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API
SPECIFICATION
for
HIGH-TEST LINE PIPE

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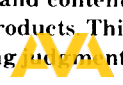
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Note

This edition supersedes the 23rd edition dated March 1980. It includes changes adopted at the 1980 & 1981 meetings.

This specification was originally adopted November 1947. It was issued as "tentative" in 1948 and reissued as "standard" in 1949. Subsequent editions have been issued in 1951, 1953, 1954, 1956, 1957, 1958, 1960, 1962, 1963, 1965, 1966, 1967, 1968, 1969, 1970, 1971, 1973, 1975, 1977, 1978, and 1980.

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SUGGESTIONS FOR ORDERING API HIGH-TEST LINE PIPE

In placing orders for high-test line pipe to be manufactured in accordance with API Spec 5LX, the purchaser should specify the following on the purchase order:

Specification	API Spec 5LX
Quantity	
Grade	Par. 1.1, Table 3.1, 4.1
Process of manufacture:	
Pipe	Par. 2.1
Material	Par. 2.2
Outside diameter	Table 6.1
Weight per foot or wall thickness	Table 6.1
Length	Par. 6.5
Mill inspection by purchaser	Par. 8.1, 8.2
Delivery date and shipping instructions	

The purchaser should also state on the purchase order his requirements concerning the following stipulations, which are optional with the purchaser:

Heat analysis	Par. 3.2
Product analysis	Par. 3.3, 3.5
Acceptance of jointers	Par. 6.9
Alternative end finish	Par. 6.7
Bare pipe — special coatings	Par. 9.6
Markings in metric units	Par. 9.3c,d,i,9.4
Method of welding jointers	Appendix A

Attention is called to the following stipulations which are subject to agreement between the purchaser and the manufacturer:

Intermediate grades	Par. 1.1, 3.1, 4.1, Table B1
Intermediate diameters	Par. 6.2
Intermediate wall thickness	Par. 6.3
Supplementary fracture toughness test	Par. 4.17, App. E
Supplementary color identification	App. E
Supplementary nondestructive inspection of seamless pipe	App. E
Supplementary hydrostatic test	Par. 5.4
Average length	Par. 6.5
Marking requirements	Par. 9.2, 9.3g, 9.4, 9.5

SPECIAL NOTE:

NOTHING IN THIS SPECIFICATION SHOULD BE INTERPRETED AS INDICATING A PREFERENCE BY THE COMMITTEE FOR ANY MATERIAL OR PROCESS, OR AS INDICATING EQUALITY BETWEEN 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.

Foreword

a. This specification is under the jurisdiction of the Committee on Standardization of Tubular Goods of the American Petroleum Institute, and was prepared with the cooperation of the American Gas Association.

b. The purpose of this specification is to provide standards for more rigorously tested line pipe having greater tensile

strength than for pipe manufactured under API Spec 5L.

c. Although high-test line pipe meeting this specification is primarily intended for field make-up by circumferential welding, the manufacturer will not assume responsibility for field welding.

d. Metric units in this specification are shown in italic type and in the text and most tables in parentheses. Outside diameters and wall thicknesses are converted from inch dimensions. The converted values are rounded to the nearest 0.1 mm for diameters less than 18 in. and to the nearest 1.0 mm for diameters 18 in. and larger. Wall thicknesses are rounded to the nearest 0.1 mm.

Metric inside diameters and drift 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 formula and rounded to the nearest 0.01 kg/m.

$$W_{pe} = .02466 (D - t)t$$

Metric hydrostatic test pressures are calculated from the metric outside diameters and wall thicknesses and metric fiber stresses as shown in Section 5.

The factors used where conversions are appropriate are as follows:

1 inch (in.)	= 25.4 millimeters (mm) exactly
1 square inch (sq. in.)	= 645.16 square millimeters (mm ²) exactly
1 foot (ft)	= 0.3048 meters (m) exactly
1 pound (lb)	= 0.45359 kilograms (kg)
1 pound per foot (lb/ft)	= 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	= 1.3558 Joules (J) for impact energy
	= 1.3558 newton-meters (N·m) for torque

The following formula was used to convert degrees Fahrenheit (°F) to degrees Celsius (°C): °C = 5/9 (°F - 32)

SECTION 1

SCOPE

NOTE: *The grade designations used herein comprise the letter X followed by the first two digits of the specified minimum yield strength.*

1.1 Coverage. This specification covers high-test line pipe in grades X42, X46, X52, X56, X60, X65, X70, and grades intermediate thereto. The chemical composition and certain physical properties of intermediate grades are subject to agreement between the purchaser and manufacturer. The agreed upon requirements must be consistent with the corresponding requirements for grades X42, X46, X52, X56, X60, X65 and X70. Pipe manufactured as grade X60 or higher shall not be substituted for pipe ordered for grade X52 and lower without purchaser approval. Requirements for through-the-flowline (TFL) pipe are provided in Appendix E, Supplemental Requirements.

1.2 Policy. American Petroleum Institute (API) specifications are published as an aid to procurement of standardized equipment and materials. These specifications are not intended to inhibit purchasers and producers from purchasing or producing products made to specifications other than API, and nothing in any API specification is intended to in any way inhibit the purchase of products from companies not authorized to use the API monogram.*

1.3 Nothing contained in any API specification is to be construed as granting any right, by implication or otherwise,

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for the manufacture, sale, or use in connection with any method, apparatus or product covered by letters patent, nor as insuring anyone against liability for infringement of letters patent.

1.4 API specifications may be used by anyone desiring to do so, and every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them. However, the Institute makes no representation, warranty or guarantee in connection with the publication of any API specification and hereby expressly disclaims any liability or responsibility for loss or damage resulting from their use, for any violation of any federal, state or municipal regulation with which an API specification may conflict, or for the infringement of any patent resulting from the use of an API specification.

1.5 The use of the API monogram is a warranty by the manufacturer to the purchaser that the manufacturer has obtained a license to use the monogram and, further, that the product which bears the monogram conforms to the applicable API specification. The marking requirements, including the API monogram, are an integral part of API specifications. Products purchased to API specifications must be marked in accordance with the requirements of the marking section of the appropriate specification. However, the American Petroleum Institute does not represent, warrant guarantee that products bearing the API monogram do in fact conform to the applicable API standard or specification.

SECTION 2

PROCESS OF MANUFACTURE AND MATERIAL

2.1 Process of Manufacture. Pipe furnished to this specification shall be made by one of the processes defined below and as shown in Table 3.1, as specified on the purchase order. Tack welding is not considered to be a welding process.

a. Seamless

Seamless pipe is defined as a wrought steel tubular product made without a welded seam. It is manufactured by hot working steel or, if necessary, by subsequently cold finishing the hot-worked tubular product to produce the desired shape, dimensions, and properties.

b. Electric-Weld.

Electric-welded pipe is defined as pipe having one longitudinal seam formed by electric-flash welding, electric-resistance welding, or electric-induction welding without the addition of extraneous metal. The weld seam of electric-resistance welded pipe and induction welded pipe shall be heat treated after welding to a minimum temperature of 1000 F (538 C), or processed in such a manner that no untempered martensite remains.

c. Submerged-arc Weld.

Submerged-arc welded pipe is defined as pipe having one longitudinal seam formed by automatic submerged-arc welding. At least one pass shall be made on the inside and at least one pass on the outside. All end welding of longitudinal seams of submerged-arc welded pipe, if not done by automatic submerged-arc welding shall be done by a procedure and welder qualified in accordance with Appendix B.

d. Gas Metal-Arc Weld (MIG).

Gas metal-arc welded pipe is defined as pipe having one longitudinal seam formed by continuous gas metal-arc welding. At least one pass shall be made on the inside and at least one pass from the outside of the pipe. Gas metal-arc welding is an arc welding process wherein coalescence is produced by heating with an arc between continuous filler metal (consumable) electrode and the work. Shielding is obtained entirely from an externally supplied gas or gas mixture. The shielding gas protects

the fluid weld metal from oxidation or contamination by the surrounding atmosphere.

e. Combination Gas Metal-Arc Weld (MIG) and Submerged-Arc Weld.

Combination gas metal-arc weld and submerged-arc weld pipe is defined as pipe having one longitudinal seam formed by the combination of continuous gas metal-arc welding and automatic submerged-arc welding. The gas metal-arc welding process shall be first and followed by the submerged-arc welding process. The provisions of 2.1(c) and 2.1(d) shall apply for each respective process in the combination weld. All other provisions of this specification for the longitudinal seam shall apply as if the weld were accomplished by the gas metal-arc welding process.

f. Double Seam Welded Pipe. (Applicable to sizes 36 in. OD and larger)

Double seam pipe is defined as pipe having two longitudinal seams formed by the submerged-arc welding process defined in Par. 2.1(c) or the gas metal-arc welding process defined in Par. 2.1(d), or the combination welding process defined in Par. 2.1(e). The location of the seams shall be approximately 180 deg. apart. All requirements specified herein for submerged-arc, gas metal-arc, and combination weld pipe shall be applicable to double-seam welded pipe. All weld tests shall be performed after forming and welding.

2.2 Cold Expansion. Pipe furnished to this specification shall be either non-expanded or cold expanded at the option of the manufacturer unless otherwise specified on the purchase order.

2.3 Material. The various grades and classes of line pipe furnished to this specification shall be made from open-hearth, electric-furnace, or basic-oxygen steel.

2.4 Heat Treatment. Pipe furnished to this specification may be as rolled, normalized, normalized and tempered, quenched and tempered, subcritically stress relieved, or subcritically age hardened. See Sect. 9 for applicable marking requirements.

SECTION 3

CHEMICAL PROPERTIES AND TESTS

3.1 Composition. The composition of grades X42, X46, X52, X56, X60, X65 and X70, as determined by heat analyses shall conform to the chemical requirements specified in Table 3.1. The composition of intermediate grades shall conform to chemical requirements agreed upon between the purchaser and the manufacturer, which requirements shall be consistent with the requirements specified in Table 3.1 for pipe made by the same process of manufacture. In addition to, or in lieu of, the elements and their respective percentages specified in Table 3.1, columns 7, 8, and 9, other elements may be added in any of the categories (process of manufacture) listed, by agreement between purchaser and manufacturer. The addition of such otherwise desirable elements may alter

the weldability of the pipe and caution (care) should be exercised in the determination of the quantity which may be added for any particular size and thickness of pipe.

3.2 Heat Analyses. When requested by the purchaser, the manufacturer shall furnish a report giving the heat analyses of each heat of steel used in the manufacture of pipe furnished on the purchase order. The analyses so determined shall conform to the requirements specified in Par. 3.1. If alloys, other than those specified in Table 3.1 for a particular grade, are added for other than deoxidation purposes, the heat analyses, including the alloy additions, shall be reported for each heat applied to the purchaser's order.

TABLE 3.1
CHEMICAL REQUIREMENTS FOR HEAT ANALYSES, Per cent

1	2	3	4	5	6	7	8	9
Process of Manufacture	Grade	Carbon max. ¹	Man- ganese max. ¹	Phospho- rus max.	Sulfur max.	Colum- bium min.	Vana- dium min.	Titanium min.
SEAMLESS								
Non-expanded	X42 ^s	0.29	1.25	0.04	0.05	....	....	....
Non-expanded	X46 ^s , X52 ^s	0.31	1.35	0.04	0.05	....	....	....
Cold-expanded	X42 ^s , X46 ^s , X52 ^s	0.29 ²	1.25	0.04	0.05	....	....	....
Non-expanded or cold-expanded	X56 ³ , X60 ³	0.26	1.35	0.04	0.05	0.005 ⁴	0.02 ⁴	0.03 ⁴
Non-expanded or cold-expanded	X65, X70	(By agreement)						
WELDED								
Non-expanded	X42 ^s	0.28	1.25	0.04	0.05	....	....	....
Non-expanded	X46 ^s , X52 ^s	0.30	1.35	0.04	0.05	....	....	....
Cold-expanded	X42 ^s , X46 ^s , X52 ^s	0.28	1.25	0.04	0.05	....	....	....
Non-expanded or cold-expanded	X56 ³ , X60 ³	0.26	1.35	0.04	0.05	0.005 ⁴	0.02 ⁴	0.03 ⁴
Non-expanded or cold-expanded	X65 ⁵	0.26	1.40	0.04	0.05	0.005 ⁵	0.02 ⁶	....
Non-expanded or cold-expanded	X70 ³	0.23 ⁷	1.60 ⁷	0.04	0.05	....	....	....

¹For grades X65 and below, for each reduction of 0.01 per cent below the specified maximum carbon content, an increase of 0.05 per cent manganese above the specified maximum is permissible, up to a maximum of 1.45 per cent for grades X52 and lower, and up to a maximum of 1.60 per cent for grades higher than X52.

²For cold-expanded seamless pipe in sizes 20 in. and larger, the maximum carbon content shall be 0.28 per cent.

³Other chemical analyses may be furnished by agreement between purchaser and manufacturer.

⁴Either columbium, vanadium, titanium, or a combination thereof, shall be used at the discretion of the manufacturer.

⁵For grades X65 in sizes 16 in. and larger with wall thickness 0.500 in. (12.7 mm) and less, the chemical composition shall be as shown or as agreed upon between the purchaser and manufacturer. For other sizes and wall thicknesses the chemical composition shall be as agreed upon between the purchaser and manufacturer.

⁶Either columbium or vanadium or a combination of both shall be used at the discretion of the manufacturer.

⁷For each reduction of 0.01 per cent below the specified maximum carbon content, an increase of 0.05 per cent manganese above the specified maximum is permissible.

⁸Columbium, Vanadium, Titanium, or a combination thereof, may be used by agreement between the purchaser and manufacturer.

3.3 Product Analyses. Product analyses shall be made by the manufacturer. The results of the product analyses shall be available to the purchaser on request.

Two samples shall be analyzed for product analyses, one from each of two lengths of pipe from each lot of 200 lengths or less of each size 12¾ in. and smaller, and one from each of two lengths from each lot of 100 lengths or less of each size 14 in. and larger. The samples shall be taken as follows:

- a. **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.
- b. **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. For pipe manufacturers who purchase 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 stated above.

The composition so determined shall conform to the chemical requirements shown in Table 3.1 within the following permissible variations for product analyses:

Carbon, per cent:

Seamless pipe	
Non-expanded	+ 0.03
Cold-expanded, smaller than 20 in.	+ 0.03
Cold-expanded, 20 in. and larger	+ 0.04
Welded pipe	+ 0.04
Manganese, per cent	+ 0.10
Phosphorus, per cent	+ 0.01
Sulfur, per cent	+ 0.01
Columbium, per cent	- 0.000
Vanadium, per cent	- 0.01
Titanium, per cent	- 0.01

3.4 Recheck Analyses. If the product analyses of both lengths of pipe representing the lot fail to conform to the specified requirements, at the manufacturer's option, either the lot shall stand rejected or all the remaining lengths in the lot shall be tested individually for conformance to the specified requirements. If only one of the two samples fails, at the manufacturer's option, either the lot shall stand rejected or two recheck analyses shall be made on two additional lengths from the same lot. If both recheck analyses conform to the requirements, the lot shall be accepted except for the length represented by the initial analyses which failed. If one or both of the recheck analyses fail, at the manufacturer's option, the entire lot shall be rejected or each of the remaining lengths shall be tested individually. In the individual testing of the remaining lengths in any lot, analysis for only the rejecting element or elements need be determined. Samples for recheck analyses shall be taken in the same manner as specified for product analyses.

3.5 Mill-Control Analyses. A chemical analysis shall be made by the manufacturer, as a mill control, of each heat of steel used for the production of pipe under this specification. A record of such analyses shall be available to the purchaser.

3.6 Analytical Procedures. Chemical analyses shall be determined by any of the procedures commonly used for determining chemical compositions such as emission spectroscopy, X-ray emission, atomic absorption, combustion techniques or wet analytical procedures. The calibration methods used shall be traceable to established standards. In case of dispute, samples used in making chemical analyses shall be prepared in accordance with ASTM E-59 and chemical determinations shall be made in accordance with ASTM E-350 or other procedures agreed upon between purchaser and manufacturer.

SECTION 4

PHYSICAL PROPERTIES AND TESTS

4.1 Tensile Properties. Grades X42, X46, X52, X56, X60, X65 and X70 shall conform to the tensile requirements specified in Table 4.1. Intermediate grades shall conform to tensile requirements agreed upon between the purchaser and the manufacturer, which requirements shall be consistent with those specified in Table 4.1. For cold-expanded pipe, the ratio of yield strength to tensile strength of each test pipe on which yield strength and body tensile strength are determined shall not exceed 0.85, except that for grade X65 pipe with wall thicknesses over 0.375 in. (9.5 mm) and for grades higher than X65 in all wall thicknesses, the ratio shall

not exceed 0.90. When a fracture toughness requirement is specified, the yield-to-tensile ratio shall not apply if agreed upon between purchaser and manufacturer. When elongation is recorded or reported the record or report shall show the nominal width of the test specimen when strip specimens are used, or state when full section specimens are used.

4.2 Yield Strength. The yield strength shall be the tensile stress required to produce a total elongation of 0.5 per cent of the gage length as determined by an extensometer or by multiplying dividers.

TABLE 4.1
TENSILE REQUIREMENTS

1 Grade	2 Yield Strength, min.		3 Tensile Strength, min.		4 Elongation, min. in 2 in. (50.80 mm) per cent
	psi	MPa	psi	MPa	
X42	42,000	(289)	60,000	(413)	See footnote ³
X46	46,000	(317)	63,000	(434)	
X52	52,000	(358)	66,000 ¹	(455 ¹)	
			72,000 ²	(496 ²)	
X56	56,000	(386)	71,000 ¹	(489 ¹)	
			75,000 ²	(517 ²)	
X60*	60,000	(413)	75,000 ¹	(517 ¹)	
			78,000 ²	(537 ²)	
X65	65,000	(448)	77,000 ¹	(531 ¹)	
			80,000 ²	(551 ²)	
X70	70,000	(482)	82,000	(565)	

*The minimum tensile strength for grade X60 electric-resistance welded pipe in all sizes and wall thicknesses shall be 75,000 psi (517 MPa).

¹For pipe less than 20 in. OD with any wall thickness, and for pipe 20 in. OD and larger with wall thickness greater than 0.375 in. (9.5 mm)

²For pipe 20 in. OD and larger with wall thickness 0.375 in (9.5 mm) and less.

³The minimum elongation in 2 inches (50.80 mm) shall be that determined by the following formula:

English formula:

$$e = 625,000 \frac{A^{0.2}}{U^{0.9}}$$

Metric formula:

$$e = 1942.57 \frac{A^{0.2}}{U^{0.9}}$$

where:

e = minimum elongation in 2 inches (50.80 mm) in per cent rounded to the nearest ½ per cent.

A = cross sectional area of the tensile test specimen in square inches (millimeters) based on specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 0.01 sq. in., (millimeter), or 0.75 sq. in. (484 mm²), whichever is smaller.

U = specified tensile strength, psi.

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. diameter with 1.4 in. gage length, and the 0.500 in. diameter with 2.00 in. gage length) shall be that shown in the Area A line of 0.20 sq. in. in the Elongation Table of Appendix D.

4.3 Longitudinal Tensile Tests. For hot-rolled seamless* pipe in all sizes, and for welded pipe and cold-worked seamless pipe in sizes 6½ in. and smaller, the tensile properties shall be determined by tests on longitudinal specimens conforming to the requirements of Par. 4.6, and ASTM A 370: *Mechanical Testing of Steel Products, Supplement II, Steel Tubular Products*. All longitudinal tensile tests shall include yield strength, tensile strength, and elongation determinations, and shall be made with the specimens at room temperature. The strain rate during tensile testing shall be in accordance with the requirements of ASTM A 370.

4.4 Transverse Tensile Tests. For welded pipe and cold-worked seamless pipe, in sizes 8½ in. and larger, the tensile properties shall be determined by tests on transverse specimens conforming to the requirements of Par. 4.7, and ASTM

A 370: *Mechanical Testing of Steel Products, Supplement II, Steel Tubular Products*. The transverse tensile properties shall be determined, at the option of the manufacturer, by one of the following methods:

- The yield strength, tensile strength, and elongation values shall all be determined on either a flattened rectangular specimen or a round bar specimen.
- The yield strength shall be determined by the ring expansion method 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. The strain rate during tensile testing shall be in accordance with the requirements of ASTM A370 and shall be made with specimens at room temperature. Hot flattening, artificial aging, or heat treatment of tensile specimens is not permitted.

*By agreement between purchaser and manufacturer, the tensile properties of hot rolled seamless pipe 8½ in. and larger may be obtained from transverse tensile tests in accordance with Par. 4.4 in lieu of the longitudinal tensile tests.

4.5 Weld Tensile Tests. For welded pipe 8% in. and larger, the transverse tensile strength of the weld shall be determined by tests on weld specimens conforming to the requirements of Par. 4.8 and ASTM A 370: *Mechanical Testing of Steel Products, Supplement II, Steel Tubular Products*. Weld tensile tests need not include determination of yield strength or elongation. Weld tensile tests shall be made with the specimens at room temperature. The strain rate during tensile testing shall be in accordance with the requirements of ASTM A 370.

4.6 Longitudinal Tensile Test Specimens. Longitudinal tensile test specimens shall be either full-section specimens or strip specimens as shown in Fig. 4.1, at the option of the manufacturer. Strip specimens from seamless pipe may be taken from any location, at the option of the manufacturer; strip specimens from mill-welded pipe shall be taken approximately 90 deg. from the weld, or at the option of the manufacturer, from the skelp, parallel to the direction of rolling and approximately midway between the edge and the center. Strip specimens shall be approximately 1½ in. (38.1 mm) wide in the gage length if suitable curved-face testing grips are used, or if the ends of the specimens are machined to reduce the curvature in the grip area, otherwise they shall be approximately ¾ in. (19.0 mm) wide for pipe 3½ in. and smaller, approximately 1 in. (25.4 mm) wide for pipe 4 in. through 6% in., and approximately 1½ in. (38.1 mm) wide for pipe 8% in. and larger. Longitudinal test specimens shall represent the full wall thickness of the pipe from which the specimen was cut, and shall be tested without flattening.

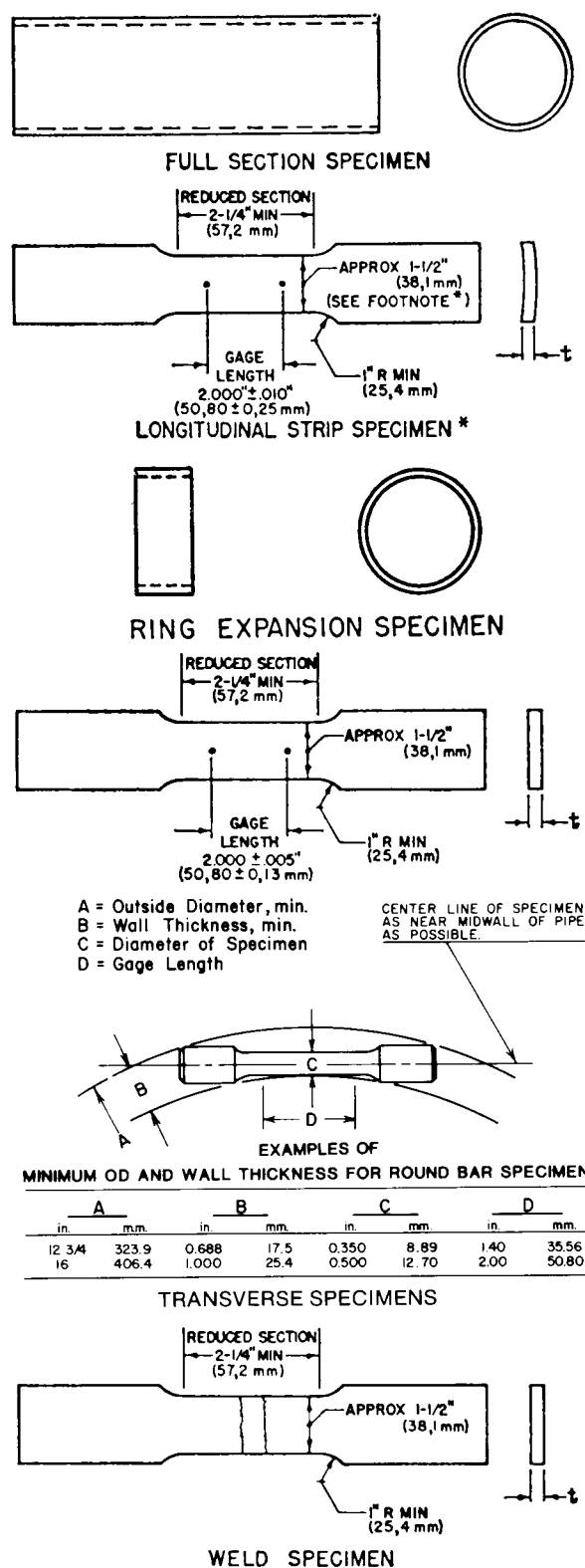
4.7 Transverse Tensile Test Specimens. Transverse tensile test specimens from seamless pipe may be taken from any location; transverse tensile test specimens from welded pipe shall be taken opposite the weld. All transverse test specimens shall be as shown in Fig. 4.1, and shall represent the full wall 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 non-flattened pipe sections and the largest possible specimen diameter shall be used.

4.8 Weld Tensile Test Specimens. Weld tensile test specimens shall be taken at 90 deg to the weld with the weld at the center, as shown in Fig. 4.1, and shall represent the full wall thickness from which the specimen was cut. The weld reinforcement may be removed at the manufacturer's option.

4.9 Number of Tensile Tests. One tensile test, either longitudinal or transverse as required, shall be made on a length of pipe from each lot of 400 lengths or less of 4½ in. OD and smaller; and from each lot of 200 lengths or less of each size 6% in. through 12¼ in.; and from each lot of 100 lengths or less of each size 14 in. and larger. For multiple-length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length.

4.10 Number of Weld Tensile Tests. For welded pipe, one weld test shall be made on each weld of a length of pipe from each lot of 200 lengths or less of each size 8% in. through 12¼ in.; and from each lot of 100 lengths or less of each size, 14 in. and larger.

4.11 Mill-Control Tensile Tests. One tensile test shall be made as a mill control on each heat of steel used by the manufacturer for the production of pipe under this specification. For welded pipe, these tensile tests shall be made on either the skelp or the finished pipe, at the option of the manufacturer. A record of such tests shall be available to the purchaser.



Note: Flattening of transverse and weld specimens shall be performed at room temperature.

*Note: See Par. 4.6 for gage width if testing is not done with properly curved grips.

FIG. 4.1
TENSILE TEST SPECIMENS

See Par. 4.3 through 4.13

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4.12 Retests. If the tensile specimen representing a lot of pipe fails to conform to the specified requirements, the manufacturer may elect to make retests on two additional lengths from the same lot. If both retest 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 retest specimens fail to conform to the specified requirements, the manufacturer may elect to test individually 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 retests shall be taken in the same manner as the specimen which failed to meet the minimum requirements.

4.13 Defective Specimens. If any tensile specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted. When the elongation of any tensile specimen is less than that specified, if any part of the fracture is outside the middle third of the gage length, as indicated by scribe scratches marked on the specimen before testing, a retest shall be allowed.

4.14 Flattening Tests. For non-expanded electric-welded pipe produced in single lengths, the crop ends cut from each end of each length shall be flattened between parallel plates until opposite walls of the pipe meet. The tests from each end shall be made alternately with the welds at 0 degrees and 90 degrees (point of maximum bending). No opening in the weld shall take place until the distance between the plates is less than two-thirds off the original outside diameter of the pipe, and no cracks or breaks in the metal, elsewhere than in the weld, shall occur until the distance between the plates is less than one-third of the original outside diameter of the pipe. Also, evidence of laminations or burnt metal shall not develop during the entire flattening operation. If any crop end fails to conform to these requirements, additional tests shall be made on specimens cut from the same end of the same length of pipe until the requirements are met, except that the finished pipe shall not be shorter than 80 per cent of its length after the initial cropping.

4.15 For non-expanded electric-welded pipe produced in multiple lengths and subsequently cut into single lengths, the crop ends cut from each end of each multiple length shall be flattened between parallel plates until opposite walls of the pipe meet. The tests shall be made with the weld at 90 degrees (point of maximum bending). Tests also shall be made on two intermediate rings cut from each multiple length of pipe with a weld at 0 degrees. 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. If any of the specimens fail to conform to the requirements specified in Par. 4.14, the manufacturer may elect to make retests cut from each end of each individual length. Retests shall be made with the welds alternately at 0 degrees and 90 degrees.

4.16 For cold-expanded electric-welded pipe, a flattening test shall be made with the weld at 90 degrees (point of

maximum bending) as described in Par. 4.15, on a ring 4 in. (101.6 mm) or wider, cut from one end of a length of pipe from each lot of 100 lengths or less of each size. If the specimen fails to conform to the requirements specified in Par. 4.14, the manufacturer may elect to make retests on specimens cut from one end of two additional lengths from the same lot. If both retest specimens conform to the specified 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 retest specimens fail to conform to the specified requirements, the manufacturer may elect to repeat the test on specimens cut from one end of the individual lengths remaining in the lot.

NOTE: For the purpose of mechanical testing of the weld of electric-welded pipe, "the weld" extends to a distance of 1/2 in. (12.7mm) on either side of the fusion line.

4.17 Fracture Toughness Tests. When so specified on the purchase order, the manufacturer shall conduct fracture toughness tests in accordance with Supplementary Requirement SR-5 or SR-6 or SR-8 (see Appendix E) 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 SR-5 and SR-6 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 SR-8 shall be selected by the purchaser and shown on the purchase order.

4.18 Submerged-Arc and Gas Metal-Arc Weld Tests. For submerged-arc welded pipe and gas metal-arc welded pipe, in grades X-42 thru X-65 the weld shall be tested by the guided-bend test described below. For Grade X-70 the weld shall be tested by either the tensile-elongation test or the guided-bend test at the option of the manufacturer. The required specimens shall be cut from a length of pipe from each lot of 50 lengths or less of each size. The specimens shall not contain any repair welding made by the manual metallic-arc procedure.

a. Tensile-Elongation Test. One specimen conforming to Fig. 4.2 shall be tested in tension, and shall conform to the elongation requirements specified in Par. 4.1.

b. Guided-Bend Test. One face-bend and one root-bend specimen, both conforming to Fig. 4.3, shall be bent approximately 180 deg. in a jig substantially in accordance with Fig. 4.4. For any combination of diameter, wall thickness, and grade the maximum value for jig dimension "A" may be calculated by the formula. 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 in. and larger. These values are listed for each diameter, wall thickness, and grade in Appendix F. 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 specimen required to contact the male die need not exceed 9 in. (228.6 mm)

For pipe with wall thickness over .750 in. a reduced wall specimen as shown in Fig. 4.3 may be used at the option of the manufacturer. Reduced wall specimens shall be tested in a jig with the "A" dimension calculated for .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 $\frac{1}{8}$ in. (3.18 mm) in length regardless of depth, and (c) shall not reveal any cracks or ruptures in the parent metal, the heat affected zone, or the fusion line longer than $\frac{1}{8}$ in. (3.18 mm) and deeper than 12½ per cent of the specified wall thickness; except cracks which occur at the edges of the specimen and which are less than $\frac{1}{4}$ in. (6.35 mm) long shall not be cause for rejection in (b) or (c) regardless of depth. If the fracture or crack in the specimen is caused by a defect or flaw, that specimen may be discarded and a new specimen substituted.

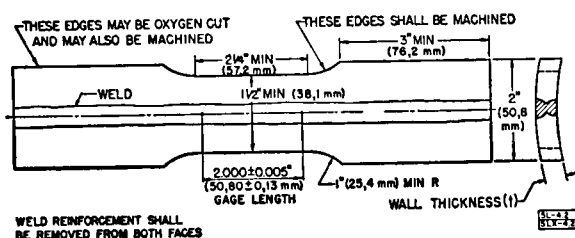
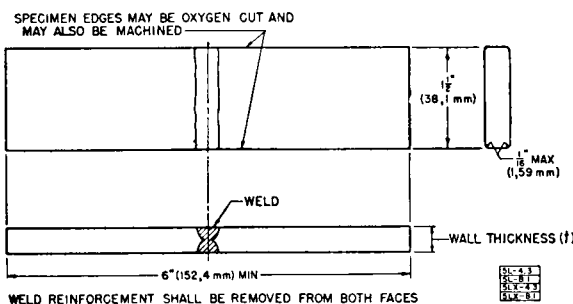


FIG. 4.2
TENSILE-ELONGATION TEST SPECIMEN
See Par. 4.18



REDUCED WALL SPECIMENS
OPTIONAL FOR WALL THICKNESSES OVER .750"

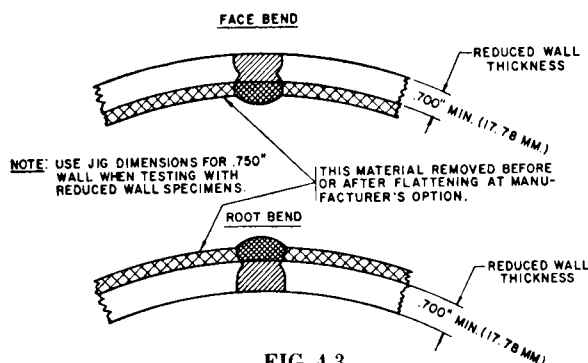
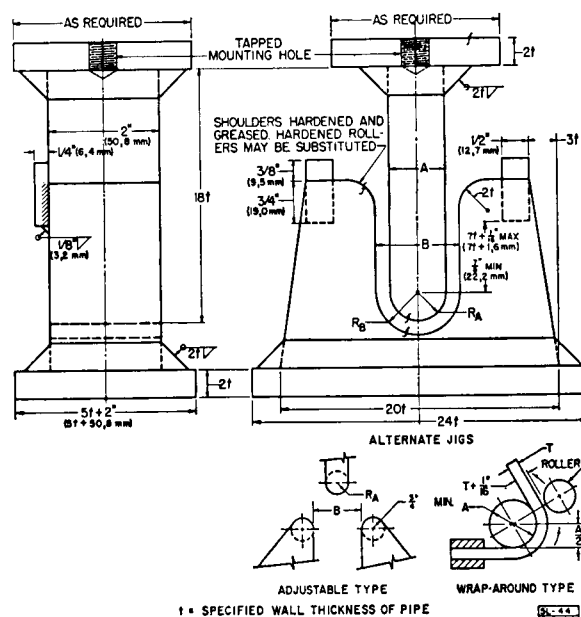


FIG. 4.3
GUIDED-BEND TEST SPECIMEN
See Par. 4.18



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

where:

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

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)

$$R_A = \frac{1}{2} A$$

$$B = A + 2t + \frac{1}{8} \text{ in.}$$

$$(A + 2t + 3.2 \text{ mm})$$

$$R_B = \frac{1}{2} B$$

FIG. 4.4
JIG FOR GUIDED-BEND TEST
See Par. 4.18

4.19 Retests. If the tensile-elongation specimen or 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 the lengths in the lot shall be accepted, except the length initially selected for test. If any of the retest 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 which 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 Par. 4.18a and 4.18b.

4.20 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 cracks or breaks exceeding $\frac{1}{8}$ 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 plates is less than the value "S" calculated by the following formulas:

Grades less than X52

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

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 which originate at the edges of the specimen and which are less than $\frac{1}{4}$ in. (6.35 mm) long shall not be cause for rejection. One test shall be made on a length of pipe from each lot of 200 lengths or less of each size $12\frac{3}{4}$ in. and smaller; and from each lot of 100 lengths or less of each size 14 in. and

larger. For multiple-length pipe, a length shall be considered as each section cut from a particular multiple length.

4.21 Retests. If the test specimen representing a lot of pipe fails to conform to the requirements of Par. 4.20, the manufacturer may elect to make retests on two additional lengths from the same lot. If both retest 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 retest 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 respect to the length of pipe from which they were cut. The manufacturer may also elect to retest any length which 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.

4.22 The weld ductility test may also serve as one of the flattening tests of Par. 4.14, 4.15, and 4.16 by complying with appropriate amounts of flattening.

SECTION 5

HYDROSTATIC TESTS

5.1 Mill Inspection Hydrostatic Test. Each length of pipe shall withstand, without leakage, a mill inspection hydrostatic test to at least the pressure specified in Par. 5.3. Test pressures for all sizes of seamless pipe and for welded pipes in sizes 18 in. and smaller, shall be held for not less than 5 sec. Test pressures for welded pipe in sizes 20 in. and larger shall be held for not less than 10 sec. Welded pipe shall be struck while under pressure, with a 2-lb. (0.9 kg) hammer or its equivalent, near the weld at both ends of the pipe.

5.2 Verification of Test. In order to insure that every length of pipe is tested to the required test pressure, each hydrostatic tester shall be equipped with a recording gage that will record the test pressure and duration of time applied to each length of pipe, or 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 mill by the purchaser's inspectors when the purchaser is so represented at the mill.

5.3 Test Pressures. The minimum test pressure shall be the standard test pressure or alternate test pressure as listed in Table 6.1 or an intermediate or higher pressure at the discretion of the manufacturer unless specifically limited by the purchaser, or a higher pressure as agreed upon between the purchaser and manufacturer. The minimum test pressures for grades, diameters, and wall thicknesses not listed shall be computed by the formula given below. When computed pressures are not an exact multiple of 10 psi (100 kPa) they shall be rounded to the nearest 10 psi (100 kPa).

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

NOTE: The test pressures given in Table 6.1 were computed by the following formula and rounded to the nearest 10 psi.

$$P \text{ (psi)} = \frac{2St}{D}, \text{ or } 3,000 \text{ psi, whichever is smaller,}$$

$$P \text{ (kPa)} = \frac{2000 St}{D}, \text{ or } 20700 \text{ kPa, whichever is smaller}$$

except for sizes 20 through 26 in. the 3,000 psi (20700 kPa) limit was reduced to accommodate hydrostatic tester limitations.

wherein:

P = hydrostatic test pressure in pounds per square inch (kPa).

S = fiber stress in pounds per square inch, (MPa), equal to a percentage of the specified minimum yield strength for the various sizes as follows:

Size, in.	Per Cent of Specified Minimum Yield Strength
4½ and smaller	
Std. Test Pressure	60
Alt. Test Pressure	75
6¾ and 8¾	75
10½ to 18 incl.	85
20 and larger	90

t = specified wall thickness in inches (mm).

D = outside diameter in inches (mm).

5.4 Supplementary Hydrostatic Tests. By agreement between the purchaser and the manufacturer, the manufacturer shall make additional internal pressure tests, which may involve one or more of the following methods. In all supplementary hydrostatic tests the formula shown in Par. 5.3 shall be used for stress calculations. The conditions of test shall be as agreed upon.

- 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.
- Full-length destructive tests made by the "hydrostatic pressure water column" method.
- Hydrostatic transverse yield strength test using accurate strain gages.¹

¹Acceptable gages are the roller-chain ring-expansion gage (The Youngstown Sheet and Tube Company, Youngstown, Ohio 44501), the SR-4 strain gage (Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.), or other suitable gages of similar accuracy.

SECTION 6

DIMENSIONS, WEIGHTS, AND LENGTHS

6.1 Dimensions and Weights. High-test line pipe shall be furnished in the outside-diameter sizes, wall thicknesses, and weights provided in Table 6.1 and Par. 6.2 and 6.3 as specified on the purchase order.

NOTE: The plain end weight, w_{pe} , shall be calculated using the following formula:

English Formula Metric Formula

$$w_{pe} = 10.68 (D-t)t \quad w_{pe} = 0.02466 (D-t)t$$

where:

W = plain end weight, rounded to the nearest 0.01 lb/ft (0.01 kg/m)

D = outside diameter, rounded to the nearest 0.001 in. (0.1 mm for sizes less than 457 mm, and 1 mm for sizes 457 mm and larger).

t = specified wall thickness, rounded to the nearest 0.001 in. (0.1 mm)

6.2 Diameter. The outside diameter shall be within the tolerances specified in Table 6.2. (Inside diameters are governed by the outside diameter and weight tolerances.) Pipe with outside diameters intermediate to those listed in Table 6.1 shall be available in sizes 20 in. and larger by agreement between purchaser and manufacturer. Such pipe shall be consistent with all requirements of this specification and shall be marked in accordance with Sect. 9.

6.3 Wall Thickness. Each length of pipe shall be measured for conformance to wall-thickness requirements. The wall thickness at any place shall be within the tolerances specified in Table 6.2, except that for welded pipe the weld area shall not be limited by the plus tolerance. Wall-thickness measurements shall be made with a mechanical caliper or with a properly calibrated nondestructive testing 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 $\frac{1}{4}$ 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 $1\frac{1}{2}$ in. (38.10 mm) for pipe 6 $\frac{3}{4}$ in. and larger, a maximum radius of $d/4$ for pipe less than 6 $\frac{3}{4}$ in., with a minimum radius of $\frac{1}{4}$ in. 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 $1\frac{1}{2}$ in. (38.10 mm). Pipe with wall thicknesses intermediate to those listed in Table 6.1 shall be furnished by agreement between purchaser and manufacturer. Such pipe shall be consistent with all requirements of this specification and shall be marked in accordance with Sect. 9.

6.4 Weight. Each length of pipe 6 $\frac{3}{4}$ in. and larger, shall be weighed separately, and the carload weights determined. Pipe 4 $\frac{1}{2}$ in. and 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 lb. (18144 kg).

6.5 Length. Unless otherwise agreed upon between the purchaser and manufacturer, pipe shall be furnished in single random lengths or double random lengths as specified on the purchase order. If single random length is specified, the average length shall not be less than 17.5 ft. (5.33 m), and no piece shall be shorter than 9.0 ft. (2.74 m). If double

random length is specified, the average length shall not be less than 35.0 ft. (10.67 m), not more than 10 per cent of the lengths shall be shorter than 26.3 ft. (8.00 m), and no piece shall be shorter than 14.0 ft. (4.27 m). If the average length agreed upon is in excess of 20.0 ft. (6.10 m), not more than 10 per cent of the lengths shall be shorter than 75 per cent of the average length agreed upon and no length shall be shorter than 40 per cent of the average length agreed upon. By agreement between the purchaser and the manufacturer, these stipulations shall apply to each carload.

6.6 Straightness. The pipe shall be random checked for straightness and deviation from a straight line shall not exceed 0.2 of 1 per cent of the length. Measurements may be made using a taut string or wire from end to end along the side of the pipe and measuring the greatest deviation.

6.7 Pipe Ends. Unless otherwise ordered, pipe covered by this specification shall be furnished with ends beveled to an angle of 30 deg. +5, -0 deg, measured from a line drawn perpendicular to the axis of the pipe, and with a root face of $\frac{1}{16}$ in., $\pm \frac{1}{32}$ in. (1.59 mm $\pm$ 0.79 mm). The pipe ends shall have all burrs removed from both the inside and outside edges. 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 that listed below.

Specified Wall Thickness, in.	Maximum Angle of Taper Deg.
Less than 0.418 (10.6 mm)	7
0.418 thru 0.555 (10.6 thru 14.1 mm)	9 $\frac{1}{2}$
0.556 thru 0.666 (14.1 thru 16.9 mm)	11
Over 0.666 (16.9 mm)	14

For the removal of an internal burr on welded pipe larger than 4 $\frac{1}{2}$ in. OD, the internal taper, measured from the longitudinal axis, shall be no larger than 7 deg. For pipe sizes 10 $\frac{3}{4}$ in. and larger the ends shall be cut square within $\frac{1}{16}$ in. (1.59 mm), measured not less than three times per 8-hour working shift. Both ends of submerged-arc and gas metal-arc welded pipe shall have the inside weld 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.

6.8 Plain Ends for Special Couplings. When so specified on the purchase order, pipe shall be furnished with ends suitable for use with Dresser, Victaulic, or other 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 make-up of coupling.

6.9 Jointers. Unless otherwise specified on the purchase order, jointers (two pieces joined by welding to make a standard length) may be furnished to a maximum of 5 per cent of the order, but no length used in making a jointer shall be less than 5 ft. (1.52 m). Welded jointers shall comply with the requirements of Appendix A.

TABLE 6.1
DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4		5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_{pe}</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>		Test Pressure, psi, min.						
					Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
*2 ³ / ₈	2.03	0.083	2.209	STD	1760	1930	2180	2350	2520	2730	2940
				ALT	2200	2410	2730	2940	3000	3000	3000
*2 ³ / ₈	2.64	0.109	2.157	STD	2310	2530	2860	3000	3000	3000	3000
				ALT	2890	3000	3000	3000	3000	3000	3000
*2 ³ / ₈	3.00	0.125	2.125	STD	2650	2910	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
*2 ³ / ₈	3.36	0.141	2.093	STD	2990	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ³ / ₈	3.65	0.154	2.067	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ³ / ₈	4.05	0.172	2.031	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ³ / ₈	4.39	0.188	1.999	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ³ / ₈	5.02	0.218	1.939	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ³ / ₈	5.67	0.250	1.875	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ³ / ₈	6.28	0.281	1.813	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ³ / ₈	9.03	0.436	1.503	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
*2 ⁷ / ₈	2.47	0.083	2.709	STD	1460	1590	1800	1940	2080	2250	2430
				ALT	1820	1990	2250	2430	2600	2810	3000
*2 ⁷ / ₈	3.22	0.109	2.657	STD	1910	2090	2370	2550	2730	2960	3000
				ALT	2390	2620	2960	3000	3000	3000	3000
*2 ⁷ / ₈	3.67	0.125	2.625	STD	2190	2400	2710	2920	3000	3000	3000
				ALT	2740	3000	3000	3000	3000	3000	3000
*2 ⁷ / ₈	4.12	0.141	2.593	STD	2470	2710	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	4.53	0.156	2.563	STD	2730	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	4.97	0.172	2.531	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	5.40	0.188	2.499	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	5.79	0.203	2.469	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	6.13	0.216	2.443	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	7.01	0.250	2.375	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	7.66	0.276	2.323	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
2 ⁷ / ₈	13.69	0.552	1.771	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
*3 ¹ / ₂	3.03	0.083	3.334	STD	1200	1310	1480	1590	1710	1850	1990
				ALT	1490	1640	1850	1990	2130	2310	2490
*3 ¹ / ₂	3.95	0.109	3.282	STD	1570	1720	1940	2090	2240	2430	2620
				ALT	1960	2150	2430	2620	2800	3000	3000
*3 ¹ / ₂	4.51	0.125	3.250	STD	1800	1970	2230	2400	2570	2790	3000
				ALT	2250	2460	2790	3000	3000	3000	3000
*3 ¹ / ₂	5.06	0.141	3.218	STD	2030	2220	2510	2710	2900	3000	3000
				ALT	2540	2780	3000	3000	3000	3000	3000
*3 ¹ / ₂	5.57	0.156	3.188	STD	2250	2460	2780	3000	3000	3000	3000
				ALT	2810	3000	3000	3000	3000	3000	3000
3 ¹ / ₂	6.11	0.172	3.156	STD	2480	2710	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
3 ¹ / ₂	6.65	0.188	3.124	STD	2710	2970	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000

(Continued on page 17)

TABLE 6.1 (Continued)
DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4		5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_{pw}</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>		Test Pressure, psi, min.						
					Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
3½	7.58	0.216	3.068	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
3½	8.68	0.250	3.000	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
3½	9.66	0.281	2.938	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
3½	10.25	0.300	2.900	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
3½	18.58	0.600	2.300	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
*4	3.47	0.083	3.834	STD	1050	1150	1290	1390	1490	1620	1740
				ALT	1310	1430	1620	1740	1870	2020	2180
*4	4.53	0.109	3.782	STD	1370	1500	1700	1830	1960	2130	2290
				ALT	1720	1880	2130	2290	2450	2660	2860
*4	5.17	0.125	3.750	STD	1580	1730	1950	2100	2250	2440	2630
				ALT	1970	2160	2440	2630	2810	3000	3000
*4	5.81	0.141	3.718	STD	1780	1950	2200	2370	2540	2750	2960
				ALT	2220	2430	2750	2960	3000	3000	3000
*4	6.40	0.156	3.688	STD	1970	2150	2430	2620	2810	3000	3000
				ALT	2460	2690	3000	3000	3000	3000	3000
4	7.03	0.172	3.656	STD	2170	2370	2680	2890	3000	3000	3000
				ALT	2710	2970	3000	3000	3000	3000	3000
4	7.65	0.188	3.624	STD	2370	2590	2930	3000	3000	3000	3000
				ALT	2960	3000	3000	3000	3000	3000	3000
4	9.11	0.226	3.548	STD	2850	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4	10.01	0.250	3.500	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4	11.16	0.281	3.438	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4	12.50	0.318	3.364	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
*4½	3.92	0.083	4.334	STD	930	1020	1150	1240	1330	1440	1550
				ALT	1160	1270	1440	1550	1660	1800	1940
*4½	5.84	0.125	4.250	STD	1400	1530	1730	1870	2000	2170	2330
				ALT	1750	1920	2170	2330	2500	2710	2920
*4½	6.56	0.141	4.218	STD	1580	1730	1960	2110	2260	2440	2630
				ALT	1970	2160	2440	2630	2820	3000	3000
*4½	7.24	0.156	4.188	STD	1750	1910	2160	2330	2500	2700	2910
				ALT	2180	2390	2700	2910	3000	3000	3000
4½	7.95	0.172	4.156	STD	1930	2110	2390	2570	2750	2980	3000
				ALT	2410	2640	2980	3000	3000	3000	3000
4½	8.66	0.188	4.124	STD	2110	2310	2610	2810	3000	3000	3000
				ALT	2630	2880	3000	3000	3000	3000	3000
4½	9.32	0.203	4.094	STD	2270	2490	2810	3000	3000	3000	3000
				ALT	2840	3000	3000	3000	3000	3000	3000
4½	10.01	0.219	4.062	STD	2450	2690	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4½	10.79	0.237	4.026	STD	2650	2910	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4½	11.35	0.250	4.000	STD	2800	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4½	12.66	0.281	3.938	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4½	13.96	0.312	3.876	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4½	14.98	0.337	3.826	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000
4½	19.00	0.438	3.624	STD	3000	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000	3000

(Continued on page 18)

TABLE 6.1 (Continued)
 DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4	5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_{pe}</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>	Test Pressure, psi, min.						
				Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
4½	22.51	0.531	3.438	STD	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000
4½	27.54	0.674	3.152	STD	3000	3000	3000	3000	3000	3000
				ALT	3000	3000	3000	3000	3000	3000
*6⅝	5.80	0.083	6.459		790	860	980	1050	1130	1220
*6⅝	7.59	0.109	6.407		1040	1140	1280	1380	1480	1600
*6⅝	8.68	0.125	6.375		1190	1300	1470	1580	1700	1840
*6⅝	9.76	0.141	6.343		1340	1470	1660	1790	1920	2080
*6⅝	10.78	0.156	6.313		1480	1620	1840	1980	2120	2300
6⅝	11.85	0.172	6.281		1640	1790	2030	2180	2340	2530
6⅝	12.92	0.188	6.249		1790	1960	2210	2380	2550	2770
6⅝	13.92	0.203	6.219		1930	2110	2390	2570	2760	2990
6⅝	14.98	0.219	6.187		2080	2280	2580	2780	2980	3000
6⅝	17.02	0.250	6.125		2380	2600	2940	3000	3000	3000
6⅝	18.97	0.280	6.065		2660	2920	3000	3000	3000	3000
6⅝	21.04	0.312	6.001		2970	3000	3000	3000	3000	3000
6⅝	23.08	0.344	5.937		3000	3000	3000	3000	3000	3000
6⅝	25.03	0.375	5.875		3000	3000	3000	3000	3000	3000
6⅝	28.57	0.432	5.761		3000	3000	3000	3000	3000	3000
6⅝	32.71	0.500	5.625		3000	3000	3000	3000	3000	3000
6⅝	36.39	0.562	5.501		3000	3000	3000	3000	3000	3000
6⅝	40.05	0.625	5.375		3000	3000	3000	3000	3000	3000
6⅝	45.35	0.719	5.187		3000	3000	3000	3000	3000	3000
6⅝	47.06	0.750	5.125		3000	3000	3000	3000	3000	3000
*8⅝	11.35	0.125	8.375		910	1000	1130	1220	1300	1410
*8⅝	14.11	0.156	8.313		1140	1250	1410	1520	1630	1760
8⅝	16.94	0.188	8.249		1370	1500	1700	1830	1960	2130
8⅝	18.26	0.203	8.219		1480	1620	1840	1980	2120	2290
8⅝	19.66	0.219	8.187		1600	1750	1980	2130	2290	2480
8⅝	22.36	0.250	8.125		1830	2000	2260	2430	2610	2830
8⅝	24.70	0.277	8.071		2020	2220	2510	2700	2890	3000
8⅝	27.70	0.312	8.001		2280	2500	2820	3000	3000	3000
8⅝	28.55	0.322	7.981		2350	2580	2910	3000	3000	3000
8⅝	30.42	0.344	7.937		2510	2750	3000	3000	3000	3000
8⅝	33.04	0.375	7.875		2740	3000	3000	3000	3000	3000
8⅝	38.30	0.438	7.749		3000	3000	3000	3000	3000	3000
8⅝	43.39	0.500	7.625		3000	3000	3000	3000	3000	3000
8⅝	48.40	0.562	7.501		3000	3000	3000	3000	3000	3000
8⅝	53.40	0.625	7.375		3000	3000	3000	3000	3000	3000
8⅝	60.71	0.719	7.187		3000	3000	3000	3000	3000	3000
8⅝	63.08	0.750	7.125		3000	3000	3000	3000	3000	3000
8⅝	67.76	0.812	7.001		3000	3000	3000	3000	3000	3000
8⅝	72.42	0.875	6.875		3000	3000	3000	3000	3000	3000
*10⅝	17.65	0.156	10.438		1040	1130	1280	1380	1480	1600
*10⅝	21.21	0.188	10.374		1250	1370	1550	1660	1780	1930
*10⅝	22.87	0.203	10.344		1350	1480	1670	1800	1930	2090
10⅝	24.63	0.219	10.312		1450	1590	1800	1940	2080	2250
10⅝	28.04	0.250	10.250		1660	1820	2060	2210	2370	2570
10⅝	31.20	0.279	10.192		1850	2030	2290	2470	2650	2870
10⅝	34.24	0.307	10.136		2040	2230	2520	2720	2910	3000
10⅝	38.23	0.344	10.062		2280	2500	2830	3000	3000	3000
10⅝	40.48	0.365	10.020		2420	2660	3000	3000	3000	3000
10⅝	48.24	0.438	9.874		2910	3000	3000	3000	3000	3000
10⅝	54.74	0.500	9.750		3000	3000	3000	3000	3000	3000
10⅝	61.15	0.562	9.626		3000	3000	3000	3000	3000	3000
10⅝	67.58	0.625	9.500		3000	3000	3000	3000	3000	3000
10⅝	77.03	0.719	9.312		3000	3000	3000	3000	3000	3000
10⅝	80.10	0.750	9.250		3000	3000	3000	3000	3000	3000
10⅝	86.18	0.812	9.126		3000	3000	3000	3000	3000	3000

(Continued on page 19)

TABLE 6.1 (Continued)
DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4	5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_{pe}</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>	Test Pressure, psi, min.						
				Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
10¾	92.28	0.875	9.000	3000	3000	3000	3000	3000	3000	3000
10¾	98.30	0.938	8.874	3000	3000	3000	3000	3000	3000	3000
*12¾	23.11	0.172	12.406	960	1050	1190	1280	1380	1490	1610
*12¾	25.22	0.188	12.374	1050	1150	1300	1400	1500	1630	1750
*12¾	27.20	0.203	12.344	1140	1250	1410	1520	1620	1760	1890
*12¾	29.31	0.219	12.312	1230	1340	1520	1640	1750	1900	2040
12¾	33.38	0.250	12.250	1400	1530	1730	1870	2000	2170	2330
12¾	37.42	0.281	12.188	1570	1720	1950	2100	2250	2440	2620
12¾	41.45	0.312	12.126	1750	1910	2160	2330	2500	2700	2910
12¾	43.77	0.330	12.090	1850	2020	2290	2460	2640	2860	3000
12¾	45.58	0.344	12.062	1930	2110	2390	2570	2750	2980	3000
12¾	49.56	0.375	12.000	2100	2300	2600	2800	3000	3000	3000
12¾	53.52	0.406	11.938	2270	2490	2810	3000	3000	3000	3000
12¾	57.59	0.438	11.874	2450	2690	3000	3000	3000	3000	3000
12¾	65.42	0.500	11.750	2800	3000	3000	3000	3000	3000	3000
12¾	73.15	0.562	11.626	3000	3000	3000	3000	3000	3000	3000
12¾	80.93	0.625	11.500	3000	3000	3000	3000	3000	3000	3000
12¾	88.63	0.688	11.374	3000	3000	3000	3000	3000	3000	3000
12¾	96.12	0.750	11.250	3000	3000	3000	3000	3000	3000	3000
12¾	103.53	0.812	11.126	3000	3000	3000	3000	3000	3000	3000
12¾	110.97	0.875	11.000	3000	3000	3000	3000	3000	3000	3000
12¾	118.33	0.938	10.874	3000	3000	3000	3000	3000	3000	3000
12¾	125.49	1.000	10.750	3000	3000	3000	3000	3000	3000	3000
12¾	132.57	1.062	10.626	3000	3000	3000	3000	3000	3000	3000
12½	139.67	1.125	10.500	3000	3000	3000	3000	3000	3000	3000
*14	27.73	0.188	13.624	960	1050	1190	1280	1370	1480	1600
*14	30.93	0.210	13.580	1070	1170	1330	1430	1530	1660	1790
*14	32.23	0.219	13.562	1120	1220	1380	1490	1600	1730	1860
*14	36.71	0.250	13.500	1280	1400	1580	1700	1820	1970	2130
*14	41.17	0.281	13.438	1430	1570	1770	1910	2050	2220	2390
14	45.61	0.312	13.376	1590	1740	1970	2120	2270	2460	2650
14	50.17	0.344	13.312	1750	1920	2170	2340	2510	2720	2920
14	54.57	0.375	13.250	1910	2090	2370	2550	2730	2960	3000
14	58.94	0.406	13.188	2070	2270	2560	2760	2960	3000	3000
14	63.44	0.438	13.124	2230	2450	2770	2980	3000	3000	3000
14	67.78	0.469	13.062	2390	2620	2960	3000	3000	3000	3000
14	72.09	0.500	13.000	2550	2790	3000	3000	3000	3000	3000
14	80.66	0.562	12.876	2870	3000	3000	3000	3000	3000	3000
14	89.28	0.625	12.750	3000	3000	3000	3000	3000	3000	3000
14	97.81	0.688	12.624	3000	3000	3000	3000	3000	3000	3000
14	106.13	0.750	12.500	3000	3000	3000	3000	3000	3000	3000
14	114.37	0.812	12.376	3000	3000	3000	3000	3000	3000	3000
14	122.65	0.875	12.250	3000	3000	3000	3000	3000	3000	3000
14	130.85	0.938	12.124	3000	3000	3000	3000	3000	3000	3000
14	138.84	1.000	12.000	3000	3000	3000	3000	3000	3000	3000
14	146.74	1.062	11.876	3000	3000	3000	3000	3000	3000	3000
14	154.69	1.125	11.750	3000	3000	3000	3000	3000	3000	3000
*16	31.75	0.188	15.624	840	920	1040	1120	1200	1300	1400
*16	34.25	0.203	15.594	910	990	1120	1210	1290	1400	1510
*16	36.91	0.219	15.562	980	1070	1210	1300	1400	1510	1630
*16	42.05	0.250	15.500	1120	1220	1380	1490	1590	1730	1860
*16	47.17	0.281	15.438	1250	1370	1550	1670	1790	1940	2090
16	52.27	0.312	15.376	1390	1520	1720	1860	1990	2150	2320
16	57.52	0.344	15.312	1540	1680	1900	2050	2190	2380	2560
16	62.58	0.375	15.250	1670	1830	2070	2230	2390	2590	2790
16	67.62	0.406	15.188	1810	1980	2240	2420	2590	2800	3000
16	72.80	0.438	15.124	1950	2140	2420	2610	2790	3000	3000
16	77.79	0.469	15.062	2090	2290	2590	2790	2990	3000	3000
16	82.77	0.500	15.000	2230	2440	2760	2980	3000	3000	3000
16	92.66	0.562	14.876	2510	2750	3000	3000	3000	3000	3000

(Continued on page 20)

TABLE 6.1 (Continued)
 DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4	5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_p</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>	Test Pressure, psi, min.						
				Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
16	102.63	0.625	14.750	2790	3000	3000	3000	3000	3000	3000
16	112.51	0.688	14.624	3000	3000	3000	3000	3000	3000	3000
16	122.15	0.750	14.500	3000	3000	3000	3000	3000	3000	3000
16	131.71	0.812	14.376	3000	3000	3000	3000	3000	3000	3000
16	141.34	0.875	14.250	3000	3000	3000	3000	3000	3000	3000
16	150.89	0.938	14.124	3000	3000	3000	3000	3000	3000	3000
16	160.20	1.000	14.000	3000	3000	3000	3000	3000	3000	3000
16	169.43	1.062	13.876	3000	3000	3000	3000	3000	3000	3000
16	178.72	1.125	13.750	3000	3000	3000	3000	3000	3000	3000
16	187.93	1.188	13.624	3000	3000	3000	3000	3000	3000	3000
16	196.91	1.250	13.500	3000	3000	3000	3000	3000	3000	3000
*18	35.76	0.188	17.624	750	820	920	990	1070	1150	1240
*18	41.59	0.219	17.562	870	950	1080	1160	1240	1340	1450
*18	47.39	0.250	17.500	990	1090	1230	1320	1420	1530	1650
*18	53.18	0.281	17.438	1110	1220	1380	1490	1590	1730	1860
18	58.94	0.312	17.376	1240	1360	1530	1650	1770	1920	2060
18	64.87	0.344	17.312	1360	1490	1690	1820	1950	2110	2270
18	70.59	0.375	17.250	1490	1630	1840	1980	2120	2300	2480
18	76.29	0.406	17.188	1610	1760	1990	2150	2300	2490	2680
18	82.15	0.438	17.124	1740	1900	2150	2320	2480	2690	2900
18	87.81	0.469	17.062	1860	2040	2300	2480	2660	2880	3000
18	93.45	0.500	17.000	1980	2170	2460	2640	2830	3000	3000
18	104.67	0.562	16.876	2230	2440	2760	2970	3000	3000	3000
18	115.98	0.625	16.750	2480	2720	3000	3000	3000	3000	3000
18	127.21	0.688	16.624	2730	2990	3000	3000	3000	3000	3000
18	138.17	0.750	16.500	2980	3000	3000	3000	3000	3000	3000
18	149.06	0.812	16.376	3000	3000	3000	3000	3000	3000	3000
18	160.03	0.875	16.250	3000	3000	3000	3000	3000	3000	3000
18	170.92	0.938	16.124	3000	3000	3000	3000	3000	3000	3000
18	181.56	1.000	16.000	3000	3000	3000	3000	3000	3000	3000
18	192.11	1.062	15.876	3000	3000	3000	3000	3000	3000	3000
18	202.75	1.125	15.750	3000	3000	3000	3000	3000	3000	3000
18	213.31	1.188	15.624	3000	3000	3000	3000	3000	3000	3000
18	223.61	1.250	15.500	3000	3000	3000	3000	3000	3000	3000
*20	46.27	0.219	19.562	830	910	1020	1100	1180	1280	1380
*20	52.73	0.250	19.500	940	1040	1170	1260	1350	1460	1580
*20	59.18	0.281	19.438	1060	1160	1320	1420	1520	1640	1770
20	65.60	0.312	19.376	1180	1290	1460	1570	1680	1830	1970
20	72.21	0.344	19.312	1300	1420	1610	1730	1860	2010	2170
20	78.60	0.375	19.250	1420	1550	1760	1890	2020	2190	2360
20	84.96	0.406	19.188	1530	1680	1900	2050	2190	2380	2560
20	91.51	0.438	19.124	1660	1810	2050	2210	2370	2560	2750
20	97.83	0.469	19.062	1770	1940	2190	2360	2530	2740	2750
20	104.13	0.500	19.000	1890	2070	2340	2520	2700	2750	2750
20	116.67	0.562	18.876	2120	2330	2630	2750	2750	2750	2750
20	129.33	0.625	18.750	2360	2590	2750	2750	2750	2750	2750
20	141.90	0.688	18.624	2600	2750	2750	2750	2750	2750	2750
20	154.19	0.750	18.500	2750	2750	2750	2750	2750	2750	2750
20	166.40	0.812	18.376	2750	2750	2750	2750	2750	2750	2750
20	178.72	0.875	18.250	2750	2750	2750	2750	2750	2750	2750
20	190.96	0.938	18.124	2750	2750	2750	2750	2750	2750	2750
20	202.92	1.000	18.000	2750	2750	2750	2750	2750	2750	2750
20	214.80	1.062	17.876	2750	2750	2750	2750	2750	2750	2750
20	226.78	1.125	17.750	2750	2750	2750	2750	2750	2750	2750
20	238.68	1.188	17.624	2750	2750	2750	2750	2750	2750	2750
20	250.31	1.250	17.500	2750	2750	2750	2750	2750	2750	2750
20	261.86	1.312	17.376	2750	2750	2750	2750	2750	2750	2750
20	273.51	1.375	17.250	2750	2750	2750	2750	2750	2750	2750

(Continued on page 21)

TABLE 6.1 (Continued)
DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4	5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_p</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>	Test Pressure, psi, min.						
				Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
*22	50.94	0.219	21.562	750	820	930	1000	1080	1160	1250
*22	58.07	0.250	21.500	860	940	1060	1150	1230	1330	1430
*22	65.18	0.281	21.438	970	1060	1200	1290	1380	1490	1610
22	72.27	0.312	21.376	1070	1170	1330	1430	1530	1660	1790
22	79.56	0.344	21.312	1180	1290	1460	1580	1690	1830	1970
22	86.61	0.375	21.250	1290	1410	1600	1720	1840	1990	2150
22	93.63	0.406	21.188	1400	1530	1730	1860	1990	2160	2330
22	100.86	0.438	21.124	1510	1650	1860	2010	2150	2330	2500
22	107.85	0.469	21.062	1610	1770	2000	2150	2300	2490	2500
22	114.81	0.500	21.000	1720	1880	2130	2290	2450	2500	2500
22	128.67	0.562	20.876	1930	2120	2390	2500	2500	2500	2500
22	142.68	0.625	20.750	2150	2350	2500	2500	2500	2500	2500
22	156.60	0.688	20.624	2360	2500	2500	2500	2500	2500	2500
22	170.21	0.750	20.500	2500	2500	2500	2500	2500	2500	2500
22	183.75	0.812	20.376	2500	2500	2500	2500	2500	2500	2500
22	197.41	0.875	20.250	2500	2500	2500	2500	2500	2500	2500
22	211.00	0.938	20.124	2500	2500	2500	2500	2500	2500	2500
22	224.28	1.000	20.000	2500	2500	2500	2500	2500	2500	2500
22	237.48	1.062	19.876	2500	2500	2500	2500	2500	2500	2500
22	250.81	1.125	19.750	2500	2500	2500	2500	2500	2500	2500
22	264.06	1.188	19.624	2500	2500	2500	2500	2500	2500	2500
22	277.01	1.250	19.500	2500	2500	2500	2500	2500	2500	2500
22	289.88	1.312	19.376	2500	2500	2500	2500	2500	2500	2500
22	302.88	1.375	19.250	2500	2500	2500	2500	2500	2500	2500
22	315.79	1.438	19.124	2500	2500	2500	2500	2500	2500	2500
22	328.41	1.500	19.000	2500	2500	2500	2500	2500	2500	2500
*24	63.41	0.250	23.500	790	860	980	1050	1120	1220	1310
*24	71.18	0.281	23.438	890	970	1100	1180	1260	1370	1480
24	78.93	0.312	23.376	980	1080	1220	1310	1400	1520	1640
24	86.91	0.344	23.312	1080	1190	1340	1440	1550	1680	1810
24	94.62	0.375	23.250	1180	1290	1460	1580	1690	1830	1970
24	102.31	0.406	23.188	1280	1400	1580	1710	1830	1980	2130
24	110.22	0.438	23.124	1380	1510	1710	1840	1970	2140	2300
24	117.86	0.469	23.062	1480	1620	1830	1970	2110	2290	2300
24	125.49	0.500	23.000	1580	1720	1950	2100	2250	2300	2300
24	140.68	0.562	22.876	1770	1940	2190	2300	2300	2300	2300
24	156.03	0.625	22.750	1970	2160	2300	2300	2300	2300	2300
24	171.29	0.688	22.624	2170	2300	2300	2300	2300	2300	2300
24	186.23	0.750	22.500	2300	2300	2300	2300	2300	2300	2300
24	201.09	0.812	22.376	2300	2300	2300	2300	2300	2300	2300
24	216.10	0.875	22.250	2300	2300	2300	2300	2300	2300	2300
24	231.03	0.938	22.124	2300	2300	2300	2300	2300	2300	2300
24	245.64	1.000	22.000	2300	2300	2300	2300	2300	2300	2300
24	260.17	1.062	21.876	2300	2300	2300	2300	2300	2300	2300
24	274.84	1.125	21.750	2300	2300	2300	2300	2300	2300	2300
24	289.44	1.188	21.624	2300	2300	2300	2300	2300	2300	2300
24	303.71	1.250	21.500	2300	2300	2300	2300	2300	2300	2300
24	317.91	1.312	21.376	2300	2300	2300	2300	2300	2300	2300
24	332.25	1.375	21.250	2300	2300	2300	2300	2300	2300	2300
24	346.50	1.438	21.124	2300	2300	2300	2300	2300	2300	2300
24	360.45	1.500	21.000	2300	2300	2300	2300	2300	2300	2300
24	374.31	1.562	20.876	2300	2300	2300	2300	2300	2300	2300
*26	68.75	0.250	25.500	730	800	900	970	1040	1120	1210
*26	77.18	0.281	25.438	820	890	1010	1090	1170	1260	1360
26	85.60	0.312	25.376	910	990	1120	1210	1300	1400	1510
26	94.26	0.344	25.312	1000	1100	1240	1330	1430	1550	1670
26	102.63	0.375	25.250	1090	1190	1350	1450	1560	1690	1820
26	110.98	0.406	25.188	1180	1290	1460	1570	1690	1830	1970
26	119.57	0.438	25.124	1270	1390	1580	1700	1820	1970	2000
26	127.88	0.469	25.062	1360	1490	1690	1820	1950	2000	2000
26	136.17	0.500	25.000	1450	1590	1800	1940	2000	2000	2000
26	152.68	0.562	24.876	1630	1790	2000	2000	2000	2000	2000

(Continued on page 22)

TABLE 6.1 (Continued)
 DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4	5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_{pe}</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>	Test Pressure, psi, min.						
				Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
26	169.38	0.625	24.750	1820	1990	2000	2000	2000	2000	2000
26	185.99	0.688	24.624	2000	2000	2000	2000	2000	2000	2000
26	202.25	0.750	24.500	2000	2000	2000	2000	2000	2000	2000
26	218.43	0.812	24.376	2000	2000	2000	2000	2000	2000	2000
26	234.79	0.875	24.250	2000	2000	2000	2000	2000	2000	2000
26	251.07	0.938	24.124	2000	2000	2000	2000	2000	2000	2000
26	267.00	1.000	24.000	2000	2000	2000	2000	2000	2000	2000
*28	74.09	0.250	27.500	680	740	840	900	960	1040	1130
*28	83.19	0.281	27.438	760	830	940	1010	1080	1170	1260
28	92.26	0.312	27.376	840	920	1040	1120	1200	1300	1400
28	101.61	0.344	27.312	930	1020	1150	1240	1330	1440	1550
28	110.64	0.375	27.250	1010	1110	1250	1350	1450	1570	1690
28	119.65	0.406	27.188	1100	1200	1360	1460	1570	1700	1830
28	128.93	0.438	27.124	1180	1300	1460	1580	1690	1830	1970
28	137.90	0.469	27.062	1270	1390	1570	1690	1810	1960	2110
28	146.85	0.500	27.000	1350	1480	1670	1800	1930	2090	2250
28	164.69	0.562	26.876	1520	1660	1880	2020	2170	2350	2530
28	182.73	0.625	26.750	1690	1850	2090	2250	2410	2610	2810
28	200.68	0.688	26.624	1860	2030	2300	2480	2650	2870	3000
28	218.27	0.750	26.500	2020	2220	2510	2700	2890	3000	3000
28	235.78	0.812	26.376	2190	2400	2710	2920	3000	3000	3000
28	253.48	0.875	26.250	2360	2590	2920	3000	3000	3000	3000
28	271.10	0.938	26.124	2530	2770	3000	3000	3000	3000	3000
28	288.36	1.000	26.000	2700	2960	3000	3000	3000	3000	3000
*30	79.43	0.250	29.500	630	690	780	840	900	980	1050
*30	89.19	0.281	29.438	710	780	880	940	1010	1100	1180
30	98.93	0.312	29.376	790	860	970	1050	1120	1220	1310
30	108.95	0.344	29.312	870	950	1070	1160	1240	1340	1440
30	118.65	0.375	29.250	940	1040	1170	1260	1350	1460	1580
30	128.32	0.406	29.188	1020	1120	1270	1360	1460	1580	1710
30	138.29	0.438	29.124	1100	1210	1370	1470	1580	1710	1840
30	147.92	0.469	29.062	1180	1290	1460	1580	1690	1830	1970
30	157.53	0.500	29.000	1260	1380	1560	1680	1800	1950	2100
30	176.69	0.562	28.876	1420	1550	1750	1890	2020	2190	2360
30	196.08	0.625	28.750	1580	1720	1950	2100	2250	2440	2630
30	215.38	0.688	28.624	1730	1900	2150	2310	2480	2680	2890
30	234.29	0.750	28.500	1890	2070	2340	2520	2700	2920	3000
30	253.12	0.812	28.376	2050	2240	2530	2730	2920	3000	3000
30	272.17	0.875	28.250	2200	2420	2730	2940	3000	3000	3000
30	291.14	0.938	28.124	2360	2590	2930	3000	3000	3000	3000
30	309.72	1.000	28.000	2520	2760	3000	3000	3000	3000	3000
30	328.22	1.062	27.876	2680	2930	3000	3000	3000	3000	3000
30	346.93	1.125	27.750	2840	3000	3000	3000	300	3000	3000
30	365.56	1.188	27.624	2990	3000	3000	3000	3000	3000	3000
30	383.81	1.250	27.500	3000	3000	3000	3000	3000	3000	3000
*32	84.77	0.250	31.500	590	650	730	790	840	910	980
*32	95.19	0.281	31.438	660	730	820	890	950	1030	1110
32	105.59	0.312	31.376	740	810	910	980	1050	1140	1230
32	116.30	0.344	31.312	810	890	1010	1080	1160	1260	1350
32	126.66	0.375	31.250	890	970	1100	1180	1270	1370	1480
32	136.99	0.406	31.188	960	1050	1190	1280	1370	1480	1600
32	147.64	0.438	31.124	1030	1130	1280	1380	1480	1600	1720
32	157.94	0.469	31.062	1110	1210	1370	1480	1580	1710	1850
32	168.21	0.500	31.000	1180	1290	1460	1580	1690	1830	1970
32	188.70	0.562	30.876	1330	1450	1640	1770	1900	2050	2210
32	209.43	0.625	30.750	1480	1620	1830	1970	2110	2290	2460
32	230.08	0.688	30.624	1630	1780	2010	2170	2320	2520	2710
32	250.31	0.750	30.500	1770	1940	2190	2360	2530	2740	2950
32	270.47	0.812	30.376	1920	2100	2380	2560	2740	2970	3000
32	290.86	0.875	30.250	2070	2260	2560	2760	2950	3000	3000

(Continued on page 23)

TABLE 6.1 (Continued)
 DIMENSIONS¹, WEIGHTS, AND TEST PRESSURES²
 See Appendix C for Metric Tables

1	2	3	4	5	6	7	8	9	10	11
Size: Outside Diameter in. <i>D</i>	Weight, lb. per ft. <i>w_{pe}</i>	Wall Thickness, in. <i>t</i>	Inside Diameter, in. <i>d</i>	Test Pressure, psi, min.						
				Grade X42	Grade X46	Grade X52	Grade X56	Grade X60	Grade X65	Grade X70
32	311.17	0.938	30.124	2220	2430	2740	2950	3000	3000	3000
32	331.08	1.000	30.000	2360	2590	2920	3000	3000	3000	3000
32	350.90	1.062	29.876	2510	2750	3000	3000	3000	3000	3000
32	370.96	1.125	29.750	2660	2910	3000	3000	3000	3000	3000
32	390.94	1.188	29.624	2810	3000	3000	3000	3000	3000	3000
32	410.51	1.250	29.500	2950	3000	3000	3000	3000	3000	3000
*34	90.11	0.250	33.500	560	610	690	740	790	860	930
*34	101.19	0.281	33.438	620	680	770	830	890	970	1040
34	112.25	0.312	33.376	690	760	860	920	990	1070	1160
34	123.65	0.344	33.312	760	840	950	1020	1090	1180	1270
34	134.67	0.375	33.250	830	910	1030	1110	1190	1290	1390
34	145.67	0.406	33.188	900	990	1120	1200	1290	1400	1500
34	157.00	0.438	33.124	970	1070	1210	1300	1390	1510	1620
34	167.95	0.469	33.062	1040	1140	1290	1390	1490	1610	1740
34	178.89	0.500	33.000	1110	1220	1380	1480	1590	1720	1850
34	200.70	0.562	32.876	1250	1370	1550	1670	1790	1930	2080
34	222.78	0.625	32.750	1390	1520	1720	1850	1990	2150	2320
34	244.77	0.688	32.624	1530	1680	1890	2040	2190	2370	2550
34	266.33	0.750	32.500	1670	1830	2060	2220	2380	2580	2780
34	287.81	0.812	32.376	1810	1980	2240	2410	2580	2790	3000
34	309.55	0.875	32.250	1950	2130	2410	2590	2780	3000	3000
34	331.21	0.938	32.124	2090	2280	2580	2780	2980	3000	3000
34	352.44	1.000	32.000	2220	2440	2750	2960	3000	3000	3000
34	373.59	1.062	31.876	2360	2590	2920	3000	3000	3000	3000
34	394.99	1.125	31.750	2500	2740	3000	3000	3000	3000	3000
34	416.31	1.188	31.624	2640	2890	3000	3000	3000	3000	3000
34	437.21	1.250	31.500	2780	3000	3000	3000	3000	3000	3000
*36	95.45	0.250	35.500	520	580	650	700	750	810	880
*36	107.20	0.281	35.438	590	650	730	790	840	910	980
36	118.92	0.312	35.376	660	720	810	870	940	1010	1090
36	131.00	0.344	35.312	720	790	890	960	1030	1120	1200
36	142.68	0.375	35.250	790	860	980	1050	1120	1220	1310
36	154.34	0.406	35.188	850	930	1060	1140	1220	1320	1420
36	166.35	0.438	35.124	920	1010	1140	1230	1310	1420	1530
36	177.97	0.469	35.062	980	1080	1220	1310	1410	1520	1640
36	189.57	0.500	35.000	1050	1150	1300	1400	1500	1620	1750
36	212.70	0.562	34.876	1180	1290	1460	1570	1690	1830	1970
36	236.13	0.625	34.750	1310	1440	1620	1750	1880	2030	2190
36	259.47	0.688	34.624	1440	1580	1790	1930	2060	2240	2410
36	282.35	0.750	34.500	1580	1720	1950	2100	2250	2440	2630
36	305.16	0.812	34.376	1710	1870	2110	2270	2440	2640	2840
36	328.24	0.875	34.250	1840	2010	2280	2450	2620	2840	3000
36	351.25	0.938	34.124	1970	2160	2440	2630	2810	3000	3000
36	373.80	1.000	34.000	2100	2300	2600	2800	3000	3000	3000
36	396.27	1.062	33.876	2230	2440	2760	2970	3000	3000	3000
36	419.02	1.125	33.750	2360	2590	2930	3000	3000	3000	3000
36	441.69	1.188	33.624	2490	2730	3000	3000	3000	3000	3000
36	463.91	1.250	33.500	2630	2870	3000	3000	3000	3000	3000
38	125.58	0.312	37.376	620	680	770	830	890	960	1030
38	138.35	0.344	37.312	680	750	850	910	980	1060	1140
38	150.69	0.375	37.250	750	820	920	990	1070	1150	1240
38	163.01	0.406	37.188	810	880	1000	1080	1150	1250	1350
38	175.71	0.438	37.124	870	950	1080	1160	1240	1350	1450
38	187.99	0.469	37.062	930	1020	1160	1240	1330	1440	1560
38	200.25	0.500	37.000	990	1090	1230	1330	1420	1540	1660
38	224.71	0.562	36.876	1120	1220	1380	1490	1600	1730	1860
38	249.48	0.625	36.750	1240	1360	1540	1660	1780	1920	2070
38	274.16	0.688	36.624	1370	1500	1690	1830	1960	2120	2280
38	298.37	0.750	36.500	1490	1630	1850	1990	2130	2310	2490
38	322.50	0.812	36.376	1620	1770	2000	2150	2310	2500	2690

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