or the remainder of the heat shall be tested individually for conformance to the specified requirements.

For such individual testing, analyses for only the rejecting element or elements need be determined.

Samples for recheck analyses shall be taken in the same location as specified for product analysis samples.

9.10.2 Tensile Retest

If the tensile test specimen representing a lot of pipe fails to conform to the specified requirements, the manufacturer may elect to retest two additional lengths from the same lot. If both retested specimens conform to the requirements, all the lengths in a lot shall be accepted, except the length from which the initial specimen was taken. If one or both of the retested specimens fail to conform to the specified requirements, the manufacturer may elect to individually test the remaining lengths in the lot, in which case determinations are required only for the particular requirements with which the specimens failed to comply in the preceding tests. Specimens for retest shall be taken in the same manner as the specimen that failed to meet the minimum requirements.

9.10.3 Flattening Retest

Flattening retest provisions are as follows:

a. Nonexpanded electric-welded pipe produced in single lengths in grades higher than A25—The manufacturer may elect to retest any failed end until the requirements are met, providing the finished pipe is not less than 80 percent of its length after initial cropping.

b. Nonexpanded electric-welded pipe produced in multiple lengths in grades higher than A25—The manufacturer may elect to retest each end of each individual length if any test fails. The retests for each end of each individual length shall be made with the weld alternately at 0 degrees and 90 degrees.

c. Cold-expanded electric-welded pipe in grades higher than A25 and all welded Grade A25 sizes $2^7/_8$ and larger—The manufacturer may elect to retest one end from each of two additional lengths of the same lot. If both retests are acceptable, all lengths in the lot shall be accepted, except the original failed length. If one or both retests fail, the manufacturer may elect to repeat the test on specimens cut from one end of each of the remaining individual lengths in the lot.

9.10.4 Bend Retest

If the specimen fails to conform to the specified requirements, the manufacturer may elect to make retests on specimens cut from two additional lengths from the same lot. If all retest specimens conform to the specified requirements, all lengths in the lot shall be accepted, except the length from which the initial specimen was taken. If one or more of the retest specimens fail to conform to the specified requirements, the manufacturer may elect to repeat the test on specimens cut from the individual lengths remaining in the lot.

9.10.5 Guided-Bend Retest

If one or both of the guided-bend specimens fail to conform to the specified requirements, the manufacturer may elect to repeat the tests on specimens cut from two additional lengths of pipe from the same lot. If such specimens conform to the specified requirements, all lengths in the lot shall be accepted, except the length initially selected for test. If any of the retested specimens fail to pass the specified requirements, the manufacturer may elect to test specimens cut from the individual lengths remaining in the lot. The manufacturer may also elect to retest any length that has failed to pass the test by cropping back and cutting two additional specimens from the same end. If the requirements of the original test are met by both of these additional tests, that length shall be acceptable. No further cropping and retesting is permitted. Specimens for retests shall be taken in the same manner as specified in 9.8.3.

9.10.6 Weld Ductility Retest

If the weld ductility test specimen representing a lot of pipe fails to conform to the requirements of 6.2.5, the manufacturer may elect to retest two additional lengths from the same lot. If both retested specimens conform to the requirements, all the lengths in the lot shall be accepted, except the length from which the initial specimen was taken. If one or both of the retested specimens fail to conform to the specified requirements, the manufacturer may elect to test specimens cut from one end of the individual lengths remaining in the lot. Precaution shall be taken so that the specimens can be identified with the length of pipe from which they were cut. The manufacturer may also elect to retest any length that has failed to pass the above test procedure by

cropping back and cutting two additional specimens from the same end. If the weld ductility test requirements are met by both of these additional tests, that length shall be acceptable. No further cropping and retesting is permitted.

10 Marking

10.1 GENERAL

Pipe and pipe couplings manufactured in conformance with this specification shall be marked by the manufacturer as specified herein (see note).

Note: Users of this specification should note that there is no longer a requirement for marking a product with the API monogram. API continues to license use of the monogram on products covered by this specification, but it is administered by the staff of the Institute separately from the specification. The policy describing use of the monogram is contained in Appendix I. No other use of the monogram is permitted. Licensees may mark products in conformance with Section 10 or Appendix I, and nonlicensees may mark products in conformance with Section 10.

10.1.1 The required marking on pipe shall be as specified hereinafter.

10.1.2 The required marking on couplings shall be die stamped unless otherwise agreed between the purchaser and the manufacturer, in which case it shall be paint stenciled.

10.1.3 Length and hydrostatic test pressure markings should be in U.S. customary units. These markings shall be in SI units or both U.S. customary and SI units if so specified on the purchase order. If not so specified, pipe made and intended for use in countries using the metric system may be marked in SI units only, at the option of the manufacturer.

10.1.4 Additional markings including those for compatible standards following the specification marking are allowed and may be applied as desired by the manufacturer or as requested by the purchaser.

10.2 LOCATION OF MARKINGS

The location of identification markings shall be as follows:

a. Sizes $1^1/_2$ and smaller—Die stamped on a metal tag fixed to the bundle or may be printed on the straps or banding clips used to tie the bundle.

b. Seamless pipe in all other sizes and welded pipe up to size 16—Paint stenciled on the outside surface starting at a point between 18 in. and 30 in. (457.2 mm and 762 mm) from the end of the pipe in the sequence shown in 10.3, except when agreed between the purchaser and the manufacturer some or all of the markings may be placed on the inside surface in a sequence convenient to the manufacturer.

c. Welded pipe size 16 and larger—Paint stenciled on the inside surface starting at a point no less than 6 in. (152.4 mm) from the end of the pipe in a sequence convenient to the manufacturer, unless otherwise specified by the purchaser.

10.3 SEQUENCE OF MARKINGS

The sequence of identification markings shall be as as specified in 10.3.1–10.3.9.

10.3.1 Manufacturer

Manufacturer's name or mark shall be the first identifying mark.

10.3.2 Specification

"Spec 5L" shall be marked when the product is in complete compliance with this specification.

10.3.3 Compatible Standards

Products in compliance with multiple compatible standards may be marked with the name of each standard.

10.3.4 Designation

The size and weight designations are dimensionless quantities based on the former U.S. customary unit diameter and weight per foot. The size designation (column 4, Tables 4, 5, 6A, 6B, and 6C) or the applicable intermediate outside diameter shall be marked.

For sizes $4^1/_2$ and larger, the nominal weight for threaded-and-coupled pipe (column 2, Tables 4 and 5), the tabulated weight for plain-end pipe (in column 4, Tables 6A , 6B, and 6C), or the applicable calculated weight for pipe having an intermediate outside diameter and/or wall thickness shall be marked.

10.3.5 Grade and Class

The symbols to be used are as follows:

Grade (See Note)	Symbol
Grade A25, Class I	A25
Grade A25, Class II	A25R
Grade A	A
Grade B	B
Grade X42	X42
Grade X46	X46
Grade X52	X52
Grade X56	X56
Grade X60	X60
Grade X65	X65
Grade X70	X70
Grade X80	X80

For grades intermediate to X42 and X80, the symbol shall be X followed by the first two digits of the specified minimum yield strength.

By agreement between the purchaser and the manufacturer and when so specified on the purchase order, the grade shall be identified by color in accordance with SR3 (see Appendix F).

Note: See 1.3 for limitations on downgrading.

10.3.6 Process of Manufacture

The symbols to be used are as follows:

a. Seamless pipe	S
b. Welded pipe, except continuous welded	E
c. Continuous welded pipe	F

10.3.7 Heat Treatment

The symbols to be used are as follows:

a. Normalized or normalized and tempered	HN
b. Subcritical stress relieved	HS
c. Subcritical age hardened	HA
d. Quenched and tempered	HQ

10.3.8 Test Pressure

When the specified hydrostatic test pressure is higher than the tabulated pressure (Tables 4, 5, 6A, 6B, and 6C), the word "TESTED" shall be marked followed by the test pressure in pounds per square inch.

10.3.9 Supplementary Requirements

See Appendix F for supplimentary requirements.

10.3.10 Examples

1. Size 14, weight 54.57, Grade B, seamless, regular-weight, plain-end pipe should be paint stenciled as follows:

AB CO Spec 5L 14 54.57 B S

2. Size $6^5/_8$, weight 18.97, Grade B, electric-welded, regular-weight, plain-end pipe should be paint stenciled as follows:

AB CO Spec 5L $6^5/_8$ 18.97 B E

3. Nominal size 4, Grade A25 continuous welded, Class 1, standard-weight, threaded-line pipe should be paint stenciled as follows:

AB CO Spec 5L 4 11.00 A25 F
Spec 5B 4 LP

4. Size 14, weight 54.57, Grade X70, seamless, quenched and tempered steel pipe should be paint stenciled as follows:

AB CO Spec 5L 14 54.57 X70 S HQ

5. Size $12^3/_4$, weight 43.77, Grade X42, seamless plain-end pipe should be paint stenciled as follows:

AB CO Spec 5L $12^3/_4$ 43.77 X42 S

6. Size $6^5/_8$, weight 14.97, Grade X42, electric-welded plain-end pipe should be paint stenciled as follows:

AB CO Spec 5L $6^5/_8$ 14.97 X42 E

7. Size $12^3/_4$, weight 43.77, Grade X42, helical seam submerged-arc welded plain-end pipe should be paint stenciled as follows:

AB CO Spec 5L $12^3/_4$ 43.77 X42 E

10.4 BUNDLE IDENTIFICATION

For pipe sizes $1^1/_2$ and smaller, the identification markings specified in 10.3 shall be placed on the tag, strap, or clip used to tie the bundle. For example, size $1^1/_2$, weight 2.72, Grade B, electric-welded, plain-end pipe should have the following marking:

AB CO Spec 5L $1^1/_2$ 2.72 B E

10.5 LENGTH

In addition to the identification markings stipulated in 10.2, 10.3, and 10.4, the length shall be marked as follows:

a. For pipe sizes larger than $1^1/_2$, the length in feet and tenths of a foot (unless otherwise specified on the purchase order) as measured on the finished pipe, shall be paint stenciled on the outside surface at a location convenient to the manufacturer, except by agreement between the purchaser and the manufacturer, the length marking may be placed inside the pipe at a convenient location.

b. For pipe sizes $1^1/_2$ and smaller, the total length of pipe in the bundle in feet and tenths of a foot, unless otherwise specified on the purchase order, shall be marked on the tag, band, or clip.

10.6 COUPLINGS

All couplings in nominal sizes 2 and larger shall be identified with the manufacturer's name or mark and "Spec 5L."

10.7 DIE STAMPING

Cold-die stamping of grades higher than A25 plate or pipe not subsequently heat treated and all pipe with wall thicknesses of 0.156 in. (4.0 mm) and less is prohibited, except by agreement between the purchaser and the manufacturer and when so specified on the purchase order, pipe or plate may be cold-die stamped. The manufacturer at his option may hot-die stamp [200°F (93°C) or higher] plate or pipe, cold-die stamp plate or pipe if it is subsequently heat treated, and cold-die stamp couplings. Cold-die stamping shall be

done with rounded or blunt dies. All die stamping shall be at least 1 in. (25.4 mm) from the weld for all grades except Grade A25.

10.8 THREAD IDENTIFICATION

At the manufacturer's option, any pipe threads that conform to the threading and gauging stipulations given in API Standard 5B may be identified by stamping or stenciling the product adjacent to threads, with the manufacturer's name or mark, the size, and the letters "LP" to indicate the type of thread. The thread marking may be applied to products that do or do not bear the API monogram. For example, nominal size 6 API line pipe threads may be marked as follows:

AB CO Spec 5B 6 LP

If the product is clearly marked elsewhere with the manufacturer's identification, his name or mark, as above, may be omitted.

10.9 THREAD CERTIFICATION

The use of the letters "Spec 5B" as provided in 10.8 shall constitute a certification by the manufacturer that the threads so marked comply with the requirements in API Standard 5B but should not be construed by the purchaser as a representation that the product so marked is, in its entirety, in accordance with any API specification. Manufacturers who use the letters "Spec 5B" for thread identification must have access to properly certified API master pipe gauges.

10.10 PIPE PROCESSOR MARKINGS

Pipe heat treated by a processor other than the original pipe manufacturer shall be marked as stipulated in 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, and 10.7. The processor shall remove any marking that does not indicate the new condition of the product as a result of heat treating (such as prior grade identity and original pipe manufacturer's name or logo).

11 Coating and Protection

11.1 COATINGS

Unless otherwise ordered, pipe shall be given an external coating to protect it from rusting in transit. An attempt should be made to make these coatings smooth, hard to the touch, and with minimum sags.

If bare pipe or specially coated pipe is desired, the purchase order should so state. For special coatings, the purchase order should state further whether the coating is to be applied to the full length or whether a certain specified distance from the end is to be left uncoated. Unless otherwise specified, such bare ends are commonly given a coating with oil for protection in transit.

11.2 THREAD PROTECTORS

On nominal pipe sizes smaller than 2, the thread protectors shall be suitable fabric wrappings or suitable metal, fiber, or plastic protectors. On nominal pipe sizes 2 and larger, the thread protectors shall be of such design, material, and mechanical strength to protect the thread and the end of the pipe from damage under normal handling and transportation conditions. The thread protectors shall cover the full length of the thread on the pipe and exclude water and dirt from the thread during transportation and the period of normal storage. The normal storage period shall be considered approximately one year. The thread forms in protectors shall be such that the pipe threads are not damaged by the protectors. Protector material shall contain no compounds capable of causing corrosion or promoting adherence of the protectors to the threads and shall be suitable for service temperatures of –50°F to +150°F (–46°C to +66°C).

12 Documents

12.1 CERTIFICATION

The manufacturer shall, upon request by the purchaser, furnish to the purchaser a certificate of compliance stating that the material has been manufactured, sampled, tested, and inspected in accordance with this specification and has been found to meet the requirements.

Where additional information is required, including the results of mechanical testing, SR15 shall be specified on the purchase order (see Appendix F).

12.2 RETENTION OF RECORDS

Tests and inspections requiring retention of records in this specification are shown in Table 21. Such records shall be retained by the manufacturer and shall be made available to the purchaser upon request for a period of three years after the date of purchase from the manufacturer.

Table 21—Retention of Records

Requirement	Reference
Chemical properties	
Heat analysis	Paragraph 9.2.1
Product analysis	Paragraph 9.2.2
Mechanical tests	
Tensile tests	Paragraph 9.3.1
Weld tensile tests	Paragraph 9.3.1.5
Mill control tests	Paragraph 9.3.1.6
Guided bend tests	Paragraph 9.3.4
Fracture toughness tests	Paragraph 6.2.6, SR5, SR6
Hydrostatic tests	
Tester recorder charts (where used)	Paragraph 9.4.2
Supplementary hydrostatic tests	Paragraph 9.4.4
Nondestructive inspection	
Film (where used)	Paragraph 9.7.2
Fluoroscopic	
Operator qualifications	Paragraph 9.7.3.2
Welded jointers	
Film	Paragraph A.4
Repair welding procedure	
Transverse tensile test	Paragraph C.2.2.2
Longitudinal tensile-elongation test	Paragraph C.2.2.3
Transverse guided bend test	Paragraph C.2.2.4
Nick break test	Paragraph C.2.2.5

APPENDIX A—SPECIFICATION FOR WELDED JOINTERS (NORMATIVE)

A.1 Method

Welding of any type that uses deposited filler metal and is generally recognized as sound practice shall be permitted unless the purchaser specifies a particular method. Welding procedures and welders and welding machine operators (hereafter called operators) shall be qualified in accordance with API Standard 1104. Copies of the welding procedure specification and procedure qualification record shall be provided to the purchaser upon request.

A.2 Workmanship

The ends of the pipe to be welded together shall be prepared in accordance with the requirements of the procedure to be used. Pipe weld seams (straight, helical, or skelp) shall be staggered between 2 in. and 8 in. (51 mm and 203 mm) unless otherwise specified by the purchaser. The completed jointers shall be straight within the limits of 7.6 of this specification. Each weld shall have a substantially uniform cross section around the entire circumference of the pipe. At no point shall its crowned surface be below the outside surface of the parent metal nor shall it rise above the parent metal by more than $^1/_8$ in. (3.18 mm) if submerged-arc welded, or by more than $^1/_{16}$ in. (1.59 mm), if welded by another process.

A.3 Marking

Each jointer shall be marked using paint stencil to identify the welder or operator.

A.4 Nondestructive Testing

The girth welds of jointers shall be 100 percent radiographed in accordance with the procedures and standards of acceptability in API Standard 1104 (see note). Jointer welds failing to pass this radiographic examination may be repaired and re-radiographed in accordance with the procedures and acceptance criteria of API Standard 1104.

Note: See 7.7 for length requirements on jointers.

APPENDIX B—REPAIR OF DEFECTS BY WELDING (NORMATIVE)

B.1 Types of Pipe

B.1.1 SEAMLESS PIPE AND PARENT METAL OF WELDED PIPE

The repair of defects in seamless pipe and parent metal of welded pipe is permissible except (a) when the depth of the defect exceeds $33^1/_3$ percent of the specified wall thickness of the pipe and the length of that portion of the defect in which the depth exceeds $12^1/_2$ percent is greater than 25 percent of the specified outside diameter of the pipe; or (b) when more than one repair is required in any length equivalent to 10 times the specified outside diameter of the pipe. Repairs shall be made in accordance with B.2. Repair welds shall be inspected by the magnetic particle method in accordance with 9.7.5.1 through 9.7.5.3, by liquid penetrant, or by other NDT methods as agreed between purchaser and manufacturer.

B.1.2 WELD SEAM OF WELDED PIPE

Defects in filler metal welds may be repaired at the option of the manufacturer; such repairs shall be in accordance with B.3. Electric welds may be repaired only by agreement between the purchaser and the manufacturer; such repairs shall be in accordance with B.4. Repair welds shall be inspected by ultrasonic methods in accordance with 9.7.4.1 through 9.7.4.3, except that the equipment need not be capable of continuous and uninterrupted operation and, at the option of the manufacturer, repairs made by submerged-arc welding or by shielded metal-arc welding may alternatively be inspected by radiological methods in 9.7.3.

B.1.3 HEAT TREATED PIPE

When heat treated pipe has been repaired by welding, the need for and type of reheat treatment shall be based on the effect of the repair on the structure and properties of the heat treated pipe, by agreement between the manufacturer and the purchaser.

B.2 Procedure for Repair by Welding of Seamless Pipe and Parent Metal of Welded Pipe

The repair of defects in seamless pipe and parent metal of welded pipe shall conform to the requirements listed in B.2.1–B.2.5. Conformance to the repair procedure is subject to approval of the purchaser's inspector.

B.2.1 The defect shall be removed completely by chipping and/or grinding. The resulting cavity shall be thoroughly cleaned and shall be inspected before welding by magnetic particle methods to ensure complete removal of the defect.

B.2.2 The minimum length of repair weld shall be 2 in. (50.8 mm). Where the orientation of the defect permits, the repair weld shall be placed in the circumferential direction.

B.2.3 The repair weld shall be made either by automatic submerged-arc welding, gas metal-arc welding, or manually shielded metal-arc welding using low-hydrogen electrodes. The metal temperature in the area to be repaired shall be a minimum of 50°F (10°C). The welding procedure and performance shall be qualified in accordance with Appendix C.

B.2.4 The repair weld shall be ground to merge smoothly into the original contour of the pipe.

B.2.5 Repaired pipe shall be tested hydrostatically after repairing in accordance with 9.4.

B.3 Procedure for Repair of Submerged-Arc and Gas Metal-Arc Welds

The repair of submerged-arc and gas metal-arc welds shall conform to the requirements listed in B.3.1–B.3.3. Conformance is subject to approval of purchaser's inspector.

B.3.1 The defect shall be completely removed and the cavity thoroughly cleaned. Where multiple pass repairs are used, the size of the cavity must be sufficiently large [at least 2 in. (50.8 mm) in length] to avoid coincidence of starts and stops of individual passes.

B.3.2 The minimum length of each repair weld shall be 2 in. (50.8 mm). The repair weld shall be made either by automatic submerged-arc welding, gas metal-arc welding, or manual shielded metal-arc welding using low-hydrogen electrodes. The welding procedure and performance shall be qualified in accordance with Appendix C.

B.3.3 Each length of repaired pipe shall be tested hydrostatically in accordance with 9.4.

B.4 Procedure for Repair of Electric Welds

The repair of electric welds shall conform to the requirements in B.4.1–B.4.6 and shall include the weld zone, which is defined for the purposes of repair as $^1/_2$ in. (12.7 mm) on

either side of the fusion line. Conformance to the repair procedure is subject to approval of the purchaser's inspector.

B.4.1 The weld zone defect shall be removed completely by chipping and/or grinding, and the resulting cavity shall be thoroughly cleaned.

B.4.2 The minimum length of repair weld shall be 2 in. (50.8 mm), and individual weld repairs must be separated by at least 10 ft (3 m).

B.4.3 The repair weld shall be made either by automatic submerged-arc welding, gas metal-arc welding, or manual shielded metal-arc welding using low-hydrogen electrodes. The metal temperature in the area to be repaired shall be a minimum of 5°F (10°C). The welding procedure and performance shall be qualified in accordance with Appendix C.

B.4.4 When a repair weld is made through the full wall thickness, it shall include weld passes made from both the ID and the OD of the pipe. Starts and stops of the ID and OD repair welds shall not coincide.

B.4.5 The repair shall be ground to merge smoothly into the original contour of the pipe and shall have a maximum crown of 0.06 in. (1.52 mm).

B.4.6 Repaired pipe shall be hydrostatically tested after repair in accordance with 9.4.

APPENDIX C—REPAIR WELDING PROCEDURE (NORMATIVE)

C.1 General

All repair welds shall be made in the flat position according to a qualified procedure and by a welding machine operator (hereafter called operator) or repair welder who is qualified in a flat position as specified in C.2. Repair welds may be made by one of the following methods:

a. Automatic submerged arc.
b. Automatic or semi-automatic gas metal arc.
c. Manual shielded metal arc using low-hydrogen electrodes.

All welding materials shall be properly handled and stored in accordance with the manufacturer's recommendations so as to preclude moisture or other contamination. Test welds may be made on either plate stock or pipe stock at the option of the manufacturer.

The manufacturer shall maintain a record of the welding procedure and procedure qualification test results. Copies of the welding procedure specification and procedure qualification record shall be provided to the purchaser upon request.

C.2 Repair Welding Procedure Qualification

Welding procedures shall be qualified by preparing and testing welds in accordance with this appendix. At the option of the manufacturer, the tests specified in the ASME *Boiler and Pressure Vessel Code*, Section IX, may be substituted herein. For the purpose of this appendix, the term automatic welding includes both machine welding and automatic welding as defined in the ASME *Boiler and Pressure Vessel Code*, Section IX.

C.2.1 ESSENTIAL VARIABLES

An existing procedure shall not be applicable and new procedure must be qualified when any of the following essential variables is changed beyond the stated limits:

a. Welding process:
   1. A change in the welding process, such as submerged arc to gas metal arc.
   2. A change in the method, such as manual to semi-automatic.
b. Pipe material:
   1. A change in grade category. When different alloying systems are used within one grade category, each alloying composition must be separately qualified. Grade categories are as follows:
      — SMYS 42,000 psi or less
      — SMYS greater than 42,000 psi, but less than 65,000 psi
      — each grade with SMYS of 65,000 psi or greater
   2. Within each grade category, a thicker material than the material qualified.
   3. Within the grade category and thickness range, a carbon equivalent, CE (see note), based on product analysis for the material to be repaired, that is more than 0.04 percent greater than the CE of the material qualified.

Note: $$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} = \frac{Ni + Cu}{15}$$

c. Welding materials:
   1. A change in filler metal classification.
   2. A change in electrode diameter.
   3. A change of more than 5 percent in the composition of shielding gas.
   4. A change of more than 10 percent in the flow rate of shielding gas.
   5. A change in submerged-arc welding flux from one designation to another.
d. Welding parameters:
   1. A change in the type of current (such as AC versus DC).
   2. A change in polarity.
   3. For automatic and semi-automatic welding, schedules of welding current, voltage, and speed may be established to cover ranges of wall thicknesses. Within the schedule, appropriately selected points shall be tested to qualify the entire schedule. Thereafter, a new qualification is required if there is a deviation from the qualified schedule greater than the following:
      — 10 percent in amperage
      — 7 percent in voltage
      — 10 percent in travel speed for automatic welding
e. Weld bead: For manual and semi-automatic welding, a change in bead width greater than 50 percent.
f. Preheat and post-weld heat treatment:
   1. Repair welding at a pipe temperature lower than the pipe temperature of the qualification test.
   2. The addition or deletion of postweld heat treatment.

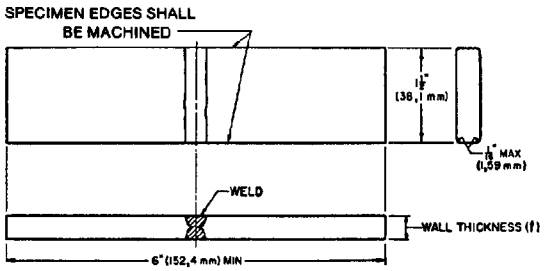
C.2.2 MECHANICAL TESTING

C.2.2.1 Number of Tests

Two specimens of each type are required from each test.

C.2.2.2 Transverse Tensile Test

The transverse tensile test specimens shall be approximately 1.5 in. (38 mm) wide and shall have the transverse



Note: Weld reinforcement shall be removed from both faces.

Figure C-1—Transverse Tensile Test Specimen

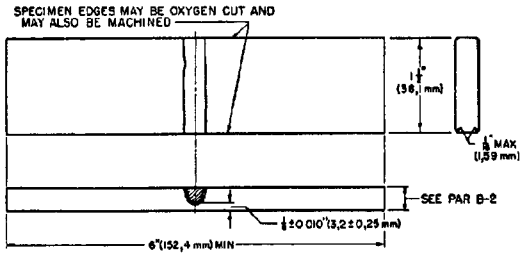
butt weld perpendicular to the longitudinal axis at the center of the test specimen (See Figure C-1 or Figure 4.) The weld reinforcement shall be removed from both faces. The ultimate tensile strength shall be at least equal to the minimum specified for the pipe grade.

C.2.2.3 Transverse Guided-Bend Test

The transverse guided-bend test specimens shall conform to Figure C-2. The weld shall be made in a groove as shown. Each specimen shall be placed on the die with the weld at midspan and shall be bent approximately 180 degrees in a jig substantially in accordance with Figure C-3 and Table C-1, with the exposed surface of the weld in tension. The bend test shall be considered acceptable if no crack or other defect exceeding $^1/_8$ in. (3.18 mm) in any direction is present in the weld metal or base metal after bending. Cracks that both originate along the edges of the specimen during testing and measure less than $^1/_4$ in. (6.35 mm) in all directions shall not be considered.

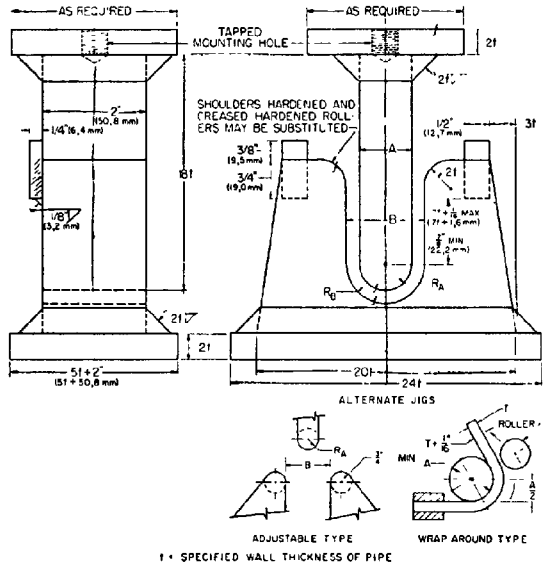
C.2.2.4 Nick-Break Test

The nick-break specimens shall conform to Figure C-4. The weld shall be made in a groove as shown. Each specimen shall be saw-notched from both edges at the center of the weld and shall be broken by pulling or hammer blows at



Note: Weld reinforcement shall be removed.

Figure C-2—Guided-Bend Test Specimen



Note: See Table C-1.

Figure C-3—Jig for Guided-Bend Test

the center of one end. The exposed surface of the specimen shall be visually examined and shall be considered acceptable if it meets the following criteria:

a. No gas pockets exceeding $^1/_{16}$ in. (1.59 mm) in any direction.

b. Not more than one gas pocket of any size for specified wall thicknesses of 0.250 in. (6.35 mm) and less.

c. Not more than two gas pockets of any size for specified wall thicknesses of 0.500 in. (12.7 mm) or less but greater than 0.250 in. (6.35 mm).

d. Not more than three gas pockets of any size for specified wall thicknesses greater than 0.500 in. (12.7 mm).

e. Slag inclusions must be separated by at least $^1/_2$ in. (12.7 mm) of sound metal and shall appear no greater than $^1/_{16}$ in. (1.59 mm) in width or $^3/_{16}$ in. (4.76 mm) in length.

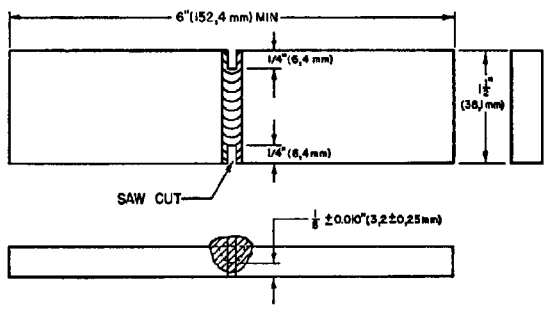


Figure C-4—Nick-Break Test Specimen

Table C-1—Guided-Bend Test Jig Dimensions

(1)	(2)	(3)	(4)	(5)	(6)
	Pipe Grade[a]				
Member Dimension	A,B & X42	X46	X52 & X56	X60 & X65	X70 & X80
Radius of male member, R_A	$3t$	$3\frac{1}{2}t$	$4t$	$4\frac{1}{2}t$	$5t$
Radius of female member, R_B	$4t + \frac{1}{16}$ in. ($4t$ + 1.6 mm)	$4\frac{1}{2}t + \frac{1}{16}$ in. ($4\frac{1}{2}t$ + 1.6 mm)	$5t + \frac{1}{16}$ in. ($5t$ + 1.6 mm)	$5\frac{1}{2}t + \frac{1}{16}$ in. ($5\frac{1}{2}t$ + 1.6 mm)	$6t + \frac{1}{16}$ in. ($6t$ + 1.6 mm)
Width of male member, A	$6t$	$7t$	$8t$	$9t$	$10t$
Width of groove in female member, B	$8t + \frac{1}{8}$ in. ($8t$ + 3.2 mm)	$9t + \frac{1}{8}$ in. ($9t$ + 3.2 mm)	$10t + \frac{1}{8}$ in. ($10t$ + 3.2 mm)	$11t + \frac{1}{8}$ in. ($11t$ + 3.2 mm)	$12t + \frac{1}{8}$ in. ($12t$ + 3.2 mm)

Notes:

1. See Figure C-4.
2. t = specified wall thickness of the pipe.

[a]For intermediate grades of pipe, the dimensions of the bending jig shall conform to those shown for the next lower grade or shall be proportional thereto.

C.3 Welding Personnel Performance Qualification

C.3.1 QUALIFICATION

C.3.1.1 General

Each repair welder and operator is required to qualify. A repair welder or operator qualified on one grade category is qualified for any lower grade category provided the same welding process is used.

C.3.1.2 Testing

To qualify, a repair welder or operator must produce welds that are acceptable in the following tests:

a. Film radiographic examination per Section 9 of this specification.
b. Two transverse guided-bend tests per C.2.2.3 of this appendix.
c. Two nick-break tests per C.2.2.4 of this appendix.

C.3.1.3 Test Failures

If one or more of the tests in C.3.1.2 fail to meet the specified requirements, the welder or operator may make one additional qualification weld. If that weld fails one or more of the tests in C.3.1.2, the welder or operator is disqualified. No further retests shall be permitted until the welder has completed additional training.

C.3.2 REQUALIFICATION

Requalification in accordance with C.3.1 is required under the following circumstances:

a. One year has elapsed since the last prior applicable qualification.
b. The individual has not been welding using qualified procedures for a period of 3 months.
c. There is reason to question the individual's ability.

APPENDIX D—ELONGATION TABLE (NORMATIVE)

The minimum elongation values calculated by the equation in Table 3 are given in Table D-1.

Table D-1—Elongation Table

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Tensile Test Specimen			Elongation in 2 inches (minimum percent)									
	Specified Wall Thickness (in.)			A25	A	B X42	X46	X52	X56	X60	X65	X70	X80
Area A sq. in.	$^3/_4$ in. Specimen	1 in. Specimen	$1^1/_2$ in. Specimen	Specified Tensile Strength (psi)									
				45,000	48,000	60,000	63,000	66,000	71,000	75,000	77,000	82,000	90,000
0.75 and greater	.994 and greater	.746 and greater	.497 and greater	38.5	36.0	29.5	28.5	27.0	25.5	24.0	23.5	22.5	20.5
0.74	.980–.993	.735–.745	.490–.496	38.0	36.0	29.5	28.0	27.0	25.5	24.0	23.5	22.0	20.5
0.73	.967–.979	.726–.734	.484–.489	38.0	36.0	29.5	28.0	27.0	25.5	24.0	23.5	22.0	20.5
0.72	.954–.966	.715–.725	.477–.483	38.0	36.0	29.5	28.0	27.0	25.0	24.0	23.5	22.0	20.5
0.71	.941–.953	.706–.714	.471–.476	38.0	35.5	29.0	28.0	27.0	25.0	24.0	23.5	22.0	20.5
0.70	.927–.940	.695–.705	.464–.470	38.0	35.5	29.0	28.0	26.5	25.0	24.0	23.5	22.0	20.0
0.69	.914–.926	.686–.694	.457–.463	37.5	35.5	29.0	28.0	26.5	25.0	24.0	23.0	22.0	20.0
0.68	.900–.913	.675–.685	.450–.456	37.5	35.5	29.0	27.5	26.5	25.0	23.5	23.0	22.0	20.0
0.67	.887–.899	.666–.674	.444–.449	37.5	35.5	29.0	27.5	26.5	25.0	23.5	23.0	22.0	20.0
0.66	.874–.886	.655–.665	.437–.443	37.5	35.0	29.0	27.5	26.6	25.0	23.5	23.0	21.5	20.0
0.65	.861–.873	.646–.654	.431–.436	37.0	35.0	28.5	27.5	26.5	24.5	23.5	23.0	21.5	20.0
0.64	.847–.860	.635–.645	.424–.430	37.0	35.0	28.5	27.5	26.5	24.5	23.5	23.0	21.5	20.0
0.63	.834–.846	.626–.634	.417–.423	37.0	35.0	28.5	27.5	26.0	24.5	23.5	23.0	21.5	20.0
0.62	.820–.833	.615–.625	.410–.416	37.0	35.0	28.5	27.0	26.0	24.5	23.5	22.5	21.5	19.5
0.61	.807–.819	.606–.614	.404–.409	36.5	34.5	28.5	27.0	26.0	24.5	23.0	22.5	21.5	19.5
0.60	.794–.806	.595–.605	.397–.403	36.5	34.5	28.5	27.0	26.0	24.5	23.0	22.5	21.5	19.5
0.59	.781–.793	.586–.594	.391–.396	36.5	34.5	28.0	27.0	26.0	24.0	23.0	22.5	21.5	19.5
0.58	.767–.780	.575–.585	.384–.390	36.5	34.5	28.0	27.0	26.0	24.0	23.0	22.5	21.0	19.5
0.57	.754–.766	.566–.574	.377–.383	36.0	34.0	28.0	27.0	25.5	24.0	23.0	22.5	21.0	19.5
0.56	.740–.753	.555–.565	.370–.376	36.0	34.0	28.0	26.5	25.5	24.0	23.0	22.5	21.0	19.5
0.55	.727–.739	.546–.554	.364–.369	36.0	34.0	28.0	26.5	25.5	24.0	22.5	22.0	21.0	19.5
0.54	.714–.726	.535–.545	.357–.363	36.0	34.0	27.5	26.5	25.5	24.0	22.5	22.0	21.0	19.0
0.53	.701–.713	.526–.534	.351–.356	35.5	33.5	27.5	26.5	25.5	23.5	22.5	22.0	21.0	19.0
0.52	.687–.700	.515–.525	.344–.350	35.5	33.5	27.5	26.5	25.0	23.5	22.5	22.0	20.5	19.0
0.51	.674–.686	.506–.514	.337–.343	35.5	33.5	27.5	26.0	25.0	23.5	22.5	22.0	20.5	19.0
0.50	.660–.673	.495–.505	.330–.336	35.5	33.5	27.0	26.0	25.0	23.5	22.5	22.0	20.5	19.0
0.49	.647–.659	.486–.494	.324–.329	35.0	33.0	27.0	26.0	25.0	23.5	22.0	21.5	20.5	19.0
0.48	.634–.646	.475–.485	.317–.323	35.0	33.0	27.0	26.0	25.0	23.0	22.0	21.5	20.5	19.0
0.47	.621–.633	.466–.474	.311–.316	35.0	33.0	27.0	26.0	24.5	23.0	22.0	21.5	20.5	18.5
0.46	.607–.620	.455–.465	.304–.310	34.5	33.0	27.0	25.5	24.5	23.0	22.0	21.5	20.0	18.5
0.45	.594–.606	.446–.454	.297–.303	34.5	32.5	26.5	25.5	24.5	23.0	22.0	21.5	20.0	18.5
0.44	.580–.593	.435–.445	.290–.296	34.5	32.5	26.5	25.5	24.5	23.0	21.5	21.0	20.0	18.5
0.43	.567–.579	.426–.434	.284–.289	34.5	32.5	26.5	25.5	24.5	22.5	21.5	21.0	20.0	18.5
0.42	.554–.566	.415–.425	.277–.283	34.0	32.0	26.5	25.0	24.0	22.5	21.5	21.0	20.0	18.5
0.41	.541–.553	.406–.414	.271–.276	34.0	32.0	26.0	25.0	24.0	22.5	21.5	21.0	20.0	18.0
0.40	.527–.540	.395–.405	.264–.270	34.0	32.0	26.0	25.0	24.0	22.5	21.5	21.0	19.5	18.0
0.39	.514–.526	.386–.394	.257–.263	33.5	31.5	26.0	25.0	24.0	22.5	21.0	20.5	19.5	18.0
0.38	.500–.513	.375–.385	.250–.256	33.5	31.5	26.0	24.5	23.5	22.0	21.0	20.5	19.5	18.0
0.37	.487–.499	.366–.374	.244–.249	33.0	31.5	25.5	24.5	23.5	22.0	21.0	20.5	19.5	18.0
0.36	.474–.486	.355–.365	.237–.243	33.0	31.0	25.5	24.5	23.5	22.0	21.0	20.5	19.5	17.5

Table D-1—Elongation Table—Continued

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Tensile Test Specimen			Elongation in 2 inches (minimum percent)									
	Specified Wall Thickness (in.)			A25	A	B X42	X46	X52	X56	X60	X65	X70	X80
Area A sq. in.	$^3/_4$ in. Specimen	1 in. Specimen	$1^1/_2$ in. Specimen	Specified Tensile Strength (psi)									
				45,000	48,000	60,000	63,000	66,000	71,000	75,000	77,000	82,000	90,000
0.35	.461–.473	.346–.354	.231–.236	33.0	31.0	25.5	24.5	23.5	22.0	21.0	20.5	19.0	17.5
0.34	.447–.460	.335–.345	.224–.230	32.5	31.0	25.0	24.0	23.0	21.5	20.5	20.0	19.0	17.5
0.33	.434–.446	.326–.334	.217–.223	32.5	30.5	25.0	24.0	23.0	21.5	20.5	20.0	19.0	17.5
0.32	.420–.433	.315–.325	.210–.216	32.5	30.5	25.0	24.0	23.0	21.5	20.5	20.0	19.0	17.5
0.31	.407–.419	.306–.314	.204–.209	32.0	30.5	25.0	23.5	22.5	21.5	20.5	20.0	18.5	17.0
0.30	.394–.406	.295–.305	.197–.203	32.0	30.0	24.5	23.5	22.5	21.0	20.0	19.5	18.5	17.0
0.29	.381–.393	.286–.294	.191–.196	31.5	30.0	24.5	23.5	22.5	21.0	20.0	19.5	18.5	17.0
0.28	.367–.380	.275–.285	.184–.190	31.5	29.5	24.5	23.0	22.5	21.0	20.0	19.5	18.5	17.0
0.27	.354–.366	.266–.274	.177–.183	31.0	29.5	24.0	23.0	22.0	20.5	19.5	19.0	18.0	16.5
0.26	.340–.353	.255–.265	.170–.176	31.0	29.0	24.0	23.0	22.0	20.5	19.5	19.0	18.0	16.5
0.25	.327–.339	.246–.254	.164–.169	30.5	29.0	23.5	22.5	22.0	20.5	19.5	19.0	18.0	16.5
0.24	.314–.326	.235–.245	.157–.163	30.5	29.0	23.5	22.5	21.5	20.0	19.0	19.0	18.0	16.5
0.23	.301–.313	.226–.234	.151–.156	30.0	28.5	23.5	22.5	21.5	20.0	19.0	18.5	17.5	16.0
0.22	.287–.300	.215–.225	.144–.150	30.0	28.5	23.0	22.0	21.0	20.0	19.0	18.5	17.5	16.0
0.21	.274–.286	.206–.214	.137–.143	29.5	28.0	23.0	22.0	21.0	19.5	18.5	18.5	17.5	16.0
0.20	.260–.273	.195–.205	.130–.136	29.5	27.5	22.5	21.5	21.0	19.5	18.5	18.0	17.0	15.5
0.19	.247–.259	.186–.194	.124–.129	29.0	27.5	22.5	21.5	20.5	19.5	18.5	18.0	17.0	15.5
0.18	.234–.246	.175–.185	.117–.123	29.0	27.0	22.0	21.5	20.5	19.0	18.0	17.5	17.0	15.5
0.17	.221–.233	.166–.174	.111–.116	28.5	27.0	22.0	21.0	20.0	19.0	18.0	17.5	16.5	15.0
0.16	.207–.220	.155–.165	.104–.110	28.0	26.5	21.5	21.0	20.0	18.5	17.5	17.5	16.5	15.0
0.15	.194–.206	.146–.154	.097–.103	27.5	26.0	21.5	20.5	19.5	18.5	17.5	17.0	16.0	15.0
0.14	.180–.193	.135–.145	.091–.096	27.5	26.0	21.0	20.0	19.5	18.0	17.5	17.0	16.0	14.5
0.13	.167–.179	.126–.134	.084–.090	27.0	25.5	21.0	20.0	19.0	18.0	17.0	16.5	15.5	14.5
0.12	.154–.166	.115–.125	.077–.083	26.5	25.0	20.5	19.5	19.0	17.5	17.0	16.5	15.5	14.0
0.11	.141–.153	.106–.114	.071–.076	26.0	24.5	20.0	19.5	18.5	17.5	16.5	16.0	15.0	14.0
0.10	.127–.140	.095–.105	.064–.070	25.5	24.0	19.5	19.0	18.0	17.0	16.0	16.0	15.0	13.5
0.09	.114–.126	.086–.094	.057–.063	25.0	23.5	19.5	18.5	17.5	16.5	16.0	15.5	14.5	13.5
0.08	.100–.113	.075–.085	.050–.056	24.5	23.0	19.0	18.0	17.5	16.0	15.5	15.0	14.5	13.0
0.07	.087–.099	.066–.074	.044–.049	24.0	22.5	18.5	—	—	—	—	—	—	13.0
0.06	.074–.086	.055–.065	.037–.043	23.0	22.0	18.0	—	—	—	—	—	—	12.5
0.05	.061–.073	.046–.054	.031–.036	22.5	21.0	17.0	—	—	—	—	—	—	12.0
0.04	.047–.060	.035–.045	.024–.030	21.5	20.0	16.5	—	—	—	—	—	—	11.5
0.03	.034–.046	.026–.034	.017–.023	20.0	19.0	15.5	—	—	—	—	—	—	11.0
0.02	.020–.033	.015–.025	.010–.016	18.5	17.5	14.5	—	—	—	—	—	—	10.0
0.01 and less	.019 and less	.014 and less	.009 and less	16.0	15.0	12.5	—	—	—	—	—	—	8.5

APPENDIX E—DIMENSIONS, WEIGHTS, AND TEST PRESSURES—METRIC EQUIVALENTS (NORMATIVE)

Tables E-1A, E-1B, and E-1C provide the metric (SI) unit equivalent of U.S. customary unit values for dimensions, weights, and test pressures shown in Tables 6A, 6B, and 6C.

Table E-1A—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Nominal Sizes 1/8 Through 1 1/2 (Metric Units)

(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Designation							Minimum Test Pressure[b] (kPa × 100[c])				
Nominal Size	Wall	Weight	Outside Diameter, D (mm)[a]	Wall Thickness, t (mm)[a]	Plain-End Weight, w_{pe} (kg/m)	Inside Diameter, d (mm)	Grade A25 Std.	Grade A Std.	Grade A Alt.	Grade B Std.	Grade B Alt.
1/8	Std.	0.24	10.3	1.7	0.36	6.9	48	48	—	48	—
1/8	XS	0.31	10.3	2.4	0.47	5.5	59	59	—	59	—
1/4	Std.	0.42	13.7	2.2	0.62	9.3	48	48	—	48	—
1/4	XS	0.54	13.7	3.0	0.79	7.7	59	59	—	59	—
3/8	Std.	0.57	17.1	2.3	0.84	12.5	48	48	—	48	—
3/8	XS	0.74	17.1	3.2	1.10	10.7	59	59	—	59	—
1/2	Std.	0.85	21.3	2.8	1.28	15.7	48	48	—	48	—
1/2	XS	1.09	21.3	3.7	1.61	13.9	59	59	—	59	—
1/2	XXS	1.71	21.3	7.5	2.55	6.3	69	69	—	69	—
3/4	Std.	1.13	26.7	2.9	1.70	20.9	48	48	—	48	—
3/4	XS	1.47	26.7	3.9	2.19	18.9	59	59	—	59	—
3/4	XXS	2.44	26.7	7.8	3.64	11.1	69	69	—	69	—
1	Std.	1.68	33.4	3.4	2.52	26.6	48	48	—	48	—
1	XS	2.17	33.4	4.5	3.21	24.4	59	59	—	59	—
1	XXS	3.66	33.4	9.1	5.45	15.2	69	69	—	69	—
1 1/4	Std.	2.27	42.2	3.6	3.43	35.0	69	83	—	90	—
1 1/4	XS	3.00	42.2	4.9	4.51	32.4	90	124	—	131	—
1 1/4	XXS	5.21	42.2	9.7	7.77	22.8	96	152	—	158	—
1 1/2	Std.	2.72	48.3	3.7	4.07	40.9	69	83	—	90	—
1 1/2	XS	3.63	48.3	5.1	5.43	38.1	90	124	—	131	—
1 1/2	XXS	6.41	48.3	10.2	9.58	27.9	96	152	—	158	—

Note: See Tables 6A, 6B, and 6C in Section 7 for U.S. customary unit equivalents of the metric values shown in this table.

[a]Outside diameter and wall thickness dimensions shown are subject to tolerances described in Table 7. Inside diameters are nominal and are given here for information (see 7.2).

[b]The test pressures given in Tables E-1A, E-1B, and E-1C apply to Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70, and X80 only. See 9.4.3 for pressures applicable to other grades.

[c]100 kPa = 1 bar.

Table E-1B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16 (Metric Units)

Designation		Outside Diameter, D (mm)[a]	Wall Thickness, t (mm)[a]	Plain-End Weight, w_{pe} (kg/m)	Inside Diameter, d (mm)		Minimum Test Pressure[b] (kPa × 100[c])										
Size	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
2 3/8[d]	2.03	60.3	2.1	3.01	56.1	Std.	41	87	101	121	132	150	161	173	187	202	207
						Alt.	—	—	—	151	166	188	202	207	207	207	207
2 3/8[d]	2.64	60.3	2.8	3.97	54.6	Std.	55	—	—	162	177	200	207	207	207	207	207
						Alt.	—	—	—	202	207	207	207	207	207	207	207
2 3/8[d]	3.00	60.3	3.2	4.51	53.9	Std.	69	—	—	185	202	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8[d]	3.36	60.3	3.6	5.03	53.1	Std.	69	—	—	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8	3.65	60.3	3.9	5.42	52.5	Std.	69	161	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8	4.05	60.3	4.4	6.07	51.5	Std.	76	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8	4.39	60.3	4.8	6.57	50.7	Std.	83	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8	5.02	60.3	5.5	7.43	49.3	Std.	90	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8	5.67	60.3	6.4	8.51	47.5	Std.	96	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8	6.28	60.3	7.1	9.31	46.1	Std.	96	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 3/8	9.03	60.3	11.1	13.47	38.1	Std.	96	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8[d]	2.47	73.0	2.1	3.67	68.8	Std.	41	71	83	100	109	124	133	143	155	167	190
						Alt.	—	—	—	125	137	155	167	179	193	207	207
2 7/8[d]	3.22	73.0	2.8	4.85	67.4	Std.	55	—	—	133	146	165	178	191	206	207	207
						Alt.	—	—	—	167	182	207	207	207	207	207	207
2 7/8[d]	3.67	73.0	3.2	5.51	66.6	Std.	69	—	—	153	167	189	203	207	207	207	207
						Alt.	—	—	—	191	207	207	207	207	207	207	207
2 7/8[d]	4.12	73.0	3.6	6.16	65.8	Std.	69	—	—	172	188	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	4.53	73.0	4.0	6.81	65.0	Std.	69	136	158	191	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	4.97	73.0	4.4	7.44	64.2	Std.	69	150	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	5.40	73.0	4.8	8.07	63.4	Std.	69	163	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	5.79	73.0	5.2	8.69	62.6	Std.	69	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	6.13	73.0	5.5	9.16	62.0	Std.	76	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	7.01	73.0	6.4	10.51	60.2	Std.	83	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	7.66	73.0	7.0	11.39	59.0	Std.	90	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
2 7/8	13.69	73.0	14.0	20.37	45.0	Std.	96	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207

Table E-1B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16 (Metric Units)—Continued

Designation		Outside Diameter, D (mm)[a]	Wall Thickness, t (mm)[a]	Plain-End Weight, w_{pe} (kg/m)	Inside Diameter, d (mm)		Minimum Test Pressure[b] (kPa × 100[c])										
Size	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
3 1/2[d]	3.03	88.9	2.1	4.50	84.7	Std.	41	59	68	82	90	102	109	117	127	137	157
						Alt.	—	—	—	103	112	127	137	147	159	171	197
3 1/2[d]	3.95	88.9	2.8	5.95	83.3	Std.	55	—	—	110	120	136	146	156	169	183	207
						Alt.	—	—	—	137	150	170	182	196	207	207	207
3 1/2[d]	4.51	88.9	3.2	6.76	82.5	Std.	69	89	104	125	137	155	167	179	194	207	207
						Alt.	—	—	—	157	171	194	207	207	207	207	207
3 1/2[d]	5.06	88.9	3.6	7.57	81.7	Std.	69	—	—	141	154	174	188	201	207	207	207
						Alt.	—	—	—	176	193	207	207	207	207	207	207
3 1/2[d]	5.57	88.9	4.0	8.37	80.9	Std.	69	112	130	157	171	194	207	207	207	207	207
						Alt.	—	—	—	196	207	207	207	207	207	207	207
3 1/2	6.11	88.9	4.4	9.17	80.1	Std.	69	123	143	172	188	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
3 1/2	6.65	88.9	4.8	9.95	79.3	Std.	69	134	156	188	205	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
3 1/2	7.58	88.9	5.5	11.31	77.9	Std.	69	154	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
3 1/2	8.68	88.9	6.4	13.02	76.1	Std.	—	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
3 1/2	9.66	88.9	7.1	14.32	74.7	Std.	—	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
3 1/2	10.25	88.9	7.6	15.24	73.7	Std.	90	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
3 1/2	18.58	88.9	15.2	27.63	58.5	Std.	—	172	172	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4[d]	3.47	101.6	2.1	5.15	97.4	Std.	—	51	60	72	79	89	96	103	111	120	137
						Alt.	—	—	—	90	98	111	120	128	139	150	171
4[d]	4.53	101.6	2.8	6.82	96.0	Std.	41	68	80	96	105	119	128	137	148	160	182
						Alt.	—	—	—	120	131	148	160	171	185	200	207
4[d]	5.17	101.6	3.2	7.76	95.2	Std.	—	78	91	110	120	136	146	156	169	183	207
						Alt.	—	—	—	137	150	170	182	196	207	207	207
4[d]	5.81	101.6	3.6	8.70	94.4	Std.	55	88	102	123	135	153	164	176	190	207	207
						Alt.	—	—	—	154	168	191	205	207	207	207	207
4[d]	6.40	101.6	4.0	9.63	93.6	Std.	—	98	114	137	150	170	182	196	207	207	207
						Alt.	—	—	—	171	187	207	207	207	207	207	207
4	7.03	101.6	4.4	10.55	92.8	Std.	69	108	125	151	165	187	201	207	207	207	207
						Alt.	—	—	—	188	206	207	207	207	207	207	207
4	7.65	101.6	4.8	11.46	92.0	Std.	83	117	137	164	180	207	207	207	207	207	207
						Alt.	—	—	—	206	207	207	207	207	207	207	207
4	9.11	101.6	5.7	13.48	90.2	Std.	83	139	162	195	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4	10.01	101.6	6.4	15.02	88.8	Std.	—	156	182	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4	11.16	101.6	7.1	16.55	87.4	Std.	—	174	193	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207

Table E-1B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16 (Metric Units)—Continued

Designation		Outside Diameter, D (mm)[a]	Wall Thickness, t (mm)[a]	Plain-End Weight, w_{pe} (kg/m)	Inside Diameter, d (mm)		Minimum Test Pressure[b] (kPa × 100[c])										
Size	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
4	12.50	101.6	8.1	18.68	85.4	Std.	117	193	193	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2[d]	3.92	114.3	2.1	5.81	110.1	Std.	—	46	53	64	70	79	85	91	99	106	122
						Alt.	—	—	—	80	87	99	106	114	123	133	152
4 1/2[d]	5.84	114.3	3.2	8.77	107.9	Std.	55	70	81	97	106	121	130	139	151	162	185
						Alt.	—	—	—	122	133	151	162	174	188	203	207
4 1/2[d]	6.56	114.3	3.6	9.83	107.1	Std.	—	78	91	110	120	136	146	156	169	183	207
						Alt.	—	—	—	137	150	170	182	196	207	207	207
4 1/2[d]	7.24	114.3	4.0	10.88	106.3	Std.	69	87	101	122	133	151	162	174	188	203	207
						Alt.	—	—	—	152	166	188	203	207	207	207	207
4 1/2	7.95	114.3	4.4	11.92	105.5	Std.	—	96	111	134	146	166	178	191	207	207	207
						Alt.	—	—	—	167	183	207	207	207	207	207	207
4 1/2	8.66	114.3	4.8	12.96	104.7	Std.	83	104	121	146	160	181	195	207	207	207	207
						Alt.	—	—	—	183	200	207	207	207	207	207	207
4 1/2	9.32	114.3	5.2	13.99	103.9	Std.	—	113	132	158	173	196	207	207	207	207	207
						Alt.	—	—	—	198	207	207	207	207	207	207	207
4 1/2	10.01	114.3	5.6	15.01	103.1	Std.	83	122	142	170	186	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	10.79	114.3	6.0	16.02	102.3	Std.	83	130	152	183	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	11.35	114.3	6.4	17.03	101.5	Std.	—	139	162	195	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	12.66	114.3	7.1	18.77	100.1	Std.	—	154	180	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	13.96	114.3	7.9	20.73	98.5	Std.	—	172	193	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	14.98	114.3	8.6	22.42	97.1	Std.	117	187	193	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	19.00	114.3	11.1	28.25	92.1	Std.	—	193	193	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	22.51	114.3	13.5	33.56	87.3	Std.	—	193	193	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
4 1/2	27.54	114.3	17.1	40.99	80.1	Std.	—	193	193	207	207	207	207	207	207	207	207
						Alt.	—	—	—	207	207	207	207	207	207	207	207
5 9/16[d]	4.86	141.3	2.1	7.21	137.1	Std.	—	37	43	52	57	64	69	72	80	86	98
5 9/16[d]	7.26	141.3	3.2	10.90	134.9	Std.	46	56	65	78	85	97	103	112	121	130	150
5 9/16[d]	9.01	141.3	4.0	13.54	133.3	Std.	58	70	82	97	107	121	132	139	146	163	187
5 9/16[d]	10.79	141.3	4.8	16.16	131.7	Std.	70	84	98	117	129	145	157	168	182	196	207
5 9/16[d]	12.50	141.3	5.6	18.74	130.1	Std.	81	98	115	137	150	170	183	195	207	207	207
5 9/16[d]	14.62	141.3	6.6	21.92	128.1	Std.	83	116	135	161	177	199	207	207	207	207	207
5 9/16[d]	15.85	141.3	7.1	23.50	127.1	Std.	105	125	145	176	192	207	207	207	207	207	207
5 9/16[d]	17.50	141.3	7.9	25.99	125.5	Std.	116	139	162	207	207	207	207	207	207	207	207
5 9/16[d]	19.17	141.3	8.7	28.45	123.9	Std.	128	153	178	207	207	207	207	207	207	207	207

Table E-1B—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 2 3/8 Through 5 9/16 (Metric Units)—Continued

Designation		Outside Diameter, D (mm)[a]	Wall Thickness, t (mm)[a]	Plain-End Weight, w_{pe} (kg/m)	Inside Diameter, d (mm)	Minimum Test Pressure[b] (kPa × 100[c])										
Size	Weight						Grade A25	Grade A	Grade B	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
5 9/16	20.78	141.3	9.5	30.88	122.3	Std.	139	167	193	207	207	207	207	207	207	207	207
5 9/16[d]	27.04	141.3	12.7	40.28	115.9	Std.	186	193	193	207	207	207	207	207	207	207	207
5 9/16[d]	32.96	141.3	15.9	49.17	109.5	Std.	193	193	193	207	207	207	207	207	207	207	207
5 9/16	38.55	141.3	19.1	57.56	103.1	Std.	193	193	193	207	207	207	207	207	207	207	207

Note: See Tables 6A, 6B, and 6C in Section 7 for U.S. customary unit equivalents of the metric values shown in this table.

[a]Outside diameter and wall-thickness dimensions shown are subject to tolerances described in Table 7. Inside diameters are nominal and are given here for information (see 7.2).

[b]The test pressures given in Tables E-1A, E-1B, and E-1C apply to Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70 and X80 only. See 9.4.3 for pressures applicable to other grades.

[c]100 kPa = 1 bar.

[d]These sizes are special plain-end weights. All other sizes are regular weight. See Table 7 for applicable weight tolerances. For Grades X42 and higher, weights intermediate to regular weights shall be considered regular weight; weights intermediate to special plain-end weights shall be considered special plain-end weights; and weights intermediate to the heaviest tabulated special plain-end weight and the lightest regular weight shall be considered special plain-end weights.

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80 (Metric Units)

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B		Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
6⅝[d]	5.80	168.3	2.1	8.61	164.1	31	39	37	45	54	59	68	72	78	84	91	103
6⅝[d]	7.59	168.3	2.8	11.43	162.7	41	51	48	59	72	79	88	95	102	110	119	138
6⅝[d]	8.68	168.3	3.2	13.03	161.9	47	59	54	68	82	90	101	109	117	127	136	157
6⅝[d]	9.76	168.3	3.6	14.62	161.1	53	66	61	77	92	101	114	123	132	143	154	177
6⅝[d]	10.78	168.3	4.0	16.21	160.3	59	73	68	85	102	112	127	136	146	158	170	196
6⅝	11.85	168.3	4.4	17.78	159.5	64	81	75	94	113	123	140	150	161	174	188	207
6⅝	12.92	168.3	4.8	19.35	158.7	70	88	82	103	123	135	152	164	176	191	205	207
6⅝	13.92	168.3	5.2	20.91	157.9	76	95	89	111	133	145	165	177	190	206	207	207
6⅝	14.98	168.3	5.6	22.47	157.1	82	103	96	120	143	157	178	192	205	207	207	207
6⅝	17.02	168.3	6.4	25.55	155.5	94	117	109	136	164	179	203	207	207	207	207	207
6⅝	18.97	168.3	7.1	28.22	154.1	105	131	123	153	183	201	207	207	207	207	207	207
6⅝	21.04	168.3	7.9	31.25	152.5	117	146	136	170	205	207	207	207	207	207	207	207
6⅝	23.08	168.3	8.7	34.24	150.9	129	161	150	172	207	207	207	207	207	207	207	207
6⅝	25.03	168.3	9.5	37.20	149.3	141	176	164	193	207	207	207	207	207	207	207	207
6⅝	28.57	168.3	11.0	42.67	146.3	—	—	—	—	207	207	207	207	207	207	207	207
6⅝	32.71	168.3	12.7	48.73	142.9	187	193	193	193	207	207	207	207	207	207	207	207
6⅝	36.39	168.3	14.3	54.31	139.7	193	193	193	193	207	207	207	207	207	207	207	207
6⅝	40.05	168.3	15.9	59.76	136.5	193	193	193	193	207	207	207	207	207	207	207	207
6⅝	45.35	168.3	18.3	67.69	131.7	193	193	193	193	207	207	207	207	207	207	207	207
6⅝	47.06	168.3	19.1	70.27	130.1	193	193	193	193	207	207	207	207	207	207	207	207
6⅝	53.73	168.3	22.2	79.98	123.9	193	193	193	193	207	207	207	207	207	207	207	207
8⅝[d]	11.35	219.1	3.2	17.04	212.7	36	45	42	52	63	69	78	84	90	97	105	121
8⅝[d]	14.11	219.1	4.0	21.22	211.1	45	56	52	65	79	86	97	105	112	121	131	151
8⅝	16.94	219.1	4.8	25.37	209.5	54	68	63	79	94	103	117	126	135	147	158	181
8⅝	18.26	219.1	5.2	27.43	208.7	—	—	—	—	102	112	127	138	146	158	170	196
8⅝	19.66	219.1	5.6	29.48	207.9	63	79	74	92	110	121	136	147	158	171	184	207
8⅝	22.36	219.1	6.4	33.57	206.3	72	90	84	105	126	138	156	167	180	195	207	207
8⅝	24.70	219.1	7.0	36.61	205.1	80	100	93	116	139	153	173	186	199	207	207	207
8⅝	27.70	219.1	7.9	41.14	203.3	90	112	105	131	157	172	194	207	207	207	207	207
8⅝	28.55	219.1	8.2	42.65	202.7	92	116	108	135	162	178	200	207	207	207	207	207
8⅝	30.42	219.1	8.7	45.14	201.7	99	123	116	144	173	189	207	207	207	207	207	207
8⅝	33.04	219.1	9.5	49.10	200.1	108	135	126	157	189	207	207	207	207	207	207	207
8⅝	38.30	219.1	11.1	56.94	196.9	126	158	147	184	207	207	207	207	207	207	207	207
8⅝	43.39	219.1	12.7	64.64	193.7	—	—	—	—	207	207	207	207	207	207	207	207
8⅝	48.40	219.1	14.3	72.22	190.5	162	193	189	193	207	207	207	207	207	207	207	207
8⅝	53.40	219.1	15.9	79.67	187.3	180	193	193	193	207	207	207	207	207	207	207	207
8⅝	60.71	219.1	18.3	90.62	182.5	193	193	193	193	207	207	207	207	207	207	207	207
8⅝	63.08	219.1	19.1	94.20	180.9	193	193	193	193	207	207	207	207	207	207	207	207
8⅝	67.76	219.1	20.6	100.84	177.9	193	193	193	193	207	207	207	207	207	207	207	207
8⅝	72.42	219.1	22.2	107.79	174.7	193	193	193	193	207	207	207	207	207	207	207	207
8⅝	81.44	219.1	25.4	121.32	168.3	193	193	193	193	207	207	207	207	207	207	207	207
10¾[d]	17.65	273.1	4.0	26.54	265.1	36	45	42	52	72	78	88	95	102	110	119	137
10¾[d]	21.21	273.1	4.8	31.76	263.5	43	54	50	63	86	94	107	114	123	133	143	165

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
10 3/4[d]	22.87	273.1	5.2	34.35	262.7	—	—	—	—	93	102	115	124	133	144	155	178
10 3/4	24.63	273.1	5.6	36.94	261.9	50	63	59	74	100	110	124	134	143	155	167	192
10 3/4	28.04	273.1	6.4	42.09	260.3	58	72	68	84	114	125	142	152	163	177	191	207
10 3/4	31.20	273.1	7.1	46.57	258.9	64	81	75	94	127	140	158	170	183	198	207	207
10 3/4	34.24	273.1	7.8	51.03	257.5	71	89	83	103	141	154	174	187	200	207	207	207
10 3/4	38.23	273.1	8.7	56.72	255.7	79	99	92	116	157	172	195	207	207	207	207	207
10 3/4	40.48	273.1	9.3	60.50	254.5	84	105	99	123	167	183	207	207	207	207	207	207
10 3/4	48.24	273.1	11.1	71.72	250.9	101	126	118	147	200	207	207	207	207	207	207	207
10 3/4	54.74	273.1	12.7	81.55	247.7	—	—	—	—	207	207	207	207	207	207	207	207
10 3/4	61.15	273.1	14.3	91.26	244.5	130	162	152	189	207	207	207	207	207	207	207	207
10 3/4	67.58	273.1	15.9	100.85	241.3	144	181	168	193	207	207	207	207	207	207	207	207
10 3/4	77.03	273.1	18.3	114.99	236.5	166	193	193	193	207	207	207	207	207	207	207	207
10 3/4	86.18	273.1	20.6	128.27	231.9	187	193	193	193	207	207	207	207	207	207	207	207
10 3/4	92.28	273.1	22.2	137.36	228.7	193	193	193	193	207	207	207	207	207	207	207	207
10 3/4	98.30	273.1	23.8	146.30	225.5	193	193	193	193	207	207	207	207	207	207	207	207
10 3/4	104.13	273.1	25.4	155.15	222.3	193	193	193	193	207	207	207	207	207	207	207	207
10 3/4	126.83	273.1	31.8	188.75	209.5	193	193	193	193	207	207	207	207	207	207	207	207
12 3/4[d]	23.11	323.9	4.4	34.67	315.1	34	42	39	49	66	72	82	88	95	103	111	127
12 3/4[d]	25.22	323.9	4.8	37.77	314.3	37	45	43	53	72	79	90	96	103	112	121	139
12 3/4[d]	27.20	323.9	5.2	40.87	313.5	—	—	—	—	79	86	97	105	112	121	130	150
12 3/4[d]	29.31	323.9	5.6	43.96	312.7	43	53	50	62	85	92	105	113	121	131	141	162
12 3/4	33.38	323.9	6.4	50.11	311.1	49	61	56	71	96	105	119	129	138	150	161	185
12 3/4	37.42	323.9	7.1	55.47	309.7	54	68	64	80	108	119	134	145	155	168	181	207
12 3/4	41.45	323.9	7.9	61.56	308.1	61	76	71	88	121	132	149	161	172	186	200	207
12 3/4	43.77	323.9	8.4	65.35	307.1	64	80	75	94	127	139	158	169	182	197	207	207
12 3/4	45.58	323.9	8.7	67.62	306.5	67	83	78	98	133	145	165	177	189	205	207	207
12 3/4	49.56	323.9	9.5	73.65	304.9	73	91	85	106	145	158	179	193	207	207	207	207
12 3/4	53.52	323.9	10.3	79.65	303.3	—	—	—	—	156	172	194	207	207	207	207	207
12 3/4	57.59	323.9	11.1	85.62	301.7	85	107	99	124	169	185	207	207	207	207	207	207
12 3/4	65.42	323.9	12.7	97.46	298.5	—	—	—	—	193	207	207	207	207	207	207	207
12 3/4	73.15	323.9	14.3	109.18	295.3	110	136	127	159	207	207	207	207	207	207	207	207
12 3/4	80.93	323.9	15.9	120.76	292.1	121	152	142	177	207	207	207	207	207	207	207	207
12 3/4	88.63	323.9	17.5	132.23	288.9	134	167	156	193	207	207	207	207	207	207	207	207
12 3/4	96.12	323.9	19.1	143.56	285.7	146	183	170	193	207	207	207	207	207	207	207	207
12 3/4	103.53	323.9	20.6	154.08	282.7	158	193	184	193	207	207	207	207	207	207	207	207
12 3/4	110.97	323.9	22.2	165.17	279.5	170	193	193	193	207	207	207	207	207	207	207	207
12 3/4	118.33	323.9	23.8	176.13	276.3	183	193	193	193	207	207	207	207	207	207	207	207
12 3/4	125.49	323.9	25.4	186.97	273.1	193	193	193	193	207	207	207	207	207	207	207	207
12 3/4	132.57	323.9	27.0	197.68	269.9	193	193	193	193	207	207	207	207	207	207	207	207
12 3/4	139.67	323.9	28.6	208.27	266.7	193	193	193	193	207	207	207	207	207	207	207	207
12 3/4	153.53	323.9	31.8	229.06	260.3	193	193	193	193	207	207	207	207	207	207	207	207
14[d]	27.73	355.6	4.8	41.52	346.0	33	41	39	48	66	72	82	88	94	102	110	126
14[d]	29.91	355.6	5.2	44.93	345.2	36	45	42	52	—	—	—	—	—	—	—	137

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B		Grade	Grade	Grade	Grade	Grade	Grade	Grade	Grade
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	X42	X46	X52	X56	X60	X65	X70	X80
14[d]	30.93	355.6	5.3	45.78	345.0	—	—	—	—	74	81	92	99	105	114	123	140
14[d]	32.23	355.6	5.6	48.33	344.4	—	—	—	—	77	84	95	103	110	119	128	148
14[d]	36.71	355.6	6.4	55.11	342.8	44	55	52	65	88	96	109	117	125	136	147	169
14[d]	41.17	355.6	7.1	61.02	341.4	50	62	58	72	99	108	122	132	141	153	165	187
14	45.61	355.6	7.9	67.74	339.8	55	69	65	81	110	120	136	146	156	169	183	207
14	50.17	355.6	8.7	74.42	338.2	61	76	71	89	121	132	150	161	173	187	201	207
14	54.57	355.6	9.5	81.08	336.6	66	83	77	97	132	144	163	176	188	204	207	207
14	58.94	355.6	10.3	87.71	335.0	—	—	—	—	143	156	176	190	204	207	207	207
14	63.44	355.6	11.1	94.30	333.4	78	97	90	113	154	169	191	205	207	207	207	207
14	67.78	355.6	11.9	100.86	331.8	—	—	—	—	165	181	204	207	207	207	207	207
14	72.09	355.6	12.7	107.39	330.2	89	111	103	130	176	192	207	207	207	207	207	207
14	80.66	355.6	14.3	120.36	327.0	100	125	116	145	198	207	207	207	207	207	207	207
14	89.28	355.6	15.9	133.19	323.8	111	138	130	161	207	207	207	207	207	207	207	207
14	97.81	355.6	17.5	145.91	320.6	122	152	142	178	207	207	207	207	207	207	207	207
14	106.13	355.6	19.1	158.49	317.4	133	166	155	193	207	207	207	207	207	207	207	207
14	114.37	355.6	20.6	170.18	314.4	144	180	168	193	207	207	207	207	207	207	207	207
14	122.65	355.6	22.2	182.52	311.2	155	193	181	193	207	207	207	207	207	207	207	207
14	130.85	355.6	23.8	194.74	308.0	166	193	193	193	207	207	207	207	207	207	207	207
14	138.84	355.6	25.4	206.83	304.8	177	193	193	193	207	207	207	207	207	207	207	207
14	146.74	355.6	27.0	218.79	301.6	189	193	193	193	207	207	207	207	207	207	207	207
14	154.69	355.6	28.6	230.63	298.4	193	193	193	193	207	207	207	207	207	207	207	207
14	170.21	355.6	31.8	253.31	292.1	193	193	193	193	207	207	207	207	207	207	207	207
16[d]	31.75	406.4	4.8	47.54	396.8	29	37	34	43	58	63	72	77	83	90	96	111
16[d]	34.25	406.4	5.2	51.45	396.0	32	39	37	46	63	68	77	83	89	96	104	120
16[d]	36.91	406.4	5.6	55.35	395.2	34	43	39	50	68	74	83	90	96	104	112	129
16[d]	42.05	406.4	6.4	63.13	393.6	39	48	45	56	77	84	95	103	110	119	128	148
16[d]	47.17	406.4	7.1	69.91	392.2	43	54	51	63	86	94	107	115	123	134	144	164
16	52.27	406.4	7.9	77.63	390.6	48	61	56	70	96	105	119	128	137	148	160	182
16	57.52	406.4	8.7	85.32	389.0	53	67	62	78	106	116	131	141	151	164	176	201
16	62.58	406.4	9.5	92.98	387.4	58	72	68	85	115	126	143	154	165	178	192	207
16	67.62	406.4	10.3	100.61	385.8	—	—	—	—	125	136	154	167	178	193	207	207
16	72.80	406.4	11.1	108.20	384.2	68	85	79	99	134	147	167	180	192	207	207	207
16	77.79	406.4	11.9	115.77	382.6	—	—	—	—	144	158	178	192	206	207	207	207
16	82.77	406.4	12.7	123.30	381.0	77	97	90	113	154	168	190	205	207	207	207	207
16	92.66	406.4	14.3	138.27	377.8	87	109	102	127	173	189	207	207	207	207	207	207
16	102.63	406.4	15.9	153.11	374.6	97	121	113	141	192	207	207	207	207	207	207	207
16	112.51	406.4	17.5	167.83	371.4	107	134	125	156	207	207	207	207	207	207	207	207
16	122.15	406.4	19.1	182.42	368.2	116	145	136	169	207	207	207	207	207	207	207	207
16	131.71	406.4	20.6	195.98	365.2	126	157	147	183	207	207	207	207	207	207	207	207
16	141.34	406.4	22.2	210.33	362.0	136	169	158	193	207	207	207	207	207	207	207	207
16	150.89	406.4	23.8	224.55	358.8	145	182	169	193	207	207	207	207	207	207	207	207
16	160.20	406.4	25.4	238.64	355.6	155	193	181	193	207	207	207	207	207	207	207	207

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
16	169.43	406.4	27.0	252.61	352.4	165	193	192	193	207	207	207	207	207	207	207	207
16	178.72	406.4	28.6	266.45	349.2	174	193	193	193	207	207	207	207	207	207	207	207
16	187.93	406.4	30.2	280.17	346.0	185	193	193	193	207	207	207	207	207	207	207	207
16	196.91	406.4	31.8	293.76	342.8	193	193	193	193	207	207	207	207	207	207	207	207
18[d]	35.76	457.0	4.8	53.53	447.4	26	32	30	38	52	56	63	68	74	79	85	98
18[d]	41.59	457.0	5.6	62.34	445.8	30	38	35	44	60	65	74	80	85	92	100	115
18[d]	47.39	457.0	6.4	71.12	444.2	34	43	40	50	68	75	85	91	98	105	114	131
18[d]	53.18	457.0	7.1	78.77	442.8	39	48	45	56	76	84	95	103	110	119	128	146
18	58.94	457.0	7.9	87.49	441.2	43	54	50	63	85	94	105	114	122	132	142	162
18	64.87	457.0	8.7	96.18	439.6	48	59	55	69	94	103	116	125	134	145	156	178
18	70.59	457.0	9.5	104.84	438.0	52	65	61	75	103	112	127	136	146	158	171	195
18	76.29	457.0	10.3	113.46	436.4	—	—	—	—	111	121	137	148	158	172	185	207
18	82.15	457.0	11.1	122.05	434.8	61	76	70	88	120	131	148	160	171	185	200	207
18	87.81	457.0	11.9	130.62	433.2	—	—	—	—	128	141	158	171	183	198	207	207
18	93.45	457.0	12.7	139.15	431.6	69	86	81	101	136	150	169	182	195	207	207	207
18	104.67	457.0	14.3	156.11	428.4	77	96	90	113	154	168	190	205	207	207	207	207
18	115.98	457.0	15.9	172.95	425.2	86	107	101	125	171	187	207	207	207	207	207	207
18	127.21	457.0	17.5	189.67	422.0	95	119	111	138	188	206	207	207	207	207	207	207
18	138.17	457.0	19.1	206.25	418.8	103	130	121	151	205	207	207	207	207	207	207	207
18	149.06	457.0	20.6	221.69	415.8	112	140	130	163	207	207	207	207	207	207	207	207
18	160.03	457.0	22.2	238.03	412.6	121	151	141	176	207	207	207	207	207	207	207	207
18	170.92	457.0	23.8	254.25	409.4	130	161	151	189	207	207	207	207	207	207	207	207
18	181.56	457.0	25.4	270.34	406.2	138	172	161	193	207	207	207	207	207	207	207	207
18	192.11	457.0	27.0	286.30	403.0	146	183	171	193	207	207	207	207	207	207	207	207
18	202.75	457.0	28.6	302.14	399.8	155	193	181	193	207	207	207	207	207	207	207	207
18	213.31	457.0	30.2	317.85	396.6	163	193	191	193	207	207	207	207	207	207	207	207
18	223.61	457.0	31.8	333.44	393.4	172	193	193	193	207	207	207	207	207	207	207	207
20[d]	46.27	508.0	5.6	69.38	496.8	27	34	32	39	57	63	71	77	82	89	96	109
20[d]	52.73	508.0	6.4	79.16	495.2	31	39	36	45	66	72	81	88	94	102	109	125
20[d]	59.18	508.0	7.1	87.70	493.8	35	43	41	51	73	80	90	97	104	113	121	139
20	65.60	508.0	7.9	97.43	492.2	39	48	45	56	81	89	100	108	116	125	135	154
20	72.21	508.0	8.7	107.12	490.6	43	53	50	62	89	98	111	119	128	138	149	170
20	78.60	508.0	9.5	116.78	489.0	47	58	54	68	97	107	121	130	139	151	162	185
20	84.96	508.0	10.3	126.41	487.4	—	—	—	—	106	116	131	141	151	164	176	201
20	91.51	508.0	11.1	136.01	485.8	54	68	63	79	114	125	141	152	163	176	190	207
20	97.83	508.0	11.9	145.58	484.2	—	—	—	—	122	134	151	163	174	189	204	207
20	104.13	508.0	12.7	155.12	482.6	62	77	72	90	130	143	161	174	186	202	207	207
20	116.67	508.0	14.3	174.10	479.4	70	87	81	102	147	161	182	196	207	207	207	207
20	129.33	508.0	15.9	192.95	476.2	77	97	90	113	163	179	202	202	207	207	207	207
20	141.90	508.0	17.5	211.68	473.0	85	107	99	125	180	197	207	207	207	207	207	207
20	154.19	508.0	19.1	230.27	469.8	93	116	109	136	196	207	207	207	207	207	207	207
20	166.40	508.0	20.6	247.60	466.8	101	126	118	147	207	207	207	207	207	207	207	207
20	178.72	508.0	22.2	265.95	463.6	109	136	127	158	207	207	207	207	207	207	207	207

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
20	190.96	508.0	23.8	284.18	460.4	116	145	136	169	207	207	207	207	207	207	207	207
20	202.92	508.0	25.4	302.28	457.2	124	155	145	181	207	207	207	207	207	207	207	207
20	214.80	508.0	27.0	320.26	454.0	132	165	154	189	207	207	207	207	207	207	207	207
20	226.78	508.0	28.6	338.11	450.8	139	174	162	189	207	207	207	207	207	207	207	207
20	238.68	508.0	30.2	355.83	447.6	147	184	172	189	207	207	207	207	207	207	207	207
20	250.31	508.0	31.8	373.43	444.4	155	189	181	189	207	207	207	207	207	207	207	207
20	261.86	508.0	33.3	389.81	441.4	162	189	189	189	207	207	207	207	207	207	207	207
20	273.51	508.0	34.9	407.17	438.2	171	189	189	189	207	207	207	207	207	207	207	207
22[d]	50.94	559.0	5.6	76.42	547.8	25	31	29	36	52	57	65	70	75	81	87	99
22[d]	58.07	559.0	6.4	87.21	546.2	28	35	33	41	60	65	74	80	85	92	99	114
22[d]	65.18	559.0	7.1	96.63	544.8	32	39	37	46	66	73	82	88	95	102	110	126
22	72.27	559.0	7.9	107.36	543.2	35	44	41	51	74	81	91	98	105	114	123	140
22	79.56	559.0	8.7	118.06	541.6	39	48	45	56	81	89	100	108	116	126	135	154
22	86.61	559.0	9.5	128.73	540.0	42	53	50	61	89	97	110	118	127	137	148	169
22	93.63	559.0	10.3	139.37	538.4	—	—	—	—	96	105	119	128	137	149	160	183
22	100.86	559.0	11.1	149.97	536.8	50	62	58	72	104	113	128	138	148	160	173	197
22	107.85	559.0	11.9	160.55	535.2	—	—	—	—	111	122	137	148	159	172	185	207
22	114.81	559.0	12.7	171.09	533.6	56	70	65	82	118	130	147	158	169	183	197	207
22	128.67	559.0	14.3	192.08	530.4	63	79	74	92	133	146	165	178	190	206	207	207
22	142.68	559.0	15.9	212.95	527.2	70	88	82	103	148	162	184	198	207	207	207	207
22	156.60	559.0	17.5	233.68	524.0	78	97	90	113	163	179	202	207	207	207	207	207
22	170.21	559.0	19.1	254.30	520.8	85	105	99	123	178	195	207	207	207	207	207	207
22	183.75	559.0	20.6	273.51	517.8	92	114	107	134	192	207	207	207	207	207	207	207
22	197.41	559.0	22.2	293.87	514.6	99	123	115	144	207	207	207	207	207	207	207	207
22	211.00	559.0	23.8	314.11	511.4	105	132	123	154	207	207	207	207	207	207	207	207
22	224.28	559.0	25.4	334.23	508.2	113	141	132	165	207	207	207	207	207	207	207	207
22	237.48	559.0	27.0	354.22	505.0	120	150	140	172	207	207	207	207	207	207	207	207
22	250.81	559.0	28.6	374.08	501.8	127	158	148	172	207	207	207	207	207	207	207	207
22	264.06	559.0	30.2	393.81	498.6	134	167	156	172	207	207	207	207	207	207	207	207
22	277.01	559.0	31.8	413.42	495.4	141	172	165	172	207	207	207	207	207	207	207	207
22	289.88	559.0	33.3	431.69	492.4	148	172	172	172	207	207	207	207	207	207	207	207
22	302.88	559.0	34.9	451.06	489.2	155	172	172	172	207	207	207	207	207	207	207	207
22	315.79	559.0	36.5	470.30	486.0	162	172	172	172	207	207	207	207	207	207	207	207
22	328.41	559.0	38.1	489.41	482.8	169	172	172	172	207	207	207	207	207	207	207	207
24[d]	63.41	610.0	6.4	95.26	597.2	26	32	30	38	55	60	68	73	78	85	91	104
24[d]	71.18	610.0	7.1	105.56	595.8	29	37	34	42	61	66	75	81	87	94	101	115
24	78.93	610.0	7.9	117.30	594.2	32	40	38	47	68	74	84	90	96	104	113	128
24	86.91	610.0	8.7	129.00	592.6	36	44	41	52	74	81	92	99	106	115	124	154
24	94.62	610.0	9.5	140.68	591.0	39	48	45	56	81	89	101	108	116	126	135	154
24	102.31	610.0	10.3	152.32	589.4	—	—	—	—	88	96	109	117	126	136	147	167
24	110.22	610.0	11.1	163.93	587.8	45	56	53	66	95	104	117	126	135	147	158	180
24	117.86	610.0	11.9	175.51	586.2	—	—	—	—	102	111	126	136	145	157	169	193
24	125.49	610.0	12.7	187.06	584.6	52	65	61	75	109	119	134	145	155	168	181	206
24	140.68	610.0	14.3	210.07	581.4	58	72	68	85	122	134	151	163	175	189	204	207

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
24	156.03	610.0	15.9	232.94	578.2	65	81	75	94	136	149	168	181	194	207	207	207
24	171.29	610.0	17.5	255.69	575.0	71	89	83	103	150	164	185	199	207	207	207	207
24	186.23	610.0	19.1	278.32	571.8	77	97	90	113	163	179	202	207	207	207	207	207
24	201.09	610.0	20.6	299.41	568.8	84	105	98	123	176	193	207	207	207	207	207	207
24	216.10	610.0	22.2	321.79	565.6	90	113	105	132	190	207	207	207	207	207	207	207
24	231.03	610.0	23.8	344.05	562.4	97	121	113	141	203	207	207	207	207	207	207	207
24	245.64	610.0	25.4	366.17	559.2	103	130	121	151	207	207	207	207	207	207	207	297
24	260.17	610.0	27.0	388.17	556.0	110	137	128	158	207	207	207	207	207	207	207	207
24	274.84	610.0	28.6	410.05	552.8	116	145	136	158	207	207	207	207	207	207	207	207
24	289.44	610.0	30.2	431.80	549.6	123	154	143	158	207	207	207	207	207	207	207	207
24	303.71	610.0	31.8	453.42	546.4	130	158	151	158	207	207	207	207	207	207	207	207
24	317.91	610.0	33.3	473.57	543.4	136	158	158	158	207	207	207	207	207	207	207	207
24	332.25	610.0	34.9	494.95	540.2	142	158	158	158	207	207	207	207	207	207	207	207
24	346.50	610.0	36.5	516.20	537.0	149	158	158	158	207	207	207	207	207	207	207	207
24	360.45	610.0	38.1	537.33	533.8	155	158	158	158	207	207	207	207	207	207	207	207
24	374.31	610.0	39.7	558.32	530.6	158	158	158	158	207	207	207	207	207	207	207	207
26[d]	68.75	660.0	6.4	103.15	647.2	24	30	28	34	51	55	63	67	72	78	84	96
26[d]	77.18	660.0	7.1	114.31	645.8	27	34	31	39	56	61	69	75	80	87	93	107
26	85.60	660.0	7.9	127.04	644.2	30	37	34	43	62	68	77	83	89	97	104	119
26	94.26	660.0	8.7	139.73	642.6	33	41	39	48	69	75	85	92	98	106	115	131
26	102.63	660.0	9.5	152.39	641.0	36	45	42	52	75	82	93	100	107	116	125	143
26	110.98	660.0	10.3	165.02	639.4	—	—	—	—	81	89	101	108	116	126	136	155
26	119.57	660.0	11.1	177.62	637.8	42	52	49	61	88	96	109	117	125	136	146	167
26	127.88	660.0	11.9	190.19	636.2	—	—	—	—	94	103	116	125	134	145	157	179
26	136.17	660.0	12.7	202.72	634.6	48	60	56	70	100	110	124	134	143	155	167	191
26	152.68	660.0	14.3	227.70	631.4	54	67	63	78	113	124	140	151	161	175	188	207
26	169.38	660.0	15.9	252.55	628.2	60	74	70	87	126	138	155	167	179	194	207	207
26	185.99	660.0	17.5	277.27	625.0	65	82	76	96	138	151	171	184	197	207	207	207
26	202.25	660.0	19.1	301.87	621.8	72	90	83	104	151	165	187	201	207	207	207	207
26	218.43	660.0	20.6	324.81	618.8	77	97	90	113	163	178	201	207	207	207	207	207
26	234.79	660.0	22.2	349.16	615.6	83	104	97	122	175	192	207	207	207	207	207	207
26	251.07	660.0	23.8	373.39	612.4	90	112	105	130	188	206	207	207	207	207	207	207
26	267.00	660.0	25.4	397.49	609.2	95	119	112	138	201	207	207	207	207	207	207	207
28[d]	74.09	711.0	6.4	111.20	698.2	22	28	25	32	47	51	58	62	66	72	78	89
28[d]	83.19	711.0	7.1	123.24	696.8	25	31	29	37	52	57	65	70	74	81	87	99
28	92.26	711.0	7.9	136.97	695.2	28	34	32	40	58	63	72	77	83	90	96	110
28	101.61	711.0	8.7	150.67	693.6	—	—	—	—	64	70	79	85	92	99	107	121
28	110.64	711.0	9.5	164.34	692.0	33	41	39	48	70	76	86	93	100	108	116	133
28	119.65	711.0	10.3	177.98	690.4	—	—	—	—	76	83	94	101	108	117	126	144
28	128.93	711.0	11.1	191.58	688.8	39	48	45	56	81	90	101	109	116	126	136	155
28	137.90	711.0	11.9	205.15	687.2	—	—	—	—	88	96	108	116	125	135	145	166
28	146.85	711.0	12.7	218.69	685.6	44	55	52	65	93	102	115	124	133	144	155	177
28	164.69	711.0	14.3	245.68	682.4	50	62	58	72	105	114	130	139	150	162	174	199
28	182.73	711.0	15.9	272.54	679.2	55	69	65	81	116	127	144	155	166	180	194	207

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
28	200.68	711.0	17.5	299.28	676.0	61	76	71	89	128	140	158	171	183	198	207	207
28	218.27	711.0	19.1	325.89	672.8	66	83	77	97	139	153	173	186	199	207	207	207
28	235.78	711.0	20.6	350.72	669.8	72	90	84	105	151	165	187	201	207	207	207	207
28	253.48	711.0	22.2	377.08	666.6	77	97	90	113	162	178	201	207	207	207	207	207
28	271.10	711.0	23.8	403.32	663.4	83	104	97	121	174	191	207	207	207	207	207	207
28	288.36	711.0	25.4	429.44	660.2	89	111	103	130	186	204	207	207	207	207	207	207
30[d]	79.43	762.0	6.4	119.25	749.2	21	25	24	30	43	48	54	58	62	68	72	83
30[d]	89.19	762.0	7.1	132.17	747.8	23	29	27	34	49	54	61	65	70	76	81	92
30	98.93	762.0	7.9	146.91	746.2	25	32	30	38	54	59	67	72	77	84	90	103
30	108.95	762.0	8.7	161.61	744.6	—	—	—	—	60	65	74	80	85	92	99	113
30	118.65	762.0	9.5	176.29	743.0	31	39	36	45	65	72	81	87	93	101	109	124
30	128.32	762.0	10.3	190.93	741.4	—	—	—	—	70	77	88	94	101	109	118	134
30	138.29	762.0	11.1	205.54	739.8	37	45	42	53	76	83	94	101	109	118	127	144
30	147.92	762.0	11.9	220.12	738.2	—	—	—	—	81	89	101	109	116	126	136	155
30	157.53	762.0	12.7	234.67	736.6	41	52	48	61	87	95	107	116	124	134	145	165
30	176.69	762.0	14.3	263.67	733.4	46	58	54	68	98	107	121	130	139	151	163	186
30	196.08	762.0	15.9	292.54	730.2	52	65	61	75	109	119	134	145	155	168	181	207
30	215.38	762.0	17.5	321.29	727.0	57	71	66	83	119	131	148	159	171	185	199	207
30	234.29	762.0	19.1	349.91	723.8	62	77	72	90	130	143	161	174	186	201	207	207
30	253.12	762.0	20.6	376.63	720.8	67	84	79	98	141	154	174	188	201	207	207	207
30	272.17	762.0	22.2	405.00	717.6	72	90	84	105	152	167	188	203	207	207	207	207
30	291.14	762.0	23.8	433.26	714.4	78	97	90	113	163	178	202	207	207	207	207	207
30	309.72	762.0	25.4	461.38	711.2	83	103	96	121	174	190	207	207	207	207	207	207
30	328.22	762.0	27.0	489.38	708.0	88	110	103	128	185	202	207	207	207	207	207	207
30	346.93	762.0	28.6	517.25	704.8	93	116	109	136	196	207	207	207	207	207	207	207
30	365.56	762.0	30.2	544.99	701.6	99	123	114	143	206	207	207	207	207	207	207	207
30	383.81	762.0	31.8	572.61	698.4	103	130	121	151	207	207	207	207	207	207	207	207
32[d]	84.77	813.0	6.4	127.30	800.2	19	24	23	28	41	45	50	54	58	63	68	78
32[d]	95.19	813.0	7.1	141.10	798.8	22	28	25	32	45	50	56	61	65	71	76	87
32	105.59	813.0	7.9	156.84	797.2	24	30	28	35	51	56	63	68	72	79	85	96
32	116.30	813.0	8.7	172.56	795.6	—	—	—	—	56	61	70	74	80	87	93	106
32	126.66	813.0	9.5	188.24	794.0	29	37	34	43	61	67	76	81	88	94	102	116
32	136.99	813.0	10.3	203.88	792.4	—	—	—	—	66	72	82	88	94	102	110	126
32	147.64	813.0	11.1	219.50	790.8	34	43	39	50	71	78	88	95	102	110	119	135
32	157.94	813.0	11.9	235.09	789.2	—	—	—	—	76	83	94	102	109	118	127	145
32	168.21	813.0	12.7	250.64	787.6	39	48	45	56	81	89	101	109	116	126	136	155
32	188.70	813.0	14.3	281.65	784.4	43	54	51	63	92	100	113	122	131	141	152	174
32	209.43	813.0	15.9	312.54	781.2	48	61	56	71	102	112	126	136	145	158	169	194
32	230.08	813.0	17.5	343.30	778.0	53	67	62	78	112	123	138	150	160	174	187	207
32	250.31	813.0	19.1	373.93	774.8	58	72	68	85	122	134	151	163	174	189	203	207
32	270.47	813.0	20.6	402.54	771.8	63	79	74	92	132	145	164	176	189	205	207	207
32	290.86	813.0	22.2	432.93	768.6	68	85	79	99	143	156	176	190	203	207	207	207
32	311.17	813.0	23.8	463.19	765.4	73	91	85	106	153	167	189	203	207	207	207	207
32	331.08	813.0	25.4	493.32	762.2	77	97	90	113	163	178	201	207	207	207	207	207

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
32	350.90	813.0	27.0	523.33	759.0	82	103	96	120	173	189	207	207	207	207	207	207
32	370.96	813.0	28.6	553.22	755.8	88	109	102	127	183	200	207	207	207	207	207	207
32	390.94	813.0	30.2	582.98	752.6	92	115	107	134	194	207	207	207	207	207	207	207
32	410.51	813.0	31.8	612.61	749.4	97	121	113	141	203	207	207	207	207	207	207	207
34[d]	90.11	864.0	6.4	135.35	851.2	18	23	21	27	39	42	48	51	54	59	64	73
34[d]	101.19	864.0	7.1	150.03	849.8	21	25	24	30	43	47	53	57	61	67	72	82
34	112.25	864.0	7.9	166.78	848.2	23	28	27	33	48	52	59	63	68	74	80	91
34	123.65	864.0	8.7	183.50	846.6	—	—	—	—	52	58	65	70	75	81	88	100
34	134.67	864.0	9.5	200.18	845.0	28	34	32	40	57	63	71	76	82	89	96	109
34	145.67	864.0	10.3	216.84	843.4	—	—	—	—	62	68	77	83	89	96	103	118
34	157.00	864.0	11.1	233.46	841.8	32	40	37	47	67	74	83	90	96	104	112	127
34	167.95	864.0	11.9	250.05	840.2	—	—	—	—	72	79	89	96	103	111	120	137
34	178.89	864.0	12.7	266.61	838.6	37	45	43	53	76	84	95	102	110	119	127	146
34	200.70	864.0	14.3	299.64	835.4	41	51	48	60	86	94	107	115	123	133	143	164
34	222.78	864.0	15.9	332.53	832.2	45	57	53	67	96	105	119	127	137	148	160	183
34	244.77	864.0	17.5	365.31	829.0	50	63	59	73	105	116	130	141	151	163	176	201
34	266.33	864.0	19.1	397.95	825.8	54	68	64	80	115	126	142	153	164	178	192	207
34	287.81	864.0	20.6	428.44	822.8	59	74	69	86	125	136	154	166	178	192	207	207
34	309.55	864.0	22.2	460.85	819.6	64	80	74	93	134	147	166	178	192	207	207	207
34	331.21	864.0	23.8	493.12	816.4	68	85	80	100	144	157	178	192	205	207	207	207
34	352.44	864.0	25.4	525.27	813.2	73	91	85	106	153	168	189	204	207	207	207	207
34	373.59	864.0	27.0	557.29	810.0	77	97	90	113	163	178	201	207	207	207	207	207
34	394.99	864.0	28.6	589.19	806.8	82	103	96	120	172	189	207	207	207	207	207	207
34	416.31	864.0	30.2	620.96	803.6	87	108	101	126	182	199	207	207	207	207	207	207
34	437.21	864.0	31.8	652.60	800.4	91	114	106	133	192	207	207	207	207	207	207	207
36[d]	95.45	914.0	6.4	143.24	901.2	17	21	20	25	36	40	45	48	52	56	61	69
36[d]	107.20	914.0	7.1	158.79	899.8	19	24	23	28	41	45	50	54	58	63	68	77
36	118.92	914.0	7.9	176.52	898.2	21	27	25	31	45	50	56	60	65	70	75	86
36	131.00	914.0	8.7	194.22	896.6	—	—	—	—	50	54	61	66	71	77	83	94
36	142.68	914.0	9.5	211.90	895.0	26	32	30	38	54	59	68	72	77	84	90	103
36	154.34	914.0	10.3	219.54	893.4	—	—	—	—	59	64	73	79	84	91	98	112
36	166.35	914.0	11.1	247.15	891.8	30	38	35	44	63	70	79	85	90	98	105	120
36	177.97	914.0	11.9	264.72	890.2	—	—	—	—	68	74	84	90	97	105	113	129
36	189.57	914.0	12.7	282.27	888.6	34	43	40	50	72	79	90	96	103	112	121	138
36	212.70	914.0	14.3	317.27	885.4	39	48	45	56	81	89	101	108	116	125	136	155
36	236.13	914.0	15.9	352.14	882.2	43	54	50	63	90	99	112	121	130	140	151	173
36	259.47	914.0	17.5	386.88	879.0	48	59	55	69	99	109	123	133	142	154	166	190
36	282.35	914.0	19.1	421.50	875.8	52	65	61	75	109	119	134	145	155	168	181	207
36	305.16	914.0	20.6	453.84	872.8	56	70	65	81	118	129	145	156	168	182	196	207
36	328.24	914.0	22.2	488.22	869.6	61	75	70	88	127	138	157	169	181	196	207	207
36	351.25	914.0	23.8	522.47	866.4	65	81	75	94	136	149	168	181	194	207	207	207
36	373.80	914.0	25.4	556.59	863.2	69	86	81	101	145	158	179	193	207	207	207	207
36	396.27	914.0	27.0	590.58	860.0	73	92	85	107	154	168	190	205	207	207	207	207
36	419.02	914.0	28.6	624.45	856.8	78	97	90	113	163	178	202	207	207	207	207	207

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
36	441.69	914.0	30.2	658.19	853.6	82	102	96	119	172	188	207	207	207	207	207	207
36	463.91	914.0	31.8	691.81	850.4	86	107	101	125	181	198	207	207	207	207	207	207
38	125.58	965.0	7.9	186.46	949.2	21	25	23	30	43	47	53	57	61	66	71	81
38	138.35	965.0	8.7	205.17	947.6	23	28	26	33	47	52	59	63	68	73	79	89
38	150.69	965.0	9.5	223.84	946.0	25	30	28	36	52	56	63	68	74	79	85	98
38	163.01	965.0	10.3	242.49	944.4	26	33	31	39	56	61	69	74	79	86	93	106
38	175.71	965.0	11.1	261.11	942.8	28	36	33	42	60	65	70	80	85	93	100	114
38	187.99	965.0	11.9	279.69	941.2	30	39	36	45	64	70	80	85	92	99	107	122
38	200.25	965.0	12.7	298.24	939.6	32	41	38	48	68	75	85	92	98	106	114	131
38	224.71	965.0	14.3	335.25	936.4	37	46	43	54	77	84	95	103	110	119	128	147
38	249.48	965.0	15.9	372.14	933.2	41	51	48	59	85	94	106	107	123	132	143	163
38	274.16	965.0	17.5	408.89	930.0	45	56	52	65	94	103	116	126	135	146	157	180
38	298.37	965.0	19.1	445.52	926.8	49	61	57	72	103	112	127	137	147	159	172	196
38	322.50	965.0	20.6	479.75	923.8	53	66	62	77	112	122	138	148	159	172	185	207
38	346.93	965.0	22.2	516.14	920.6	57	72	67	83	120	132	149	160	172	185	200	207
38	371.28	965.0	23.8	552.40	917.4	61	76	72	90	129	141	159	172	184	199	207	207
38	395.16	965.0	25.4	588.53	914.2	65	81	76	95	137	150	169	183	196	207	207	207
38	418.96	965.0	27.0	624.54	911.0	70	87	81	101	145	159	181	194	207	207	207	207
38	443.05	965.0	28.6	660.42	907.8	74	92	85	107	154	169	191	205	207	207	207	207
38	467.06	965.0	30.2	696.18	904.6	78	97	90	113	163	178	202	207	207	207	207	207
38	490.61	965.0	31.8	731.80	901.4	81	102	95	119	172	187	207	207	207	207	207	207
40	132.25	1016.0	7.9	196.39	1000.2	19	24	23	28	41	45	50	54	58	63	68	77
40	145.69	1016.0	8.7	216.11	998.6	21	27	25	31	45	49	55	60	64	70	81	85
40	158.70	1016.0	9.5	235.79	997.0	23	29	27	34	49	54	61	65	70	76	74	93
40	171.68	1016.0	10.3	255.45	995.4	25	32	30	37	53	58	65	70	76	82	88	101
40	185.06	1016.0	11.1	275.07	993.8	27	34	32	39	57	63	70	76	81	88	95	108
40	198.01	1016.0	11.9	294.66	992.2	29	37	34	43	61	67	76	81	88	94	102	116
40	210.93	1016.0	12.7	314.22	990.6	31	39	36	45	65	72	81	87	93	101	109	124
40	236.71	1016.0	14.3	353.24	987.4	35	43	41	51	73	80	91	98	105	113	122	140
40	262.83	1016.0	15.9	392.13	984.2	39	48	45	56	81	89	101	109	116	126	136	155
40	288.86	1016.0	17.5	430.90	981.0	43	53	50	62	90	98	111	119	128	138	150	171
40	314.39	1016.0	19.1	469.55	977.8	47	58	54	68	98	107	121	130	139	151	163	186
40	339.84	1016.0	20.6	505.66	974.8	50	63	59	74	105	116	131	141	151	164	176	201
40	365.62	1016.0	22.2	544.06	971.6	54	68	63	79	114	125	141	152	163	176	190	207
40	391.32	1016.0	23.8	582.33	968.4	58	73	68	85	122	134	151	163	174	189	203	207
40	416.52	1016.0	25.4	620.48	965.2	62	77	72	90	130	143	161	174	186	201	207	207
40	441.64	1016.0	27.0	658.50	962.0	66	82	77	96	138	152	172	185	188	207	207	207
40	467.08	1016.0	28.6	696.39	958.8	70	88	81	102	147	161	181	195	207	207	207	207
40	492.44	1016.0	30.2	734.16	955.6	74	92	86	107	155	169	192	206	207	207	207	207
40	517.31	1016.0	31.8	771.80	952.4	78	97	90	113	163	178	202	207	207	207	207	207
42	153.04	1067.0	8.7	227.05	1049.6	20	25	23	30	43	47	53	57	61	66	71	81
42	166.71	1067.0	9.5	247.74	1048.0	22	28	26	32	47	51	58	62	66	72	78	88
42	180.35	1067.0	10.3	268.40	1046.4	24	30	28	35	50	55	62	67	72	78	84	96

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6⅝ Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
42	194.42	1067.0	11.1	289.03	1044.8	26	32	30	38	54	59	68	72	78	84	90	103
42	208.03	1067.0	11.9	309.62	1043.2	28	34	32	41	58	63	72	78	83	90	97	111
42	221.61	1067.0	12.7	330.19	1041.6	30	37	34	43	62	68	76	83	89	96	103	118
42	248.72	1067.0	14.3	371.22	1038.4	33	41	39	48	70	76	86	93	100	108	116	133
42	276.18	1067.0	15.9	412.13	1035.2	37	46	43	54	77	85	96	103	111	120	130	148
42	303.55	1067.0	17.5	452.91	1032.0	41	51	48	59	85	94	105	114	122	132	142	163
42	330.41	1067.0	19.1	493.57	1028.8	44	55	52	65	93	102	115	124	133	144	155	178
42	357.19	1067.0	20.6	531.57	1025.8	48	60	56	70	101	110	125	134	144	156	168	191
42	384.31	1067.0	22.2	571.98	1022.6	52	65	61	75	109	119	134	145	155	168	181	207
42	411.35	1067.0	23.8	612.26	1019.4	55	69	65	81	116	127	144	155	166	180	194	207
42	437.88	1067.0	25.4	652.42	1016.2	59	74	69	86	124	136	154	165	177	192	207	207
42	464.33	1067.0	27.0	692.45	1013.0	63	79	73	92	132	144	163	176	188	204	207	207
42	491.11	1067.0	28.6	732.36	1009.8	66	83	78	97	140	153	173	186	199	207	207	207
42	517.82	1067.0	30.2	772.14	1006.6	70	88	82	102	147	161	183	196	207	207	207	207
42	544.01	1067.0	31.8	811.79	1003.4	74	92	86	107	155	169	192	207	207	207	207	207
44	160.39	1118.0	8.7	237.99	1100.6	19	24	23	28	41	45	50	54	58	63	68	77
44	174.72	1118.0	9.5	259.69	1099.0	21	26	25	31	44	49	55	59	63	69	74	84
44	189.03	1118.0	10.3	281.35	1097.4	23	29	27	33	48	52	59	64	69	74	80	91
44	203.78	1118.0	11.1	302.99	1095.8	25	31	29	36	52	56	64	69	74	80	86	98
44	218.04	1118.0	11.9	324.59	1094.2	26	33	31	39	56	61	69	74	79	86	92	106
44	232.29	1118.0	12.7	346.16	1092.6	28	35	33	41	59	65	73	79	85	92	99	113
44	260.72	1118.0	14.3	389.21	1089.4	32	39	37	46	67	73	83	89	95	103	111	127
44	289.53	1118.0	15.9	432.13	1086.2	35	44	41	52	74	81	92	99	105	114	123	141
44	318.25	1118.0	17.5	474.92	1083.0	39	48	45	56	81	89	101	109	116	126	136	155
44	346.43	1118.0	19.1	517.59	1079.8	42	53	50	61	89	97	110	119	127	137	148	169
44	374.53	1118.0	20.6	557.47	1076.8	45	57	54	67	96	105	119	128	137	149	161	183
44	403.00	1118.0	22.2	599.90	1073.6	50	61	58	72	103	114	128	138	148	161	173	197
44	431.39	1118.0	23.8	642.19	1070.4	53	66	62	77	111	122	138	148	158	172	185	207
44	459.24	1118.0	25.4	684.37	1067.2	56	70	65	82	119	130	147	158	169	183	197	207
44	487.01	1118.0	27.0	726.41	1064.0	60	75	70	88	125	138	156	167	180	194	207	207
44	515.14	1118.0	28.6	768.33	1060.8	63	79	74	92	133	146	165	178	190	206	207	207
44	543.19	1118.0	30.2	810.12	1057.6	67	83	78	98	141	154	174	187	201	207	207	207
44	570.71	1118.0	31.8	851.79	1054.4	70	88	82	103	148	162	183	197	207	207	207	207
46	167.74	1168.0	8.7	248.72	1150.6	19	23	21	27	39	43	48	52	56	60	65	74
46	182.73	1168.0	9.5	271.40	1149.0	20	25	23	30	43	47	52	56	61	65	71	81
46	197.70	1168.0	10.3	294.05	1147.4	22	28	25	32	46	50	57	61	65	71	76	87
46	213.13	1168.0	11.1	316.67	1145.8	23	30	28	34	50	54	61	66	71	76	83	94
46	228.06	1168.0	11.9	339.26	1144.2	25	32	30	37	53	58	65	71	86	82	88	101
46	242.97	1168.0	12.7	361.82	1142.6	27	34	32	39	56	62	70	76	81	88	94	108
46	272.73	1168.0	14.3	406.84	1139.4	30	38	35	44	63	70	79	85	91	99	106	121
46	302.88	1168.0	15.9	451.73	1136.2	34	42	39	49	71	77	88	94	101	110	118	135
46	332.95	1168.0	17.5	496.50	1133.0	37	46	43	54	78	85	96	104	112	121	130	149
46	362.45	1168.0	19.1	541.14	1129.8	41	50	47	59	85	93	105	113	121	132	141	162
46	391.88	1168.0	20.6	582.87	1126.8	44	54	51	64	92	101	114	123	132	143	153	175

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
46	421.69	1168.0	22.2	627.27	1123.6	47	59	55	69	99	109	123	132	141	154	165	189
46	451.42	1168.0	23.8	671.54	1120.4	50	63	69	74	106	116	132	142	152	165	177	202
46	480.60	1168.0	25.4	715.68	1117.2	54	68	63	79	113	124	140	151	162	175	189	207
46	509.69	1168.0	27.0	759.70	1114.0	57	72	67	83	121	132	149	161	172	186	200	207
46	539.17	1168.0	28.6	803.59	1110.8	61	76	71	88	127	139	158	170	182	197	207	207
46	568.57	1168.0	30.2	847.36	1107.6	64	80	74	94	134	147	167	179	192	207	207	207
46	597.41	1168.0	31.8	890.99	1104.4	68	84	79	99	141	155	175	189	202	207	207	207
48	175.08	1219.0	8.7	259.66	1201.6	18	22	21	26	37	41	46	50	53	58	62	71
48	190.74	1219.0	9.5	283.35	1200.0	19	24	23	28	41	45	50	54	58	63	68	77
48	206.37	1219.0	10.3	307.01	1198.4	21	26	25	30	44	48	54	59	63	68	74	84
48	222.49	1219.0	11.1	330.63	1196.8	23	28	26	33	48	52	59	63	68	74	79	90
48	238.08	1219.0	11.9	354.23	1195.2	24	30	28	35	51	56	63	68	73	79	85	97
48	253.65	1219.0	12.7	377.79	1193.6	26	32	30	38	54	59	68	72	77	84	90	103
48	284.73	1219.0	14.3	424.82	1190.4	29	37	34	42	61	67	76	81	87	94	102	116
48	316.23	1219.0	15.9	471.73	1187.2	32	41	38	47	68	74	84	90	97	105	113	129
48	347.64	1219.0	17.5	518.51	1184.0	36	44	41	52	74	82	92	99	107	116	125	142
48	378.47	1219.0	19.1	565.16	1180.8	39	48	45	56	81	89	101	109	116	126	136	155
48	409.22	1219.0	20.6	608.78	1177.8	42	52	49	61	88	96	109	118	126	136	147	168
48	440.38	1219.0	22.2	655.19	1174.6	45	56	53	66	95	104	118	127	136	147	158	181
48	471.46	1219.0	23.8	701.47	1171.4	48	61	56	71	102	112	126	136	145	158	169	194
48	501.96	1219.0	25.4	747.63	1168.2	52	65	61	75	109	119	134	145	155	168	181	207
48	532.38	1219.0	27.0	793.66	1165.0	55	69	64	80	115	126	143	154	165	178	192	207
48	563.20	1219.0	28.6	839.56	1161.8	58	72	68	85	122	134	151	163	174	189	203	207
48	593.94	1219.0	30.2	885.34	1158.6	61	76	72	90	129	141	160	172	184	200	207	207
48	624.11	1219.0	31.8	930.99	1155.4	65	81	75	94	136	149	168	181	194	207	207	207
52	206.76	1321.0	9.5	307.25	1302.0	18	22	21	26	38	41	47	50	54	58	63	71
52	223.72	1321.0	10.3	332.92	1300.4	19	24	23	28	41	45	50	54	58	63	68	77
52	241.20	1321.0	11.1	358.55	1298.8	21	26	24	30	44	48	54	59	63	68	73	83
52	258.11	1321.0	11.9	384.16	1297.2	22	28	26	32	47	52	58	63	67	73	79	89
52	275.01	1321.0	12.7	409.74	1295.6	24	30	28	34	50	55	62	67	72	78	83	95
52	308.74	1321.0	14.3	460.79	1292.4	27	34	31	39	56	61	70	75	81	87	94	107
52	342.93	1321.0	15.9	511.72	1289.2	30	37	34	43	63	69	78	83	90	97	104	119
52	377.03	1321.0	17.5	562.53	1286.0	33	41	39	48	69	76	85	92	99	107	115	131
52	410.51	1321.0	19.1	613.20	1282.8	36	45	42	52	75	82	93	100	107	116	125	143
52	443.91	1321.0	20.6	660.60	1279.8	39	48	45	56	81	89	101	108	116	126	136	155
52	477.76	1321.0	22.2	711.03	1276.6	42	52	49	61	88	96	109	117	125	136	146	167
52	511.53	1321.0	23.8	761.34	1273.4	45	56	52	65	94	103	116	125	134	145	156	179
52	544.68	1321.0	25.4	811.52	1270.2	48	60	56	70	100	110	124	134	143	155	167	191
52	577.75	1321.0	27.0	861.57	1267.0	51	63	59	74	106	116	132	142	152	165	177	203
52	611.26	1321.0	28.6	911.50	1263.8	54	67	63	79	113	123	140	150	161	174	188	207
52	644.69	1321.0	30.2	961.30	1260.6	56	71	66	83	119	130	147	158	170	184	198	207
52	677.51	1321.0	31.8	1010.98	1257.4	60	74	70	87	125	137	155	167	179	194	207	207
56	222.78	1422.0	9.5	330.91	1403.0	17	21	19	24	35	38	43	46	50	54	58	66

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
56	241.06	1422.0	10.3	358.57	1401.4	18	23	21	26	38	41	47	50	54	59	63	72
56	259.91	1422.0	11.1	386.20	1399.8	19	24	23	28	41	45	50	54	58	63	68	77
56	278.15	1422.0	11.9	413.80	1398.2	21	26	24	30	43	48	54	58	62	68	73	83
56	296.37	1422.0	12.7	441.37	1396.6	22	28	26	32	47	51	58	62	66	72	78	89
56	332.75	1422.0	14.3	496.41	1393.4	25	31	29	37	52	57	65	70	74	81	87	100
56	369.63	1422.0	15.9	551.32	1390.2	28	34	32	41	58	63	72	77	83	90	97	111
56	406.42	1422.0	17.5	606.11	1387.0	30	38	36	45	64	70	79	85	92	99	107	122
56	442.55	1422.0	19.1	660.77	1383.8	33	41	39	48	70	76	86	93	100	108	116	133
56	478.60	1422.0	20.6	711.91	1380.8	36	45	42	52	76	83	94	101	108	117	126	144
56	515.14	1422.0	22.2	766.32	1377.6	39	48	55	56	81	89	101	108	116	126	136	155
56	551.60	1422.0	23.8	820.61	1374.4	41	52	48	61	88	96	108	116	125	135	145	166
56	587.40	1422.0	25.4	874.78	1371.2	44	55	52	65	93	102	115	124	133	144	155	177
56	623.12	1422.0	27.0	928.82	1368.0	47	24	55	69	99	108	123	132	141	153	165	188
56	659.32	1422.0	28.6	982.73	1364.8	50	62	58	72	105	114	130	139	150	162	174	199
56	695.45	1422.0	30.2	1036.52	1361.6	52	65	61	76	110	121	137	147	158	171	184	207
56	730.91	1422.0	31.8	1090.18	1358.4	55	69	65	81	116	127	144	155	166	180	194	207
60	238.80	1524.0	9.5	355.69	1505.0	16	19	18	23	32	36	41	43	47	50	54	62
60	258.40	1524.0	10.3	384.89	1503.4	17	21	19	25	35	39	43	47	50	54	59	67
60	278.62	1524.0	11.1	415.00	1501.8	18	23	21	26	38	41	47	51	54	59	63	72
60	298.19	1524.0	11.9	444.15	1500.2	19	24	23	28	41	45	50	54	58	63	68	77
60	317.73	1524.0	12.7	473.31	1498.6	21	26	24	30	43	48	54	58	62	68	72	83
60	356.76	1524.0	14.3	532.38	1495.4	23	29	27	34	49	54	61	65	70	76	81	93
60	396.33	1524.0	15.9	591.32	1492.2	26	32	30	38	54	59	68	72	78	84	90	103
60	435.82	1524.0	17.5	650.13	1489.0	28	36	33	41	60	65	74	80	85	92	99	114
60	474.59	1524.0	19.1	708.82	1485.8	31	39	37	45	65	71	81	87	93	101	109	124
60	513.29	1524.0	20.6	763.72	1482.8	34	42	39	49	70	77	88	94	101	109	118	134
60	552.52	1524.0	22.2	822.16	1479.6	37	45	42	53	76	83	94	101	109	118	127	144
60	591.67	1524.0	23.8	880.48	1476.4	39	48	45	56	81	89	101	106	116	126	136	155
60	630.12	1524.0	25.4	938.67	1473.2	41	52	48	61	87	95	107	116	124	134	145	165
60	668.48	1524.0	27.0	996.73	1470.0	44	55	51	64	92	101	114	123	132	143	154	176
60	707.38	1524.0	28.6	1054.67	1466.8	47	58	54	68	98	107	121	130	140	151	163	186
60	746.20	1524.0	30.2	1112.48	1463.6	49	61	57	72	103	113	127	138	147	160	172	197
60	784.31	1524.0	31.8	1170.17	1460.4	52	65	61	75	109	119	134	145	155	168	181	207
64	254.82	1626.0	9.5	378.70	1607.0	14	18	17	21	30	34	38	41	43	48	51	58
64	275.75	1626.0	10.3	410.38	1605.4	16	20	19	23	33	37	41	44	48	51	55	63
64	297.33	1626.0	11.1	442.04	1603.8	17	21	20	25	36	39	44	48	51	55	59	68
64	318.22	1626.0	11.9	473.66	1602.2	18	23	21	26	38	42	48	51	54	59	63	73
64	339.09	1626.0	12.7	505.26	1600.6	19	24	23	28	41	45	50	54	58	63	68	77
64	380.77	1626.0	14.3	568.35	1597.4	22	28	25	32	45	50	56	61	65	71	76	87
64	423.03	1626.0	15.9	631.31	1594.2	24	30	28	35	51	56	63	68	72	79	85	97
64	465.21	1626.0	17.5	694.15	1591.0	27	33	31	39	56	61	70	74	80	87	93	107
64	506.63	1626.0	19.1	756.86	1587.8	29	37	34	43	61	67	76	81	88	94	102	117
64	547.98	1626.0	20.6	815.54	1584.8	32	39	37	46	66	72	82	88	94	102	110	126
64	589.90	1626.0	22.2	878.00	1581.6	34	43	39	50	71	78	88	95	102	110	119	135

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D	Wall Thickness, t	Plain-End Weight, w_{pe}	Inside Diameter, d	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight	(mm)[a]	(mm)[a]	(kg/m)	(mm)	Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
64	631.75	1626.0	23.8	940.34	1578.4	37	45	43	53	76	83	94	102	109	118	127	145
64	672.84	1626.0	25.4	1002.56	1575.2	39	48	45	56	81	89	101	108	116	126	136	155
64	713.85	1626.0	27.0	1064.65	1572.0	41	52	48	60	86	94	107	115	123	134	144	165
64	755.44	1626.0	28.6	1126.61	1568.8	43	54	51	63	92	101	114	122	131	142	152	174
64	796.95	1626.0	30.2	1188.44	1565.6	46	58	54	67	96	106	120	129	138	150	161	184
64	837.71	1626.0	31.8	1250.15	1562.4	48	61	56	71	102	112	126	136	145	158	169	194
68	338.26	1727.0	11.9	503.30	1703.2	17	21	20	25	36	39	45	48	51	56	60	68
68	360.45	1727.0	12.7	536.89	1701.6	18	23	21	27	39	42	48	51	54	59	64	73
68	404.77	1727.0	14.3	603.96	1698.4	21	25	24	30	43	47	53	57	61	67	72	82
68	449.73	1727.0	15.9	670.91	1695.2	23	28	27	33	48	52	59	64	68	74	80	91
68	494.60	1727.0	17.5	737.73	1692.0	25	32	29	37	52	58	65	70	75	81	88	101
68	538.67	1727.0	19.1	804.43	1688.8	28	34	32	40	57	63	71	76	82	89	96	110
68	582.66	1727.0	20.6	866.84	1685.8	30	37	34	43	62	68	77	83	89	96	103	118
68	627.28	1727.0	22.2	933.30	1682.6	32	40	37	47	67	74	83	90	96	104	112	127
68	671.82	1727.0	23.8	999.62	1679.4	34	43	40	50	72	79	89	96	103	111	120	137
68	715.56	1727.0	25.4	1065.82	1676.2	37	45	43	53	76	84	95	102	110	119	127	146
68	759.22	1727.0	27.0	1131.89	1673.0	39	48	45	56	81	89	101	108	116	126	136	155
68	803.50	1727.0	28.6	1197.84	1669.8	41	51	48	60	86	94	107	115	123	134	143	164
68	847.70	1727.0	30.2	1263.66	1666.6	43	54	50	63	91	100	113	121	130	141	152	173
68	891.11	1727.0	31.8	1329.36	1663.4	45	57	53	67	96	105	119	127	137	148	160	183
72	381.81	1829.0	12.7	568.83	1803.6	17	21	20	25	37	39	45	48	52	56	61	69
72	428.78	1829.0	14.3	639.93	1800.4	19	24	23	28	41	45	50	54	58	63	68	78
72	476.43	1829.0	15.9	710.91	1797.2	21	27	25	32	45	50	56	60	65	70	75	86
72	523.99	1829.0	17.5	781.75	1794.0	23	30	28	34	50	54	61	66	71	77	83	95
72	570.71	1829.0	19.1	852.47	1790.8	26	32	30	38	54	59	68	72	78	84	90	104
72	617.35	1829.0	20.6	918.66	1787.8	28	35	32	41	59	64	73	79	84	91	98	112
72	664.66	1829.0	22.2	989.14	1784.6	30	38	35	44	63	70	79	84	90	98	105	120
72	711.89	1829.0	23.8	1059.49	1781.4	32	41	38	47	68	74	84	90	97	105	113	129
72	758.28	1829.0	25.4	1129.69	1778.2	34	43	40	50	72	79	90	96	103	112	121	138
72	804.59	1829.0	27.0	1199.81	1775.0	37	45	43	53	77	84	95	103	110	119	128	146
72	851.56	1829.0	28.6	1269.78	1771.8	39	48	45	56	81	89	101	108	116	126	136	155
72	898.45	1829.0	30.2	1339.62	1768.6	41	51	48	60	86	94	106	114	123	133	143	164
72	944.51	1829.0	31.8	1409.34	1765.4	43	54	50	63	90	99	112	121	130	140	151	172
76	403.17	1930.0	12.7	600.46	1904.6	17	21	19	24	34	37	43	45	49	53	57	65
76	452.79	1930.4	14.3	675.55	1901.4	19	23	21	27	39	42	48	52	55	60	64	73
76	503.13	1930.0	15.9	750.51	1898.2	21	25	24	30	43	47	53	57	61	66	72	82
76	553.38	1930.0	17.5	825.34	1895.0	23	28	26	33	47	52	59	63	68	73	79	90
76	602.75	1930.0	19.1	900.05	1891.8	25	30	28	36	52	56	63	68	74	79	85	98
76	652.04	1930.0	20.6	969.97	1888.8	26	33	31	39	56	61	69	74	79	86	93	106
76	702.04	1930.0	22.2	1044.43	1885.6	28	36	33	41	60	65	74	80	85	93	100	114
76	751.96	1930.0	23.8	1118.76	1882.4	30	39	36	45	64	70	80	85	92	99	107	122
76	801.00	1930.0	25.4	1192.97	1879.2	32	41	38	48	68	75	85	92	98	106	114	131
76	849.96	1930.0	27.0	1267.06	1876.0	34	43	41	50	73	80	90	97	104	112	121	139

Table E-1C—Plain-End Line Pipe Dimensions, Weights, and Test Pressures for Sizes 6 5/8 Through 80 (Metric Units)—Continued

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Designation		Outside Diameter, D (mm)[a]	Wall Thickness, t (mm)[a]	Plain-End Weight, w_{pe} (kg/m)	Inside Diameter, d (mm)	Minimum Test Pressure[b] (kPa × 100[c])											
						Grade A		Grade B									
Size	Weight					Std.	Alt.	Std.	Alt.	Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70	Grade X80
76	899.62	1930.0	28.6	1341.02	1872.8	37	46	43	54	77	85	96	103	110	119	129	147
76	949.20	1930.0	30.2	1414.84	1869.6	39	48	45	56	81	89	101	109	116	126	136	155
76	997.91	1930.0	31.8	1488.55	1866.4	41	51	48	59	85	94	106	114	123	132	143	163
80	476.80	2032.0	14.3	711.52	2003.4	17	22	21	25	37	40	45	49	52	56	61	70
80	529.83	2032.0	15.9	790.50	2000.2	19	24	23	28	41	45	50	54	58	63	68	78
80	582.77	2032.0	17.5	869.36	1997.0	21	27	25	31	45	49	55	60	64	70	74	85
80	634.79	2032.0	19.1	948.09	1993.8	23	29	27	34	49	54	61	65	70	76	81	93
80	686.73	2032.0	20.6	1021.78	1990.8	25	32	30	37	53	58	65	70	76	82	88	101
80	739.42	2032.0	22.2	1100.27	1987.6	27	34	32	39	57	63	70	76	81	88	95	108
80	792.03	2032.0	23.8	1178.63	1984.4	29	37	34	43	61	67	76	81	88	94	102	116
80	843.72	2032.0	25.4	1256.86	1981.2	31	39	37	45	65	71	81	87	93	101	109	124
80	895.33	2032.0	27.0	1334.97	1978.0	33	41	39	48	69	76	85	92	99	107	115	132
80	947.68	2032.0	28.6	1412.95	1974.8	35	43	41	51	73	80	91	98	105	114	122	140
80	999.95	2032.0	30.2	1490.80	1971.6	37	46	43	54	77	85	96	103	110	120	129	147
80	1051.31	2032.0	31.8	1568.53	1968.4	39	48	45	56	81	89	101	108	116	126	136	155

Note: See Tables 6A, 6B, and 6C in Section 7 for U.S. customary unit equivalents of the metric values shown in this table.

[a]Outside diameter and wall-thickness dimensions shown are subject to tolerances described in Table 7. Inside diameters are nominal, and are given here for information (see 7.2).

[b]The test pressures given in Table E-1A, E-1B, and E-1C apply to Grades A25, A, B, X42, X46, X52, X56, X60, X65, X70 and X80 only. See 9.4.3 for pressures applicable to other grades.

[c]100 kPa = 1 bar.

[d]These sizes are special plain-end weights. All other sizes are regular weight. See Table 7 for applicable weight tolerances. For Grades X42 and higher, weights intermediate to regular weights shall be considered regular weight; weights intermediate to special plain-end weights shall be considered special plain-end weights; and weights intermediate to the heaviest tabulated special plain-end weight and the lightest regular weight shall be considered special plain-end weights.

APPENDIX F—SUPPLEMENTARY REQUIREMENTS (NORMATIVE)

By agreement between the purchaser and the manufacturer and when specified on the purchase order, the following supplementary requirements (SR) shall apply.

SR3 Color Identification

SR3.1 Grades X46 and higher, pipe size $4^1/_2$ and larger shall be identified by color in accordance with the color code given in SR3.3.

SR3.2 The manufacturer shall apply a 2 in. (50 mm) daub of paint of the appropriate color on the inside surface at one end of each length of pipe.

SR3.3 The grade identification colors are as follows:

Grade	Color
X46	Black
X52	Green
X56	Blue
X60	Red
X65	White
X70	Purple
X80	Yellow

SR4 Nondestructive Inspection of Seamless Line Pipe

SR4.1 SUPPLEMENTARY NONDESTRUCTIVE INSPECTION

Seamless pipe shall be inspected full length for longitudinal defects by either magnetic particle inspection or by ultrasonic or electromagnetic methods. The location of the equipment in the mill shall be at the discretion of the manufacturer; however, the nondestructive inspection must take place after all heat treating and expansion operations, if performed, but may take place before cropping, beveling, and end sizing.

SR4.2 MAGNETIC PARTICLE INSPECTION

When magnetic particle inspection is employed to inspect for longitudinal defects, the entire outside surface shall be inspected. The depth of all imperfections revealed by magnetic particle inspection shall be determined; and when found to be greater than $12^1/_2$ percent of the specified wall thickness, the imperfection shall be considered a defect. Pipe containing defects shall be disposed of in accordance with 9.7.5.4.

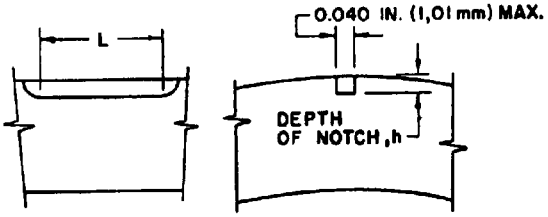
SR4.3 ULTRASONIC OR ELECTROMAGNETIC INSPECTION

SR4.3.1 Equipment

Any equipment utilizing the ultrasonic or electromagnetic principles and capable of continuous and uninterrupted inspection of the entire outer surface of the pipe or tube may be used. The equipment shall be of sufficient sensitivity to indicate defects and shall be checked as prescribed in SR4.3.2.

SR4.3.2 Reference Standards

At least once every working shift, a reference standard having the same nominal diameter and thickness as the product being inspected shall be used to demonstrate the effectiveness of the inspection equipment and procedures. The reference standard may be of any convenient length as determined by the manufacturer. It shall be scanned by the inspection unit in a manner simulating the inspection of the product. For ultrasonic inspection, the reference standard shall contain a machined notch as specified in Figure F-1. For electromagnetic inspection, the reference standard shall contain either a machined notch as specified in Figure F-1 or a $^1/_8$ in. (3.2 mm) drilled hole (see Note 1). The notch shall be in the outer surface of the reference standard and

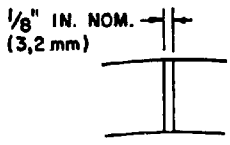


Depth of notch, h, shall be 12½ per cent of the nominal wall thickness of the pipe being inspected, but not less than 0.012 in. (0,30 mm).

For ultrasonic and eddy current the length of notch at full depth, L, shall be at least twice the width of the scanning head.

For diverted flux the length of notch shall be as required by the equipment design to provide a reproducible signal when the reference standard is passed through the equipment at the inspection line speed for the pipe being inspected. Three passes through the equipment shall be required to insure reproducibility.

NOTCH



DRILLED HOLE

Figure F-1—Reference Standards

parallel to the longitudinal axis of the pipe or, at the option of the manufacturer, may be oriented at such an angle as to optimize the detection of anticipated defects (see Note 2). The $^1/_8$ in. (3.2 mm) hole shall be drilled radially through the wall of the reference standard. The inspection equipment shall be adjusted to produce a well-defined indication when the reference standard is scanned by the inspection unit.

Note 1: The reference standards defined above are convenient standards for calibration of nondestructive testing equipment. The dimensions of these standards should not be construed as the minimum size imperfection detectable by such equipment.
Note 2: Reference standards other than the specific notch described above may be used by agreement between the purchaser and the manufacturer.

SR4.3.3 Acceptance Limits

Any imperfection that produces a signal greater than the signal received from the reference standard shall be considered a defect unless it can be demonstrated by the manufacturer that the imperfection does not exceed the provisions of 7.8. Pipe containing defects shall be given one of the dispositions specified in 9.7.5.4.

SR4.4 MARKING

Pipe nondestructively inspected in accordance with this supplementary requirement shall be marked SR4.

SR5 Fracture Toughness Testing (Charpy V-Notch) for Outside Diameter 4.500 Inches or Larger

SR5.1 The manufacturer is responsible for the performance of Charpy V-notch tests in accordance with ASTM A 370, *Mechanical Testing of Steel Products*, Annex II—Steel Tubular Products. Either or both toughness criteria (SR5A—Shear Area or SR5B—Absorbed Energy) may be specified under this supplementary requirement.

SR5.2 The following applies to all specified limits and observed values to be used in connection with this supplementary requirement.

For purposes of determining conformance with these supplementary requirements, an observed value shall be rounded off to the nearest whole number in accordance with the rounding-off method of ASTM E 29, *Practice for Using Significant Digits in Test Data to Determine Conformance With Specifications*. Further, limiting values as specified or calculated under this supplementary requirement shall be expressed as whole numbers rounded, if necessary.

SR5.3 The following Charpy V-notch specimens are permissible by agreement between the purchaser and the manufacturer:

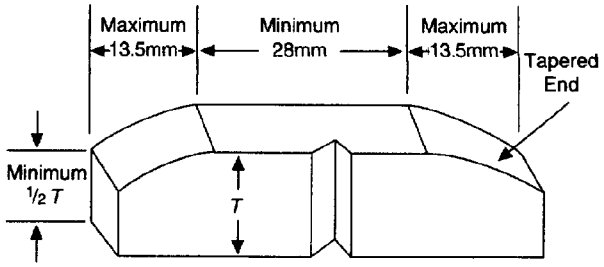


Figure F-2—Impact Test Specimen
Tapered End Allowance

a. Full-size specimens. Full-size specimens (10 mm by 10 mm) with or without tapered ends may be used (see note). (See Figure F-2.)
b. Subsize specimens. The largest possible subsize specimen (see Table F-1) with or without tapered ends may be used. All dimensions other than thickness are the same as the full-size specimen. Selecting subsize specimens for pipe whose size permits full-size specimens is also permissible by agreement between the purchaser and the manufacturer.

Note: When tapered-end specimens are used, the tapering shall not reduce the specimen length on one side below 28 mm or the end thickness below one-half the nominal specimen thicknes

SR5A Shear Area

SR5A.1 Three transverse specimens shall be taken from one length of pipe from each heat supplied on the order.

The requirements of this supplementary requirement are limited to pipe sizes and thicknesses from which a $^1/_2$-size specimen may be secured.

The specimen shall be oriented circumferentially from a location 90 degrees from the weld with the axis of the notch oriented through the pipe wall thickness as shown in Figure F-3.

SR5A.2 The specimens shall be tested at 50°F (10°C) or at a lower temperature as specified by the purchaser. The average shear value of the fracture appearance of the three specimens shall not be less than 60 percent, and the all-heat average for each order per diameter size and grade shall not be less than 80 percent.

SR5A.3 If the average of the three specimens from one heat does not meet the requirement of 60 percent shear, the manufacturer may elect to repeat the tests on specimens cut from two additional lengths of pipe from the same heat. If such specimens conform to the specified requirements, all the lengths in the heat shall be accepted except the length initially selected for test. If any of the retest specimens fail to pass this specified retest requirement, the manufacturer may

elect to test specimens cut from the individual lengths remaining in the heat.

SR5A.4 The average shear value for a heat shall be the average of the original three specimens if the average is 60 percent or more; the combined average of the retest specimens, provided the average of each group of three specimens is 60 percent or more; or, in the event individual lengths are tested, the combined average of all groups of three specimens that meet 60 percent. The all-heat average value is the combined average of the value established for each heat.

SR5A.5 If the all-heat average of the order does not meet the requirement of 80 percent shear, the manufacturer shall be responsible for replacement of such heats as may be necessary to bring the average shear area up to 80 percent.

SR5A.6 Alternatively, the manufacturer may elect to test two or more additional lengths from one or more of the heats. In determining the new heat average, the original test values may be discarded if the pipe length represented is rejected or the three or more individual values are averaged. In any case, the new test values shall be incorporated into the value for the heat.

SR5A.7 Specimens showing material defects or defective preparation, whether observed before or after breaking, may be discarded and replacements shall be considered as original specimens.

SR5A.8 Pipe tested in accordance with SR5A shall be marked to indicate the type of test and the test temperature. The following are examples:

a. At +32°F, mark: SR5A-32F.
b. At –40°F, mark; SR5A-M40F (see note).

Note: Temperatures below zero shall be preceded by the letter M.

SR5B Absorbed Energy

SR5B.1 The fracture toughness of the pipe shall be determined using Charpy V-notch impact test specimens in accordance with ASTM A 370 and the requirements of SR5A.1, except that test frequency shall be as indicated in SR5B.2. The purchaser shall specify, in whole numbers, both the test temperature and the minimum average absorbed energy for full-size specimens.

Specimens used for shear area determination according to SR5A may also be used for the determination of absorbed energy.

SR5B.2 Three transverse specimens representing one test shall be taken from one length of pipe from each lot of 100 lengths per heat produced.

SR5B.3 For acceptance, the average absorbed energy of the three individual specimens from a length shall not be less than the full-size value specified by the purchaser. In addition, the lowest individual reading of the three specimens shall not be less than 75 percent of the specified value. When substitute specimens are used, the individual readings and the average of the three readings are divided by the ratio of the specimen thickness tested to the full-size specimen thickness and compared with the full-size acceptance criteria.

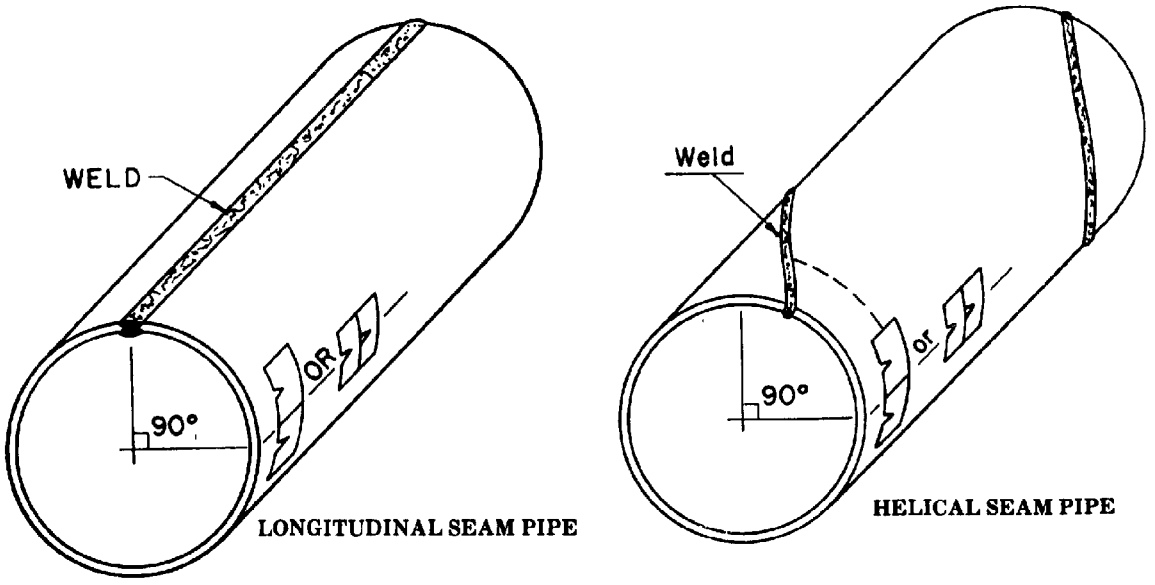


Figure F-3—Drop Weight Tear Test Specimen

Table F-1—Minimum Wall for Transverse Charpy V-Notch Specimens

Outside Diameter (in.)	Minimum Wall Thickness					
	Full Size Specimen		$^2/_3$ Size Specimen		$^1/_2$ Size Specimen	
	in.	mm	in.	mm	in.	mm
4.500	0.672	(17.06)	0.541	(13.74)	0.475	(12.05)
5.563	0.614	(15.60)	0.483	(12.27)	0.417	(10.59)
6.625	0.578	(14.68)	0.445	(11.30)	0.378	(9.60)
8.625	0.532	(13.51)	0.401	(10.19)	0.335	(8.51)
10.750	0.504	(12.80)	0.373	(9.47)	0.307	(7.80)
12.750	0.487	(12.37)	0.352	(8.94)	0.290	(7.37)
14.000	0.478	(12.14)	0.347	(8.81)	0.281	(7.14)
16.000	0.468	(11.89)	0.337	(8.56)	0.271	(6.88)
18.000	0.459	(11.66)	0.328	(8.33)	0.262	(6.65)
20.000	0.453	(11.51)	0.323	(8.20)	0.256	(6.50)
22.000	0.447	(11.35)	0.316	(8.03)	0.250	(6.35)
24.000	0.443	(11.25)	0.312	(7.92)	0.246	(6.25)
26.000	0.439	(11.15)	0.308	(7.82)	0.242	(6.15)
28.000	0.436	(11.07)	0.305	(7.75)	0.239	(6.07)
30.000	0.433	(11.00)	0.302	(7.67)	0.236	(5.99)
32.000	0.431	(10.95)	0.300	(7.62)	0.234	(5.94)
34.000	0.429	(10.90)	0.298	(7.57)	0.232	(5.89)
36.000	0.427	(10.85)	0.296	(7.52)	0.230	(5.84)
38.000	0.425	(10.80)	0.294	(7.47)	0.228	(5.79)
40.000	0.423	(10.74)	0.292	(7.42)	0.226	(5.74)
42.000	0.422	(10.72)	0.291	(7.39)	0.225	(5.72)
44.000	0.421	(10.70)	0.290	(7.37)	0.224	(5.69)
46.000	0.419	(10.64)	0.288	(7.32)	0.222	(5.64)
48.000	0.418	(10.62)	0.287	(7.30)	0.221	(5.61)
52.000	0.417	(10.59)	0.286	(7.26)	0.220	(5.59)
56.000	0.415	(10.54)	0.284	(7.21)	0.218	(5.54)
60.000	0.414	(10.52)	0.283	(7.19)	0.217	(5.51)
64.000	0.412	(10.46)	0.281	(7.14)	0.215	(5.46)

SR5B.4 Specimens showing material defects or defective preparations, whether observed before or after breaking, may be discarded and replacements shall be considered original specimens.

In the event a set of test specimens fails to meet the acceptance criteria, the manufacturer may elect to replace the lot of material involved or alternatively to test two more lengths from the same lot. If both of the new tests meet the acceptance criteria, then all pipe in that lot with the exception of the original selected length shall be considered to meet the requirement. Failure of either of the two additional tests shall require testing of each length in the lot for acceptance.

SR5B.5 Pipe complying with SR5B shall be marked to indicate the type of test, the specified (full-size) minimum average absorbed energy, and the test temperature. For example:

a. For 20 ft-lbs at +32°F, mark: SR5B-20-32F.
b. For 20 ft-lbs at –40°F, mark: SR5B-20-M40F (see note).
c. For both SR5A and SR5B (27 Joules) at 0°C, mark: SR5AB-27J-O°C.

Note: Temperatures below zero shall be preceded by the letter M.

SR6 Drop-Weight Tear Testing on Welded Pipe Sizes 20 and Larger, Grade X52 and Higher

SR6.1 Fracture toughness of pipe sizes 20 and larger, Grade X52 and higher, shall be determined by the manufacturer using drop-weight tear tests in accordance with the requirements in SR6.2–SR6.8.

SR6.2 Two transverse specimens shall be taken from one length of pipe from each heat supplied in the order. The specimens shall be oriented circumferentially from a location 90 degrees from the weld with the axis of the notch oriented through the pipe wall thickness as shown in Figure F-3. The specimens shall be tested at 50°F (10°C) or at a lower temperature as specified by the purchaser.

SR6.3 The test specimens, testing procedure, and rating of the specimens shall be in accordance with API Recommended Practice 5L3.

SR6.4 At least 80 percent of the heats shall exhibit a fracture appearance shear area of 40 percent or more for the specified test temperature (see note).

Note: Due to manufacturing difficulties encountered with thicker materials, pipe producers may not be able to offer materials in all grades that meet this requirement.

SR6.5 In the event the average value of the two specimens from the length selected to represent the heat is less than 40 percent, the manufacturer may elect to establish the heat average by testing two specimens from each of two or more additional lengths of pipe in the heat. In establishing the new heat average, the manufacturer may elect (a) to employ the combined average of the three tests or more or (b) to discard the result of the first test, reject the pipe from which it was taken, and employ the combined average of the two or more additional tests. Alternatively, the manufacturer may elect to test all the pipe in the heat, in which case 80 percent or more of the lengths tested and applied to the order must exhibit an average of 40 percent or more shear.

SR6.6 Specimens showing material defects or defective preparation, whether observed before or after breaking, may be discarded and replacements shall be considered as original specimens.

SR6.7 The manufacturer shall be responsible for replacement of such heats as may be necessary to meet the above requirements.

SR6.8 Pipe tested in accordance with SR6 shall be marked to indicate the type of test and the testing temperature. The following is an example:

SR6-32F

SR7 Through-the-Flowline (TFL) Pipe

SR7.1 GENERAL

Through-the-flowline (TFL) pipe shall comply with all requirements of this specification except as specified in SR7.2–SR7.6.

SR7.2 DIMENSIONS AND GRADES

TFL pipe shall be seamless or longitudinal-seam pipe in the outside diameters, wall thicknesses, and grades listed in Table F-2.

SR7.3 LENGTH

Unless otherwise specified, TFL pipe shall be furnished only in double random lengths with no jointers (girth welds).

SR7.4 DRIFT TESTS

Each length of TFL pipe shall be tested throughout its entire length with a cylindrical drift mandrel conforming to the requirements listed below. The leading edge of the drift mandrel shall be rounded to permit easy entry into the pipe. The drift mandrel shall pass freely through the pipe with reasonably exerted force equivalent to the weight of the mandrel being used for the test. Pipe shall not be rejected until it has been drift tested when it is free of all foreign matter and properly supported to prevent sagging.

	Drift Mandrel Size			
	Length		Diam., min.	
Outside Diameter	in.	mm	in.	mm
$2^7/_8$ and smaller	42	(1,066)	$(d - {}^3/_{32})$	$d - 2.4$
$3^1/_2$ and larger	42	(1,066)	$(d - {}^1/_8)$	$d - 3.2$

SR7.5 HYDROSTATIC TESTS

TFL pipe shall be hydrostatically tested in accordance with the requirements of 9.4, except that the minimum test pressures shall be as shown in Table F-2. These values are computed by the equation given in 9.4.3 using a fiber stress (S) equal to 80 percent of the specified minimum yield strength or 10,000 psi (68.9 MPa), whichever is less.

SR7.6 MARKING

TFL pipe manufactured in accordance with SR7 shall be marked with the letters TFL in addition to the marking required in Section 10 or Appendix I.

SR14 End Load Compensation for Hydrostatic Test Pressures in Excess of 90 Percent of Specified Minimum Yield Strength

SR14.1 As a measure to prevent distortion when testing at pressures equivalent to stresses in excess of 90 percent of specified minimum yield strength, the manufacturer may apply a calculation to compensate for the forces applied to the pipe end that produce a compressive longitudinal stress. The calculation in SR14 is based on Barlow's equation (see 9.4.3) modified by a factor based on the Maximum Shear Theory (see note). The calculation may be applied only when testing in excess of 90 percent of the specified minimum yield strength. In no case may the gag pressure for testing be less than that calculated using Barlow's equation at 90 percent of specified minimum yield strength.

Table F-2—Dimensions, Weights, and Test Pressures for TFL Pipe

(1)	(2)		(3)	(4)		(5)		(6)		(7)	
Size Designation	Outside Diameter, D		Grade	Wall Thickness, t		Weight, w_{pe}		Inside Diameter, d		Hydrostatic Test Pressure	
	in.	mm		in.	mm	lb/ft	kg/m	in.	mm	psi	100 kPa
$2^3/_8$[a]	2.375	(60.3)	X56	0.188	(4.8)	4.39	(6.54)	1.999	(50.7)	7100	(489)
$2^7/_8$	2.875	(73.0)	X56	0.438	(11.1)	11.40	(16.98)	1.999	(50.8)	10000	(689)
$2^7/_8$[a]	2.875	(73.0)	X56	0.216	(5.5)	6.13	(9.13)	2.443	(62.2)	6700	(462)
$3^1/_2$	3.500	(88.9)	X56	0.530	(13.5)	16.81	(25.04)	2.440	(61.9)	10000	(689)
4	4.000	(101.6)	X60	0.750	(19.1)	26.03	(38.77)	2.500	(63.4)	10000	(689)
4	4.000	(101.6)	X42	0.500	(12.7)	18.69	(27.84)	3.000	(76.2)	8400	(579)
4	4.000	(101.6)	X60	0.500	(12.7)	18.69	(27.84)	3.000	(76.2)	10000	(689)
4[a]	4.000	(101.6)	X70	0.250	(6.4)	10.01	(14.91)	3.500	(88.8)	7000	(482)
$4^1/_2$	4.500	(114.3)	X52	0.750	(19.1)	30.04	(44.74)	3.000	(76.1)	10000	(689)
$4^1/_2$[a]	4.500	(114.3)	X70	0.281	(7.1)	12.66	(18.86)	3.938	(100.1)	7000	(482)

[a]Standard size, weight, and grade.

Note: The calculation is an approximation of the effective hoop stress (*SE*), which is practical for application under mill pipe testing conditions. Other calculations provide closer approximations of effective hoop stress but are complex and therefore impractical for application.

SR14.2 The test pressure calculated shall be rounded to the nearest 10 psi (100 kPa).

SR14.3 The hydrostatic test pressure compensated for pipe end loading shall be calculated according to the following equation:

U.S. customary unit equation:

$$P_I = \frac{\dfrac{P_R A_R}{S_E - A_P}}{\dfrac{D}{2t} - \dfrac{A_I}{A_P}}$$

Metric equation:

$$P_I = 1000\,\frac{\dfrac{P_R A_R}{S_E - A_P}}{\dfrac{D}{2t} - \dfrac{A_I}{A_P}}$$

Where:

A_I = internal cross-sectional area of pipe.
A_P = cross-sectional area of pipe wall.
A_R = cross-sectional area of ram.
P_I = hydrostatic test pressure in psi (kPa).
P_R = internal pressure on end sealing ram.
S_E = effective hoop stress in psi (MPa) equal to a percentage of the specified minimum yield strength.
D = specified outside diameter, in. (mm).
t = specified wall thickness, in. (mm).

SR14.4 The above equation may be manipulated algebraically to provide calculation in other terms appropriate to the manufacturer's testing facility.

SR14.5 Appropriate techniques for controlling effective hoop stress based on measurements of internal pipe and ram pressures vary according to hydrotester system design. The manufacturer shall provide a control technique appropriate to his installation.

SR15 Test Certificates for Line Pipe

SR15.1 The manufacturer shall provide the following data, as applicable, for each item for which this supplementary requirement is specified on the purchase order. The manufacturer's certificate shall state the API specification and date of revision to which pipe was manufactured.

a. Specified diameter, wall thickness, grade, process of manufacture, and type of heat treatment.
b. Chemical analyses (heat, product, control, and recheck) showing the weight in percent of all elements whose limits or reporting requirements are set in this specification.
c. Test data for all tensile tests required by this specification, including yield strength, ultimate tensile strength, and elongation. The type, size, and orientation of specimens shall be shown.
d. Fracture toughness test results (including test type and criteria and the size, location, and orientation of the specimen) where such testing is specified by the purchaser.
e. Minimum hydrostatic test pressure and duration.
f. For welded pipe for which nondestructive inspection of the weld seam is required by this specification, the method of nondestructive inspection employed (radiological, ultrasonic, electromagnetic, and/or magnetic particle), and the type and size of all penetrameters and reference standards used.
g. For seamless pipe for which nondestructive inspection (SR4) is specified by the purchaser, the method of inspection employed (ultrasonic, electromagnetic, or magnetic particle), and the type and size of the reference standard used.
h. For electric-welded pipe, the minimum temperature for heat treatment of the weld seam. Where such heat treatment is not performed, the words "No Seam Heat Treatment" shall be stated on the certificate.
i. Results of any supplemental testing required by the purchaser.

SR15.2 The manufacturer shall establish and follow procedures for maintaining heat and lot identity of all pipe covered by this supplementary requirement. The procedures shall provide means for tracing any length of pipe or coupling to the proper heat and lot and to all applicable chemical and mechanical test results.

SR17 Nondestructive Inspection of Welds in Electric-Welded Pipe

SR17.1 SUPPLEMENTARY NONDESTRUCTIVE INSPECTION

The weld in electric-welded pipe shall be inspected full length for surface and subsurface defects by either ultrasonicor electromagnetic methods. The location of the equipment in the mill shall be at the discretion of the manufacturer. However, the nondestructive inspection must take place after all heat treating, hydrostatic testing, expansion, and rotary straightening operations, if performed, but may take place before cropping, beveling, and sizing of pipe.

SR17.2 EQUIPMENT AND REFERENCE STANDARDS

The ultrasonic or electromagnetic inspection equipment requirements are given in 9.7.4.1, and the reference standards are described in 9.7.4.2. Details of the specific techniques (such as method, reference standards, transducer

properties, and sensitivity) shall be agreed upon between the purchaser and the manufacturer for the implementation of this supplementary requirement.

SR17.3 ACCEPTANCE LIMITS AND EMI INSPECTIONS

Table 20 gives the height of acceptance limit signals in percent of height of signals produced by reference standards. An imperfection that produced a signal greater than the acceptance limit signal given in Table 20 shall be classified as a defect.

SR17.4 DISPOSITION

Defects shall be disposed of in accordance with 9.7.5.4, Items a, c, and d. Repair by welding is not permitted. If a defect is removed by grinding, the ground area shall be reinspected by the same method originally used.

SR17.5 MARKING

Pipe nondestructively inspected in accordance with this supplementary requirement shall be marked SR17.

SR18 Carbon Equivalent

SR18.1 For pipe grades up to Grade X70 inclusive, the carbon equivalent, *CE*, calculated using product analysis and the following equation shall not exceed 0.43 percent:

$$CE = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} = \frac{Ni + Cu}{15}$$

SR18.2 The elements analyzed for product analysis shall include all elements contained in the carbon equivalent equation.

APPENDIX G—GUIDED-BEND TEST JIG DIMENSIONS (NORMATIVE)

Table G-1 contains guided-bend test jig dimensions discussed in 9.8.3.

Table G-1—Guided Bend Test Jig Dimensions

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
$12^3/_4$	.172	1.0	25.4	1.4	35.6	1.4	35.6	1.6	40.6	1.6	40.6	1.6	40.6	1.6	40.6	1.9	48.3	2.2	55.9
$12^3/_4$	.188	1.2	30.5	1.4	35.6	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	1.9	48.3	2.2	55.9	2.6	66.0
$12^3/_4$	.203	—	—	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0
$12^3/_4$	.219	1.4	35.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	3.1	78.7
$12^3/_4$	.250	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
$12^3/_4$	.281	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
$12^3/_4$	.312	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	5.2	132.1
$12^3/_4$	.330	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
$12^3/_4$	.344	2.2	55.9	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1
$12^3/_4$	.375	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
$12^3/_4$	.406	—	—	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
$12^3/_4$	.438	3.1	78.7	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	8.8	223.5
$12^3/_4$	.500	—	—	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
$12^3/_4$	.562	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
$12^3/_4$	.625	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	18.1	459.7
$12^3/_4$	.688	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7	26.0	660.4
$12^3/_4$	.750	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	31.2	792.5
$12^3/_4$	.812	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5
$12^3/_4$	.875	10.5	266.7	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5
14	.188	1.2	30.5	1.4	35.6	1.6	40.6	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.6	66.0
14	.203	1.2	30.5	1.6	40.6	—	—	—	—	—	—	—	—	—	—	—	—	2.6	66.0
14	.210	—	—	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0
14	.219	—	—	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	3.1	78.7
14	.250	1.6	40.6	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
14	.281	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	4.4	111.8
14	.312	1.9	48.3	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
14	.344	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
14	.375	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
14	.406	—	—	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	7.4	188.0
14	.438	3.1	78.7	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
14	.469	—	—	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
14	.500	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	10.5	266.7
14	.562	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	12.6	320.0
14	.625	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
14	.688	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
14	.750	6.2	157.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	26.0	660.4
14	.812	7.4	188.0	10.5	266.7	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	.812	7.4	188.0	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	31.2	792.5
14	.875	8.8	223.5	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	31.2	792.5	31.2	792.5
14	.938	10.5	266.7	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5
16	.188	1.2	30.5	1.4	35.6	1.6	40.6	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.6	66.0
16	.203	1.2	30.5	1.6	40.6	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0
16	.219	1.4	35.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.6	55.9	2.6	66.0	3.1	78.7
16	.250	1.6	40.6	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7
16	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
16	.312	1.9	48.3	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
16	.344	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
16	.375	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	6.2	157.5
16	.406	—	—	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5
16	.438	3.1	78.7	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
16	.469	—	—	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0
16	.500	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
16	.562	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
16	.625	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
16	.688	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
16	.750	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	21.7	551.2
16	.812	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	26.0	660.4
16	.875	7.4	188.0	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	31.2	792.5
16	.938	8.8	223.5	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5
16	1.000	10.5	266.7	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	26.0	564.2	26.0	564.2	31.2	792.5	31.2	792.5
16	1.062	10.5	266.7	18.1	459.7	18.1	459.7	21.7	551.2	26.0	564.2	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
16	1.125	12.6	320.0	21.7	551.2	21.7	551.2	26.0	564.2	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
18	.188	1.0	25.4	1.4	35.6	1.4	35.6	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	1.9	48.3	—	—
18	.219	1.4	35.6	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0
18	.250	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7
18	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0
18	.312	1.9	48.3	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
18	.344	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
18	.375	2.2	55.9	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
18	.406	—	—	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
18	.438	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	7.4	188.0
18	.469	—	—	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
18	.500	3.1	78.7	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	8.8	223.5
18	.562	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	10.5	266.7
18	.625	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	12.6	320.0
18	.688	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	15.1	383.5
18	.750	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	18.1	459.7
18	.812	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	21.7	551.2
18	.875	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	26.1	662.9
18	.938	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	31.2	792.5
18	1.000	8.8	223.5	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5
18	1.062	10.5	266.7	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5
18	1.125	10.5	266.7	18.1	459.7	18.1	459.7	21.7	551.2	26.0	660.4	26.0	660.4	31.2	782.5	31.2	792.5	31.2	792.5
18	1.188	12.6	320.0	18.1	459.7	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
18	1.250	15.1	383.5	21.7	551.2	26.0	660.4	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
20	.219	1.2	30.5	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0
20	.250	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7
20	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0
20	.312	1.9	48.3	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
20	.344	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
20	.375	2.2	55.9	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
20	.406	—	—	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
20	.438	2.6	66.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5
20	.469	—	—	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
20	.500	3.1	78.7	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0
20	.562	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5
20	.625	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
20	.688	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
20	.750	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
20	.812	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
20	.875	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	21.7	551.2
20	.938	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	26.0	660.4
20	1.000	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	31.2	792.5
20	1.062	8.8	223.5	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
20	1.125	10.5	266.7	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5
20	1.188	10.5	266.7	18.1	459.7	18.1	459.7	21.7	551.2	26.0	660.4	26.0	660.4	26.0	660.4	31.2	792.5	31.2	792.5
20	1.250	12.6	320.0	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
20	1.312	12.6	320.0	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
20	1.375	15.1	383.5	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
22	.219	1.2	30.5	1.6	40.6	1.6	40.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0
22	.250	1.4	35.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7
22	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
22	.312	1.9	48.3	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
22	.344	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
22	.375	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
22	.406	—	—	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	6.2	157.5
22	.438	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5
22	.469	—	—	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
22	.500	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
22	.562	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
22	.625	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
22	.688	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
22	.750	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	15.1	383.5
22	.812	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
22	.875	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
22	.938	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
22	1.000	7.4	188.0	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	26.0	660.4
22	1.062	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	31.2	792.5
22	1.125	10.5	266.7	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5
22	1.188	10.5	266.7	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5
22	1.250	12.6	320.0	18.1	459.7	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	26.0	660.4	31.2	792.5	31.2	792.5
22	1.312	12.6	320.0	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
22	1.375	12.6	320.0	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
22	1.438	15.1	383.5	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
22	1.500	15.1	383.5	26.0	660.4	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
24	.250	1.4	35.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7
24	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
24	.312	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	3.1	66.0	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
24	.344	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
24	.375	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
24	.406	—	—	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
24	.438	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
24	.469	—	—	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
24	.500	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
24	.562	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
24	.625	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
24	.688	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	12.6	320.0
24	.750	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
24	.812	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
24	.875	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	18.1	459.7
24	.938	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	21.7	551.2
24	1.000	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
24	1.062	8.8	223.5	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	26.0	660.4
24	1.125	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7	18.1	459.7	18.1	459.7	21.7	551.2	31.2	792.5
24	1.188	10.5	266.7	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5
24	1.250	10.5	266.7	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	26.0	660.4	31.2	792.5
24	1.312	12.6	320.0	18.1	459.7	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	26.0	660.4	31.2	792.5	31.2	792.5
24	1.375	12.6	320.0	18.1	459.7	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
24	1.438	15.1	383.5	21.7	551.2	21.7	551.2	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
24	1.500	15.1	383.5	21.7	551.2	26.0	660.4	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
24	1.562	15.1	383.5	26.0	660.4	26.0	660.4	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5	31.2	792.5
26	.250	1.4	35.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7
26	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
26	.312	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
26	.344	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8
26	.375	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
26	.406	—	—	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
26	.438	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
26	.469	—	—	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
26	.500	3.1	78.7	3.7	94.0	4.4	111.8	4.4	132.1	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
26	.562	3.7	94.0	4.4	111.8	5.1	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
26	.625	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	10.5	266.7
26	.688	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
26	.750	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
26	.812	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
26	.875	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5
26	.938	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
26	1.000	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	21.7	551.2
28	.250	1.4	35.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	3.1	78.7
28	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
28	.312	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
28	.344	—	—	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8
28	.375	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
28	.406	—	—	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1
28	.438	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
28	.469	—	—	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5
28	.500	3.1	78.7	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
28	.562	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	8.8	223.5
28	.625	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
28	.688	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
28	.750	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
28	.812	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
28	.875	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
28	.938	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
28	1.000	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
30	.250	1.4	35.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	3.1	78.7
30	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
30	.312	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
30	.344	—	—	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
30	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
30	.406	—	—	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1
30	.438	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
30	.469	—	—	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5
30	.500	3.1	78.7	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
30	.562	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
30	.625	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5
30	.688	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
30	.750	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
30	.812	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0
30	.875	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
30	.938	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	18.1	459.7
30	1.000	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
32	.250	1.4	35.6	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	3.1	78.7
32	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
32	.312	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
32	.344	—	—	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
32	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	3.7	94.0	5.2	132.1
32	.406	—	—	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.7	144.8
32	.438	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
32	.469	—	—	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5
32	.500	3.1	78.7	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
32	.562	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
32	.625	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
32	.688	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
32	.750	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
32	.812	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
32	.875	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
32	.938	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5
32	1.000	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
32	1.062	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7
32	1.125	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
32	1.188	8.8	223.5	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	26.0	660.4
32	1.250	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	21.7	551.2	26.0	660.4
34	.250	1.4	35.6	1.9	48.3	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	3.1	78.7
34	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
34	.312	1.9	48.3	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
34	.344	—	—	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
34	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
34	.406	—	—	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
34	.438	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1
34	.469	—	—	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
34	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
34	.562	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
34	.625	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
34	.688	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
34	.750	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
34	.812	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	15.0	381.0
34	.875	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	15.1	383.5
34	.938	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
34	1.000	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
34	1.062	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
34	1.125	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
34	1.188	8.8	223.5	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
34	1.250	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	18.1	459.7	26.0	660.4
36	.250	1.4	35.6	1.9	48.3	1.9	48.3	1.9	48.3	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	3.1	78.7
36	.281	1.6	40.6	2.2	55.9	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.7	94.0
36	.312	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
36	.344	—	—	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
36	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
36	.406	—	—	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
36	.438	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
36	.469	—	—	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
36	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
36	.562	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0
36	.625	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
36	.688	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
36	.750	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
36	.812	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
36	.875	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
36	.938	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
36	1.000	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
36	1.062	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
36	1.125	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	21.7	551.2
36	1.188	8.8	223.5	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
36	1.250	8.8	223.5	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	18.1	459.7	26.0	660.4
38	.312	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
38	.344	1.9	48.3	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
38	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
38	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
38	.438	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
38	.469	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
38	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
38	.562	3.1	78.7	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0
38	.625	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
38	.688	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
38	.750	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7
38	.812	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
38	.875	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
38	.938	6.2	157.1	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
38	1.000	6.2	157.1	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5
38	1.062	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
38	1.125	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7
38	1.188	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
38	1.250	8.8	223.5	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
40	.312	1.9	48.3	2.2	55.9	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0
40	.344	1.9	48.3	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
40	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
40	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
40	.438	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
40	.469	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
40	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
40	.562	3.1	78.7	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0
40	.625	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
40	.688	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
40	.750	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
40	.812	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
40	.875	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0
40	.938	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
40	1.000	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5
40	1.062	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
40	1.125	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
40	1.188	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	21.7	551.2

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
40	1.250	8.8	223.5	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
42	.344	1.9	48.3	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
42	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
42	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
42	.438	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
42	.469	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
42	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
42	.562	3.1	78.7	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
42	.625	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
42	.688	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
42	.750	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
42	.812	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7
42	.875	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0
42	.938	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
42	1.000	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
42	1.062	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	18.1	459.7
42	1.125	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
42	1.188	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7
42	1.250	8.8	223.5	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7	21.7	551.2
44	.344	1.9	48.3	2.6	66.0	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	4.4	111.8
44	.375	2.2	55.9	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
44	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
44	.438	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
44	.469	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
44	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5
44	.562	3.1	78.7	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
44	.625	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
44	.688	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
44	.750	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
44	.812	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
44	.875	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
44	.938	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
44	1.000	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	408.9
44	1.062	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5

(1)	(2)	(3)		
Size Designation	Wall Thickness, t (in.)	Grade A		G
		in.	mm	
44	1.125	7.4	188.0	
44	1.188	7.4	188.0	1
44	1.250	8.8	223.5	1
46	.344	1.9	48.3	
46	.375	2.2	55.9	
46	.406	2.2	55.9	
46	.438	2.6	66.0	
46	.469	2.6	66.0	
46	.500	3.1	78.7	
46	.562	3.1	78.7	
46	.625	3.7	94.0	
46	.688	4.4	111.8	
46	.750	4.4	111.8	
46	.812	5.2	132.1	
46	.875	5.2	132.1	
46	.938	6.2	157.5	
46	1.000	6.2	157.5	
46	1.062	7.4	188.0	
46	1.125	7.4	188.0	
46	1.188	7.4	188.0	1
46	1.250	8.8	223.5	1
48	.344	1.9	48.3	
48	.375	2.2	55.9	
48	.406	2.2	55.9	
48	.438	2.6	66.0	
48	.469	2.6	66.0	
48	.500	3.1	78.7	
48	.562	3.1	78.7	
48	.625	3.7	94.0	
48	.688	4.4	111.8	
48	.750	4.4	111.8	
48	.812	5.2	132.1	
48	.875	5.2	132.1	
48	.938	6.2	157.5	
48	1.000	6.2	157.5	

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
48	1.062	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
48	1.125	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
48	1.188	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
48	1.250	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	21.7	551.2
52	.375	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
52	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
52	.438	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
52	.469	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
52	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5
52	.562	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
52	.625	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
52	.688	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5
52	.750	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
52	.812	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
52	.875	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
52	.938	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
52	1.000	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
52	1.062	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	366.7	12.6	320.0	12.6	320.0	15.1	383.5
52	1.125	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	10.5	226.7	12.6	320.0	12.6	320.0	12.6	320.0	18.1	459.7
52	1.188	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
52	1.250	8.8	223.6	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	15.1	383.5	18.1	459.7
56	.375	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8
56	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
56	.438	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1
56	.469	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
56	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
56	.562	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
56	.625	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
56	.688	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5
56	.750	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
56	.812	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7
56	.875	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
56	.938	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0
56	1.000	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
56	1.062	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
56	1.125	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
56	1.188	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
56	1.250	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	15.1	383.5	18.1	459.7
60	.375	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8
60	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
60	.438	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1
60	.469	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1
60	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
60	.562	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
60	.625	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
60	.688	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
60	.750	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5
60	.812	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7
60	.875	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7
60	.938	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0
60	1.000	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
60	1.062	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
60	1.125	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
60	1.188	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
60	1.250	7.4	188.0	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
64	.375	2.2	55.9	2.6	66.0	2.6	66.0	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8
64	.406	2.2	55.9	3.1	78.7	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	5.2	132.1
64	.438	2.6	66.0	3.1	78.7	3.1	78.7	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1
64	.469	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1
64	.500	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
64	.562	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
64	.625	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
64	.688	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
64	.750	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
64	.812	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7
64	.875	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7
64	.938	5.2	132.1	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
64	1.000	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
64	1.062	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
64	1.125	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5
64	1.188	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
64	1.250	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
68	.469	2.6	66.0	3.1	78.7	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1
68	.500	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
68	.562	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	7.4	188.0
68	.625	3.7	94.0	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
68	.688	3.7	94.0	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
68	.750	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
68	.812	5.2	132.1	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
68	.875	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
68	.938	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
68	1.000	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
68	1.062	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
68	1.125	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5
68	1.188	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
68	1.250	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
72	.500	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
72	.562	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5
72	.625	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
72	.688	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
72	.750	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
72	.812	4.4	111.8	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
72	.875	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
72	.938	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
72	1.000	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
72	1.062	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
72	1.125	7.4	188.0	8.8	233.5	8.8	233.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	15.1	383.5
72	1.188	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
72	1.250	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
76	.500	2.6	66.0	3.7	94.0	3.7	94.0	3.7	94.0	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	6.2	157.5
76	.562	3.1	78.7	4.4	111.8	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5
76	.625	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
76	.688	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5

Table G-1—Guided Bend Test Jig Dimensions—Continued

(1)	(2)	(3)		(4)		(5)		(6)		(7)		(8)		(9)		(10)		(11)	
		Dimension A																	
Size Designation	Wall Thickness, t (in.)	Grade A		Grades B & X42		X46		X52		X56		X60		X65		X70		X80	
		in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
76	.750	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
76	.812	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
76	.875	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
76	.938	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
76	1.000	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
76	1.062	6.2	157.5	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
76	1.125	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	15.1	383.5
76	1.188	7.4	188.0	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
76	1.250	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7
80	.562	3.1	78.7	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.6	167.6
80	.625	3.7	94.0	4.4	111.8	4.4	111.8	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0
80	.688	3.7	94.0	5.2	132.1	5.2	132.1	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	8.8	223.5
80	.750	4.4	111.8	5.2	132.1	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5
80	.812	4.4	111.8	6.2	157.5	6.2	157.5	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	10.5	266.7
80	.875	5.2	132.1	6.2	157.5	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7
80	.938	5.2	132.1	7.4	188.0	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	8.8	223.5	10.5	266.7	12.6	320.0
80	1.000	6.2	157.5	7.4	188.0	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0
80	1.062	6.2	157.5	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0
80	1.125	6.2	157.5	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	10.5	226.7	10.5	266.7	12.6	320.0	15.1	383.5
80	1.188	7.4	188.0	8.8	223.5	8.8	223.5	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5
80	1.250	7.4	188.0	10.5	266.7	10.5	266.7	10.5	266.7	12.6	320.0	12.6	320.0	12.6	320.0	15.1	383.5	18.1	459.7

APPENDIX H—PURCHASER INSPECTION (NORMATIVE)

H.1 Inspection Notice

Where the inspector representing the purchaser desires to inspect pipe or witness tests, reasonable notice shall be given of the time at which the run is to be made.

H.2 Plant Access

The inspector representing the purchaser shall have unrestricted access, at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works that will concern the manufacture of the pipe ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy the inspector that the pipe is being manufactured in accordance with this specification. All inspections should be made at the place of manufacture prior to shipment, unless otherwise specified on the purchase order, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

H.3 Compliance

The manufacturer is responsible for complying with all of the provisions of this specification. The purchaser may make any investigation necessary to assure compliance by the manufacturer and may reject any material that does not comply with this specification.

H.4 Rejection

Unless otherwise provided, material that shows defects on inspection or subsequent to acceptance at the manufacturer's works, or material that proves defective when properly applied in service, may be rejected and the manufacturer so notified. If tests that require the destruction of material are made, any product proven not to have met the requirements of the specification shall be rejected. Disposition of rejected product shall be a matter of agreement between the manufacturer and the purchaser.

APPENDIX I—MARKING INSTRUCTIONS FOR API LICENSEES (NORMATIVE)

I.1 General

The marking requirements in this appendix apply to licensed manufacturers using the API monogram on products covered by this specification.

Pipe and pipe couplings manufactured in conformance with this specification may be marked by the licensee as specified in Appendix I or Section 10. Products to which the monogram is applied shall be marked as specified in Appendix I.

I.1.1 The required marking on pipe shall be as stipulated hereinafter.

I.1.2 The required marking on couplings shall be die stamped unless otherwise agreed between the purchaser and the manufacturer, in which case they shall be paint stenciled.

I.1.3 Length and hydrostatic test pressure marking should be in U.S. customary units. If so specified on the purchase order, these markings shall be SI (metric) units or both U.S. customary and metric units. If not so specified, for pipe made and intended for use in countries using the metric system, these markings may be given in metric units only, at the option of the manufacturer.

Additional markings, including those for compatible standards following the specification marking, are allowed and may be applied as desired by the manufacturer or as requested by the purchaser.

I.2 Location of Markings

The location of identification markings shall be as specified in I.2.1–I.2.3.

I.2.1 SIZES $1^1/_2$ AND SMALLER

The marking is die stamped on a metal tag fixed to the bundle or may be printed on the straps or banding clips used to tie the bundle.

I.2.2 SEAMLESS PIPE IN ALL OTHER SIZES AND WELDED PIPE UP TO SIZE 16

Paint stencil the marking on the outside surface starting at a point between 18 in. and 30 in. from the end of the pipe, and in the sequence shown in I.2.3, except when agreed between the purchaser and the manufacturer, some or all of the markings may be placed on the inside surface in a sequence convenient to the manufacturer.

I.2.3 WELDED PIPE SIZES 16 AND LARGER

Paint stencil the inside surface starting at a point no less than 6 in. from the end of the pipe in a sequence convenient to the manufacturer, unless otherwise specified by the purchaser.

I.3 Sequence of Markings

The sequence of identification markings shall be as specified in I.3.1–I.3.9.

I.3.1 MANUFACTURER'S API LICENSE NUMBER

The manufacturer's API license number shall be marked. (The manufacturer's name or mark is optional.)

I.3.2 API MONOGRAM (Ⓐ) AND DATE

The API monogram (Ⓐ), immediately followed by the date of manufacture (defined as the month and year when the monogram is applied), shall be applied only to products complying with the requirements of the specification and only by authorized manufacturers.

I.3.3 COMPATIBLE STANDARDS

Products in compliance with multiple compatible standards may be marked with the name of each standard.

I.3.4 DESIGNATION

The size and weight designations are dimensionless quantities based on the former U.S. customary unit diameter and weight per foot. The size designation (column 1, Tables 4, 5, 6A, 6B, and 6C) or the applicable intermediate outside diameter shall be marked.

For sizes $4^1/_2$ and larger, the nominal weight for threaded-and-coupled pipe (column 2, Tables 4 and 5), the tabulated weight for plain-end pipe (column 4, Tables 6A, 6B, and 6C), or the applicable calculated weight for pipe having an intermediate outside diameter and/or wall thickness, shall be marked.

I.3.5 GRADE AND CLASS

The symbols to be used are as follows:

Grade (See Note)	Symbol
Grade A25, Class I	A25
Grade A25, Class II	A25R
Grade A	A
Grade B	B
Grade X42	X42
Grade X46	X46
Grade X52	X52
Grade X56	X56
Grade X60	X60
Grade X65	X65
Grade X70	X70
Grade X80	X80

Note: See 1.3 for limitations on downgrading.

For grades intermediate to X42 and X80, the symbol shall be X followed by the first two digits of the specified minimum yield strength.

By agreement between the purchaser and the manufacturer and when so specified on the purchase order, the grade shall be identified by color in accordance with SR3.

I.3.6 PROCESS OF MANUFACTURE

The symbols to be used are as follows:

a. Seamless pipe	S
b. Welded pipe, except continuous welded	E
c. Continuous welded pipe	F

I.3.7 HEAT TREATMENT

The symbols to be used are as follows:

a. Normalized or normalized and tempered	HN
b. Subcritical stress relieved	HS
c. Subcritical age hardened	HA
d. Quenched and tempered	HQ

I.3.8 TEST PRESSURE

When the specified hydrostatic test pressure is higher than the tabulated pressure (Tables 4 and 5), the test pressure in pounds per square inch, preceded by the word TESTED, shall be marked.

I.3.9 SUPPLEMENTARY REQUIREMENTS

See Appendix F for supplemental requirements.

I.3.10 EXAMPLES

1. Size 14, weight 54.57, Grade B, seamless, regular-weight, plain-end pipe should be paint stenciled as follows:

5LXXXX.X Ⓐ (MO-YR) 14 54.57 B S

2. Size $6^5/_8$, weight 18.97, Grade B, electric-welded, regular-weight, plain-end pipe should be paint stenciled as follows:

5LXXXX.X Ⓐ (MO-YR) $6^5/_8$ 18.97 B E

3. Nominal size 4, Grade A25 continuous welded, Class I, standard-weight, threaded line pipe should be paint stenciled as follows:

5LXXXX.X Ⓐ (MO-YR) 4 11.00 A25 F

4. Size 14, weight 54.57, Grade X70, seamless, quenched-and-tempered steel pipe should be paint stenciled as follows:

5LXXXX.X Ⓐ (MO-YR) 14 54.57 X70 S HQ

5. Size $12^3/_4$, weight 43.77, Grade X42, seamless plain-end pipe should be paint stenciled as follows:

5LXXXX.X Ⓐ (MO-YR) $12^3/_4$ 43.77 X42 S

6. Size $6^5/_8$, weight 14.97, Grade X42, electric-welded plain-end pipe should be paint stenciled as follows:

5LXXXX.X Ⓐ (MO-YR) $6^5/_8$ 14.97 X42 E

7. Size $12^3/_4$, weight 43.77, Grade X42, helical seam submerged-arc welded plain-end pipe should be paint stenciled as follows:

5LXXXX.X Ⓐ (MO-YR) $12^3/_4$ 43.77 X42 E

I.4 Bundle Identification

For pipe sizes $1^1/_2$ and smaller, the identification markings specified in I.3 shall be placed on the tag, strap, or clip used to tie the bundle. For example, size $1^1/_2$, weight 2.72, Grade B, electric-welded plain-end pipe should have the following marking:

5LXXXX.X Ⓐ (MO-YR) $1^1/_2$ 2.72 BE

I.5 Length

In addition to the identification markings stipulated in I.2, I.3, and I.4, the length shall be marked as follows:

a. For pipe sizes larger than $1^1/_2$, the length in feet and tenths of a foot (unless otherwise specified on the purchase order) as measured on the finished pipe shall be paint stenciled on the outside surface at a location convenient to the manufacturer, except by agreement between the purchaser and the manufacturer, the length marking may be placed inside the pipe at a convenient location.

b. For pipe sizes $1^1/_2$ and smaller, the total length of pipe in the bundle in feet and tenths of a foot (unless otherwise specified on the purchase order) shall be marked on the tag, band, or clip.

I.6 Couplings

All couplings in nominal sizes 2 and larger shall be identified with the manufacturer's name or mark and the API monogram (Ⓐ), immediately followed by the date of manufacture (defined as the month and year when the monogram is applied).

I.7 Die Stamping

Cold-die stamping of grades higher than A25 plate or pipe not subsequently heat treated and all pipe with wall thicknesses of 0.156 in. (4.0 mm) and less is prohibited, except that by agreement between the purchaser and the manufacturer and when so specified on the purchase order, pipe or plate may be cold-die stamped. The manufacturer at his option may hot-die stamp (200°F or higher) plate or pipe, cold-die stamp plate or pipe if it is subsequently heat treated, and cold-die stamp couplings. Cold-die stamping shall be done with rounded or blunt dies. All die stamping shall be at least 1 in. (25.4 mm) from the weld for all grades except Grade A25.

I.8 Thread Identification

At the manufacturer's option, any pipe threads that conform to the threading and gauging stipulations given in API Standard 5B may be identified by stamping or stenciling the product adjacent to such thread with the threader's API license number, the size, the API monogram (Ⓐ), immediately followed by the date of threading (defined as the month and year the monogram is applied) and "LP" to indicate the type of thread. The thread marking may be applied to products that do or do not bear the API monogram. For example, nominal size 6 API line pipe threads may be marked as follows:

5LXXXX.X Ⓐ (MO-YR of threading) 6 LP

If the product is clearly marked elsewhere with the manufacturer's identification, his license number, as above, may be omitted.

I.9 Thread Certification

The use of the monogram (Ⓐ) as provided in I.8 shall constitute a certification by the manufacturer that the threads so marked comply with the requirements stipulated in the latest edition of API Standard 5B but should not be construed by the purchaser as a representation that the product so marked is, in its entirety, in accordance with any API specification. Manufacturers who use the monogram (Ⓐ) for thread identification must have access to properly certified API reference master pipe gauges.

I.10 Pipe Processor Markings

Pipe heat treated by a processor other than the original pipe manufacturer shall be marked as stipulated in I.1, I.2, I.3, I.4, I.5, I.6, and I.7. The processor shall remove any identification that is not indicative of a new condition of the product as a result of heat treating (such as, prior grade and original pipe manufacturer's name or logo).

APPENDIX J—METRIC (SI) UNIT CONVERSIONS AND ROUNDING PROCEDURES (NORMATIVE)

J.1 Rounding of Metric Units

Outside diameters and wall thicknesses are converted from inch dimensions. The converted diameters are rounded to the nearest 0.1 mm for diameters less than 18 in. (457 mm) and to the nearest 1.0 mm for diameters 18 in. (457 mm) and larger.

Wall thicknesses are rounded to the nearest 0.1 mm.

Metric inside diameters are calculated from the metric outside diameters and wall thicknesses and rounded to the nearest 0.1 mm.

Metric plain-end weights are calculated from the metric outside diameters and wall thicknesses by the following equation and rounded to the nearest 0.01 kilograms per meter (kg/m):

$$w_{pe} = 0.02466\ (D - t)t$$

Metric hydrostatic pressures are calculated from the metric outside diameters and wall thicknesses and metric fiber stresses shown in 9.4.

J.2 Metric Conversion Factors

The factors used where conversions are appropriate are as follows:

U.S. Customary Unit	SI Unit
1 inch (in.)	= 25.4 millimeters (mm) exactly
1 square inch (sq. in) exactly	= 645.16 square millimeters (mm^2)
1 foot (ft)	= 0.3048 meters (m) exactly
1 pound (lb)	= 0.45359 kilograms (kg)
1 pound per foot	= 1.4882 kilograms per meter (kg/m)
1 pound per square inch (psi)	= 6.895 kilopascals (kPa) for pressure
	= 0.006895 megapascals (MPa) for stress
1 foot-pound (ft-lb)	= 1.3558 joules (J) for impact energy

The following equation was used to convert degrees Fahrenheit (°F) to degrees Celsius (°C):

$$°C = {}^{5}/_{9}\ (°F - 32)$$

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