Date of Issue: May 1999
Affected Publication: Spec 5CT Sixth Edition

ERRATA

Page 1, Par 1.1: *Delete M from Group 1 and add to Group 2.*

Page 2, Par 3.15: *At next revision will put in alphabetical order.*

Pages 3/4/5/6: *Replace pages 3, 4, 5, and 6 with those found in this Errata.*

Page 7, Par 5.3.2: *Change the title of the paragraph to 5.3.2 Group 2 – Grades M65 and L80.*

Page 7, Par 5.3.3: *Add the following new 5.3.3:*

5.3.3 Group 2 – Grades C90 and T95

Grades C90 and T95 pipe may be subjected to cold rotary straightening if, subsequent to the cold rotary straightening operation, the pipe is heated to a minimum temperature of 900 °F for stress relieving. When necessary, light gag straightening for grades C90 and T95 shall be permitted. Grade C90 pipe shall be subjected to no tensile or expansion cold working, except for that which is incidental to normal straightening operations, and to no more than 3 percent compressive cold working, after the final tempering operation.

Page 7, 5.3.3: *Renumber existing 5.3.3 to 5.3.4.*

Page 9, Table 3, Column 4: Change *"Maximum" to "Minimum."*

Page 10, Par 6.2.3.6: *Delete Group 4.*

Page 11, Par 6.2.4.2: Change title to:

6.2.4.2 Casing, Pup Joints, and Externally Threaded Connector Material – Group 2 (Grade M65 only) and Group 4

Page 26, Par 7.9: *In second paragraph, change the reference from Table 54 to Table 55.*

Page 26, Par 7.10.1: *For nonupset pipe, $4^1/_2$ to less than 5, change tolerance to "+0.005, +1.00 percent D".*

Page 26, Par 7.10.1: *For nonupset pipe, 5 and larger, add the following footnote to the tolerance.*

**The +0.016 inch, +1.00 percent D tolerance shall become effective April 15, 2000. Until that time the tolerance remains as shown in the 5th edition, +1.00 percent D,–0.50 percent D.*

Note to reader: This change is not Errata material. This action was requested by the manufacturers at the January 1999 Winter Work Week, approved by the SC5 Steering Committee and the SC5 Chairman.

Page 29, Par 7.14.1.5: *Change Bulletin 5A2 to 5A3.*

Page 35, Table 23: *In heading of column 4, correct spelling of "Diameter."*

Page 35, Table 24, Column 7: *Change length minimum of 2.063" 3.25# to 1 $^{1}/_{16}$.*

Page 41, Footnote b: *Change to: L_o shall be 9 in. max. for 7-35 and 7-38 designation casing.*

Page 54, Par 9.4.1: *Add a "g." in front of Pup joints .....* .
Note: Item f is one sentence and one line long.

Page 57, Table 38, Note b: *Change Note [b] to:*
[b] Grade M65 casing is furnished with L80 couplings.

Page 58, Table 39: *For 9$^{5}/_{8}$" 58.40#, column 3, change 7,700 to 7,900.*

Page 70, Table 48: *Change heading for column 8 from "Grade H40" to "Grade J55". Also change heading for column 9 from "Grade J55" to "Grade L80".*

Page 71, Table 49: *Change heading for column 8 from "Grade H40" to "Grade N80". Also change heading for column 9 from "Grade J55" to "Grade P110".*

Pages 72 and 73, Table 50: *Change heading for column 5 from "Plain End[a]" to "Plain End[b]".*

Page 77, Par 9.4.2.3: *For Yp, add "minimum" between specified and yield.*

Page 80, Par 9.7.7: *Insert the following at the end of Par 9.7.7:*
The inspections performed in accordance with 9.7, with the equipment calibrated to the reference indicators in Table 57, should not be construed as assuring that the material requirements in 7.12 have been met.

Note to reader: The addition to 9.7.7 above was approved by letter ballot, spring 1992, ballot item 2177.

Page 82, Par 9.8.7.2: *Change tolerance of test temperature in the last sentence to +/–5 °F.*

Page 84, Par 9.10.4.1: *Change title to "Group 2 (Grades M65 and L80)".*

Page 84, Par 9.10.4.2: *Change title to "Group 2 (Grades C90 and T95)".*

Page 85, Par 10.2.2: *Change reference from Table 50 to Table 60.*

Page 85, Par 10.3: *In "Stencil marking requirements," second paragraph, change the reference to Table 59.*

Page 86, Par 10.3. *Change Table 5B to Table 59.*

Page 86, Par 10.6. Replace the second paragraph with the following:

The threader shall mark on the body of the pipe the hydrostatic test pressure unless the pipe has been previously tested and marked to the pressure required for the thread as shown in tables 36 through 53.

Example: for 7 – 29# long thread coupling

1) If the pipe manufacturer produced UF pipe and hydrostatic pressure tested to 3,000 psi and marked 3K then the threader shall pressure test the pipe to 8,800 psi and mark the pipe in accordance with Figure 16.

2) If the pipe manufacturer produced UF pipe and hydrostatic pressure tested to 8,800 psi and marked the pipe HP8800 then the threader is not required to pressure test or mark the test pressure.

The markings applied to the body of the pipe by the original pipe manufacturer shall not be removed or altered.

Note to reader : The above is the result of ballot resolution on item 1041, 1995, to have a positive mark of the test pressure on the pipe. Every threaded pipe shall be pressure tested to the pressure specified in the hydrostatic pressure test tables for the designated threaded connection.

Pages 87/88, Table 59: *Replace Table 59 with that found in this Errata.*

Pages 89/90: *Replace Figure 16 with the one found in this Supplement.*

Page 91, Table 61: *For the M65 line replace text under Couplings with "L80 couplings are used on M65 pipe".*

Page 93, Par 13.1: *Replace 13.1, 13.2, and 13.3 with the following:*

13.1 Electronic Media, All Groups

A Material Test Report, Certificate of Compliance or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of this specification and conform to any existing EDI agreement between the purchaser and supplier.

13.2 Certification, Groups 1, 2, and 3

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 in the purchase order.
13.3 Certification Requirements – Group 4
A certification shall be provided by the manufacturer for all pipe shipped meeting Group 4 requirements. This shall include the results of all tests required in this specification for Group 4 and any other special provisions as required by the purchaser on the purchase order.

Page 93, Par 13.3: *Renumber to 13.4.*

Page 103, Par SR1: *Delete the comma after N80 in the last sentence.*

Page 103, SR9.5: *Change Q125-SR9 to S9 Q1.*

Page 104, Par SR11.3: *Change "casing" to "pipe" in the first line.*

Page 105, Figure B-1: *Change Note 1 to read "1. Depth: 5%t, with a tolerance of either +/– 15% or +/– 0.002, whichever is greater."*

Page 106, Par SR12.1. *Change last sentence to read "The basis of the testing procedure is explained in"* Note: Explanation of Testing Frequency in SR12.2.

Page 106. Par SR12.2, First paragraph, fourth line: *Change reference to Figure 12.*

Page 107, Par SR12.5, second line: *Change reference to 6.2.3.*

Page 107, SR13.3: *Change SR13 to S13.*

Page 112, SR14.4: *Change SR14 to S14.*

Page 112, SR15.3: *Delete this paragraph.*

Page 116, SR16.5: *Change marking from SR16-20 +14F to S16-20 +14F.*

Pages 119, 120, 121, 122, 123, 124. *Replace pages 119, 120, 121, 122, 123, and 124 with those found in this Errata.*

Manufacturing Condition	Special Processes
a. Seamless	
1. As-rolled	Final reheating practice and hot sizing or stretch reducing. Nondestructive testing. If applicable, upsetting, and cold finishing.
2. Heat treated	Heat treatment. Nondestructive testing.
b. Electric weld	
1. As-rolled	Sizing and seam welding. Nondestructive testing. If applicable, seam heat treatment and upsetting.
2. Heat treated	Seam welding. Nondestructive testing and full body heat treatment.

3.28 thread protector: A cap or insert used to protect threads and seals during handling, transportation, and storage.

3.29 tubing: Pipe placed within a well to serve to produce well fluids or to inject fluids.

4 Information to be Supplied by the Purchaser

4.1 CASING

4.1.1 In placing orders for pipe to be manufactured in accordance with API Specification 5CT, the purchaser should specify the following information on the purchase order:

Information	Reference
Specification	API Spec 5CT
Quantity	
Type of pipe or couplings:	
Casing:	
Threaded or plain end	Paragraph 7.13.1
Round (short or long), buttress, or extreme-line threads	Paragraph 7.13.1 and Table A-1
With or without couplings	Paragraph 7.13.1
Liners	Paragraph 8.13.2 and Table A-2
Size designation or outside diameter	Tables A-1 and A-2
Weight designation or wall thickness	Tables A-1 and A-2
Grade and type where applicable (see Note 1)	Tables 3, A-1, and A-2
Range length	Paragraph 7.5 and Table 26
Seamless or electric welded (see Note 1)	Paragraph 5.1 and Table 1
Delivery date and shipping instructions	

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

Information	Reference
Certification	Paragraph 13.1 and SR15
Heat treatment	Paragraph 5.2
Heat and supplementary analyses—Groups 1–3	Paragraphs 9.2.1, 9.2.2, and 9.2.2.3
Casing jointers	Paragraph 7.6
Drifting requirements	Paragraph 7.9
Casing with couplings detached	Paragraph 7.14
Coupling makeup (other than power-tight)	Paragraph 7.14
Pipe coatings	Section 11
Seal-ring couplings	Paragraph 8.10 and SR13.1 of Appendix B
Coupling blanks	Paragraph 8.1.4 and SR9 of Appendix B
Statistical impact testing—Grade Q125	Paragraph 6.2.3.6 and SR12 of Appendix B
Inspection by purchaser (see Note 2)	Appendix C
Monogram marking (see Note 3)	Appendix D

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

Information	Reference
Hydrostatic pressure test for handling-tight makeup, connectors, and Group 4 pup joints	Paragraph 9.4
Alternative hydrostatic test pressures	Paragraph 9.4
Thread and storage compound	Paragraph 7.14
Thread protectors	Paragraph 11.2
Marking requirements	Paragraph 10.1 and Appendix D
Nondestructive inspection	Paragraph 9.7 and SR1, SR2, and SR14 of Appendix B
Cold rotary straightening—Grade Q125	Paragraph 5.3.3
Reduced section tensile specimens—Grade Q125	Paragraph 9.3.3.1.3
Alternate F factor in SR12—Grade Q125	Paragraph SR12.2 of Appendix B
Coupling blanks—Grade Q125	SR9 of Appendix B
Upset casing—Grade Q125	SR10 of Appendix B
Plain-end casing hydrostatic testing—Grade Q-125	Paragraph 9.4.2.1.3
Electric welded casing—Groups 3 and 4	SR11 of Appendix B
Coupling inspection	SR14 of Appendix B
Supplementary	
Coupling thread plating—Grade Q125	Paragraph 8.16
Sulfide stress cracking test—Grades C90 and T95	Paragraph 6.2.12
Additional hardness testing—Grades C90 and T95	Paragraph 9.3.2.3.2.2

4.2 TUBING

4.2.1 In placing orders for pipe to be manufactured in accordance with API Specification 5CT, the purchaser should specify the following on the purchase order:

Information	Reference
Specification	API Spec 5CT
Quantity	
Type of pipe or couplings:	
Tubing:	
Nonupset, external-upset, or integral joint	Table A-3
Threaded, plain end, or special end	Paragraph 7.13.3
With or without couplings	Paragraph 7.13.3
Special-bevel couplings	Paragraph 8.11 and Tables 33, 34 and A-3
Special-clearance couplings	Paragraph 8.7 and Tables 32, 34, and A-3
Size designation or outside diameter	Table A-3
Weight designation or wall thickness	Table A-3
Grade and type where applicable (see Note 1)	Tables 3 and A-3
Range length	Paragraph 7.5 and Table 26
Seamless or electric welded (see Note 1)	Paragraph 5.1 and Table 1
Delivery date and shipping instructions	

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

Requirement	Reference
Certification	Paragraph 13.1 and SR 15
Heat treatment	Paragraph 5.2
Heat and supplementary analyses—Groups 1–3	Paragraphs 9.2.1, 9.2.2, and 9.2.2.3
Upset length—standard or extended	Paragraph 7.11
Rounded nose	Paragraph 7.13.4
Coupling makeup (other than power-tight)	Paragraph 7.14
Pipe coatings	Section 11
Seal-ring couplings	Paragraph 8.10 and SR13 of Appendix B
Tubing with couplings detached	Paragraph 7.14
Inspection by purchaser (see Note 2)	Appendix C
Monogram marking (see Note 3)	Appendix D

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

Requirement	Reference
Hydrostatic pressure test for handling-tight makeup and pup joints	Paragraph 9.4.2
Alternative hydrostatic test pressures	Paragraph 9.4.2, and Tables 36, 37, 45, 46, 47, 48 and 53
Thread compound	Paragraph 7.14
Thread protectors	Paragraph 11.2
Marking requirements	Paragraph 10.1 and Appendix D
Nondestructive inspection	Paragraph 9.7 and SR1, SR2, and SR14 of Appendix B
Supplementary	
Sulfide stress cracking test—Grades C90 and T95	Paragraph 6.2.12
Additional hardness testing—Grades C90 and T95	Paragraph 9.3.2.3.2.2

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 selecting materials and processes, the purchaser must be guided by his experience and the service for which the pipe is intended.
2. A mutual understanding of the specification and inspection requirements should exist when a purchase order is accepted by the manufacturer.
3. 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 D. No other use of the monogram is permitted. Licensees may mark products in conformance with Appendix D or Section 10, and nonlicensees may mark products in conformance with Section 10.

5 Process of Manufacture

5.1 GENERAL

5.1.1 The various grades and groups of pipe furnished to this specification shall be made to a fine grain practice. Steel made to a fine grain practice contains one or more grain refining elements, such as aluminum, columbium, vanadium, or titanium in amounts intended to result in the steel having a fine austenitic grain size.

5.1.2 Pipe furnished to this specification shall be made by the seamless (S) or electric weld (EW) process as shown in Table 1 and as specified on the purchase order. Pup joints and connectors may be made from standard casing or tubing or by machining heavy wall casing, tubing, or bar stock. Couplings shall be manufactured by one of the processes listed in 8.2. Cold drawn tubular products without appropriate heat treatment are not acceptable.

5.1.3 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.

5.1.4 Electric welded pipe is defined as pipe having one longitudinal seam formed by electric-resistance or electric-induction welding, without the addition of filler metal, wherein the edges to be welded are mechanically pressed together and the heat for welding is generated by the resistance to flow of electric current. The weld seam of electric welded pipe shall be heat treated after welding to a minimum temperature of 1000°F or processed in such a manner that no untempered martensite remains.

5.2 HEAT TREATMENT

5.2.1 General

Pipe shall be heat treated in accordance with a documented procedure as stipulated in Table 1 for the particular grade and type specified on the purchase order. Heat treated upset pipe shall be heat treated full length after upsetting. Pipe and coupling stock requiring heat treatment shall be heat treated the full length. Individually heat treated coupling blanks are acceptable. All pipe processed through a hot stretch mill (such as stretch reduced) shall be considered normalized, provided the exit temperature is above the upper critical temperature [Ar_3 (see note)] for the steel being processed and the pipe is air cooled.

Note: Ar_3 refers to the critical temperature for the austenite to ferrite transformation on cooling.

5.2.2 Group 1

Grade N pipe and coupling stock shall be normalized, or at the manufacturer's option shall be normalized and tempered or quenched and tempered [including the interrupted quenching followed by controlled cooling method (see Notes 1 and 2)] full length. Grades J and K casing and Grade J tubing shall be heat treated if so specified on the purchase order.

Notes:
1. Interrupted quenching means the pipe being quenched is removed from the quenching medium while the pipe is at a temperature substantially higher than that of the quenching medium.
2. Controlled cooling is cooling from an elevated temperature in a predetermined manner to avoid hardening, cracking, or internal damage or to produce a desired microstructure or mechanical properties.

5.2.3 Group 2

When requested by the purchaser, the manufacturer shall produce evidence to show that the tempering practice will result in the pipe attaining the minimum tempering temperature.

Table 1—Process of Manufacture and Heat Treatment

Group	Grade	Type	Process of Manufacture	Heat Treatment	Tempering Temperature, Minimum °F
1	H40	—	S or EW	None	—
	J55	—	S or EW	None–See note	—
	K55	—	S or EW	None See note	—
	N80		S or EW	See note	—
2	M65		S or EW	See note[c]	
	L80	1	S or EW	Q&T	1050
	L80	9 Cr	S	Q&T[a]	1100
	L80	13 Cr	S	Q&T[a]	1100
	C90	1	S	Q&T	1150
	C90	2	S	Q&T	1150
	C95	—	S or EW	Q&T	1000
	T95	1	S	Q&T	1200
	T95	2	S	Q&T	1200
3	P110	—	S or EW[b]	Q&T	—
4	Q125	1	S or EW[b]	Q&T	—
	Q125	2	S or EW[b]	Q&T	—
	Q125	3	S or EW[b]	Q&T	—
	Q125	4	S or EW[b]	Q&T	—

Note: Full length normalized, normalized and tempered (N&T), or quenched and tempered (Q&T) at the manufacturer's option or if so specified on the purchase order.
[a]Types 9Cr and 13Cr may be air quenched.
[b]Special requirements unique to electric welded (EW) P110 and Q125 are specified in SR11. When EW P110 or Q125 casing is furnished, the provisions of SR11 are automatically in effect.
[c]All pipe shall be full body heat treated. The selection of normalized, normalized and temper, or quench and temper heat treatment is at the manufacturer's option or shall be specified in the order.

Table 59—Marking Requirements and Sequence

Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
1. Manufacturer's name or mark	____	D,P	D,P	P	P
2. Specification marking	"5CT"	D,P	D,P	P	P
Compatible Standards	____	As Specified	As Specified	As Specified	As Specified
3. Unthreaded pipe or end finish not detailed herein, if applicable (place symbol after specification marking)	"UF"	D,P		P	
4. Size Designation (fill-in size designation from column 1 of Tables 20–25):	____	P		P	
5. Weight Designation (fill-in weight designation from Tables 20–25)					
Casing and Tubing		D,P		P	
Liner		D,P			
6. Grade of Pipe					
H40	"H"				
J55	"J"				
K55	"K"				
M65	"M"				
N80	"N"				
L80 Type 1	"L"				
L80 Type 9CR	"L9"				
L80 Type 13CR	"L13"				
C90 Type 1	"C90-1"				
C90 Type 2	"C90-2"				
T-95 Type 1	"T1"				
T-95 Type 2	"T2"				
C-95	"C95"				
P-110	"P"				
Q-125 Type 1	"Q1"				
Q-125 Type 2	"Q2"				
Q-125 Type 3	"Q3"				
Q-125 Type 4	"Q4				
All grade designations		D,P	D,P	P	P
7. Reduced alternate impact test temperature, if applicable:					
Couplings and female connectors (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F		P		P
Group 4 pipe (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F			P	
8. Heat treatment, if applicable:					
J-55, K-55, or M65 Normalized	"Z"	P	P		
J-55, K-55, M65 or N-80 Quenched & Tempered	"Q"	P	P		

Table 59—Marking Requirements and Sequence (Continued)

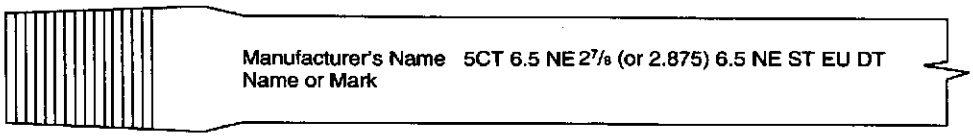
Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
9. Process of manufacture:					
Seamless	"S"				
Electric-Welded	"E"				
All size designations		D,P		P	
10. Supplemental requirements, if applicable					
SR 1	"S1"	P		P	
SR 2	"S2"	P		P	
SR 9 (fill-in type)	"S9 Q ____"				P
SR 13	"S13"		D,P		P
SR 14	"S14"		P		
SR 16 (fill-in minimum full size energy absorption requirement in ft-lbs and test temperature including ± symbol and °F)	"S16 ____ F"	P		P	
11. Hydrostatic Test Pressure					
1. Standard Test Pressure	"ST"				
2. Alternate Test Pressure	"AT"				
3. Agreed on pressure greater than standard test pressure	"HP" ____				
4. Test pressure is 3000 psi and the standard test pressure is greater than 3000 psi	"3K"				
For all designations		P		P	
12. Type of casing thread, if applicable:					
Casing buttress, extreme-line or round threads (fill-in type of thread from Table 62)	____	P		P	
13. Size of drift test:					
Standard Casing	"D"				
Standard Tubing	"DT"				
Alternate Casing	"Dxx"				
Alternate Tubing (where xx is the size of the alternate drift)	"Dtxx"				
For casing specified (per Table 28) for tubing service	"DT 42"				
For all drift[3] conditions		P			P
14. Serialization of Grades C-90, T-95 and Q-125				D[3],P	D[3],P
15. Tin plating of couplings, if applicable	"T"		P		P

Notes:
1. D is for optional (die) stamping; P is a requirement for (paint) stenciling. Optional marking is permitted as specified in 10.1 and 10.2.
2. A blank space, ____, indicates information to be filled-in.
3. Conform to requirements of 10.2.5.

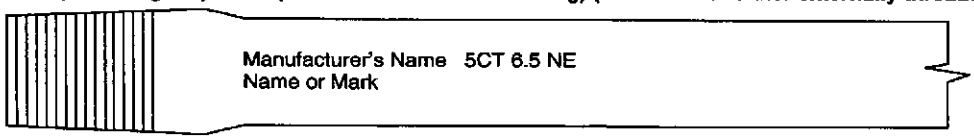
Example 1 — Tubing

Tubing: size 2⅞, weight 6.5, Grade N80, normalized, electric weld, external upset, threaded pin-by-pin without couplings.

Stencil Marking (at least 2 feet from either externally threaded end)



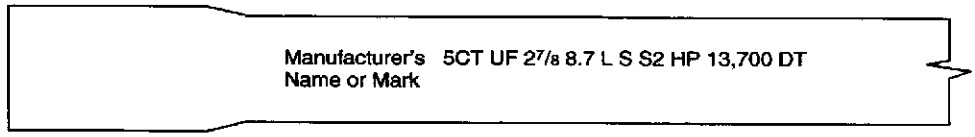
Stamp Marking—Optional (in addition to stencil marking) (within 12" of either externally threaded end)



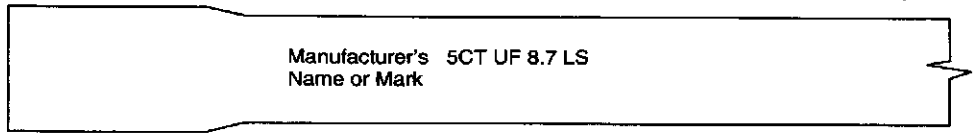
Example 2 — Tubing

Tubing: size 2⅞, weight 8.7, Grade L80, Type 1, seamless, external upset, for special end finish plain end. Additional requirements include hydrostatic testing to 13,700 psi and inspection to SR2.

Stencil Marking (at least 2 feet from either end)



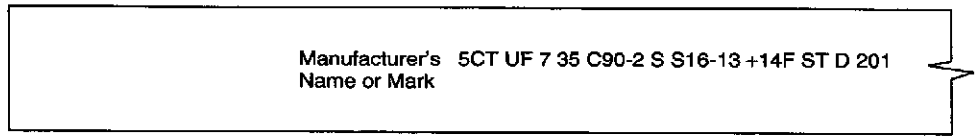
Stamp Marking—Optional (in addition to stencil marking) (within 12" from either end)



Example 3 — Casing

Casing: size 7, weight 35, Grade C90, Type 2, seamless, plain end, serial number 201. Supplementary Requirement 16 (SR16) for test at +14°F.

Stencil Marking (at least 12" from either end)



Stamp Marking—Optional (in addition to stencil marking) (within 12" from either end)

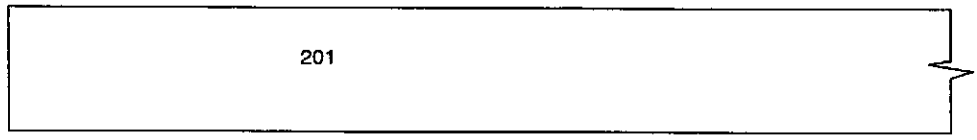
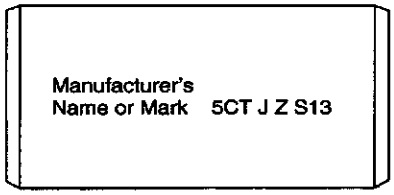


Figure 16—Examples of Marking Requirements and Sequence

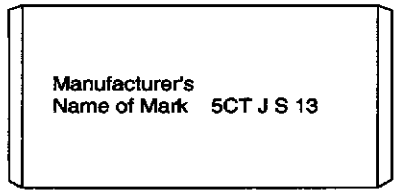
Example 4 — Coupling

Tubing coupling for size 2⅞, Grade J55, normalized upset (or nonupset) tubing, to supplementary requirement SR13.

Stencil Marking



Stamp Marking—Optional (in addition to stencil marking)



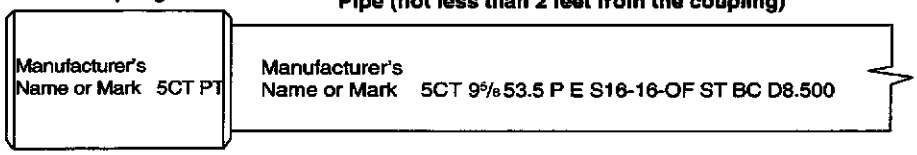
Note: Marking in center of coupling may be stamped in either the longitudinal or transverse direction.

Example 5 — Casing With Couplings

Buttress casing: size 9⅝, weight 53.5, Grade P110, electric weld; supplementary requirements are SR16 for test at 0°F and 8.500 inch drift test. Coupling is tin plated.

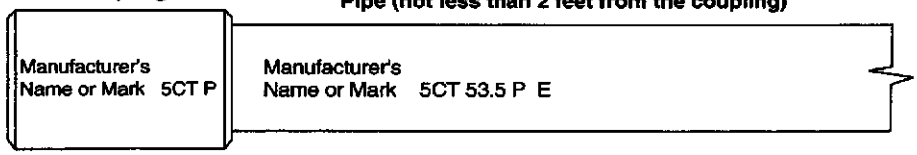
Stencil Marking

Coupling **Pipe (not less than 2 feet from the coupling)**



Stamp Marking—Optional (in addition to stencil marking)

Coupling **Pipe (not less than 2 feet from the coupling)**



Marking in the center of the coupling may be in either the longitudinal or transverse direction.

Example 6 — Threader

Casing: size 7, weight 29, grade C95 long round thread, pipe manufacturer previously hydrostatically tested to 3000 psi and included 3K in marking.

Stencil Marking (adjacent to the threads)

Figure 16—Examples of Marking Requirements and Sequence (Continued)

APPENDIX D—MARKING INSTRUCTIONS FOR API LICENSEES (NORMATIVE)

D.1 General

D.1.1 Products manufactured in conformance with this specification may be marked by the API licensee as specified in Section 10 or as specified herein. Products to which the monogram is applied shall be marked per this appendix.

D.1.2 For all manufacturers, except threaders, the marking instructions in this appendix, except those in D.6 are applicable. For threaders, the marking instructions in D.5, D.6 and Table D-1 are applicable. Processors shall remove any identity which is not indicative of the new condition of the product as a result of heat treating (for example, prior grade identity, original pipe manufacturer's name or logo).

D.1.3 Products shall be color coded as specified in D.4.

D.1.4 Products shall be marked by stenciling, or a combination of stenciling and stamping, at the option of the manufacturer, as stipulated with two exceptions:

a. By agreement between the purchaser and manufacturer, stamping can be required, in which case a combination of stamping and stencil markings shall be used.

b. At the option of the manufacturer, hot-rolled or hot-stamped markings on pipe and couplings may be substituted for die-stamped markings and are permitted at intervals along the length.

D.1.5 Requirements for optional stamp marking are specified in D.2 and stencil markings are specified in D.3. Marking instructions and sequence of markings are specified in Table D-1, which includes only those items that are stamped or stencilled for product identification. Examples of recommended markings are shown in Figure D-1. Markings shall not overlap and shall be applied in such a manner as not to injure the pipe.

D.1.6 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.

D.1.7 The complete monogram consists of the following: "5CT", license number of the plant doing the manufacturing, the API monogram and the date of manufacture. The date of manufacture is defined as a minimum of a two digit number representing the last digit of the year and the calendar quarter the monogram is applied.

D.1.8 In a circumstance where it is necessary to remark pipe with the original marking information, the accuracy and traceability of the transferred markings shall be the responsibility of the entity remarking the pipe. The transferred markings shall include the words "transferred by."

D.2 Optional Stamp Marking Requirements

D.2.1 METHODS

Methods of stamp marking are as follows:

Number	Method
1.	Hot-rolled or hot-stamped markings.
2.	Cold die stamping with standard dies.
3.	Cold die stamping with interrupted dot face dies.
4.	Cold die stamping with rounded face dies.
5.	Vibratory method.

After stamp marking, Group 2 and 4 products may require subsequent heat treatment as specified in D.25. Such heat treatment shall be in accordance with 5.2. Sequence of stamp markings shall be as shown in Table D-1.

D.2.2 SIZE

Sizes of stamp markings shall be as shown in Table D-2.

D.2.3 LOCATION

Placement of these markings on casing, liners and tubing sizes 1.660 and larger shall be on the outside surface of each length within 12 inches from the coupling or box, either end of plain-end pipe or either end of pin-by-pin threaded pipe. The optional stamp marking on sizes smaller than 1.660 may be either on a metal tag affixed to each length, or for bundled tubing, stamped on a metal tag affixed to each bundle.

D.2.4 GROUP 1 AND 3

When specified on the purchase order, products shall be stamped by either one or more of the methods in D.2.1 at the option of the manufacturer.

D.2.5 GROUP 2 AND 4

When specified on the purchase order, products may be stamped by one or more of the methods in D.2.1 at the option of the manufacturer.

Group 2 (except Grades C-90 and T-95) products shall be heat treated subsequent to use of method 2.

Group 2 (C-90 and T-95 only) and Group 4 products shall be heat treated subsequent to the use of methods 2 and 4, with the following exceptions:

a. The make-up triangle mark.

b. When the stamp markings are removed to a depth not less than twice the depth of the stamping by grinding, machining, threading or by cropping.

c. When not removing the stamping is by agreement between the purchaser and the manufacturer.

Table D-1—Marking Requirements and Sequence

Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
1. Licensed manufacturer's name or mark (optional; neither is required)	____	D,P	D,P	P	P
2. Monogram marking:					
Mark "5CT" and manufacturer's	"5CT"				
API license number	____	D,P	D,P	P	P
API Monogram and date of manufacture as in D.1.7	____	D,P	D,P	P	P
Compatible Standards	____	As Specified	As Specified	As Specified	As Specified
3. Unthreaded pipe or end finish not detailed herein, if applicable	"UF"	D,P		P	
4. Size Designation (fill-in size designation from column 1 of Tables 20–25):	____	P		P	
5. Weight Designation (fill-in weight designation from Tables 20–25)					
Casing and Tubing		D,P		P	
Liner		D,P		P	
6. Grade of Pipe					
H40	"H"				
J55	"J"				
K55	"K"				
M65	"M"				
N80	"N"				
L80 Type 1	"L"				
L80 Type 9CR	"L9"				
L80 Type 13CR	"L13"				
C90 Type 1	"C90-1"				
C90 Type 2	"C90-2"				
T-95 Type 1	"T1"				
T-95 Type 2	"T2"				
C-95	"C95"				
P-110	"P"				
Q-125 Type 1	"Q1"				
Q-125 Type 2	"Q2"				
Q-125 Type 3	"Q3"				
Q-125 Type 4	"Q4				
All grade designations		D,P	D,P	P	P
7. Reduced alternate impact test temperature, if applicable:					
Couplings and female connectors (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F		P		P
Group 4 pipe (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F			P	

Table D-1—Marking Requirements and Sequence (Continued)

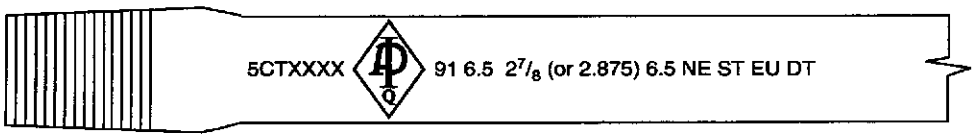
Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
8. Heat treatment, if applicable:					
J-55, K-55 or M65 Normalized	"Z"	P	P		
J-55, K-55, M65 or N-80 Quenched & Tempered	"Q"	P	P		
9. Process of manufacture:					
Seamless	"S"				
Electric-Welded	"E"				
All designations		D,P		P	
10. Supplemental requirements, if applicable					
SR 1	"S1"	P		P	
SR 2	"S2"	P		P	
SR 9 (fill in type)	"S9 Q ____"				P
SR 13	"S13"		D,P		P
SR 14	"S14"		P		
SR 16 (fill-in minimum full size absorption requirement in ft-lbs and test temperature including ± symbol and °F)	"S16 ____ F"	P		P	
11. Hydrostatic Test Pressure					
1. Standard Test Pressure	"ST"				
2. Alternate Test Pressure	"AT"				
3. Agreed on pressure greater than standard test pressure	"HP" ____				
4. Test pressure is 3000 psi and the standard test pressure is greater than 3000 psi	"3K"				
For all designations		P		P	
12. Type of casing thread, if applicable:					
Casing buttress, extreme-line or round threads (fill-in type of thread from Table D-4)	____	P		P	
13. Size of drift test:					
Standard Casing	"D"				
Standard Tubing	"DT"				
Alternate Casing	"Dxx"				
Alternate Tubing (where xx is the size of the alternate drift)	"Dtxx"				
For casing specified (per Table 28) for tubing service	"DT 42"	"			
For all designations		P		P	
14. Serialization of Grades C-90, T-95 and Q-125				D[3],P	D[3],P
15. Tin plating of couplings, if applicable	"T"		P		P

Notes:
1. D is for optional (die) stamping; P is a requirement for (paint) stenciling. Optional marking is permitted as specified in 10.1 and 10.2.
2. A blank space, "____", indicates information to be filled in.
3. Conform to requirements of 10.2.5.

Example 1 — Tubing

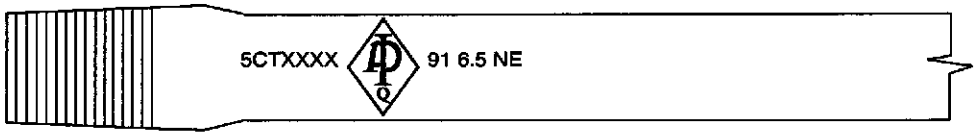
Tubing: size $2^{7}/_{8}$, weight 6.5, Grade N80, normalized, electric weld, external upset, threaded pin-by-pin without couplings; monogrammed in January 1999.

Stencil Marking (at least 2 feet from either externally threaded end)



Note: For Groups 1 and 3, the marking "5CT" and the license number shall be stamped or stenciled at the option of the manufacturer.

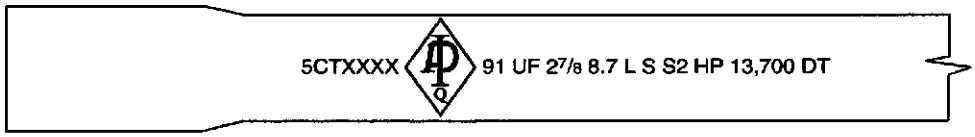
Stamp Marking (in addition to stencil marking) (within 12" of either externally threaded end)



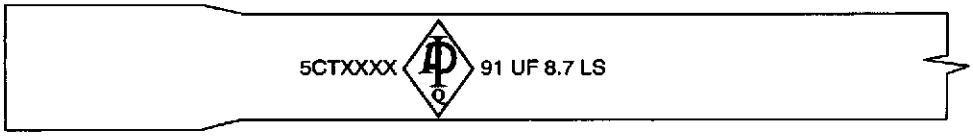
Example 2 — Tubing

Tubing: size $2^{7}/_{8}$, weight 8.7, Grade L80, Type 1, seamless, external upset for special end finish plain end. Additional requirements include hydrostatic testing to 13,700 psi and inspection to SR2; monogrammed in January 1999.

Stencil Marking (at least 2 feet from either end)



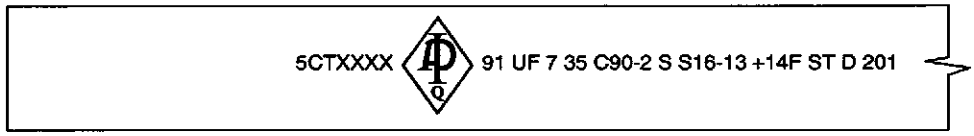
Stamp Marking Optional (in addition to stencil marking) (within 12" from either end)



Example 3 — Casing

Casing: size 7, weight 35, Grade C90, Type 2 seamless, plain end, serial number 201. Supplementary Requirement 16 (SR16) for test at +14°F; monogrammed in February 1999.

Stencil Marking (at least 2 feet from either end)



Stamp Marking Optional (in addition to stencil marking) (within 12" from either end)

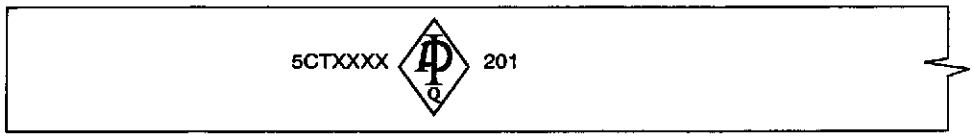
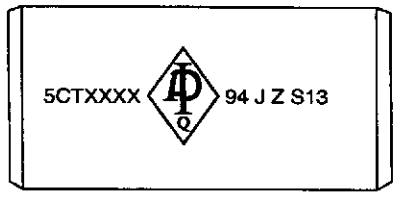


Figure D-1—Examples of Marking Requirements and Sequence

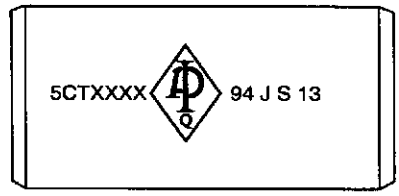
Example 4 — Coupling

Tubing coupling for size 2⁷/₈. Grade J55, normalized upset (or nonupset) tubing, to supplementary requirement SR13; monogrammed in November 1999.

Stencil Marking



Stamp Marking Optional (in addition to stencil marking)



Note: Marking in center of coupling may be stamped in either the longitudinal or transverse direction.

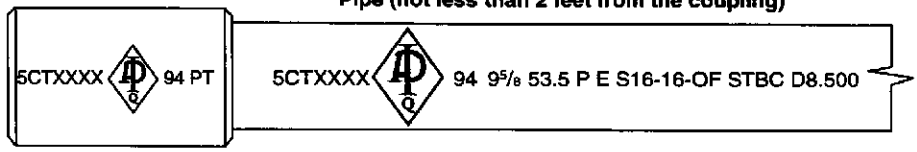
Example 5 — Casing With Couplings

Buttress casing: size 9⁵/₈, weight 53.5, Grade P110, electric weld; supplementary requirements are SR16 for test at 0°F and 8.500 inch drift test. Coupling is tim plated, monogrammed in December 1999.

Stencil Marking

Coupling

Pipe (not less than 2 feet from the coupling)

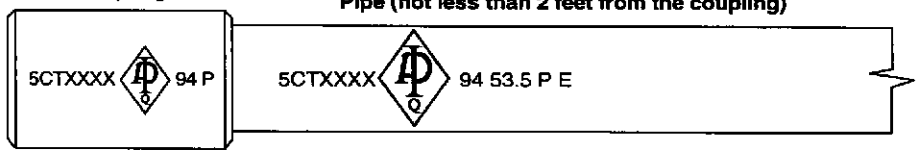


Note: Marking in the center of the coupling may be in either the longitudinal or transverse direction.

Stamp Marking Optional (in addition to stencil marking)

Coupling

Pipe (not less than 2 feet from the coupling)



Example 6 — Threader

Casing: size 7, weight 29, grade C95 long round thread, pipe manufacturer previously hydrostatically tested to 3000 psi and included 3K in marking, monogrammed in January 1999.

Stencil Marking (adjacent to the threads)

Figure D-1—Examples of Marking Requirements and Sequence (Continued)

D.2.6 MAKE-UP TRIANGLE MARK

For buttress casing in all sizes and grades and round thread casing in sizes 16 and larger in grades H, J, K, and M the make-up triangle shall be stamped on the outside of each length on both ends. Unless otherwise specified on the purchase order, the triangle mark may be replaced with a transverse white paint band $^3/_8$-inch-wide by 3-inches-long. To assist in locating the triangle or transverse white paint band on buttress casing, a 1-inch-wide by 24-inches-long longitudinal white paint stripe shall be placed adjacent to the triangle or transverse paint band on the field end; additionally, a 1-inch-wide by 4-inches-long longitudinal white paint stripe shall be placed adjacent to the triangle or transverse paint band on the mill end.

For Groups 1 and 3, the triangle shall be stamped by methods 2 or 4 only.

For Group 2, Grades C90 and T95 only, the triangle shall be stamped by method 3 only.

For Group 4 and Group 2 (except Grades C-90 and T-95), the triangle shall be stamped by methods 3 or 4 only.

D.3 Stencil Marking Requirements

Stenciled markings shall be placed on the outside surface of each length of pipe starting not less than 2 feet from the coupling or box or from either end of plain-end pipe or either end of pin by pin threaded pipe. For connectors and pup joints less than 6 feet in length, the required stencil markings may be placed on a decal attached to the outside surface within 12 inches of the end. These markings shall be separated by a dash or shall be adequately spaced.

Sequence of stencil markings shall be as shown in Table D-1, except the thread marking shall be at a location convenient to the manufacturer.

D.4 Color Code Identification

D.4.1 METHOD

Each product shall be color coded unless otherwise specified on the purchase order. Such color coding shall be by one or more of the following methods:

a. For pipe and pup joints 6 feet or longer use one or more of the following methods:

1. Paint band encircling the pipe at a distance not greater than 2 ft. from the coupling or box or either end of plain end or pin by pin threaded pipe.
2. Paint the entire outside surface of the coupling including the appropriate coupling color bands.

b. If the pipe is furnished with special clearance couplings or if the pipe and couplings are of a different grade (except Grades H-40, J-55 and K-55 couplings applied as allowed in B.1.1), paint both the pipe and couplings as specified in subitems 1 and 2 above.

c. For loose couplings paint the entire outside surface of the coupling including the appropriate color bands.

d. For pup joints and connectors shorter than 6 feet in length, paint the entire outside surface, except the threads, including the appropriate color bands.

e. Special clearance couplings shall be painted the colors indicative of the steel grade from which the couplings are manufactured and shall also be painted with a black band around the center.

D.4.2 GRADE COLOR CODES

The colors and number of bands for each grade shall be as shown in Table D-3.

D.5 Thread Marking—All Groups

For manufacturers, thread identification shall be stenciled on casing with round, buttress or extreme-line threads as shown in Table D-4.

For threaders, thread identification is required on casing and tubing as shown in Table D-4.

D.6 Pipe Threader Marking Requirements—All Groups

Pipe threaded by an API-licensed threader other than the original pipe manufacturer shall be identified consistent with D-1 and D-3 adjacent to the threads with the threader's name or mark, the API monogram, and size and type of thread as listed in D-5.

The threader shall mark on the body of the pipe the hydrostatic test pressure, if higher than the standard test pressure. The markings applied to the body of the pipe by the original pipe manufacturer shall not be removed or altered.

Use of the letters "API" to identify or certify that threads on tubular goods comply with API Standard 5B is not permitted.

Additional copies available from API Publications and Distribution:
(202) 682-8375

Information about API Publications, Programs and Services
is available on the World Wide Web at: http://www.api.org

American
Petroleum
Institute

1220 L Street, Northwest
Washington, D.C. 20005-4070
202-682-8000

Order No. G05CTE

Specification for Casing and Tubing (U.S. Customary Units)

API SPECIFICATION 5CT
SIXTH EDITION, OCTOBER 1998

EFFECTIVE DATE: APRIL 15, 1999

American Petroleum Institute

Helping You Get The Job Done Right.℠

Specification for Casing and Tubing (U.S. Customary Units)

Exploration and Production Department

API SPECIFICATION 5CT
SIXTH EDITION, OCTOBER 1998

EFFECTIVE DATE: APRIL 15, 1999

American Petroleum Institute

Helping You Get The Job Done Right.℠

SPECIAL NOTES

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

API is not undertaking to meet the duties of employers, manufacturers, or suppliers to warn and properly train and equip their employees, and others exposed, concerning health and safety risks and precautions, nor undertaking their obligations under local, state, or federal laws.

Information concerning safety and health risks and proper precautions with respect to particular materials and conditions should be obtained from the employer, the manufacturer or supplier of that material, or the material safety data sheet.

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. Sometimes a one-time extension of up to two years will be added to this review cycle. This publication will no longer be in effect five years after its publication date as an operative API standard or, where an extension has been granted, upon republication. Status of the publication can be ascertained from the API Exploration and Production Department [telephone (202) 682-8000]. A catalog of API publications and materials is published annually and updated quarterly by API, 1220 L Street, N.W., Washington, D.C. 20005.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this standard or comments and questions concerning the procedures under which this standard was developed should be directed in writing to the director of the Exploration and Production Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

API standards are published to facilitate the broad availability of proven, sound engineering and operating practices. These standards are not intended to obviate the need for applying sound engineering judgment regarding when and where these standards should be utilized. The formulation and publication of API standards is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

FOREWORD

This specification covers steel casing, tubing, and liners for the four groups listed in Section 1, as well as pup joints, connectors, couplings, and thread protection. Supplementary requirements are included as Appendix B.

This specification contains requirements for buttress and extreme-line casing. Acknowledgment is hereby given to the United States Steel Corporation for dedicating to the public all patents covering buttress casing and to the Armco Division, Armco Steel Corporation for dedicating to the public all patents covering extreme-line casing.

API Specification 5CT is under the jurisdiction of the API Committee on Standardization of Tubular Goods and includes changes to the previous edition approved by letter ballot through June 1997.

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.

Suggested revisions are invited and should be submitted to the director of the Exploration and Production Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

CONTENTS

Page

Page

Tables

Page

Page

Specification for Casing and Tubing (U.S. Customary Units)

1 Scope

1.1 This specification covers steel casing, tubing, and liners in the designations and wall thicknesses applicable to the following four groups and shown in Tables A-1, A-2, and A-3 of Appendix A. This specification also covers pup joints, connectors, couplings, and thread protection. Supplementary requirements are specified in Appendix B.

a. Group 1—All casing and tubing in Grades H, J, K, M, and N listed in Tables A-1, A-2, and A-3.

b. Group 2—All restricted yield strength casing and tubing grades C, L, and T listed in Tables A-1 and A-3 and other outside diameters and/or wall thicknesses of Grades C90 and T95 as agreed upon between the purchaser and the manufacturer.

c. Group 3—All high strength casing and tubing in Grade P listed in Tables A-1 and A-3.

d. Group 4—All special service casing in Grade Q that is listed in Table A-1 or other outside diameters and/or wall thicknesses as specified on the purchase order.

All requirements given herein for casing and tubing shall apply to pup joints and connectors, except as otherwise specified.

In developing an order for products made to this specification, the user should refer to Section 4 to properly define specific requirements.

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.

1.3 In the dimensional tables herein, pipe is designated by outside diameter size. The outside diameter size of external-upset pipe is the outside diameter of the body of the pipe, not the upset portion.

1.4 Metric conversions of U.S. customary units are provided in the metric version of this specification.

2 References

2.1 This specification includes by reference, either in total or in part, the latest editions of the following API, industry, and government standards, unless a specific edition is listed:

API

Bull 5A2	*Bulletin on Thread Compounds*
Bull 5C2	*Bulletin on Performance Properties of Casing, Tubing and Drill Pipe*
Bull 5C3	*Bulletin on Formulas and Calculations for Casing, Tubing, Drill Pipe and Line Pipe Properties*
Std 5B	*Specification for Threading, Gauging, and Thread Inspection of Casing, Tubing and Line Pipe Threads*

ASNT[1]

SNT-TC-1A	*Personnel Qualifications and Certification in Nondestructive Testing (1984 ed.)*

ASTM[2]

A 370	*Mechanical Testing of Steel Products, Annex II—Steel Tubular Products*
A 751	*Methods, Practices and Definitions for Chemical Analysis of Steel Products*
E 4	*Practices for Load Verification of Testing Machines*
E 10	*Standard Method of Test for Brinell Hardness of Metallic Materials*
E 18	*Standard Methods of Tests for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials*
E 23	*Methods for Notched Bar Impact Testing of Metallic Materials*
E 44	*Definitions of Terms Relating to Heat Treatment of Metals*
E 83	*Method of Verification and Classification of Extensometers*
E 112	*Methods for Determining Average Grain Size*
E 165	*Standard Practice for Liquid Penetrant Inspection Method*
E 213	*Standard Practice for Ultrasonic Examination of Metal Pipe and Tubing*
E 273	*Standard Practice for Ultrasonic Examination of Longitudinal Welded Pipe and Tubing*
E 309	*Standard Practice for Eddy-Current Examination of Steel Tubular Products Using Magnetic Saturation*
E 570	*Standard Practice for Flux Leakage Examination of Ferro-magnetic Steel Tubular Products*
E 709	*Standard Practice for Magnetic Particle Examination*

[1]American Society for Nondestructive Testing, Inc., 1711 Arlington Lane, P.O. Box 28518, Columbus, Ohio 43228-0518.
[2]American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428-2959.

NACE International[3]

TM-01-77 *Laboratory Testing of Metals for Resistance to Sulfide Stress Cracking in H_2S Environments*

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.

3 Definitions

For the purposes of this specification, the following definitions apply:

3.1 carload: The quantity of pipe loaded on a railway car for shipment from the pipe-making facility.

3.2 casing: A pipe run from the surface and intended to line the walls of a drilled well.

3.3 connection: Threaded assembly of tubular components.

3.4 connector: A one-piece tubular section, not including pipe or couplings, used for the purpose of joining or changing from one size, mass, or type of thread connection to the same or another size, mass, or type of threaded connection.

3.5 coupling: An internally threaded cylinder for joining two lengths of threaded pipe.

3.6 coupling blank: Material used to produce an individual coupling. Coupling blanks may be obtained from coupling stock, forgings, or centrifugal castings.

3.7 coupling stock: Tubular used for the manufacture of coupling blanks.

3.8 defect: An imperfection of sufficient magnitude to warrant rejection of the product based on the stipulations of this specification.

3.9 heat: The metal produced by a single cycle of a batch melting process.

3.10 heat analysis: The chemical analysis representative of a heat as reported by the metal producer.

3.11 inspection: The process of measuring, examining, testing, gauging, or otherwise comparing the unit of product with the applicable requirements.

[3]NACE International (formerly the National Association of Corrosion Engineers), 1440 South Creek Drive, P.O. Box 218340, Houston, TX 77218-8340.

3.12 inspection lot: A definite quantity of product manufactured under conditions that are considered uniform for the attribute to be inspected.

3.13 inspection lot sample: One or more units of product selected from an inspection lot to represent that inspection lot.

3.14 inspection lot size: The number of units of product in an inspection lot.

3.15 imperfection: A discontinuity or irregularity in the product detected by methods outlined in this specification.

3.16 linear imperfections: Linear imperfections include, but are not limited to, seams, laps, cracks, plug scores, cuts, and gouges.

3.17 manufacturer: A firm, company, or corporation responsible for marking the product to warrant that it conforms to this specification. The manufacturer may be, as applicable, a pipe mill or processor; a maker of couplings, pup joints or connectors; or a threader. The manufacturer is responsible for compliance with all of the applicable provisions of this specification.

3.18 may: Used as a verb to indicate that a provision is optional.

3.19 pipe: Casing, tubing, plain-end casing liners, and pup joints as a group.

3.20 pipe mill: A firm, company, or corporation that operates pipe making facilities.

3.21 plain-end casing liner: Casing provided unthreaded with a wall thickness often greater than that specified for J55.

3.22 processor: A firm, company, or corporation that operates facilities capable of heat treating pipe made by a pipe mill.

3.23 product: Pipe, coupling, connector, coupling stock, and coupling blank, either individually or collectively as applicable.

3.24 pup-joint: A length of casing, tubing, or plain-end casing liner shorter than Range 1.

3.25 shall: Used to indicate that a provision is mandatory.

3.26 should: Used to indicate that a provision is not mandatory but is recommended as good practice.

3.27 special processes: Final operations performed during pipe manufacturing that affect attribute compliance required in this document (except chemistry and dimensions). The applicable special processes are as follows:

Manufacturing Condition	Special Processes
a. Seamless	
1. As-rolled	Final reheating practice and hot sizing or stretch reducing nondestructive testing. If applicable, upsetting, and cold finishing.
2. Heat treated	Heat treatment nondestructive testing.
b. Electric weld	
1. As-rolled	Sizing and seam welding nondestructive testing. If applicable, seam heat treatment and upsetting.
2. Heat treated	Seam welding nondestructive testing and full body heat treatment.

3.28 thread protector: A cap or insert used to protect threads and seals during handling, transportation, and storage.

3.29 tubing: A pipe placed within a productive well to serve as an exhaust or delivery duct.

4 Information to be Supplied by the Purchaser

4.1 CASING

4.1.1 In placing orders for pipe to be manufactured in accordance with API Specification 5CT, the purchaser should specify the following information on the purchase order:

Information	Reference
Specification	API Spec 5CT
Quantity	
Type of pipe or couplings:	
Casing:	
Threaded or plain end	Paragraph 7.14
Round (short or long), buttress, or extreme-line threads	Paragraph 7.1 and Table A-1
With or without couplings	Paragraph 7.14
Liners	Paragraph 7.14 and Table A-2
Size designation or outside diameter	Tables A-1 and A-2
Weight designation or wall thickness	Tables A-1 and A-2
Grade and type where applicable (see Note 1)	Tables 3, A-1, and A-2
Range length	Paragraph 7.5 and Table 26
Seamless or electric welded (see Note 1)	Paragraph 5.1 and Table 1
Markings in metric units	Table 59 and Appendix D
Delivery date and shipping instructions	

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

Information	Reference
Certification	Paragraph 13.1
Heat treatment	Paragraph 5.2
Heat and supplementary analyses—Groups 1–3	Paragraphs 9.2.1, 9.2.2, and 9.2.2.3
Casing jointers	Paragraph 7.6
Drifting requirements	Paragraph 7.9
Casing with couplings detached	Paragraph 7.13.1
Coupling makeup (other than power-tight)	Paragraph 7.14
Pipe coatings	Section 11
Seal-ring couplings	Paragraph 8.10 and SR13.1 and SR13.2 of Appendix B
Coupling blanks	Paragraph 8.1.3 and SR9 of Appendix B
Statistical impact testing—Grade Q125	Paragraph 4.3 and SR12 of Appendix B
Inspection by purchaser (see Note 2)	Appendix C
Monogram marking (see Note 3)	Appendix D

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

Information	Reference
Hydrostatic pressure test for handling-tight makeup, connectors, and Group 4 pup joints	Paragraph 9.4
Alternative hydrostatic test pressures	Paragraph 9.4
Thread and storage compound	Paragraph 7.14
Thread protectors	Paragraph 11.2
Marking requirements	Paragraph 10.1 and Appendix D
Nondestructive inspection	Paragraph 9.7 and SR1, SR2, and SR14 of Appendix B
Cold rotary straightening—Grade Q125	Paragraph 5.3.3
Alternate chemical analysis procedures—Grade Q125	Paragraph 9.2
Reduced section tensile specimens—Grade Q125	Paragraph 9.3.3.1.3
Alternate F factor in SR12—Grade Q125	Paragraph SR12.2 of Appendix B
Coupling blanks—Grade Q125	SR9 of Appendix B
Upset casing—Grade Q125	SR10 of Appendix B
Plain-end casing hydrostatic testing—Grade Q-125	Paragraph 9.4.2.1.2
Electric welded casing—Groups 3 and 4	SR11 of Appendix B
Coupling inspection	SR14 of Appendix B
Supplementary	
Coupling thread plating—Grade Q125	Paragraph 8.16
Sulfide stress cracking test—Grades C90 and T95	Paragraph 6.2.12
Additional hardness testing—Grades C90 and T95	Paragraph 9.3.2.3.2.2

4.2 TUBING

4.2.1 In placing orders for pipe to be manufactured in accordance with API Specification 5CT, the purchaser should specify the following on the purchase order:

Information	Reference
Specification	API Spec 5CT
Quantity	
Type of pipe or couplings:	
Tubing:	
Nonupset, external-upset, or integral joint	Table A-3
Threaded, plain end, or special end	Paragraph 7.14
With or without couplings	Paragraph 7.14
Special-bevel couplings	Paragraph 8.8 and Tables 34 and A-3
Special-clearance couplings	Paragraph 8.5 and Tables 32, 34, and A-3
Size designation or outside diameter	Table A-3
Weight designation or wall thickness	Table A-3
Grade and type where applicable (see Note 1)	Tables 3 and A-3
Range length	Paragraph 7.5 and Table 26
Seamless or electric welded (see Note 1)	Paragraph 5.1 and Table 1
Markings in metric units	Table 59 and Appendix D
Delivery date and shipping instructions	

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

Requirement	Reference
Certification	Paragraph 13.1
Heat treatment	Paragraph 5.2
Heat and supplementary analyses—Groups 1–3	Paragraphs 9.2.1, 9.2.2, and 9.2.2.3
Upset length—standard or extended	Paragraph 7.11
Rounded nose	Paragraph 7.13.4
Coupling makeup (other than power-tight)	Paragraph 7.14
Pipe coatings	Section 11
Seal-ring couplings	Paragraph 8.10 and SR13.1 and SR13.2 of Appendix B
Tubing with couplings detached	Paragraph 7.13.3
Inspection by purchaser (see Note 2)	Appendix C
Monogram marking (see Note 3)	Appendix D

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

Requirement	Reference
Hydrostatic pressure test for handling-tight makeup and pup joints	Paragraph 9.4
Alternative hydrostatic test pressures	Paragraph 9.4
Thread compound	Paragraph 7.14
Thread protectors	Paragraph 11.2
Marking requirements	Paragraph 10.1 and Appendix D
Nondestructive inspection	Paragraph 9.7 and SR1, SR2, and SR14 of Appendix B
Supplementary	
Sulfide stress cracking test—Grades C90 and T95	Paragraph 6.2.12
Additional hardness testing—Grades C90 and T95	Paragraph 9.3.2.3.2.2

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 selecting materials and processes, the purchaser must be guided by his experience and the service for which the pipe is intended.
2. A mutual understanding of the specification and inspection requirements should exist when a purchase order is accepted by the manufacturer.
3. 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 D. No other use of the monogram is permitted. Licensees may mark products in conformance with Appendix D or Section 10, and nonlicensees may mark products in conformance with Section 10.

5 Process of Manufacture

5.1 GENERAL

5.1.1 The various grades and groups of pipe furnished to this specification shall be made to a fine grain practice. Steel made to a fine grain practice contains one or more grain refining elements, such as aluminum, columbium, vanadium, or titanium in amounts intended to result in the steel having a fine austenitic grain size.

5.1.2 Pipe furnished to this specification shall be made by the seamless (S) or electric weld (EW) process as shown in Table 1 and as specified on the purchase order. Pup joints and connectors may be made from standard casing or tubing or by machining heavy wall casing, tubing, or bar stock. Couplings shall be manufactured by one of the processes listed in 8.2. Cold drawn tubular products without appropriate heat treatment are not acceptable.

5.1.3 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.

5.1.4 Electric welded pipe is defined as pipe having one longitudinal seam formed by electric-resistance or electric-induction welding, without the addition of filler metal, wherein the edges to be welded are mechanically pressed together and the heat for welding is generated by the resistance to flow of electric current. The weld seam of electric welded pipe shall be heat treated after welding to a minimum temperature of 1000°F or processed in such a manner that no untempered martensite remains.

5.2 HEAT TREATMENT

5.2.1 General

Pipe shall be heat treated in accordance with a documented procedure as stipulated in Table 1 for the particular grade and type specified on the purchase order. Heat treated upset pipe shall be heat treated full length after upsetting. Pipe and coupling stock requiring heat treatment shall be heat treated the full length. Individually heat treated coupling blanks are acceptable. All pipe processed through a hot stretch mill (such as stretch reduced) shall be considered normalized, provided the exit temperature is above the upper critical temperature [Ar_3 (see note)] for the steel being processed and the pipe is air cooled.

Note: Ar_3 refers to the critical temperature for the austenite to ferrite transformation on cooling.

5.2.2 Group 1

Grade N pipe and coupling stock shall be normalized, or at the manufacturer's option shall be normalized and tempered or quenched and tempered [including the interrupted quenching followed by controlled cooling method (see Notes 1 and 2)] full length. Grades J and K casing and Grade J tubing shall be heat treated if so specified on the purchase order.

Notes:
1. Interrupted quenching means the pipe being quenched is removed from the quenching medium while the pipe is at a temperature substantially higher than that of the quenching medium.
2. Controlled cooling is cooling from an elevated temperature in a predetermined manner to avoid hardening, cracking, or internal damage or to produce a desired microstructure or mechanical properties.

5.2.3 Group 2

When requested by the purchaser, the manufacturer shall produce evidence to show that the tempering practice will result in the pipe attaining the minimum tempering temperature.

Table 1—Process of Manufacture and Heat Treatment

Group	Grade	Type	Process of Manufacture	Heat Treatment	Tempering Temperature, Minimum °F
1	H40	—	S or EW	None	—
	J55	—	S or EW	See note	—
	K55	—	S or EW	See note None	—
	N80		S or EW	See note See note	—
2	M65		S or EW	See note[c]	
	L80	1	S or EW	Q&T	1050
	L80	9 Cr	S	Q&T[a]	1100
	L80	13 Cr	S	Q&T[a]	1100
	C90	1	S	Q&T	1150
	C90	2	S	Q&T	1150
	C95	—	S or EW	Q&T	1000
	T95	1	S	Q&T	1200
	T95	2	S	Q&T	1200
3	P110	—	S or EW[b]	Q&T	—
4	Q125	1	S or EW[b]	Q&T	—
	Q125	2	S or EW[b]	Q&T	—
	Q125	3	S or EW[b]	Q&T	—
	Q125	4	S or EW[b]	Q&T	—

Note: Full length normalized, normalized and tempered (N&T), or quenched and tempered (Q&T) at the manufacturer's option or if so specified on the purchase order.

[a]Types 9Cr and 13Cr may be air quenched.

[b]Special requirements unique to electric welded (EW) P110 and Q125 are specified in SR11. When EW P110 or Q125 casing is furnished, the provisions of SR11 are automatically in effect.

[c]All pipe shall be full body heat treated. The selection of normalized, normalized and temper, or quench and temper heat treatment is at the manufacturer's option or shall be specified in the order.

5.2.4 Group 3 and Group 4

Pipe and couplings furnished to this specification shall be quenched and tempered.

5.3 STRAIGHTENING

5.3.1 Group 1 and Group 3

No specific methods are required.

5.3.2 Group 2

Grades M65 and L80 pipe shall not be subjected to cold working after the final tempering treatment, except for that which is incidental to normal straightening operations. Grades M65 and L80 pipe rotary straightened at temperatures less than 900°F shall not contain roll marks that exceed 23 HRC, however:

a. Roll marks that are not detectable by feel and have no measurable surface deformation are acceptable without further evaluation.
b. Roll marks that are not more severe than those previously evaluated and verified by the manufacturer in a documented procedure to not exceed 23 HRC are acceptable without further evaluation.
c. Pipe with more severe roll marks shall be either rejected or stress relieved at 900°F or higher.

5.3.3 Group 4

Gag press straightening or hot rotary straightening (750°F minimum at the end of rotary straightening unless otherwise specified on purchase order) is acceptable. If hot rotary straightening is not possible, the pipe may be cold rotary straightened provided it is then stress relieved at 950°F or higher. Pipe may be cold rotary straightened without subsequent stress relieving only when agreed to by the purchaser and manufacturer.

5.4 TRACEABILITY

5.4.1 General

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 has been shown.

5.4.2 Serialization of Group 2 (Grades C90 and T95) and Group 4

Serial numbers shall be marked on products as specified in 5.4.2.1–5.4.2.3. It is the responsibility of the manufacturer to maintain the identification of material until it is received by the purchaser.

5.4.2.1 Pipe—Group 2 (Grades C90 and T95 Only) and Group 4

Each length of pipe shall be uniquely numbered so that test data may be related to individual lengths.

5.4.2.2 Pipe—Group 4 Manufactured to SR12

In addition to the requirements in 5.4.2.1, when SR12 is specified the number shall identify the sequence in which the length was tempered to allow retest per SR12.3.

5.4.2.3 Coupling, Pup Joint, and Connector Material

Each tube length of coupling, pup joint, or connector material shall be uniquely numbered so that test data may be related to individual lengths. When couplings, couplings blanks, or pup joints and connector material are cut from material that is heat treated full length, the pieces shall be marked with the serial number of the full length piece. When coupling, pup joint, or connector material is heat treated in coupling blank or individual lengths, each heat treated lot shall be uniquely numbered. Additionally, when coupling, pup joint, or connector material in coupling blank or individual lengths is heat treated on a unit in a continuous process run, the pieces within the lot shall be sequentially numbered in the order in which they are heat treated.

6 Material Requirements

6.1 CHEMICAL REQUIREMENTS

Pipe and couplings furnished to this specification shall conform to the chemical requirements specified in Table 2 for the grade and type specified.

6.2 MECHANICAL PROPERTIES REQUIREMENTS

6.2.1 Tensile Properties

6.2.1.1 General

Pipe and couplings furnished to this specification shall conform to the tensile requirements specified in Table 3.

When elongation is recorded or reported, the record or report shall show the nominal width of the test specimen when strip specimens are used, the diameter and gauge length when round bar specimens are used, or state when full section specimens are used.

The tensile properties, except elongation of the upset ends of upset casing and tubing, shall comply with the requirements given for the pipe body. In case of dispute, the properties (except elongation) of the upset shall be determined from a tensile test specimen cut from the upset. A record of such tests shall be available to the purchaser.

Table 2—Chemical Requirements (by Percentage of Weight)

(1)	(2)	(3)	(4)		(5)		(6)		(7)		(8)	(9)	(10)	(11)	(12)
			Carbon		Manganese		Molybdenum		Chromium		Nickel	Copper	Phosphorous	Sulfur	Silicon
Group	Grade	Type	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Max.	Max.	Max.	Max.	Max.
1	H40	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
	J55	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
	K55	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
	N80	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
2	M65	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
	L80	1	—	0.43[a]	—	1.90	—	—	—	—	0.25	0.35	0.030	0.030	0.45
	L80	9Cr	—	0.15	0.30	0.60	0.90	1.10	8.00	10.00	0.50	0.25	0.020	0.010	1.00
	L80	13Cr	0.15	0.22	0.25	1.00	—	—	12.00	14.00	0.50	0.25	0.020	0.010	1.00
	C90	1	—	0.35	—	1.00	0.25[b]	0.75	—	1.20	0.99	—	0.020	0.010	—
	C90	2	—	0.50	—	1.90	—	N.L.	—	N.L.	0.99	—	0.030	0.010	—
	C95	—	—	0.45[c]	—	1.90	—	—	—	—	—	—	0.030	0.030	0.45
	T95	1	—	0.35	—	1.20	0.25[d]	0.85	0.40	1.50	0.99	—	0.020	0.010	—
	T95	2	—	0.50	—	1.90	—	—	—	—	0.99	—	0.030	0.010	—
3	P110	—	—	—	—	—	—	—	—	—	—	—	0.030[e]	0.030[e]	—
4	Q125	1	—	0.35	—	1.00	—	0.75	—	1.20	0.99	—	0.020	0.010	—
	Q125	2	—	0.35	—	1.00	—	N.L.	—	N.L.	0.99	—	0.020	0.020	—
	Q125	3	—	0.50	—	1.90	—	N.L.	—	N.L.	0.99	—	0.030	0.010	—
	Q125	4	—	0.50	—	1.90	—	N.L.	—	N.L.	0.99	—	0.030	0.020	—

Note: N.L. = No limit. Elements shown must be reported in product analysis.

[a]The carbon content for L80 may be increased to 0.50 percent maximum if the product is oil quenched.

[b]The molybdenum content for Grade C90, Type 1, has no minimum tolerance if the wall thickness is less than 0.700 inch.

[c]The carbon content for Grade C95 may be increased to 0.55 percent maximum if the product is oil quenched.

[d]The molybdenum content for Grade T95, Type 1, may be decreased to 0.15 percent minimum if the wall thickness is less than 0.700 inch.

[e]The phosphorous is 0.020 percent maximum and the sulfur is 0.010 percent maximum for EW Grade P110.

Table 3—Tensile and Hardness Requirements

(1)	(2)	(3)	(4)	(5)	(6)	(7)		(8)	(9)
			Yield Strength		Tensile Strength,	Hardness Maximum[a]			Allowable Hardness
Group	Grade	Type	Maximum (psi)	Maximum (psi)	Minimum (psi)	HRC	BHN	Specified Wall Thickness (inches)	Variation (HRC)
1	H40		40,000	80,000	60,000	—	—		
	J55		55,000	80,000	75,000	—	—		
	K55		55,000	80,000	95,000	—	—		
	N80		80,000	110,000	100,000	—	—		
2	M65		65,000	85,000	85,000	22	235		
	L80	1	80,000	95,000	95,000	23	241		
	L80	9Cr	80,000	95,000	95,000	23	241		
	L80	13Cr	80,000	95,000	95,000	23	241		
	C90	1, 2	90,000	105,000	100,000	25.4	255	0.500 or less	3.0
	C90	1, 2	90,000	105,000	100,000	25.4	255	0.501 to 0.749	4.0
	C90	1, 2	90,000	105,000	100,000	25.4	255	0.750 to 0.999	5.0
	C90	1, 2	90,000	105,000	100,000	25.4	255	1.000 and above	6.0
	C95		95,000	110,000	105,000	—	—		
	T95	1, 2	95,000	110,000	105,000	25.4	255	0.500 or less	3.0
	T95	1, 2	95,000	110,000	105,000	25.4	255	0.501 to 0.749	4.0
	T95	1, 2	95,000	110,000	105,000	25.4	255	0.750 to 0.999	5.0
3	P110		110,000	140,000	125,000	—	—		
4	Q125	1–4	125,000	150,000	135,000	—	—	0.500 or less	3.0
	Q125	1–4	125,000	150,000	135,000	—	—	0.501 to 0.749	4.0
	Q125	1–4	125,000	150,000	135,000	—	—	0.750 and above	5.0

[a]In case of dispute, laboratory Rockwell C hardness tests shall be used as the referee method.

6.2.1.2 Elongation—All Groups

The minimum elongation in 2 inches shall be that determined by the following formula:

$$e = 625{,}000(A^{0.2}/U^{0.9})$$

where:

e = minimum elongation in 2 inches in percent rounded to nearest $^1/_2$ percent.

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

U = specified tensile strength, psi.

See Table 4 for minimum elongation values for various size tensile specimens and grades. The minimum elongations for both round bar tensile specimens (0.350-inch diameter with 1.4-inch gauge length and 0.500-inch diameter with 2.00-inch gauge length) shall be that shown on the line of Table 4 for the 0.20 square inch area.

6.2.2 Yield Strength

The yield strength shall be the tensile stress required to produce the extension under load shown in Table 5, as determined by an extensometer.

6.2.3 Charpy V-Notch (CVN) Impact Test Specimens—General Requirements—All Groups

A test shall consist of three specimens from a single tubular product length. The average value of the three impact specimens shall equal or exceed the absorbed energy requirement specified in 6.2.4.1, 6.2.4.2, or 6.2.4.3. In addition, not more than one impact specimen may exhibit an absorbed energy below the absorbed energy requirement, and in no case shall an individual impact specimen exhibit an absorbed energy below two-thirds of the absorbed energy requirement.

6.2.3.1 Critical Thickness

The absorbed energy requirements are based on the critical thickness. The critical thickness for API couplings is defined as the thickness at the root of the thread at the middle of the coupling based on the specified coupling diameter and the specified thread dimensions. The critical thicknesses for all

API couplings are provided in Table 6. For pipe, the critical thickness is the specified wall thickness. For other applications, the critical thickness and absorbed energy requirement shall be specified on the purchase order.

6.2.3.2 Specimen Size

When full size (10 millimeters by 10 millimeters) transverse test specimens are not possible, the largest possible subsize transverse test specimen listed in Table 7 shall be used. When it is not possible (or allowed as specified in 6.2.3.5) to test using any of these transverse test specimens, the largest possible longitudinal test specimen (listed in Table 7) shall be used.

When the OD or wall thickness precludes machining longitudinal impact test specimens $^1/_2$ size or larger, the product need not be tested; however, the manufacturer must use a chemical composition and processing that is documented and demonstrated to result in impact energy absorption in excess of the minimum specified requirement.

6.2.3.3 Hierarchy of Test Specimens

The hierarchy of test specimen orientation and size is as specified in Table 8.

6.2.3.4 Alternate Size Impact Test Specimens

At the manufacturer's option, alternate size impact test specimens, listed in Table 7, may be used in lieu of the minimum size specified in the tables referenced in 6.2.4.1 and 6.2.4.2. However, the alternate test specimen selected shall be higher on the hierarchy table (Table 8) than the specified size, and the absorbed energy requirement shall be adjusted consistent with the impact specimen orientation and size.

6.2.3.5 Subsize Test Specimens

The minimum CVN absorbed energy requirement for subsize test specimens shall be those specified for full size test specimens multiplied by the reduction factor in Table 7; however, in no event shall a subsize test specimen be used if the reduced absorbed energy requirement is less than 8 ft-lbs.

6.2.3.6 Statistical Impact Testing—Group 4

By agreement between the purchaser and manufacturer, the supplemental requirements for statistical impact testing in SR12 shall apply.

6.2.3.7 Reference Information

API Bulletin 5C3 includes reference information on fracture mechanics and equations and tables used in preparing these requirements.

6.2.4 Charpy V-Notch (CVN) Absorbed Energy Requirements—All Groups

6.2.4.1 Coupling Stock, Coupling Blanks, Couplings with API Threads, and Connectors with Internal API Threads, Except Integral Joint API Tubing Connections and Extreme-Line Casing Connections—All Groups

Coupling stock suitable for more than one type connection may be qualified by a test to demonstrate conformance to the most stringent requirements. The test specimen orientation and size shall be the highest possible listed on the hierarchy table (Table 8), and the absorbed energy requirement shall equal or exceed the applicable requirements.

6.2.4.1.1 Group 1 (Grade H40 Only)

There is no CVN absorbed energy requirement.

6.2.4.1.2 Group 1 (Grades J55 and K55 only)

The minimum full size transverse CVN absorbed energy requirement is 15 ft-lbs. The minimum full size longitudinal CVN absorbed energy requirement is 20 ft-lbs. Table 9 provides the impact specimen orientation, minimum size, minimum absorbed energy requirement, and test temperature reduction (as applicable) for API couplings.

6.2.4.1.3 Group 1 (Grade N80 Only) and Groups 2, 3, and 4

Tables 10 through 14 provides the impact specimen orientation, minimum size, and minimum CVN absorbed energy requirement for API couplings based on the equations in items a and b below. In these equations, the following is applicable:

S = the maximum specified yield strength in ksi for the grade evaluated.

t = the critical thickness in inches based on specified dimensions for couplings.

a. Transverse requirements. The minimum full size transverse CVN absorbed energy requirement shall be as specified in Table 15 for various critical thicknesses based on the following:

$$CVN \text{ (ft-lbs)} = S(0.152t + 0.064) \text{ or } 15 \text{ ft-lbs, whichever is greater}$$

b. Longitudinal requirements. The minimum full size longitudinal CVN absorbed energy requirement shall be as

specified in Table 16 for various critical thicknesses based on the following:

$$CVN \text{ (ft-lbs)} = S(0.304t + 0.128)$$
or 30 ft-lbs, whichever is greater

6.2.4.2 Casing, Pup Joints, and Externally Threaded Connector Material—Group 1, Grade M65 and Group 4

6.2.4.2.1 Transverse Requirement

The minimum full size transverse absorbed energy requirement shall be 15 ft-lbs (20 Joules) for Group 2, Grade M65 and as specified by the equation in 6.2.4.1.3a for Group 4 (see Table 15). Table 17 provides the calculated wall thickness required to machine full size, $^3/_4$ size, and $^1/_2$ size transverse impact test specimens. The impact test specimen size that shall be selected from Table 17 is the largest impact test specimen having a calculated wall thickness that is less than the specified wall thickness for the pipe tested.

6.2.4.2.2 Longitudinal Requirement

The minimum full size longitudinal absorbed energy requirement shall be 30 ft-lbs (41 Joules) for Group 2, Grade M65 and as specified by the equation in 6.2.4.1.3b for Group 4 (see Table 16). When the wall thickness does not permit machining full size longitudinal test specimens, the largest possible subsize longitudinal specimen specified in Table 18 shall be used. Table 18 is constructed and used the same as Table 17.

6.2.4.3 Pipe-Groups 1, 2 (Except Grade M65), and 3

By agreement between the manufacturer and the purchaser, the provisions of SR16 shall apply.

6.2.5 Hardness Maximums

6.2.5.1 Casing, Tubing, Couplings, Pup Joints, and Connectors—Group 2 (Grade M65 and L80)

For each tensile specimen required, a hardness survey specimen (ring or block) shall be removed from the product in the location shown in Figure 12 in Section 9 and described in the notes of the figure. The hardness survey specimen shall be prepared and tested in accordance with the requirements of 9.3.3.3, 9.8.4, and 9.9.2. The hardness values obtained shall comply with the requirements given in Table 3.

6.2.5.2 Casing, Tubing, Couplings, Pup Joints, and Connectors—Group 2 (Grades C90 and T95)

Any hardness value (see Figure 13 in Section 9) not exceeding 25.4 HRC is acceptable. If any hardness reading exceeds 27.0 HRC, the piece shall be rejected. Hardness values falling between these limits require retest. Hardness tests shall be taken on each ring in accordance with Figure 13 to provide three hardness values in one quadrant for nonupset pipe and in each of four quadrants for upset pipe.

6.2.5.3 Casing, Couplings, Pup Joints, and Connectors—Group 4

There is no upper or lower hardness limit for this material.

6.2.6 Hardness Variation—Group 2 (Grades C90 and T95) and Group 4

Material shall conform to the hardness variation requirements of Table 3. Hardness variation is defined as the difference between any two hardness values within one quadrant. This criteria shall not apply between specimens.

6.2.7 Process Control—Group 2 (Grades C90 and T95) and Group 4

All individually heat treated coupling blanks, pup joints, or connectors shall be hardness tested to verify process control. Hardness test results need not be provided by the manufacturer unless specified on purchase order.

6.2.8 Hardenability—Minimum Percentage Martensite

6.2.8.1 Group 2 (Grades C90 and T95)

A full body as-quenched sample shall be taken to characterize the hardening response for a particular size, weight, chemistry, and austenitize/quench combination. Hardness values shall equal or exceed the hardness corresponding to 90 percent minimum martensite as determined by the following equation:

$$HRC_{min} = 58 \times \%C + 27 \text{ (see note)}$$

Note: The above equation was derived from a table shown in an article by Hodge and Orehoski appearing in *Trans. AIME*, Volume 167, pp. 627–642. Based on the data of Hodge and Orehoski, the above equation is valid from 0.15 percent carbon to 0.50 percent carbon.

6.2.8.2 Quenched and Tempered Pipe (Except Grades C90 and T95)

Samples from a full body as-quenched pipe shall be taken as part of a documented procedure to confirm sufficient hardening for each size, weight, chemistry, and austenitize/quench combination. To be in compliance, hardness values (see 9.3.3.3) taken during the documentation procedure shall equal or exceed the hardness corresponding to 50 percent minimum martensite as determined by the following equation:

$$HRC_{min} = 52 \times \%C + 21$$

6.2.9 Grain Size—Group 2 (Grades C90 and T95)

Prior austenitic grain size shall be ASTM grain size 5 or finer.

6.2.10 Surface Condition—Group 2, Types 9Cr and 13Cr

Types 9Cr and 13Cr shall be free of internal scale after final heat treatment.

6.2.11 Flattening—All Groups

All products that are produced by the electric weld process of manufacture must comply with the flattening requirements shown in Table 19.

6.2.12 Sulfide Stress Cracking Test—Group 2 (Grades C90 and T95)

It is the responsibility of the purchaser (and/or the user) of Grade C90 and T95 pipe to determine the level of resistance to sulfide stress cracking, (SSC), (such as threshold stress) necessary for the end use of the pipe and to determine the manufacturers who are capable of manufacturing Grade C90 and T95 pipe to meet this resistance level.

The details of a manufacturer's qualification, frequency of sulfide stress cracking testing, retest procedures, and testing practices should be addressed by the purchaser and the manufacturer prior to placing or accepting a purchase order.

Manufacturers can qualify to make Grades C90 and T95 by complying with the requirements in this specification, and in addition for each heat must demonstrate an absolute minimum SSC threshold using one of the test methods given below. If the user requires an SSC threshold stress higher than the minimum, or requires a specific test method from the list below, agreement must be reached between the manufacturer and purchaser. In case of dispute, NACE retests shall use the same method shown on the mill test report.

a. NACE Method A, Tensile
Full size specimen: 80% of the specified minimum yield strength, 72,000 psi for C90 and 76,000 psi for T95.
Subsize specimen: 72% of the specified minimum yield strength, 64,800 psi for C90 and 68,400 psi for T95.
b. NACE Method B, Bent Beam
S_c 12.0 for C90 and S_c 12.6 for T95
c. NACE Method D, DCB
Standard specimen: 32 ksi-square root inches average for both C90 and T95, the test having an arm displacement within the range of 0.029 to 0.031 inches. In addition, no fatigue precracking of the specimen is allowed.
Alternate specimen: 30 ksi-square root inches average for both C90 and T95, the test having an arm displacement within the range of 0.024 to 0.026 inches. In addition, no fatigue precracking of the specimen is allowed.

Table 4—Elongation Table

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Elongation in 2 inches, minimum, percent							
				Grade							
Tensile Test Specimen				H40	J55	M65	K55 L80	C90 N80	C95 T95	P110	Q125
	Specified Wall Thickness, in.			Specified Tensile Strength, psi							
Area A (sq. in.)	3/4 in. Specimen	1 in. Specimen	1 1/2 in. Specimen	60,000	75,000	85,000	95,000	100,000	105,000	125,000	135,000
0.75 & Greater	.994 & Greater	.746 & Greater	.497 & Greater	29.5	24.0	21.5	19.5	18.5	18.0	15.0	14.0
0.74	.980-.993	.735-.745	.490-.496	29.5	24.0	21.5	19.5	18.5	18.0	15.0	14.0
0.73	.967-.979	.726-.734	.484-.489	29.5	24.0	21.5	19.5	18.5	18.0	15.0	14.0
0.72	.954-.966	.715-.725	.477-.483	29.5	24.0	21.5	19.5	18.5	17.5	15.0	14.0
0.71	.941-.953	.706-.714	.471-.476	29.0	24.0	21.5	19.5	18.5	17.5	15.0	14.0
0.70	.927-.940	.695-.705	.464-.470	29.0	24.0	21.5	19.5	18.5	17.5	15.0	14.0
0.69	.914-.926	.686-.694	.457-.463	29.0	24.0	21.5	19.0	18.5	17.5	15.0	14.0
0.68	.900-.913	.675-.685	.450-.456	29.0	23.5	21.0	19.0	18.5	17.5	15.0	14.0
0.67	.887-.899	.666-.674	.444-.449	29.0	23.5	21.0	19.0	18.0	17.5	15.0	14.0
0.66	.874-.886	.655-.665	.437-.443	29.0	23.5	21.0	19.0	18.0	17.5	15.0	14.0
0.65	.861-.873	.646-.654	.431-.436	28.5	23.5	21.0	19.0	18.0	17.5	15.0	14.0
0.64	.847-.860	.635-.645	.424-.430	28.5	23.5	21.0	19.0	18.0	17.5	15.0	14.0
0.63	.834-.846	.626-.634	417-.423	28.5	23.5	21.0	19.0	18.0	17.0	14.5	14.0

Table 4—Elongation Table (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Elongation in 2 inches, minimum, percent							
				Grade							
	Tensile Test Specimen			H40	J55	M65	K55 L80	C90 N80	C95 T95	P110	Q125
	Specified Wall Thickness, in.			Specified Tensile Strength, psi							
Area A (sq. in.)	$^3/_4$ in. Specimen	1 in. Specimen	$1^1/_2$ in. Specimen	60,000	75,000	85,000	95,000	100,000	105,000	125,000	135,000
0.62	.820-.833	.615-.625	.410-.416	28.5	23.5	21.0	19.0	18.0	17.0	14.5	13.5
0.61	.807-.819	.606-.614	.404-.409	28.5	23.0	21.0	18.5	18.0	17.0	14.5	13.5
0.60	.794-.806	.595-.605	.397-.403	28.5	23.0	20.5	18.5	18.0	17.0	14.5	13.5
0.59	.781-.793	.586-.594	.391-.396	28.0	23.0	20.5	18.5	18.0	17.0	14.5	13.5
0.58	.767-.780	.575-.585	.384-.390	28.0	23.0	20.5	18.5	17.5	17.0	14.5	13.5
0.57	.754-.766	.566-.574	.377-.383	28.0	23.0	20.5	18.5	17.5	17.0	14.5	13.5
0.56	.740-.753	.555-.565	.370-.376	28.0	23.0	20.5	18.5	17.5	17.0	14.5	13.5
0.55	.727-.739	.546-.554	.364-.369	28.0	22.5	20.5	18.5	17.5	17.0	14.5	13.5
0.54	.714-.726	.535-.545	.357-.363	27.5	22.5	20.5	18.5	17.5	16.5	14.5	13.5
0.53	.701-.713	.526-.534	.351-.356	27.5	22.5	20.5	18.0	17.5	16.5	14.0	13.5
0.52	.687-.700	.515-.525	.344-.350	27.5	22.5	20.0	18.0	17.5	16.5	14.0	13.0
0.51	.674-.686	.506-.514	.337-.343	27.5	22.5	20.0	18.0	17.5	16.5	14.0	13.0
0.50	.660-.673	.495-.505	.330-.336	27.0	22.5	20.0	18.0	17.0	16.5	14.0	13.0
0.49	.647-.659	.486-.494	.324-.329	27.0	22.0	19.5	18.0	17.0	16.5	14.0	13.0
0.48	.634-.646	.475-.485	.317-.323	27.0	22.0	19.5	18.0	17.0	16.5	14.0	13.0
0.47	.621-.633	.466-.474	.311-.316	27.0	22.0	19.5	18.0	17.0	16.5	14.0	13.0
0.46	.607-.620	.455-.465	.304-.310	27.0	22.0	19.0	17.5	17.0	16.0	14.0	13.0
0.45	.594-.606	.446-.454	.297-.303	26.5	22.0	19.5	17.5	17.0	16.0	14.0	13.0
0.44	.580-.593	.435-.445	.290-.296	26.5	21.5	19.5	17.5	17.0	16.0	13.5	13.0
0.43	.567-.579	.426-.434	.284-.289	26.5	21.5	19.5	17.5	16.5	16.0	13.5	12.5
0.42	.554-.566	.415-.425	.277-.283	26.5	21.5	19.5	17.5	16.5	16.0	13.5	12.5
0.41	.541-.553	.406-.414	.271-.276	26.0	21.5	19.0	17.5	16.5	16.0	13.5	12.5
0.40	.527-.540	.395-.405	.264-.270	26.0	21.5	19.0	17.0	16.5	15.5	13.5	12.5
0.39	.514-.526	.386-.394	.257-.263	26.0	21.0	19.0	17.0	16.5	15.5	13.5	12.5
0.38	.500-.513	.375-.385	.250-.256	26.0	21.0	19.0	17.0	16.5	15.5	13.5	12.5
0.37	.487-.499	.366-.374	.244-.249	25.5	21.0	19.0	17.0	16.0	15.5	13.5	12.5
0.36	.474-.486	.355-.365	.237-.243	25.5	21.0	18.5	17.0	16.0	15.5	13.0	12.5
0.35	.461-.473	.346-.354	.231-.236	25.5	21.0	18.5	17.0	16.0	15.5	13.0	12.0
0.34	.447-.460	.335-.345	.224-.230	25.0	20.5	18.5	16.5	16.0	15.0	13.0	12.0
0.33	.434-.446	.326-.334	.217-.223	25.0	20.5	18.5	16.5	16.0	15.0	13.0	12.0
0.32	.420-.463	.315-.325	.210-.216	25.0	20.5	18.0	16.5	15.5	15.0	13.0	12.0
0.31	.407-.419	.306-.314	.204-.209	25.0	20.5	18.0	16.5	15.5	15.0	13.0	12.0
0.30	.394-.406	.295-.305	.197-.203	24.5	20.0	18.0	16.5	15.5	15.0	12.5	12.0
0.29	.381-.393	.286-.294	.191-.196	24.5	20.0	18.0	16.0	15.5	15.0	12.5	12.0
0.28	.367-.380	.275-.285	.184-.190	24.5	20.0	18.0	16.0	15.5	14.5	12.5	11.5
0.27	.354-.366	.266-.274	.177-.183	24.0	19.5	17.5	16.0	15.0	14.5	12.5	11.5
0.26	.340-.353	.255-.265	.170-.176	24.0	19.5	17.5	16.0	15.0	14.5	12.5	11.5
0.25	.327-.339	.246-.254	.164-.169	23.5	19.5	17.5	15.5	15.0	14.5	12.5	11.5
0.24	.314-.326	.235-.245	.157-.163	23.5	19.0	17.0	15.5	15.0	14.0	12.0	11.5
0.23	.301-.313	.226-.234	.151-.156	23.5	19.0	17.0	15.5	14.5	14.0	12.0	11.0
0.22	.287-.300	.215-.225	.144-.150	23.0	19.0	17.0	15.5	14.5	14.0	12.0	11.0

Table 4—Elongation Table (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Elongation in 2 inches, minimum, percent							
				Grade							
	Tensile Test Specimen			H40	J55	M65	K55 L80	C90 N80	C95 T95	P110	Q125
	Specified Wall Thickness, in.			Specified Tensile Strength, psi							
Area A (sq. in.)	3/4 in. Specimen	1 in. Specimen	1 1/2 in. Specimen	60,000	75,000	85,000	95,000	100,000	105,000	125,000	135,000
0.21	.274-.286	.206-.214	.137-.143	23.0	18.5	17.0	15.0	14.5	14.0	12.0	11.0
0.20	.260-.273	.195-.205	.130-.136	22.5	18.5	16.5	15.0	14.5	13.5	11.5	11.0
0.19	.247-.259	.186-.194	.124-.129	22.5	18.5	16.5	15.0	14.0	13.5	11.5	11.0
0.18	.234-.246	.175-.185	.117-.123	22.0	18.0	16.5	14.5	14.0	13.5	11.5	10.5
0.17	.221-.233	.166-.174	.111-.116	22.0	18.0	16.0	14.5	14.0	13.5	11.5	10.5
0.16	.207-.220	.155-.165	.104-.110	21.5	17.5	16.0	14.5	13.5	13.0	11.0	10.5
0.15	.194-.206	.146-.154	.097-.103	21.5	17.5	15.5	14.0	13.5	13.0	11.0	10.5
0.14	.180-.193	.135-.145	.091-.096	21.0	17.5	15.5	14.0	13.5	13.0	11.0	10.0
0.13	.167-.179	.126-.134	.084-.090	21.0	17.0	15.0	14.0	13.0	12.5	11.0	10.0
0.12	.154-.166	.115-.125	.077-.083	20.5	17.0	15.0	13.5	13.0	12.5	10.5	10.0
0.11	.141-.153	.106-.114	.071-.076	20.0	16.5	14.5	13.5	12.5	12.0	10.5	9.5
0.10	.127-.140	.095-.105	.064-.070	19.5	16.0	14.5	13.0	12.5	12.0	10.0	9.5
0.09	.114-.126	.086-.094	.057-.063	19.5	16.0	14.0	13.0	12.0	11.5	10.0	9.5
0.08	.100-.113	.075-.085	.050-.056	19.0	15.5	14.0	12.5	12.0	11.5	10.0	9.0

Table 5—Total Extension Under Load of Gauge Length

Grade	Percent
H40	0.50
J55	0.50
K55	0.50
M65	0.50
L80	0.50
N80	0.50
C90	0.50
C95, T95	0.50
P110	0.60
Q125	0.65

Table 6—Critical Thicknesses of Various API Couplings

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Critical Thickness in Inches for Various API Couplings						
			Special Clearance				
Pipe OD (in.)	NUE	EUE	EUE SC	BTC SC	BTC	LTC	STC
1.050	0.169	0.211	—	—	—	—	—
1.315	0.211	0.258	—	—	—	—	—
1.660	0.239	0.240	—	—	—	—	—
1.900	0.196	0.251	—	—	—	—	—
2.375	0.304	0.300	0.224	—	—	—	—
2.875	0.380	0.358	0.254	—	—	—	—
3.500	0.451	0.454	0.294	—	—	—	—
4.000	0.454	0.458	—	—	—	—	—
4.500	0.435	0.493	—	0.259	0.322	0.349	0.337
5.000	—	—	—	0.266	0.360	0.392	0.372
5.500	—	—	—	0.268	0.356	0.389	0.370
6.625	—	—	—	0.274	0.469	0.508	0.485
7.000	—	—	—	0.280	0.420	0.458	0.430
7.625	—	—	—	0.348	0.536	0.573	0.546
8.625	—	—	—	0.352	0.602	0.647	0.612
9.625	—	—	—	0.352	0.602	0.657	0.614
10.750	—	—	—	0.352	0.602	—	0.618
11.750	—	—	—	—	0.602	—	0.618
13.375	—	—	—	—	0.602	—	0.618
16.000	—	—	—	—	0.667	—	0.632
18.625	—	—	—	—	0.854	—	0.819
20.000	—	—	—	—	0.667	0.673	0.634

Note: The coupling blank thickness is greater than indicated above, due to the thread height and manufacturing allowance to avoid black crested threads.

Table 7—Acceptable Size Impact Specimens and Absorbed Energy Reduction Factors

(1)	(2)	(3)
Test Specimen Size	Specimen Dimensions	Reduction Factor
Full size	10.0 mm × 10.0 mm	1.00
3/4	10.0 mm × 7.5 mm	0.80
1/2	10.0 mm × 5.0 mm	0.55

Table 8—Hierarchy of Test Specimen Orientation and Size

(1)	(2)	(3)
Choice	Orientation	Size
1st	Transverse	Full
2nd	Transverse	3/4
3rd	Transverse	1/2
4th	Longitudinal	Full
5th	Longitudinal	3/4
6th	Longitudinal	1/2

Table 9—Charpy Impact Test Specimen Orientation, Minimum Size, Minimum Absorbed Energy Requirement, and Test Temperature Reduction Requirement for Various API Couplings—Group 1 (Grades J55 and K55 Only)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Charpy Specimen Orientation, Size, and Impact Energy						
			Special Clearance				
Pipe OD (in.)	NUE	EUE	EUE	BTC	BTC	LTC	STC
1.050	N	L-5-11-A	—	—	—	—	—
1.315	L-5-11-A	L-7-16-A	—	—	—	—	—
1.660	L-5-11-B	L-5-11-B	—	—	—	—	—
1.900	L-5-11-A	L-7-16-B	—	—	—	—	—
2.375	L-7-16-A	L-7-16-A	L-7-16-A	—	—	—	—
2.875	L-10-20-A	L-10-20-A	L-10-20-A	—	—	—	—
3.500	T-5-8-E	T-5-8-E	T-5-8-D	—	—	—	—
4.000	T-7-12-B	T-7-12-B	—	—	—	—	—
4.500	T-7-12-B	T-7-12-B	—	L-7-16-A	L-7-16-A	L-10-20-A	L-10-20-A
5.000	—	—	—	T-5- 8-C	T-5-8-D	T-5-8-D	T-5-8-D
5.500	—	—	—	T-5-8-C	T-5-8-D	T-5-8-D	T-5-8-D
6.625	—	—	—	T-10-15-A	T-10-15-A	T-10-15-A	T-10-15-A
7.000	—	—	—	T-7-12-A	T-7-12-A	T-10-15-A	T-7-12-B
7.625	—	—	—	T-10-15-A	T-10-15-A	T-10-15-A	T-10-15-A
8.625	—	—	—	T-10-15-A	T-10-15-A	T-10-15-A	T-10-15-A
9.625	—	—	—	T-10-15-A	T-10-15-A	T-10-15-A	T-10-15-A
10.750	—	—	—	T-10-15-A	T-10-15-A	—	T-10-15-A
11.750	—	—	—	—	T-10-15-A	—	T-10-15-A
13.375	—	—	—	—	T-10-15-A	—	T-10-15-A
16.000	—	—	—	—	T-10-15-A	—	T-10-15-A
18.625	—	—	—	—	T-10-15-A	—	T-10-15-A
20.000	—	—	—	—	T-10-15-A	T-10-15-A	T-10-15-A

Notes:

1. In columns 2–8, the specimen orientation (T or L) is followed by the minimum specimen size (10, 7, or 5), which is followed by the minimum absorbed energy requirement (ft-lbs) and the temperature reduction in °F (A, B, C, D, or E), according to the codes listed below. Both the absorbed energy requirement and the test temperature reduction requirement are adjusted for the test specimen size indicated.

   N = not thick enough to test.
   T = transverse specimen orientation (see Figure 14).
   L = longitudinal specimen orientation (see Figure 14).
   10 = full size (such as, 10 mm × 10 mm).
   7 = $^3/_4$ size (such as, 10 mm × 7.5 mm).
   5 = $^1/_2$ size (such as, 10 mm × 5.0 mm).
   A = no reduction
   B = 5°F
   C = 10°F
   D = 15°F
   E = 20°F

2. The size requirement is based on the assumption that special clearance couplings are machined from standard couplings.

Table 10—Charpy Impact Test Specimen Orientation, Minimum Size, and Minimum Absorbed Energy Requirement for Various API Couplings—Group 2 (Grade L80 Only)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Charpy Specimen Orientation, Size, and Impact Energy						
			Special Clearance				
Pipe OD (in.)	NUE	EUE	EUE	BTC	BTC	LTC	STC
1.050	N	L-5-16	—	—	—	—	—
1.315	L-5-16	L-7-24	—	—	—	—	—
1.660	L-5-16	L-5-16	—	—	—	—	—
1.900	L-5-16	L-7-24	—	—	—	—	—
2.375	L-7-24	L-7-24	L-7-24	—	—	—	—
2.875	L-10-30	L-10-30	L-10-30	—	—	—	—
3.500	T-5-8	T-5-8	T-5-8	—	—	—	—
4.000	T-7-12	T-7-12	—	—	—	—	—
4.500	T-7-12	T-7-12	—	L-7-24	L-7-24	L-10-30	L-10-30
5.000	—	—	—	T-5-8	T-5-8	T-5-8	T- 5-8
5.500	—	—	—	T-5-8	T-5-8	T-5-8	T- 5-8
6.625	—	—	—	T-10-15	T-10-15	T-10-15	T-10-15
7.000	—	—	—	T-7-12	T-7-12	T-10-15	T- 7-12
7.625	—	—	—	T-10-15	T-10-15	T-10-15	T-10-15
8.625	—	—	—	T-10-15	T-10-15	T-10-15	T-10-15
9.625	—	—	—	T-10-15	T-10-15	T-10-16	T-10-15
10.750	—	—	—	T-10-15	T-10-15	—	T-10-15
11.750	—	—	—	—	T-10-15	—	T-10-15
13.375	—	—	—	—	T-10-15	—	T-10-15
16.000	—	—	—	—	T-10-16	—	T-10-15
18.625	—	—	—	—	T-10-18	—	T-10-18
20.000	—	—	—	—	T-10-16	T-10-16	T-10-15

Notes:

1. In columns 2–8, the specimen orientation (T or L) is followed by the minimum specimen size (10, 7, or 5), which is followed by the minimum absorbed energy requirement (ft-lbs), consistent with the specimen size indicated, according to the following code:

   N = not thick enough to test.
   T = transverse specimen orientation (see Figure 14).
   L = longitudinal specimen orientation (see Figure 14).
   10 = full size (such as, 10 mm × 10 mm).
   7 = $^3/_4$ size (such as, 10 mm × 7.5 mm).
   5 = $^1/_2$ size (such as, 10 mm × 5.0 mm).

2. The size requirement is based on the assumption that special clearance couplings are machined from standard couplings.

Table 11—Charpy Impact Test Specimen Orientation, Minimum Size, and Minimum Absorbed Energy Requirement for Various API Couplings—Group 2 (Grade C90 Only)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Charpy Specimen Orientation, Size, and Impact Energy						
			Special Clearance				
Pipe OD (in.)	NUE	EUE	EUE	BTC	BTC	LTC	STC
1.050	N	L-5-16	—	—	—	—	—
1.315	L-5-16	L-7-24	—	—	—	—	—
1.660	L-5-16	L-5-16	—	—	—	—	—
1.900	L-5-16	L-7-24	—	—	—	—	—
2.375	L-7-24	L-7-24	L-7-24	—	—	—	—
2.875	L-10-30	L-10-30	L-10-30	—	—	—	—
3.500	T-5-8	T-5-8	T-5-8	—	—	—	—
4.000	T-7-12	T-7-12	—	—	—	—	—
4.500	T-7-12	T-7-12	—	L-7-24	L-7-24	L-10-30	L-10-30
5.000	—	—	—	T-5-8	T-5-8	T-5-8	T- 5- 8
5.500	—	—	—	T-5-8	T-5-8	T-5-8	T- 5- 8
6.625	—	—	—	T-10-15	T-10-15	T-10-15	T-10-15
7.000	—	—	—	T-7-12	T-7-12	T-10-15	T- 7-12
7.625	—	—	—	T-10-15	T-10-15	T-10-16	T-10-15
8.625	—	—	—	T-10-15	T-10-16	T-10-17	T-10-16
9.625	—	—	—	T-10-15	T-10-16	T-10-17	T-10-17
10.750	—	—	—	T-10-15	T-10-16	—	T-10-17
11.750	—	—	—	—	T-10-16	—	T-10-17
13.375	—	—	—	—	T-10-16	—	T-10-17
16.000	—	—	—	—	T-10-17	—	T-10-17
18.625	—	—	—	—	T-10-20	—	T-10-20
20.000	—	—	—	—	T-10-17	T-10-17	T-10-17

Notes:

1. In columns 2–8, the specimen orientation (T or L) is followed by the minimum specimen size (10, 7, or 5), which is followed by the minimum absorbed energy requirement (ft-lbs), consistent with the specimen size indicated, according to the following code:

   N = not thick enough to test.
   T = transverse specimen orientation (see Figure 14).
   L = longitudinal specimen orientation (see Figure 14).
   10 = full size (such as 10 mm × 10 mm).
   7 = $^3/_4$ size (such as 10 mm × 7.5 mm).
   5 = $^1/_2$ size (such as 10 mm × 5.0 mm).

2. The size requirement is based on the assumption that special clearance couplings are machined from standard couplings.

Table 12—Charpy Impact Test Specimen Orientation, Minimum Size, and Minimum Absorbed Energy Requirement for Various API Couplings—Group 1 (Grade N80 Only) and Group 2 (Grades C95 and T95)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Charpy Specimen Orientation, Size, and Impact Energy						
			Special Clearance				
Pipe OD (in.)	NUE	EUE	EUE	BTC	BTC	LTC	STC
1.050	N	L-5-16	—	—	—	—	—
1.315	L-5-16	L-7-24	—	—	—	—	—
1.660	L-5-16	L-5-16	—	—	—	—	—
1.900	L-5-16	L-7-24	—	—	—	—	—
2.375	L-7-24	L-7-24	L-7-24	—	—	—	—
2.875	L-10-30	L-10-30	L-10-30	—	—	—	—
3.500	T-5-8	T-5-8	T-5-8	—	—	—	—
4.000	T-7-12	T-7-12	—	—	—	—	—
4.500	T-7-12	T-10-15	—	L-7-24	L-7-24	L-10-30	L-10-30
5.000	—	—	—	T-5-8	T-5-8	T-5-8	T-5-8
5.500	—	—	—	T-5-8	T-5-8	T-5-8	T-5 8
6.625	—	—	—	T-10-15	T-10-15	T-10-16	T-10-15
7.000	—	—	—	T-7-12	T-7-12	T-10-15	T-7-12
7.625	—	—	—	T-10-15	T-10-16	T-10-17	T-10-16
8.625	—	—	—	T-10-15	T-10-17	T-10-18	T-10-17
9.625	—	—	—	T-10-15	T-10-17	T-10-18	T-10-17
10.750	—	—	—	T-10-15	T-10-17	—	T-10-17
11.750	—	—	—	—	T-10-17	—	T-10-17
13.375	—	—	—	—	T-10-17	—	T-10-17
16.000	—	—	—	—	T-10-18	—	T-10-18
18.625	—	—	—	—	T-10-21	—	T-10-21
20.000	—	—	—	—	T-10-18	T-10-18	T-10-18

Notes:

1. In columns 2–8, the specimen orientation (T or L) is followed by the minimum specimen size (10, 7, or 5), which is followed by the minimum absorbed energy requirement (ft-lbs), consistent with the specimen size indicated, according to the following code:

   N = not thick enough to test.
   T = transverse specimen orientation (see Figure 14).
   L = longitudinal specimen orientation (see Figure 14).
   10 = full size (such as 10 mm × 10 mm).
   7 = $^3/_4$ size (such as 10 mm × 7.5 mm).
   5 = $^1/_2$ size (such as 10 mm × 5.0 mm).

2. The size requirement is based on the assumption that special clearance couplings are machined from standard couplings.

Table 13—Charpy Impact Test Specimen Orientation, Minimum Size, and Minimum Absorbed Energy Requirement for Various API Couplings—Group 3 (Grade P110)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Charpy Specimen Orientation, Size, and Impact Energy						
			Special Clearance				
Pipe OD (in.)	NUE	EUE	EUE	BTC	BTC	LTC	STC
1.050	N	L-5-16	—	—	—	—	—
1.315	L-5-16	L-7-24	—	—	—	—	—
1.660	L-5-16	L-5-16	—	—	—	—	—
1.900	L-5-16	L-7-24	—	—	—	—	—
2.375	L-7-25	L-7-25	L-7-24	—	—	—	—
2.875	L-10-34	L-10-33	L-10-30	—	—	—	—
3.500	T-5-10	T-5-10	T-5-8	—	—	—	—
4.000	T-7-15	T-7-15	—	—	—	—	—
4.500	T-7-14	T-7-15	—	L-7-24	L-7-26	L-10-33	L-10-32
5.000	—	—	—	T-5-8	T-5-9	T-5-9	T-5-9
5.500	—	—	—	T-5-8	T-5-9	T-5-9	T-5-9
6.625	—	—	—	T-10-15	T-10-19	T-10-20	T-10-19
7.000	—	—	—	T-7-12	T-7-14	T-10-19	T-7-14
7.625	—	—	—	T-10-16	T-10-20	T-10-21	T-10-21
8.625	—	—	—	T-10-16	T-10-22	T-10-23	T-10-22
9.625	—	—	—	T-10-16	T-10-22	T-10-23	T-10-22
10.750	—	—	—	T-10-16	T-10-22	—	T-10-22
11.750	—	—	—	—	T-10-22	—	T-10-22
13.375	—	—	—	—	T-10-22	—	T-10-22
16.000	—	—	—	—	T-10-23	—	T-10-22
18.625	—	—	—	—	T-10-27	—	T-10-26
20.000	—	—	—	—	T-10-23	T-10-23	T-10-22

Notes:

1. In columns 2–8, the specimen orientation (T or L) is followed by the minimum specimen size (10, 7, or 5), which is followed by the minimum absorbed energy requirement (ft-lbs), consistent with the specimen size indicated, according to the following code:

   N = not thick enough to test.
   T = transverse specimen orientation (see Figure 14).
   L = longitudinal specimen orientation (see Figure 14).
   10 = full size (such as 10 mm × 10 mm).
   7 = $^3/_4$ size (such as 10 mm × 7.5 mm).
   5 = $^1/_2$ size (such as 10 mm × 5.0 mm).

2. The size requirement is based on the assumption that special clearance couplings are machined from standard couplings.

Table 14—Charpy Impact Test Specimen Orientation, Minimum Size, and Minimum Absorbed Energy Requirement for Various API Couplings—Group 4 (Grade Q125)

(1)	(2)	(3)	(4)	(5)
	Charpy Specimen Orientation, Size, and Impact Energy			
Pipe OD (in.)	Special Clearance BTC	BTC	LTC	STC
4.500	L-7-25	L-7-27	L-10-35	L-10-35
5.000	T-5-9	T-5-10	T-5-10	T-5-10
5.500	T-5-9	T-5-10	T-5-10	T-5-10
6.625	T-10-16	T-10-20	T-10-21	T-10-21
7.000	T-7-13	T-7-15	T-10-19	T-7-15
7.625	T-10-18	T-10-22	T-10-23	T-10-22
8.625	T-10-18	T-10-23	T-10-24	T-10-24
9.625	T-10-18	T-10-23	T-10-25	T-10-24
10.750	T-10-18	T-10-23	—	T-10-24
11.750	—	T-10-23	—	T-10-24
13.375	—	T-10-23	—	T-10-24
16.000	—	T-10-25	—	T-10-24
18.625	—	T-10-29	—	T-10-28
20.000	—	T-10-25	T-10-25	T-10-24

Notes:

1. In columns 2–8, the specimen orientation (T or L) is followed by the minimum specimen size (10, 7, or 5), which is followed by the minimum absorbed energy requirement (ft-lbs), consistent with the specimen size indicated, according to the following code:

N = not thick enough to test.
T = transverse specimen orientation (see Figure 14).
L = longitudinal specimen orientation (see Figure 14).
10 = full size (such as 10 mm × 10 mm).
7 = 3/4 size (such as 10 mm × 7.5 mm).
5 = 1/2 size (such as 10 mm × 5.0 mm).

2. The size requirement is based on the assumption that special clearance couplings are machined from standard couplings.

Table 15—Transverse Charpy Absorbed Energy Requirement

(1)	(2)	(3)	(4)	(5)	(6)
Maximum Critical Thickness (Inches) for Various Grades					
L80	C90	N80 C95 T95	P110	Q125	Minimum Transverse Absorbed Energy (ft-lb)
0.652	0.550	0.506	0.307	0.259	15
0.722	0.613	0.566	0.354	0.303	16
0.791	0.675	0.626	0.401	0.346	17
0.860	0.738	0.685	0.448	0.390	18
0.929	0.801	0.745	0.495	0.434	19
0.999	0.863	0.805	0.542	0.478	20
1.068	0.926	0.865	0.589	0.522	21
—	0.989	0.925	0.636	0.566	22
—	1.051	0.984	0.683	0.610	23
—	—	1.044	0.730	0.654	24
—	—	—	0.777	0.697	25
—	—	—	0.824	0.741	26
—	—	—	0.871	0.785	27
—	—	—	0.918	0.829	28
—	—	—	0.965	0.873	29
—	—	—	1.012	0.917	30
—	—	—	—	0.960	31
—	—	—	—	1.004	32

Notes:
1. Critical thicknesses greater than 0.854-inch (such as 18⅝ BTC) are not applicable for API couplings and are provided for information only for special applications.
2. The round-off procedures were followed in the preparation of this table.

Table 16—Longitudinal Charpy Absorbed Energy Requirement

(1)	(2)	(3)	(4)	(5)	(6)
Maximum Critical Thickness (Inches) for Various Grades					
L80	C90	N80 C95 T95	P110	Q125	Minimum Transverse Absorbed Energy (ft-lb)
0.635	0.534	0.491	0.296	0.248	30
0.670	0.566	0.521	0.319	0.270	31
0.704	0.597	0.551	0.343	0.292	32
0.739	0.628	0.581	0.366	0.314	33
0.774	0.660	0.611	0.390	0.336	34
0.808	0.691	0.641	0.413	0.357	35
0.843	0.722	0.670	0.437	0.379	36
0.877	0.754	0.700	0.460	0.401	37
0.912	0.785	0.730	0.484	0.423	38
0.947	0.816	0.760	0.507	0.445	39
0.981	0.848	0.790	0.531	0.467	40
1.016	0.879	0.820	0.554	0.489	41
—	0.910	0.850	0.578	0.511	42
—	0.942	0.880	0.601	0.533	43
—	0.973	0.910	0.625	0.555	44
—	1.004	0.940	0.648	0.577	45
—	—	0.969	0.672	0.599	46
—	—	0.999	0.695	0.621	47
—	—	1.029	0.719	0.643	48
—	—	—	0.742	0.664	49
—	—	—	0.766	0.686	50

Notes:
1. Critical thicknesses greater than 0.374-inch (such as, 2⅞ EUE) are not applicable for API couplings and are provided as information only for special applications.
2. The round-off procedures were followed in the preparation of this table.

Table 17—Transverse Impact Specimen Size Requirement—Grade M65 and Q125 Casing

(1)	(2)	(3)	(4)
Pipe Outside Diameter (inches)	Calculated Wall Thickness (Inches) Required to Machine Transverse Charpy Impact Specimens		
	Full Size	3/4 Size	1/2 Size
4.500	0.711	0.613	0.514
5.000	0.680	0.582	0.483
5.500	0.656	0.557	0.459
6.625	0.616	0.517	0.419
7.000	0.605	0.507	0.409
7.625	0.591	0.492	0.394
7.750	0.588	0.490	0.391
8.625	0.572	0.473	0.375
9.625	0.557	0.459	0.360
10.750	0.544	0.445	0.347
11.750	0.534	0.436	0.337
13.375	0.522	0.423	0.325
16.000	0.507	0.409	0.310
18.625	0.497	0.398	0.300
20.000	0.492	0.394	0.296

Notes:
1. The wall thicknesses in columns 2, 3, and 4 that are in excess of the maximum API wall thickness are provided for information only.
2. The above provides a 0.020-inch ID and a 0.020-inch OD machining allowance.

Table 18—Longitudinal Impact Specimen Size Requirement—Grade M65 and Q125 Casing

(1)	(2)	(3)	(4)
Pipe Outside Diameter (inches)	Calculated Wall Thickness (Inches) Required to Machine Transverse Charpy Impact Specimens		
	Full Size	3/4 Size	1/2 Size
4.500	0.442	0.344	0.245
5.000	0.441	0.343	0.245
5.500	0.441	0.342	0.244
6.625	0.440	0.341	0.243
7.000	0.439	0.341	0.242
7.625	0.439	0.340	0.242
7.750	0.439	0.340	0.242
8.625	0.438	0.340	0.241
9.625	0.438	0.339	0.241
10.750	0.437	0.339	0.240
11.750	0.437	0.339	0.240
13.375	0.437	0.338	0.240
16.000	0.436	0.338	0.239
18.625	0.436	0.337	0.239
20.000	0.436	0.337	0.239

Notes:
1. The wall thicknesses in columns 2, 3, and 4 that are in excess of the maximum API wall thickness are provided for information only.
2. The above provides a 0.020-inch ID and a 0.020-inch OD machining allowance.

Table 19—Distance Between Plates for Electric Weld Flattening Tests

(1)	(2)	(3)
Grade	D/t[a] Ratio	Minimum Distance Between Plates (in.)
H40	16 and over	$0.5D$
	Less than 16	$D(0.830 - 0.0206\ D/t)$
J55 & K55	16 and over	$0.65D$
	3.93 to 16	$D(0.980 - 0.0206\ D/t)$
	Less than 3.93	$D(1.104 - 0.0518\ D/t)$
M65	All	$D(1.074 - 0.0194\ D/t)$
N80[b]	9 to 28	$D(1.074 - 0.0194\ D/t)$
L80	9 to 28	$D(1.074 - 0.0194\ D/t)$
C95[b]	9 to 28	$D(1.080 - 0.0178\ D/t)$
P110	All	$D(1.086 - 0.0163\ D/t)$
Q125[c]	All	$D(1.092 - 0.014\ D/t)$

[a] D = the specified outside diameter of pipe, in inches; t = the specified wall thickness of the pipe, in inches.
[b] If the flattening test fails at 12 or 6 o'clock, the flattening shall continue until the remaining portion of the specimen fails at the 3 or 9 o'clock position. Premature failure at 12 or 6 o'clock shall not be considered basis for rejection.
[c] See SR11. Flattening shall be at least $0.85D$.

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

7.1 DIMENSIONS AND WEIGHTS

All grades of pipe (see note) shall be furnished in the outside diameters, wall thicknesses, and weights specified on the purchase order (see Tables 20–25 and Figures 1–8). All dimensions shown herein without tolerances are related to the basis for design and are not subject to measurement to determine acceptance or rejection of the product.

Note: Exceptions are Grades C90, T95, and Q125, which may be furnished in other sizes, weights, and wall thicknesses as agreed between the purchaser and the manufacturer.

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 the legibility of markings and general wear of fixed reference points. The adjustable and nonadjustable designation of measuring devices utilized 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 this 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.

7.2 DIAMETER

The outside diameter shall be within the tolerances specified in 7.10.1. For threaded pipe, the outside diameter at the threaded ends shall be such that the thread length, L_4, and the full-crest thread length, L_c, are within the dimensions and tolerances specified in API Standard 5B. (Inside diameters are governed by the outside diameter and weight tolerances.) For nonupset pipe furnished plain-end, specified on the purchase order for the manufacture of pup joints, the nonupset plain-end tolerances shall apply to the full length.

7.3 WALL THICKNESS

Each length of pipe shall be measured for conformance to wall-thickness requirements. The wall thickness at any place shall not be less than the tabulated thickness, t, minus the permissible undertolerance specified in 7.10.2.

7.4 WEIGHT

Weights that are determined as described in 9.5.4 shall conform to the calculated weights specified herein (or adjusted calculated weights) for the end finish specified on the purchase order, within the tolerances stipulated in 7.10.3. Calculated weights shall be determined in accordance with the following formula:

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

where:

W_L = calculated weight of a piece of pipe length, L, lbs.

w_{pe} = plain-end weight, lbs/ft.

L = length of pipe, including end finish, as defined in 7.5, feet.

e_w = weight gain or loss due to end finishing, lbs. For plain-end nonupset pipe, e_w equals 0.

Note: The densities of martensitic chromium steels (L80, Types 9Cr and 13Cr) are different from carbon steels. The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

7.5 LENGTH

Casing, tubing, plain-end liners, and pup joints shall be furnished in lengths conforming to Table 26. The length of connectors, except couplings, shall be as agreed between the purchaser and the manufacturer.

The length of each finished pipe shall be determined for conformance to length requirements. Length determination shall be in feet and tenths of a foot.

The accuracy of length measuring devices for lengths of pipe less than 100 feet shall be ± 0.1 feet.

7.6 CASING JOINTERS

If so specified on the purchase order, for round thread casing only, jointers (two pieces coupled to make a standard length) may be furnished to a maximum of 5 percent of the order; but no length used in making a jointer shall be less than 5 feet.

7.7 HEIGHT AND TRIM OF ELECTRIC WELD FLASH

The outside flash of electric welded casing and tubing shall be trimmed to an essentially flush condition.

It shall be the aim of the manufacturer to provide an inside surface at the weld of electric welded casing and tubing that

(a) is reasonably close to flush after trimming and (b) contains no jagged edges from the original weld flash. It may be desirable for the manufacturer to provide an inside surface at the trimmed weld with a slight groove in order to meet this aim. The inside flash of electric welded casing and tubing shall be trimmed as described in 7.7.1 and 7.7.2.

7.7.1 Groups 1 and 2

7.7.1.1 The height of the inside weld flash shall not exceed 0.045 inch for casing or 0.015 inch for tubing, measured from the inside surface adjacent to the flash.

7.7.1.2 The depth of groove resulting from removal of the inside flash shall not be greater than the amount listed below for the various wall thicknesses. Depth of groove is defined as the difference between the wall thickness measured approximately 1 inch from the weld line and the remaining wall under the groove.

Wall Thickness (t)	Maximum Depth of Trim
0.151 inch to 0.301 inch	0.015 inch
0.301 inch and greater	0.05t

7.7.2 Groups 3 and 4

No inside flash height shall be permitted. The groove on the inside weld surface shall not exceed a depth of 0.015-inch and shall not contain sharp corners that would interfere with ultrasonic inspection. Casing or tubing with weld flash exceeding the above limits shall be either rejected or repaired by grinding.

7.8 STRAIGHTNESS

All pipe shall be visually examined and shall be reasonably straight. Pipe sizes $4\frac{1}{2}$ and larger shall be checked for straightness, when necessary, as follows:

a. Full length. Full length straightness shall be checked using a taut string (wire). Chord height deviation shall not exceed 0.20 percent of the total length of the pipe measured from one end of the pipe to the other end as shown in Figure 9. Measurement of the deviation shall not be made in the plane of the upset, the upset fade-away, or the coupling.

b. Pipe ordered plain-end only. To determine the amount of end hook (drop), the ends shall be checked by using a minimum 6-foot straight edge contacting the pipe surface beyond the extent of the hook. The distance between the straight edge and the pipe surface in the hooked area shall not exceed 0.125-inch as shown in Figure 10.

7.9 DRIFT REQUIREMENTS

Each length of casing and tubing either finished or unfinished (see Note 1) shall be drift tested throughout its entire length. Casing and tubing finished by a threader other than the pipe manufacturer shall also be drift tested for a distance of 2 feet from the coupled end on casing and 42 inches from the coupled end on tubing.

All drift testing shall be performed as indicated in 9.5.2 with a cylindrical drift mandrel conforming to the requirements listed in Table 54. 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.

When specified by the purchaser, casing may be furnished when tested with the larger diameter drift mandrels as shown in Table 27. Pipe that is drifted with the larger diameter drift mandrels shall be marked as described in Section 10. Casing sizes larger than $4\frac{1}{2}$ but smaller than $10\frac{3}{4}$ specified by the purchaser to be used in tubing service shall be drift tested with drift mandrels as shown in Table 28 and marked as specified in Section 10 (see Note 2).

Notes:
1. Unfinished pipe is pipe furnished unthreaded, either upset or nonupset, but in compliance with all requirements of this specification for a particular grade, and shall be identified by the UF symbol in addition to the other marking requirements. See Section 10 or Appendix D.
2. See API Bulletin 5C3 for the joint strength of casing used in tubing service.

7.10 TOLERANCES ON DIMENSIONS AND WEIGHTS

7.10.1 Outside Diameter, *D*

The following tolerances apply to the outside diameter, D, of pipe:

Pipe Size	Tolerance
Smaller than $4\frac{1}{2}$	±0.031 inch
$4\frac{1}{2}$ and larger	+1.00, –0.50 percent D

For nonupset pipe ordered plain-end, the following tolerances apply to the outside diameter, D, for a minimum distance of 4 inches from the end:

Pipe Size	Tolerance
$4\frac{1}{2}$ to less than 5	+0.005, +0.031 inch
5 and larger	+0.016 inch, +1.00 percent D

For upset casing the following tolerances apply to the outside diameter of the pipe body immediately behind the upset for a distance of approximately 5 inches for sizes $5\frac{1}{2}$ and smaller and a distance approximately equal to the OD for sizes larger than $5\frac{1}{2}$. Measurements shall be made with calipers or snap gauges.

Pipe Size	Tolerances Behind m_{eu} or L_o (in.)
$3\frac{1}{2}$ and smaller	$+\frac{3}{32}$, $-\frac{1}{32}$
Larger than $3\frac{1}{2}$ to 5 incl.	$+\frac{7}{64}$, –0.75 percent D
Larger than 5 to $8\frac{5}{8}$ incl.	$+\frac{1}{8}$, –0.75 percent D
Larger than $8\frac{5}{8}$	$+\frac{5}{32}$, –0.75 percent D

For $2\frac{3}{8}$ and larger external-upset tubing, the following tolerances shall apply to the outside diameter at distance L_a from the end of the pipe. The measurements shall be made with snap-gauges or calipers. Changes in diameter between L_a and L_b shall be smooth and gradual. Pipe body OD tolerances do not apply for a distance of L_b from the end of the pipe.

Pipe Size	Tolerance
$2\frac{3}{8}$–$3\frac{1}{2}$	$+\frac{3}{32}$, $-\frac{1}{32}$ inch
Larger than $3\frac{1}{2}$ to 4 incl.	$+\frac{7}{64}$, $-\frac{1}{32}$ inch
Larger than 4	$+\frac{7}{64}$, –0.75 percent D

7.10.2 Wall Thickness

The tolerance for wall thickness, t, is –12.5 percent.

7.10.3 Weight

Tolerances for single lengths are +6.5 percent, –3.5 percent.

The tolerance for carloads, 40,000 pounds or more, is –1.75 percent. The tolerance for carloads less than 40,000 pounds is –3.5 percent.

The tolerance for order items, 40,000 pounds or more, is –1.75 percent. The tolerance for order items less than 40,000 pounds is –3.5 percent.

7.10.4 Inside Diameter

Inside diameter, d, is governed by the outside diameter and weight tolerances.

7.10.5 Upset Dimensions

Tolerances on upset dimensions are given in Tables 22, 23, and 24.

7.11 EXTENDED LENGTH UPSETS

External-upset tubing may be ordered with extended length upsets (L_{el}) as agreed between the purchaser and the manufacturer. A minimum of 95 percent of the number of joints (both ends) must meet the L_{el} with the remaining balance meeting L_{eu} requirements unless otherwise agreed between the purchaser and the manufacturer.

7.12 IMPERFECTIONS AND DEFECTS

An imperfection is a discontinuity or irregularity in the product, detected by methods outlined in this specification. An imperfection is considered a defect when it is of sufficient magnitude to warrant rejection of the product based on the stipulations of this specification. All pipe shall be free from defects as outlined in 7.12.1–7.12.4.

7.12.1 Surface Breaking Pipe Body and Weld Seam Defects

Any imperfection on the outside or inside surface, of any orientation, shall be considered a defect if either

a. It is linear (see Note 1) and deeper than 12.5 percent of the specified wall thickness in the radial direction for Grades H40, J55, K55, M65, L80, C95, N80, and P110 manufactured to SR16; or is linear (see Note 1) and deeper than 5 percent of the specified wall thickness in the radial direction for Grades C90, T95, P110 without SR16, and Q125; or,

b. It is linear (see Note 1) or nonlinear (see Note 2) and results in a wall thickness above or below the imperfection that is less than 87.5 percent of the specified wall thickness.

Notes:
1. Linear imperfections include, but are not limited to, cracks, seams, laps, plug scores, cuts, and gouges.
2. Nonlinear imperfections include, but are not limited to, pits and round bottom die stamping.

7.12.2 Surface Breaking Pipe Upset Defects

Any imperfection on the outside or inside surface, of any orientation, that is deeper than shown in Table 29 shall be considered a defect. The internal-upset configuration on all upset products shall exhibit no sharp corners or drastic changes of section that would cause a 90 degree hook-type tool to hang up.

7.12.3 Quench Cracks

Quench cracks detected by methods outlined in this specification shall be considered defects (see note).

Note: Quench cracks in steel result from stresses produced during the austenite-to-martensite transformation, which is accompanied by an increase in volume.[4]

7.12.4 Nonsurface Breaking Weld Seam Defects

Any weld seam imperfection within $\frac{1}{16}$-inch of either side of the weld line, not on the inside or outside surface, that is proven to reduce the net effective wall thickness below 87.5 percent of the specified wall thickness shall be considered a defect.

[4]"Failure Analysis and Prevention," ASM *Metals Handbook*, Volume 11, 9th Edition, 1986.

7.13 PIPE ENDS

7.13.1 Casing

Casing shall be furnished threaded and coupled, 8-round thread (see note), or, if so specified on the purchase order, with any of the following end finishes:

a. Plain-end.
b. 8-round thread without coupling.
c. Buttress thread with coupling.
d. Buttress thread without coupling.
e. Extreme-line thread.
f. Special end finish.
g. Seal-ring configuration SR13.

Note: If long-thread casing, Grades H40, J55, or K55, in accordance with Table 22 is desired, the purchaser must so specify on the purchase order. Otherwise, short-thread casing in accordance with Table 22 will be furnished. Likewise, if special threads or end finish is desired, agreement must be reached with the manufacturer, and the requirements must be specified on the purchase order.

7.13.2 Liners

Liners shall be furnished with square-cut plain ends, with all burrs removed from both inside and outside edges.

7.13.3 Tubing

Tubing shall be furnished threaded and coupled or, if so specified on the purchase order, with any of the following end finishes:

a. Plain-end.
b. Threaded ends without coupling.
c. Integral joint.
d. Special end finish.
e. Seal-ring configuration SR13.

Ends shall be either upset or nonupset as specified on the purchase order.

7.13.4 Rounded Nose

In lieu of the conventional corner breaks on the threaded ends of tubing, the "round" or "bullet-nose" end may be supplied at the manufacturer's option or may be specified by the purchaser. The modified end shall be rounded to provide for coatable service, and the radius transition shall be smooth with no sharp corners, burrs, or slivers on the ID or OD chamfer surfaces. See Figure 6 for an illustration and dimensions. It is recognized that the above dimensions are recommended values but are not subject to measurement to determine acceptance or rejection of the product.

7.13.5 Pup Joints and Connectors

Pup joints and connectors shall be furnished with threaded ends without couplings unless otherwise specified (see note).

Note: Special marking as shown in Section 10 and Appendix D is required for pipe furnished with plain ends or with end finishes not specified herein but having the body of the pipe manufactured in accordance with the requirements specified herein.

7.13.6 Threading

Pipe threads, gauging practice, and thread inspection shall conform to the requirements of API Standard 5B. Pipe ends shall not be rounded out by hammering to secure conformance with threading requirements. Pipe threaded by a facility other than the pipe manufacturer shall be marked in accordance with 10.6.

7.13.7 Workmanship of Ends

The inside and outside edges of the ends of all pipe shall be free of burrs. The threads of martensitic chromium alloys have shown a tendency toward adhesive wear or galling during makeup and breakout. Their galling resistance may be improved by surface preparations that are beyond the scope of this document.

7.14 COUPLING MAKEUP AND THREAD PROTECTION

7.14.1 Groups 1, 2, and 3

7.14.1.1 All casing couplings and regular tubing couplings shall meet all specified requirements in effect at the date of manufacture of each coupling (see Note 1) and shall be screwed onto the pipe power-tight, except they shall be screwed on handling-tight (see Note 2) or shipped separately, if so specified on the purchase order.

7.14.1.2 Special clearance tubing couplings shall be screwed onto the pipe handling-tight (see Note 2), except if so specified on the purchase order, they shall be shipped separately.

7.14.1.3 Buttress casing shall be marked with a makeup triangle or paint band as shown in Figure 3 and as specified in API Standard 5B.

7.14.1.4 Round thread casing in Grades H, J, K, and M, sizes 16 and larger, shall be marked with a makeup triangle as shown in Figures 1 and 2 and as specified in API Standard 5B. When pipe is furnished threaded and coupled, the field end and the coupling shall be provided with thread protectors. When pipe is furnished threaded, but without couplings attached, each end shall be provided with a thread protector. Thread protectors shall conform to the requirements of 11.2.

7.14.1.5 A thread compound shall be applied to cover the full surface on the engaged thread of either the coupling or pipe before making up the joint. 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.

All exposed threads shall be coated with this thread compound. A storage compound of distinct color may be substituted for this thread compound on all exposed threads. Whatever compound is used shall be applied to a surface that is clean and reasonably free of moisture and cutting fluids (see Note 3).

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 the use of 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 using the pipe. This procedure has been found to result in less chance for thread leakage because mill-applied couplings made up power-tight, although leak proof at the time of makeup, may not always remain so after transportation, handling, and use.
3. Martensitic chromium steels are sensitive to galling. Special precautions may be necessary for thread surface treatment and/or lubrication to minimize galling during hydrostatic testing (plug application and removal).

7.14.2 Group 4

All requirements are the same as those shown in 7.14.1 above, except casing couplings shall be shipped separately unless power-tight makeup is specified on the purchase order.

Table 20—Dimensions and Weights for Round Thread, Buttress Thread, and Extreme-Line Casing (See Note)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
						Calculated Weight[a]						
						e_w Weight Gain or Loss due to End Finishing[b]						
Designation[c]		Outside Diameter	Wall Thickness	Inside Diameter	T & C Drift Diameter	Plain-End	Round Thread		Buttress Thread		Extreme-Line	
Size	Weight	D (in.)	t (in.)	d (in.)	(in.)	w_{pe} (lb/ft)	Short (lb)	Long (lb)	Reg. OD (lb)	SCC (lb)	Std. (lb)	Opt. (lb)
4 1/2	9.50	4.500	0.205	4.090	3.965	9.41	4.20	—	—	—	—	—
4 1/2	10.50	4.500	0.224	4.052	3.927	10.24	3.80	—	5.00	2.56	—	—
4 1/2	11.60	4.500	0.250	4.000	3.875	11.36	3.40	3.80	4.60	2.16	—	—
4 1/2	13.50	4.500	0.290	3.920	3.795	13.05	—	3.20	4.00	1.56	—	—
4 1/2	15.10	4.500	0.337	3.826	3.701	15.00	—	2.80	3.20	0.76	—	—
5	11.50	5.000	0.220	4.560	4.435	11.24	5.40	—	—	—	—	—
5	13.00	5.000	0.253	4.494	4.369	12.84	4.80	5.80	6.60	2.42	—	—
5	15.00	5.000	0.296	4.408	4.283	14.88	4.20	5.20	5.80	1.62	4.60	—
5	18.00	5.000	0.362	4.276	4.151	17.95	—	4.20	4.40	0.22	1.40	—
5	21.40	5.000	0.437	4.126	4.001	21.32	—	2.95	2.46	–1.72	—	—
5	23.20	5.000	0.478	4.044	3.919	23.11	—	2.30	2.05	–2.09	—	—
5	24.10	5.000	0.500	4.000	3.875	24.05	—	1.95	1.24	–2.94	—	—
5 1/2	14.00	5.500	0.244	5.012	4.887	13.71	5.40	—	—	—	—	—
5 1/2	15.50	5.500	0.275	4.950	4.825	15.36	4.80	5.80	6.40	2.10	5.80	4.20
5 1/2	17.00	5.500	0.304	4.892	4.767	16.89	4.40	5.40	5.80	1.50	4.80	3.20
5 1/2	20.00	5.500	0.361	4.778	4.653	19.83	—	4.40	4.60	0.30	1.40	–0.20
5 1/2	23.00	5.500	0.415	4.670	4.545	22.56	—	3.20	3.40	–0.90	0.00	–1.60
5 1/2	26.80	5.500	0.500	4.500	4.375	26.72	—	—	—	—	—	—
5 1/2	29.70	5.500	0.562	4.376	4.251	29.67	—	—	—	—	—	—
5 1/2	32.60	5.500	0.625	4.250	4.125	32.57	—	—	—	—	—	—
5 1/2	35.30	5.500	0.687	4.126	4.001	35.35	—	—	—	—	—	—
5 1/2	38.00	5.500	0.750	4.000	3.875	38.08	—	—	—	—	—	—
5 1/2	40.50	5.500	0.812	3.876	3.751	40.69	—	—	—	—	—	—
5 1/2	43.10	5.500	0.875	3.750	3.625	43.26	—	—	—	—	—	—
6 5/8	20.00	6.625	0.288	6.049	5.924	19.51	11.00	13.60	14.40	2.38	—	—
6 5/8	24.00	6.625	0.352	5.921	5.796	23.60	9.60	12.00	12.60	0.58	3.40	1.80

Table 20—Dimensions and Weights for Round Thread, Buttress Thread, and Extreme-Line Casing (See Note) (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
							Calculated Weight[a]					
							e_w, Weight Gain or Loss due to End Finishing[b]					
Designation[c]		Outside Diameter	Wall Thickness	Inside Diameter	T & C Drift Diameter	Plain-End	Round Thread		Buttress Thread		Extreme-Line	
Size	Weight	D (in.)	t (in.)	d (in.)	(in.)	w_{pe} (lb/ft)	Short (lb)	Long (lb)	Reg. OD (lb)	SCC (lb)	Std. (lb)	Opt. (lb)
6 5/8	28.00	6.625	0.417	5.791	5.666	27.67	—	10.20	10.60	–1.42	0.20	–1.40
6 5/8	32.00	6.625	0.475	5.675	5.550	31.23	—	8.80	9.00	–3.02	–1.40	–3.00
7	17.00	7.000	0.231	6.538	6.413	16.72	10.00	—	—	—	—	—
7	20.00	7.000	0.272	6.456	6.331	19.56	9.40	—	—	—	—	—
7	23.00	7.000	0.317	6.366	6.250[d]	22.65	8.00	10.40	11.00	1.60	6.00	4.20
7	23.00	7.000	0.317	6.366	6.241	22.65	8.00	10.40	11.00	1.60	6.00	4.20
7	26.00	7.000	0.362	6.276	6.151	25.69	7.20	9.40	9.60	0.20	2.80	1.00
7	29.00	7.000	0.408	6.184	6.059	28.75	—	8.00	8.20	–1.20	0.60	–1.20
7	32.00	7.000	0.453	6.094	6.000[d]	31.70	—	6.60	6.80	–2.60	–0.60	–2.40
7	32.00	7.000	0.453	6.094	5.969	31.70	—	6.60	6.80	–2.60	–0.60	–2.40
7	35.00	7.000	0.498	6.004	5.879	34.61	—	5.60	5.60	–3.80	1.00	–1.80
7	38.00	7.000	0.540	5.920	5.795	37.29	—	4.40	4.20	–5.20	–0.20	–3.00
7	42.70	7.000	0.626	5.750	5.625	42.65	—	—	—	—	—	—
7	46.40	7.000	0.687	5.625	5.500	46.36	—	—	—	—	—	—
7	50.10	7.000	0.750	5.500	5.375	50.11	—	—	—	—	—	—
7	53.60	7.000	0.812	5.376	5.251	53.71	—	—	—	—	—	—
7	57.10	7.000	0.875	5.250	5.125	57.29	—	—	—	—	—	—
7 5/8	24.00	7.625	0.300	7.025	6.900	23.49	15.80	—	—	—	—	—
7 5/8	26.40	7.625	0.328	6.969	6.844	25.59	15.20	19.00	20.60	6.21	6.40	4.00
7 5/8	29.70	7.625	0.375	6.875	6.750	29.06	—	17.40	18.80	4.41	2.60	0.20
7 5/8	33.70	7.625	0.430	6.765	6.640	33.07	—	15.80	17.00	2.61	0.00	–2.40
7 5/8	39.00	7.625	0.500	6.625	6.500	38.08	—	13.60	14.60	0.21	–2.20	–4.60
7 5/8	42.80	7.625	0.562	6.501	6.376	42.43	—	12.01	11.39	–3.01	—	—
7 5/8	45.30	7.625	0.595	6.435	6.310	44.71	—	11.04	11.04	–3.36	—	—
7 5/8	47.10	7.625	0.625	6.375	6.250	46.77	—	10.16	9.23	–5.17	—	—
7 5/8	51.20	7.625	0.687	6.251	6.126	50.95	—	—	—	—	—	—
7 5/8	55.30	7.625	0.750	6.125	6.000	55.12	—	—	—	—	—	—
7 3/4	46.10	7.750	0.595	6.560	6.500[d]	45.54	—	—	—	—	—	—
7 3/4	46.10	7.750	0.595	6.560	6.435	45.54	—	—	—	—	—	—
8 5/8	24.00	8.625	0.264	8.097	7.972	23.60	23.60	—	—	—	—	—
8 5/8	28.00	8.625	0.304	8.017	7.892	27.04	22.20	—	—	—	—	—
8 5/8	32.00	8.625	0.352	7.921	7.875[d]	31.13	20.80	27.60	28.30	6.03	13.20	8.80
8 5/8	32.00	8.625	0.352	7.921	7.796	31.13	20.80	27.60	28.20	6.03	13.20	8.80
8 5/8	36.00	8.625	0.400	7.825	7.700	35.17	19.40	25.60	26.20	4.03	7.60	4.20
8 5/8	40.00	8.625	0.450	7.725	7.625[d]	39.33	—	23.80	24.20	2.03	4.00	0.60
8 5/8	40.00	8.625	0.450	7.725	7.600	39.33	—	23.80	24.20	2.03	4.00	0.60
8 5/8	44.00	8.625	0.500	7.625	7.500	43.43	—	21.80	22.20	0.03	1.60	–1.80
8 5/8	49.00	8.625	0.557	7.511	7.386	48.04	—	19.60	19.80	–2.37	–0.80	–4.20
9 5/8	32.30	9.625	0.312	9.001	8.845	31.06	24.40	—	—	—	—	—
9 5/8	36.00	9.625	0.352	8.921	8.765	34.89	23.00	32.00	31.00	6.48	—	—

Table 20—Dimensions and Weights for Round Thread, Buttress Thread, and Extreme-Line Casing (See Note) (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
						Calculated Weight[a]						
						e_w, Weight Gain or Loss due to End Finishing[b]						
Designation[c]		Outside Diameter	Wall Thickness	Inside Diameter	T & C Drift Diameter	Plain-End	Round Thread		Buttress Thread		Extreme-Line	
Size	Weight	D (in.)	t (in.)	d (in.)	(in.)	w_{pe} (lb/ft)	Short (lb)	Long (lb)	Reg. OD (lb)	SCC (lb)	Std. (lb)	Opt. (lb)
9 5/8	40.00	9.625	0.395	8.835	8.750[d]	38.97	21.40	30.00	29.00	4.48	10.60	7.20
9 5/8	40.00	9.625	0.395	8.835	8.679	38.97	21.40	30.00	29.00	4.48	10.60	7.20
9 5/8	43.50	9.625	0.435	8.755	8.599	42.73	—	28.20	27.20	2.68	5.40	2.00
9 5/8	47.00	9.625	0.472	8.681	8.525	46.18	—	26.60	25.60	1.08	2.20	–1.20
9 5/8	53.50	9.625	0.545	8.535	8.500[d]	52.90	—	23.40	22.40	–2.12	–1.20	–4.60
9 5/8	53.50	9.625	0.545	8.535	8.379	52.90	—	23.40	22.40	–2.12	–1.20	–4.60
9 5/8	58.40	9.625	0.595	8.435	8.375[d]	57.44	—	21.50	20.13	–4.40	—	—
9 5/8	58.40	9.625	0.595	8.435	8.279	57.44	—	21.50	20.13	–4.40	—	—
9 5/8	59.40	9.625	0.609	8.407	8.251	58.70	—	—	—	—	—	—
9 5/8	64.90	9.625	0.672	8.281	8.125	64.32	—	—	—	—	—	—
9 5/8	70.30	9.625	0.734	8.157	8.001	69.76	—	—	—	—	—	—
9 5/8	75.60	9.625	0.797	8.031	7.875	75.21	—	—	—	—	—	—
10 3/4	32.75	10.750	0.279	10.192	10.036	31.23	29.00	—	—	—	—	—
10 3/4	40.50	10.750	0.350	10.050	9.894	38.91	26.40	—	34.40	7.21	—	—
10 3/4	45.50	10.750	0.400	9.950	9.875[d]	44.26	24.40	—	31.80	4.61	21.20	—
10 3/4	45.50	10.750	0.400	9.950	9.794	44.26	24.40	—	31.80	4.61	21.20	—
10 3/4	51.00	10.750	0.450	9.850	9.694	49.55	22.60	—	29.40	2.21	18.40	—
10 3/4	55.50	10.750	0.495	9.760	9.625[d]	54.26	20.80	—	27.00	–0.19	15.80	—
10 3/4	55.50	10.750	0.495	9.760	9.604	54.26	20.80	—	27.00	–0.19	15.80	—
10 3/4	60.70	10.750	0.545	9.660	9.504	59.45	18.80	—	24.40	—	13.00	—
10 3/4	65.70	10.750	0.595	9.560	9.404	64.59	16.80	—	22.00	—	—	—
10 3/4	73.20	10.750	0.672	9.406	9.250	72.40	—	—	—	—	—	—
10 3/4	79.20	10.750	0.734	9.282	9.126	78.59	—	—	—	—	—	—
10 3/4	85.30	10.750	0.797	9.156	9.000	84.80	—	—	—	—	—	—
11 3/4	42.00	11.750	0.333	11.084	11.000[d]	40.64	29.60	—	—	—	—	—
11 3/4	42.00	11.750	0.333	11.084	10.928	40.64	29.60	—	—	—	—	—
11 3/4	47.00	11.750	0.375	11.000	10.844	45.60	27.60	—	35.80	—	—	—
11 3/4	54.00	11.750	0.435	10.880	10.724	52.62	25.00	—	32.40	—	—	—
11 3/4	60.00	11.750	0.489	10.772	10.625[d]	58.87	22.60	—	29.60	—	—	—
11 3/4	60.00	11.750	0.489	10.772	10.616	58.87	22.60	—	29.60	—	—	—
11 3/4	65.00	11.750	0.534	10.682	10.625[d]	64.03	—	—	—	—	—	—
11 3/4	65.00	11.750	0.534	10.682	10.526	64.03	—	—	—	—	—	—
11 3/4	71.00	11.750	0.582	10.586	10.430	69.48	—	—	—	—	—	—
13 3/8	48.00	13.375	0.330	12.715	12.559	46.02	33.20	—	—	—	—	—
13 3/8	54.50	13.375	0.380	12.615	12.459	52.79	30.80	—	40.20	—	—	—
13 3/8	61.00	13.375	0.430	12.515	12.359	59.50	28.40	—	36.80	—	—	—
13 3/8	68.00	13.375	0.480	12.415	12.259	66.17	25.80	—	33.60	—	—	—
13 3/8	72.00	13.375	0.514	12.347	12.250[d]	70.67	24.20	—	31.60	—	—	—
13 3/8	72.00	13.375	0.514	12.347	12.191	70.67	24.20	—	31.60	—	—	—

Table 20—Dimensions and Weights for Round Thread, Buttress Thread, and Extreme-Line Casing (See Note) (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
						Calculated Weight[a]						
						e_w Weight Gain or Loss due to End Finishing[b]						
Designation[c]		Outside Diameter	Wall Thickness	Inside Diameter	T & C Drift Diameter	Plain-End	Round Thread		Buttress Thread		Extreme-Line	
Size	Weight	D (in.)	t (in.)	d (in.)	(in.)	w_{pe} (lb/ft)	Short (lb)	Long (lb)	Reg. OD (lb)	SCC (lb)	Std. (lb)	Opt. (lb)
16	65.00	16.000	0.375	15.250	15.062	62.64	42.60	—	—	—	—	—
16	75.00	16.000	0.438	15.124	14.936	72.86	38.20	—	45.60	—	—	—
16	84.00	16.000	0.495	15.010	14.822	82.05	34.20	—	39.60	—	—	—
16	109.00	16.000	0.656	14.688	14.500	107.60	—	—	—	—	—	—
$18^5/_8$	87.50	18.625	0.435	17.755	17.567	84.59	73.60	—	86.40	—	—	—
20	94.00	20.000	0.438	19.124	18.936	91.59	47.00	61.20	54.80	—	—	—
20	106.50	20.000	0.500	19.000	18.812	104.23	41.60	54.80	48.40	—	—	—
20	133.00	20.000	0.635	18.730	18.542	131.45	30.00	40.60	35.20	—	—	—

Note: See Figures 1, 2, 3, and 8.

[a]The densities of martensitic chromium steels (L80 Types 9Cr and 13Cr) are different than carbon steels. The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

[b]Weight gain or loss due to end finishing. See 7.4.

[c]Designations (columns 1 and 2) are shown for the purpose of identification in ordering.

[d]Drift diameter for most common bit size. This drift diameter shall be specified on the purchase order and marked on the pipe. See 7.9 for drift requirements.

Table 21—Dimensions and Weights for Nonupset, External-Upset, and Integral-Joint Tubing (See Note)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
							Calculated Weight[c]				
							e_w Weight Gain or Loss Due to End Finishing[b]				
	Weight Designation[a,c]							External Upset[d]			
Size Designation[a]	Non-upset T & C	Upset T & C	External Integral-Joint (in.)	Outside Diameter D (in.)	Wall Thickness t (in.)	Inside Diameter d (in.)	Plain-End w_{pe} (lb/ft)	Non-upset (lb)	Regular (lb)	Special Clearance (lb)	Integral Joint (lb)
1.050	1.14	1.20	—	1.050	0.113	0.824	1.13	0.20	1.40	—	—
1.050	1.48	1.54	—	1.050	0.154	0.742	1.48	—	1.32	—	—
1.315	1.70	1.80	1.72	1.315	0.133	1.049	1.68	0.40	1.40	—	0.20
1.315	2.19	2.24	—	1.315	0.179	0.957	2.17	—	1.35	—	—
1.660	—	—	2.10	1.660	0.125	1.410	2.05	—	—	—	0.20
1.660	2.30	2.40	2.33	1.660	0.140	1.380	2.27	0.80	1.60	—	0.20
1.660	3.03	3.07	—	1.660	0.191	1.278	3.00	—	1.50	0.20	—
1.900	—	—	2.40	1.900	0.125	1.650	2.37	—	—	—	0.20
1.900	2.75	2.90	2.76	1.900	0.145	1.610	2.72	0.60	2.00	—	0.20
1.900	3.65	3.73	—	1.900	0.200	1.500	3.63	—	2.03	—	—
1.900	4.42	—	—	1.900	0.250	1.400	4.41	—	—	—	—
1.900	5.15	—	—	1.900	0.300	1.300	5.13	—	—	—	—
2.063	—	—	3.25	2.063	0.156	1.751	3.18	—	—	—	0.20
2.063	—	—	—	2.063	0.225	1.613	4.42	—	—	—	—

Table 21—Dimensions and Weights for Nonupset, External-Upset, and Integral-Joint Tubing (See Note) (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
								Calculated Weight[c]			
								e_w, Weight Gain or Loss Due to End Finishing[b]			
	Weight Designation[a,c]								External Upset[d]		
Size Designation[a]	Non-upset T & C	Upset T & C	External Integral-Joint (in.)	Outside Diameter D (in.)	Wall Thickness t (in.)	Inside Diameter d (in.)	Plain-End w_{pe} (lb/ft)	Non-upset (lb)	Regular (lb)	Special Clearance (lb)	Integral Joint (lb)
$2^3/_8$	4.00	—	—	2.375	0.167	2.041	3.94	1.60	—	—	—
$2^3/_8$	4.60	4.70	—	2.375	0.190	1.995	4.44	1.60	4.00	2.96	—
$2^3/_8$	5.80	5.95	—	2.375	0.254	1.867	5.76	1.40	3.60	2.56	—
$2^3/_8$	6.60	—	—	2.375	0.295	1.785	6.56	—	—	—	—
$2^3/_8$	7.35	7.45	—	2.375	0.336	1.703	7.32	—	—	—	—
$2^7/_8$	6.40	6.50	—	2.875	0.217	2.441	6.17	3.20	5.60	3.76	—
$2^7/_8$	7.80	7.90	—	2.875	0.276	2.323	7.67	2.80	5.80	3.92	—
$2^7/_8$	8.60	8.70	—	2.875	0.308	2.259	8.45	2.60	5.00	3.16	—
$2^7/_8$	9.35	9.45	—	2.875	0.340	2.195	9.21	—	—	—	—
$2^7/_8$	10.50	—	—	2.875	0.392	2.091	10.40	—	—	—	—
$2^7/_8$	11.50	—	—	2.875	0.440	1.995	11.45	—	—	—	—
$3^1/_2$	7.70	—	—	3.500	0.216	3.068	7.58	5.40	—	—	—
$3^1/_2$	9.20	9.30	—	3.500	0.254	2.992	8.81	5.00	9.20	5.40	—
$3^1/_2$	10.20	—	—	3.500	0.289	2.922	9.92	4.80	—	—	—
$3^1/_2$	12.70	12.95	—	3.500	0.375	2.750	12.53	4.00	8.20	4.40	—
$3^1/_2$	14.30	—	—	3.500	0.430	2.640	14.11	—	—	—	—
$3^1/_2$	15.50	—	—	3.500	0.476	2.548	15.39	—	—	—	—
$3^1/_2$	17.00	—	—	3.500	0.530	2.440	16.83	—	—	—	—
4	9.50	—	—	4.000	0.226	3.548	9.12	6.20	—	—	—
4	—	11.00	—	4.000	0.262	3.476	10.47	—	10.60	—	—
4	13.20	—	—	4.000	0.330	3.340	12.95	—	—	—	—
4	16.10	—	—	4.000	0.415	3.170	15.90	—	—	—	—
4	18.90	—	—	4.000	0.500	3.000	18.71	—	—	—	—
4	22.20	—	—	4.000	0.610	2.780	22.11	—	—	—	—
$4^1/_2$	12.60	12.75	—	4.500	0.271	3.958	12.25	6.00	13.20	—	—
$4^1/_2$	15.20	—	—	4.500	0.337	3.826	15.00	—	—	—	—
$4^1/_2$	17.00	—	—	4.500	0.380	3.740	16.77	—	—	—	—
$4^1/_2$	18.90	—	—	4.500	0.430	3.640	18.71	—	—	—	—
$4^1/_2$	21.50	—	—	4.500	0.500	3.500	21.38	—	—	—	—
$4^1/_2$	23.70	—	—	4.500	0.560	3.380	23.59	—	—	—	—
$4^1/_2$	26.10	—	—	4.500	0.630	3.240	26.06	—	—	—	—

Note: See Figures 4, 5, and 7.

[a]Designations (columns 1–4) are shown for the purpose of identification in ordering.

[b]Weight gain or loss due to end finishing. See 7.4.

[c]The densities of martensitic chromium steels (L80 Types 9Cr and 13Cr) are different from carbon steels (columns 2, 3, and 4). The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

[d]The length of the upset may alter the weight gain or loss due to end finishing.

Table 22—Dimensions and Weights for Upset End of Extreme-Line Casing (See Note)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
				Finished Pin and Box Dimensions								
	Designation		Outside Diameter, OD	Pin and Box OD (Turned) +0.020, −0.010		Pin ID (Bored) +0.015, −0.015	Box ID (Bored) +0.030, −0.000	Pin and Box Made-up[a] (Power-tight)			Drift Diameter for Finish Bored Upset Members	Drift Diameter[b] for Full Length Drifting (Minimum)
								OD +0.020, -0.010		ID +0.010, -0.005		
				Standard	Optional	Standard & Optional	Standard & Optional			Standard & Optional	Standard & Optional	Standard & Optional
				M	M	B	D					
Group	Size	Weight	(in.)	(in.)	(in.)	(in.)	(in.)	Standard[c] (in.)	Optional[c] (in.)	(in.)	(in.)	(in.)
1, 2, 3	5	15.00	5.000	5.360	—	4.208	4.235	5.360	—	4.198	4.183	4.151
1, 2, 3	5	18.00	5.000	5.360	—	4.208	4.235	5.360	—	4.198	4.183	4.151
1	5 1/2	15.50	5.500	5.860	5.780	4.746	4.773	5.860	5.780	4.736	4.721	4.653
1, 2, 3	5 1/2	17.00	5.500	5.860	5.780	4.711	4.738	5.860	5.780	4.701	4.686	4.653
1, 2, 3	5 1/2	20.00	5.500	5.860	5.780	4.711	4.738	5.860	5.780	4.701	4.686	4.653
1, 2, 3	5 1/2	23.00	5.500	5.860	5.780	4.619	4.647	5.860	5.780	4.610	4.595	4.545
1, 2, 3	6 5/8	24.00	6.625	7.000	6.930	5.792	5.818	7.000	6.930	5.781	5.766	5.730
1, 2, 3	6 5/8	28.00	6.625	7.000	6.930	5.741	5.768	7.000	6.930	5.731	5.716	5.666
1, 2, 3	6 5/8	32.00	6.625	7.000	6.930	5.624	5.652	7.000	6.930	5.615	5.600	5.550
1, 2	7	23.00	7.000	7.390	7.310	6.182	6.208	7.390	7.310	6.171	6.156	6.151
1, 2, 3	7	26.00	7.000	7.390	7.310	6.182	6.208	7.390	7.310	6.171	5.156	6.151
1, 2, 3	7	29.00	7.000	7.390	7.310	6.134	6.160	7.390	7.310	6.123	6.108	6.059
1, 2, 3	7	32.00	7.000	7.390	7.310	6.042	6.069	7.390	7.310	6.032	6.017	5.969
1, 2, 3	7	35.00	7.000	7.530	7.390	5.949	5.977	7.530	7.390	5.940	5.925	5.879
1, 2, 3	7	38.00	7.000	7.530	7.390	5.869	5.897	7.530	7.390	5.860	5.845	5.795
1, 2	7 5/8	26.40	7.625	8.010	7.920	6.782	6.807	8.010	7.920	6.770	6.755	6.750
1, 2, 3	7 5/8	29.70	7.625	8.010	7.920	6.782	6.807	8.010	7.920	6.770	6.755	6.750
1, 2, 3	7 5/8	33.70	7.625	8.010	7.920	6.716	6.742	8.010	7.920	6.705	6.690	6.640
1, 2, 3	7 5/8	39.00	7.625	8.010	7.920	6.575	6.602	8.010	7.920	6.565	6.550	6.500
1	8 5/8	32.00	8.625	9.120	9.030	7.737	7.762	9.120	9.030	7.725	7.710	7.700
1, 2	8 5/8	36.00	8.625	9.120	9.030	7.737	7.762	9.120	9.030	7.725	7.710	7.700
1, 2, 3	8 5/8	40.00	8.625	9.120	9.030	7.674	7.700	9.120	9.030	7.663	7.648	7.600
1, 2, 3	8 5/8	44.00	8.625	9.120	9.030	7.575	7.602	9.120	9.030	7.565	7.550	7.500
1, 2, 3	8 5/8	49.00	8.625	9.120	9.030	7.460	7.488	9.120	9.030	7.451	7.436	7.386
1, 2	9 5/8	40.00	9.625	10.100	10.020	8.677	8.702	10.100	10.020	8.665	8.650	8.599
1, 2, 3	9 5/8	43.50	9.625	10.100	10.020	8.677	8.702	10.100	10.020	8.665	8.650	8.599
1, 2, 3	9 5/8	47.00	9.625	10.100	10.020	8.633	8.658	10.100	10.020	8.621	8.606	8.525
1, 2, 3	9 5/8	53.50	9.625	10.100	10.020	8.485	8.512	10.100	10.020	8.475	8.460	8.379
1	10 3/4	45.50	10.750	11.460	—	9.829	9.854	11.460	—	9.819	9.804	9.794
1, 2, 3	10 3/4	51.00	10.750	11.460	—	9.729	9.754	11.460	—	9.719	9.704	9.694
1, 2, 3	10 3/4	55.50	10.750	11.460	—	9.639	9.664	11.460	—	9.629	9.614	9.604
3	10 3/4	60.70	10.750	11.460	—	9.539	9.564	11.460	—	9.529	9.514	9.504

Note: Due to the nature of extreme-line casing, certain dimensional symbols and nomenclature differ from those for similar details for other pipe covered by this specification. See Figure 8.

[a]Shown for reference.

[b]See Table 54.

[c]Made-up joint OD is the same as outside diameter dimension M.

Table 23—Dimensions and Weights for Upset End of External-Upset Tubing—Groups 1, 2, and 3 (See Note)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				Upset Dimensions, in.			
	Designation[d,e]		Outside Diameter (in.)	Outside Diametric +0.0625	Length,[a,b] End of Pipe to Start of Taper +0, –1	Length,[b] End of Pipe to End of Taper	Length,[a,b] End of Pipe to Start of Pipe Body (maximum)
Group	Size	Weight	D	D_4	L_{eu}	L_a	L_b
1, 2	1.050	1.20	1.050	1.315	$2^3/_8$	—	—
1, 2	1.315	1.80	1.315	1.469	$2^1/_2$	—	—
1, 2	1.660	2.40	1.660	1.812	$2^5/_8$	—	—
1, 2	1.900	2.90	1.900	2.094	$2^{11}/_{16}$	—	—
1, 2, 3	$2^3/_8$	4.70	2.375	2.594	4	6	10
1, 2, 3	$2^3/_8$	5.95	2.375	2.594	4	6	10
1, 2, 3	$2^7/_8$	6.50	2.875	3.094	$4^1/_4$	$6^1/_4$	$10^1/_4$
1, 2, 3	$2^7/_8$	7.90	2.875	3.094	$4^1/_4$	$6^1/_4$	$10^1/_4$
1, 2, 3	$2^7/_8$	8.70	2.875	3.094	$4^1/_4$	$6^1/_4$	$10^1/_4$
1, 2, 3	$3^1/_2$	9.30	3.500	3.750	$4^1/_2$	$6^1/_2$	$10^1/_2$
1, 2, 3	$3^1/_2$	12.95	3.500	3.750	$4^1/_2$	$6^1/_2$	$10^1/_2$
1, 2	4	11.00	4.000	4.250	$4^1/_2$	$6^1/_2$	$10^1/_2$
1, 2	$4^1/_2$	12.75	4.500	4.750	$4^3/_4$	$6^3/_4$	$10^3/4$

Note: See Figure 5.

[a]For pup joints only the length tolerance on L_{eu} is +4, –1 inch. The length on L_b may be 4 inches longer than specified.

[b]For extended length upsets on external upset tubing, add 1 inch to the dimensions in columns. 4, 5, and 6.

[c]The minimum outside diameter of upset, D_4, is limited by the minimum length of full-crest threads. See API Standard 5B.

[d]Designations (columns 1 and 2) are shown for the purpose of identification in ordering.

[e]The densities of martensitic chromium steels (L80 Types 9Cr and 13Cr) are different from carbon steels. The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

Table 24—Dimensions and Weights for Upset End of Integral-Joint Tubing—Groups 1 and 2 (See Note)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
				Upset Dimensions, in.								
				Pin				Box				
	Designation[c]		Outside Diameter (in.)	Outside Diameter,[a] +0.0625	Inside Diameter,[b] +0.015	Length Min.	Length of Taper Min.	Outside Diameter, +0.005, –0.025	Length Min.	Length of Taper	Diameter of Recess	Width of Face Min.
Group	Size	Weight	D	D_4	d_{iu}	L_{iu}	m_{iu}	W_b	L_{eu}	m_{eu}	Q	b
1, 2	1.315	1.72	1.315	—	0.970	$1^3/_8$	$1/_4$	1.550	1.750	1	1.378	$1/_{32}$
1	1.660	2.10	1.660	—	1.301	$1^1/_2$	$1/_4$	1.880	1.875	1	1.723	$1/_{32}$
1, 2	1.660	2.33	1.660	—	1.301	$1^1/_2$	$1/_4$	1.880	1.875	1	1.723	$1/_{32}$
1	1.900	2.40	1.900	—	1.531	$1^5/_8$	$1/_4$	2.110	2.000	1	1.963	$1/_{32}$
1, 2	1.900	2.76	1.900	—	1.531	$1^5/_8$	$1/_4$	2.110	2.000	1	1.963	$1/_{32}$
1, 2	2.063	3.25	2.063	2.094	1.672	$1^{11}/_{16}$	$1/_4$	2.325	2.125	1	2.156	$1/_{32}$

Note: See Figure 7.

[a]The minimum outside diameter, D_4, is limited by the minimum length of full-crest threads. See API Standard 5B.

[b]The minimum inside diameter, d_{iu}, is limited by the drift test.

[c]Designations (columns 1 and 2), are shown for purpose of identification in ordering.

Table 25—Dimensions and Weights for Plain-End Liners—Group 1 (Grade J55 Only)

(1)	(2)	(3)	(4)	(5)
Designation		Outside Diameter, *D*	Wall Thickness, *t*	Inside Diameter, *d*
Size	Weight	(in.)	(in.)	(in.)
$3^1/_2$	9.91	3.500	0.289	2.922
4	11.34	4.000	0.286	3.428
$4^1/_2$	13.04	4.500	0.290	3.920
5	17.93	5.000	0.362	4.276
$5^1/_2$	19.81	5.500	0.361	4.778
$6^5/_8$	27.65	6.625	0.417	5.791

Table 26—Range Lengths

	Range 1 (feet)	Range 2 (feet)	Range 3 (feet)
Casing and Liners			
Range length, minimum	16.0	25.0	34.0
Range length, maximum	25.0	34.0	48.0
Range length[a] for 95 percent or more of carload:			
Permissible variation within the range length, maximum	6.0	5.0	6.0
Permissible length, minimum	18.0	28.0	36.0
Tubing			
Range length, minimum	20.0	28.0	—
Range length[b], maximum	24.0	32.0	—
Range length[a] for 100 percent of carload:			
Permissible variation within the range length, maximum	2.0	2.0	—
Pup Joints			
Lengths[c]—2, 3, 4, 6, 8, 10, and 12 feet			
Tolerance—±3 inches			

[a]Carload tolerances shall not apply to order items of less than 40,000 pounds of pipe. For any carload of 40,000 pounds or more of pipe that is shipped to the final destination without transfer or removal from the car, the tolerance shall apply to each car. For any order item consisting of 40,000 pounds or more of pipe that is shipped from the manufacturer's facility by rail, but not to the final destination, the carload tolerances shall apply to the overall quantity of pipe shipped on the order item, but not to the individual carloads.

[b]By agreement between the purchaser and the manufacturer, the total range length for Range 1 tubing may be 20–28 feet.

[c]Two-foot pup joints may be furnished up to 3-feet-long by agreement between the purchaser and the manufacturer, and lengths other than those listed may be furnished by agreement between the purchaser and the manufacturer.

Table 27—Drift Mandrel Dimensions for Casing Used With Common Bit Sizes

Designation		Minimum Drift Mandrel	
Size	Weight	Length (in.)	Diameter (in.)
7	23.0	6	6.250
7	32.0	6	6.000
$7^3/_4$	46.1	6	6.500
$8^5/_8$	32.0	6	7.875
$8^5/_8$	40.0	6	7.625
$9^5/_8$	40.0	12	8.750
$9^5/_8$	53.5	12	8.500
$9^5/_8$	48.4	12	8.375
$10^3/_4$	45.5	12	9.875
$10^3/_4$	55.5	12	9.625
$11^3/_4$	42.0	12	11.000
$11^3/_4$	60.0	12	10.625
$11^3/_4$	65.0	12	10.625
$13^3/_8$	72.0	12	12.250

Table 28—Drift Mandrel Dimensions for Casing Used in Tubing Service

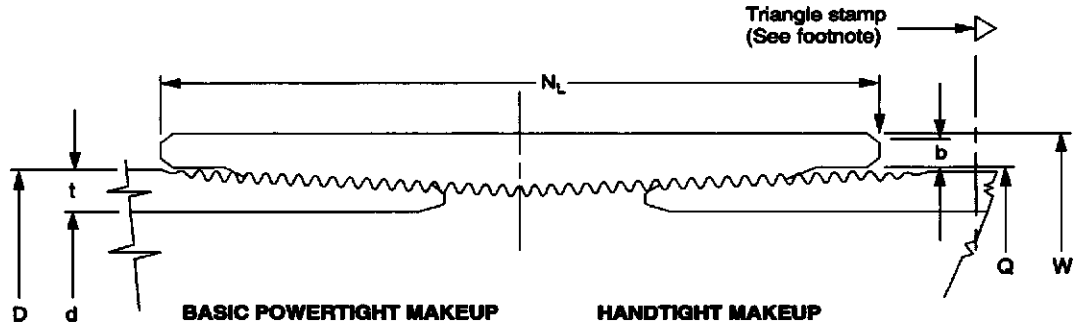
Size Designation	Minimum Drift Mandrel	
	Length (in.)	Diameter (in.)
$4^1/_2$ exclusive to $8^5/_8$ inclusive	42	d-$^1/_8$
$8^5/_8$ exclusive to $10^3/_4$ exclusive	42	d-$^5/_{32}$

Table 29—Maximum Permissible Depth of Imperfections for Upset Products (Measured From the Surface)

(1)	(2)	(3)
Surface	Depth	Measurement Notes
(A) Extreme-Line Casing, Integral Joint, and External-Upset Tubing		
1. All surfaces of upset and upset runout interval, except as stated below.	$12^1/_2$ percent	Percent of specified pipe body wall thickness for nonlinear imperfections for all groups of pipe.
	$12^1/_2$ percent	Percent of specified pipe body wall thickness for linear imperfections for Group 1 and Group 2 (except C90 and T95) pipe.
	5 percent	Percent of specified pipe body wall thickness for linear imperfections for Group 3, Group 4, and Grades C90 and T95 pipe.
2. The minimum wall thickness in the upset runout interval, and the maximum combined effect of coincident internal and external imperfections in all areas shall not result in less than $87^1/_2$ percent of the specified wall thickness.		
(B) Extreme-Line Casing		
1. Box end external surface	0.010 inch	For $7^5/_8$-inches and smaller (from the end of the pipe to a plane $4^3/_4$-inches from the end).
	0.010 inch	For $8^5/_8$-inches and larger (from the end of the pipe to a plane $6^1/_2$-inches from the end).
2. Pin end internal surface	0.015 inch	From the end of the pipe to a plane of the external shoulder (bored).

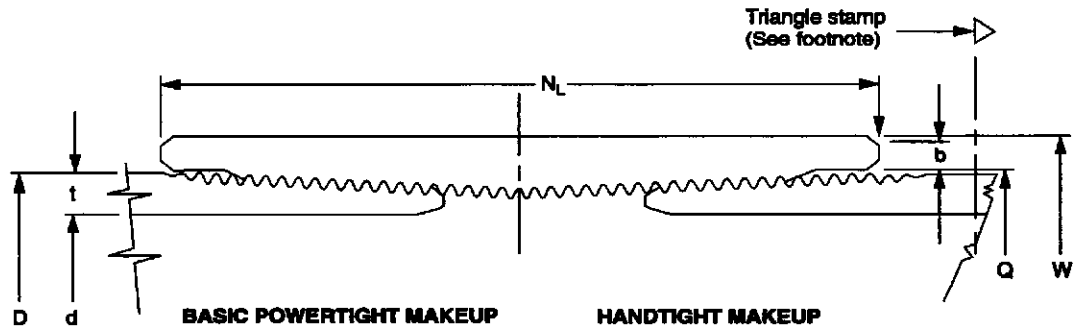
Table 29—Maximum Permissible Depth of Imperfections for Upset Products (Measured From the Surface) (Continued)

(1) Surface	(2) Depth	(3) Measurement Notes
3. All machined surfaces of the box shall be free of seams, laps, and cracks. The pin and box shall be free of any imperfections that break the continuity of the threads or seals.		
(C) Integral Joint Tubing		
1. Box end external surface	0.010 inch	From the end of the pipe to a plane at a distance equal to the specified minimum dimension, L_{eu}, from end of pipe (see Figure 7).
2. Pin end internal surface	0.015 inch	From the end of the pipe to a plane at a distance equal to the specified minimum dimension, L_{iu}, from the end of the pipe (see Figure 7). For Grades C90 and T95, the maximum permissible depth for linear imperfections shall be 5 percent of the specified pipe body wall thickness.
3. Upset underfills in the upset runout intervals shall not be considered a defect unless the remaining wall thickness (at the upset underfill) is less than $87^1/_2$ percent of the specified pipe body wall thickness.		



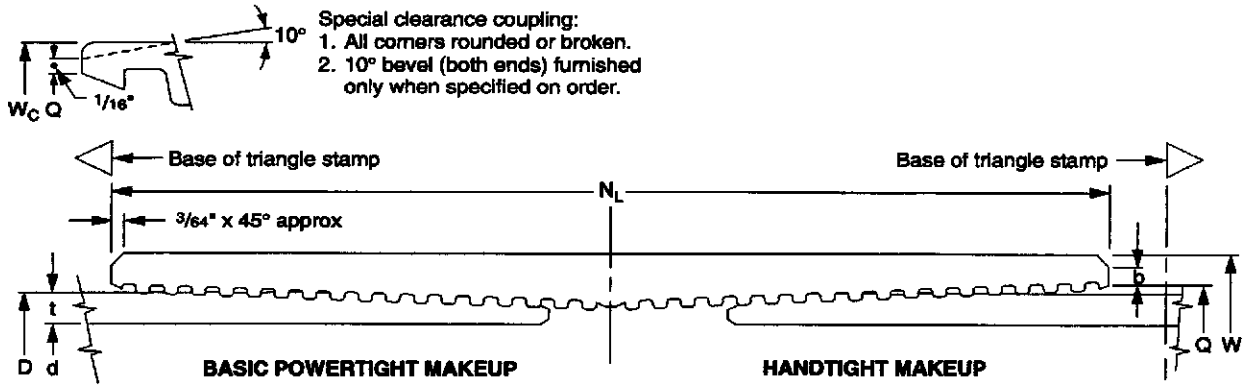
Notes:
1. A $^3/_8$-inch-high equilateral triangle die stamp shall be placed at a distance of $L_4 + {}^1/_{16}$-inch from each end of sizes 16, $18^5/_8$, and 20, short round thread casing in Grades H40, J55, K55, and M65; see API Standard 5B.
2. See Table 20 for pipe dimensions, Table 31 for coupling dimensions, and API Standard 5B for thread details.

Figure 1—Short Round Thread Casing and Coupling



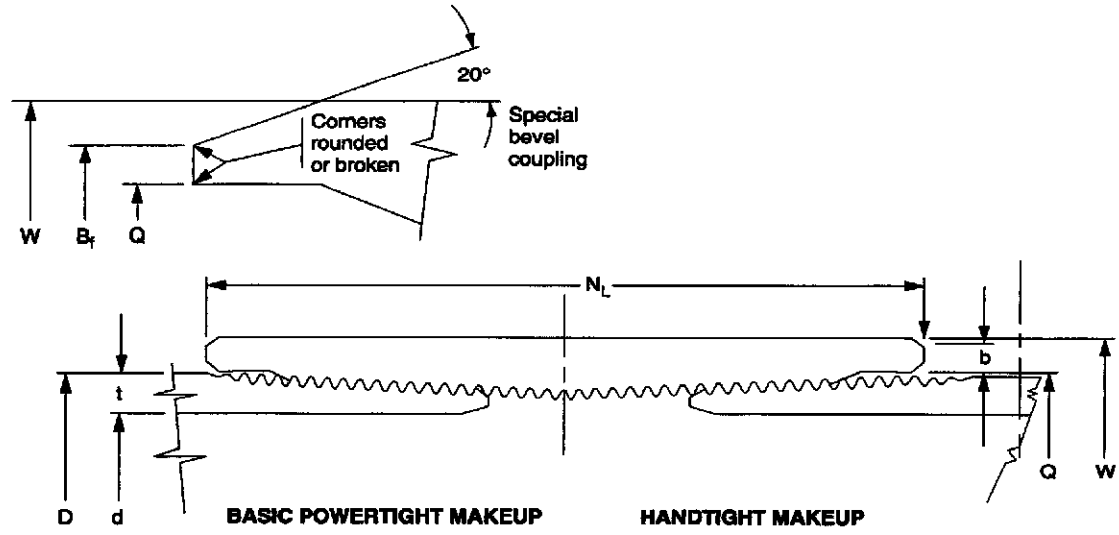
Notes:
1. A $^3/_8$-inch-high equilateral triangle die stamp shall be placed at a distance of $L_4 + {}^1/_{16}$-inch from each end of sizes 20, long round thread casing in Grades H40, J55, K55, and M65; see API Standard 5B.
2. See Table 20 for pipe dimensions, Table 31 for coupling dimensions, and API Standard 5B for thread details.

Figure 2—Long Round Thread Casing and Coupling



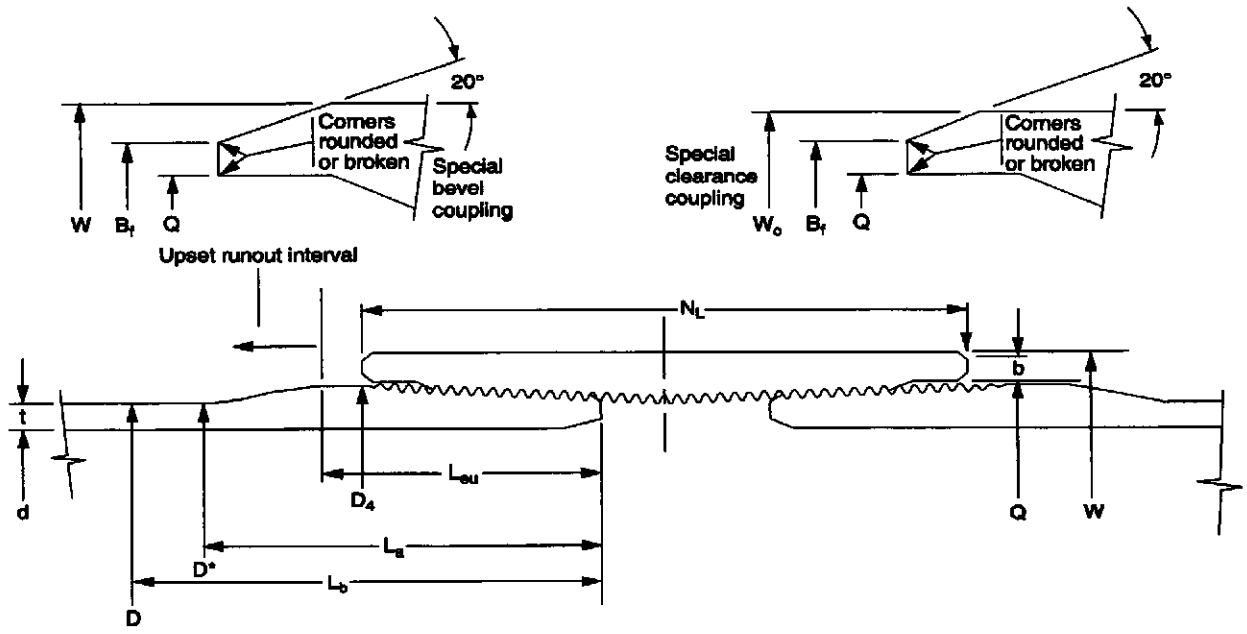
Notes:
1. A 3/8-inch-high equilateral triangle die stamp or paint band shall be placed at a distance of A1 from each end of buttress casing; see API Standard 5B.
2. See Table 20 for pipe dimensions, Table 32 for coupling dimensions, and API Standard 5B for thread details.

Figure 3—Buttress Thread Casing and Coupling



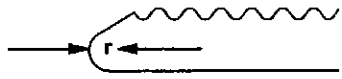
Note: See Table 21 for pipe dimensions, Table 33 for coupling dimensions, and API Standard 5B for thread details.

Figure 4—Nonupset Tubing and Coupling



*See Tables 21 and 23 for pipe dimensions, Table 34 for coupling dimensions, and API Standard 5B for thread details.

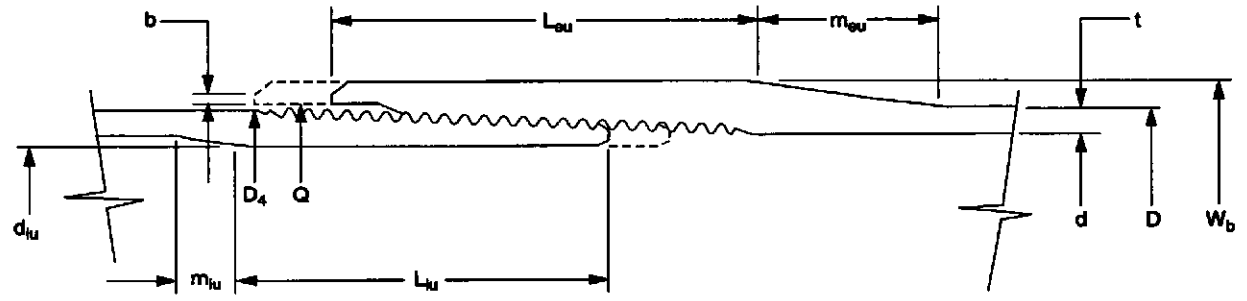
Figure 5—External-Upset Tubing and Coupling



Size	Radius, r (See Note 1)
2⅜	3/32 inch
2⅞	3/32 inch
3½	⅛ inch
4½	⅛ inch

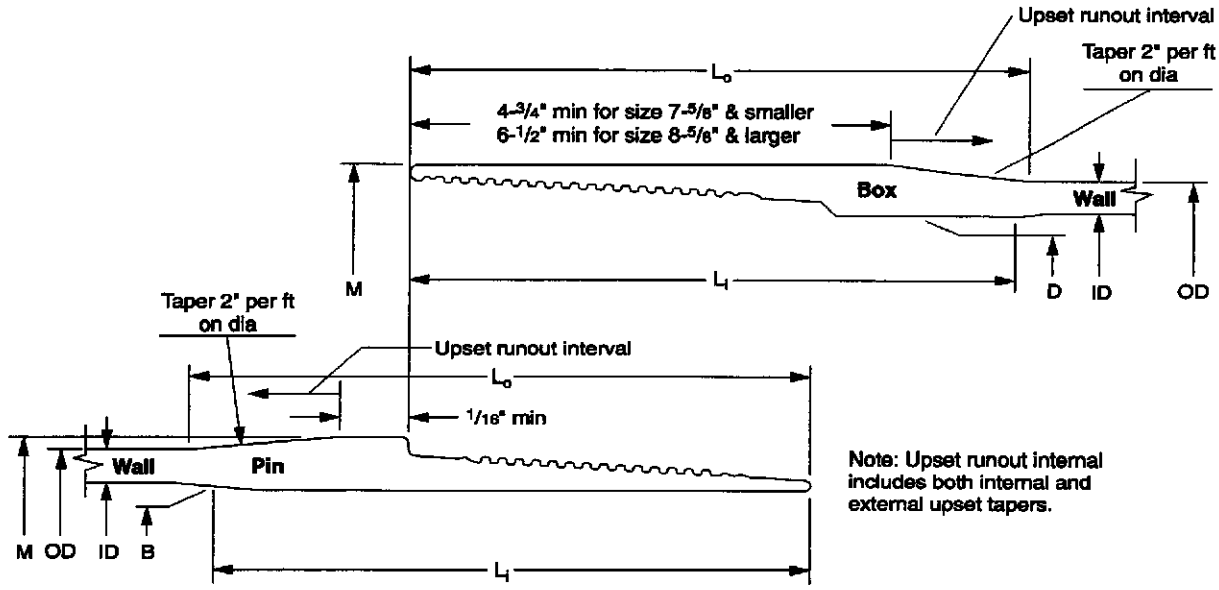
Notes:
1. These dimensions are for reference only and are not subject to measurement for determining product acceptance.
2. See API Standard 5B for details.

Figure 6—Rounded Nose for External-Upset Tubing

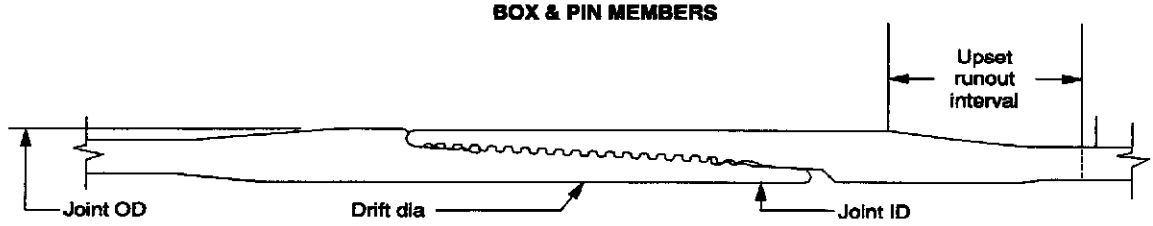


Notes:
1. Dashed lines indicate power-tight makeup.
2. See Tables 21 and 24 for pipe dimensions and API Standard 5B for thread details.

Figure 7—Integral-Joint Tubing



BOX & PIN MEMBERS



POWER-TIGHT MAKEUP

Size Designation	Length of Upset: Pin,[a] Min. in. L_i	Box,[a] Min. in. L_i	Pin or Box,[c] Max. in. L_o
5	$6^5/_8$	7	8
$5^1/_2$	$6^5/_8$	7	8
$6^5/_8$	$6^5/_8$	7	8
7	$6^5/_8$	7	8[b]
$7^5/_8$	$6^5/_8$	7	8
$8^5/_8$	8	$8^3/_4$	11
$9^5/_8$	8	$8^3/_4$	11
$10^3/_4$	8	$8^3/_4$	$12^3/_4$

[a] L_i is the minimum length from end of pipe of the machined diameter B on pin, or machined diameter D plus length of thread on box, to the beginning of the internal upset runout.
[b] L_o shall be 9 in. max. for 7–35 and 7–designation casing.
[c] For pup joints only, L_o may be 5 in. longer than specified for either pin or box.

Note: See Table 20 for pipe dimensions and API Standard 5B for thread details.

Figure 8—Extreme-Line Casing

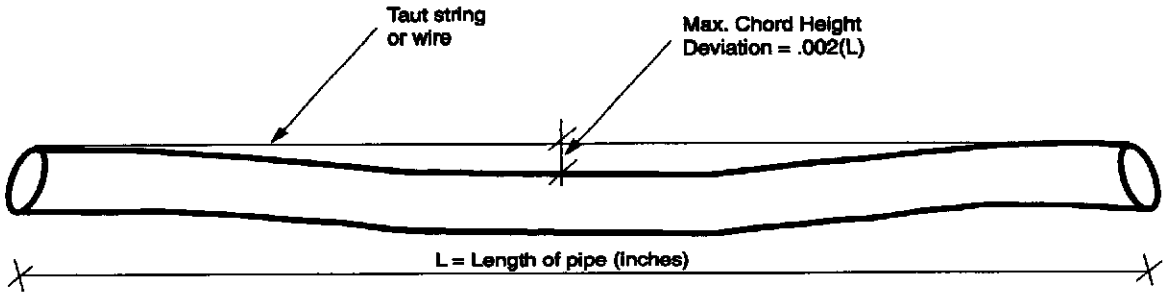


Figure 9—Measuring Full Length Straightness

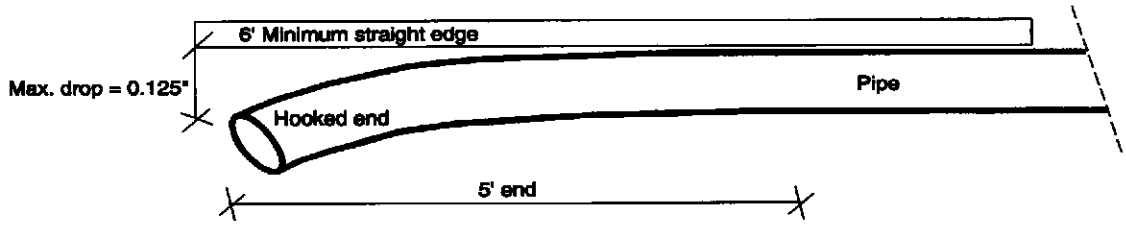


Figure 10—Measuring End Straightness

8 Couplings

8.1 MATERIAL

Couplings (see note) for pipe conforming to this specification shall be seamless, of the same grade and type as the pipe, and given the same heat treatment as the pipe, with the exceptions listed in 8.1.1–8.1.4.

Note: When couplings are electroplated, the electroplating process should be controlled to minimize hydrogen absorption.

8.1.1 Group 1

8.1.1.1 When heat treatment is not stipulated on the purchase order, Grade H40 pipe may be furnished with either as-rolled, normalized, normalized and tempered, or quenched and tempered Grade H40, J55, or K55 couplings.

8.1.1.2 When heat treatment is not stipulated on the purchase order, Grade J55 pipe may be furnished with either as-rolled, normalized, normalized and tempered, or quenched and tempered Grade J55 or K55 couplings.

8.1.1.3 When heat treatment is not stipulated on the purchase order, Grade K55 pipe may be furnished with either as-rolled, normalized, normalized and tempered, or quenched and tempered Grade K55 couplings.

8.1.1.4 Grade J55 EUE tubing shall be furnished with L80 special clearance couplings when specified on the purchase order.

8.1.1.5 Grade J55 and K55 buttress casing shall be furnished with L80 couplings when specified on the purchase order.

8.1.1.6 Normalized Grade N80 pipe may be furnished with either normalized, normalized and tempered, or quenched and tempered Grade N80 couplings.

8.1.1.7 Normalized and tempered Grade N80 pipe may be furnished with either normalized and tempered or quenched and tempered Grade N80 couplings.

8.1.1.8 Grade N80 EUE tubing shall be furnished with P110 special clearance couplings when specified on the purchase order.

8.1.1.9 Grade N80 buttress casing shall be furnished with P110 couplings when specified on the purchase order.

8.1.2 Group 2

Grade M65 shall be furnished with L80 couplings.

8.1.3 Group 3

Grade P110 buttress casing shall be furnished with Q125 couplings when specified on the purchase order.

8.1.4 Group 4

The couplings shall be of seamless manufacture using the same requirements and quality control provisions as casing

manufactured to this specification. (See Sections 5 and 6.) Couplings and coupling blanks must be cut from coupling stock. For coupling blanks, refer to SR9 in Appendix B.

8.2 PROCESS OF MANUFACTURE

8.2.1 Groups 1, 2, and 3

8.2.1.1 Seamless Pipe and Hot Forging

Couplings made from seamless pipe as defined in 5.1.3 or hot forgings shall be heat treated as required in 5.2.

8.2.1.2 Subcritical Forging

Grade J and K couplings made by subcritical forging shall be stress relieved or, at the option of the manufacturer, may be normalized or normalized and tempered. Grade N80 couplings shall be normalized and tempered or, at the option of the manufacturer, may be quenched and tempered. For Groups 2 and 3, couplings shall be heat treated as specified in 5.2 for the particular grade and type.

8.2.1.3 Centrifugal Casting

Couplings made by centrifugal casting shall be cast in a rotating mold, shall be given a homogenizing heat treatment (as defined in the latest edition of ASTM E 44) prior to the final treatment, and shall be fully machined on all surfaces. All grades of centrifugally cast couplings shall be either normalized and tempered or quenched and tempered at the option of the manufacturer.

8.2.2 Group 4

Couplings made from seamless pipe as defined in 5.1.3 shall be heat treated as required in 5.2.

8.3 PERFORMANCE PROPERTIES

Buttress thread casing in the sizes and weights shown in Table 30 will not develop the highest minimum joint strengths listed in API Bulletin 5C2 unless couplings of the next higher grade are specified.

8.4 MECHANICAL PROPERTIES

Couplings shall conform to the mechanical requirements specified in Sections 6 and 9, including the frequency of testing, retest provision, etc. A record of these tests shall be open to inspection by the purchaser.

8.5 DIMENSIONS AND TOLERANCES

8.5.1 Groups 1, 2, and 3

Couplings shall conform to the dimensions and tolerances shown in Tables 31 through 34. Unless otherwise specified, threaded-and-coupled casing and tubing shall be furnished with regular couplings.

8.5.2 Group 4

Couplings may be machined on the complete outside surface in addition to the inside surface (see note). Dimensions shall be as specified on the purchase order unless standard API couplings are ordered, in which case the dimension shall be as shown in Tables 31 and 32.

Note: The purchaser should recognize that API threaded couplings with the regular outside diameter may not have a leak resistance as high as the internal yield pressure rating of the pipe body due to inadequate bearing pressure between the coupling and pin.

8.6 REGULAR COUPLINGS

Regular couplings have outside diameters as shown in column 2 of Tables 31 through 34. The inside and outside edges of the bearing face shall be rounded or broken but shall not materially reduce dimension *b* so that enough thickness is left to safely support the weight of the pipe on the elevator. The ends of couplings shall be faced true at right angles to the axis.

8.7 SPECIAL CLEARANCE COUPLINGS—GROUPS 1, 2, AND 3

Special clearance (reduced OD) couplings for buttress casing and external upset tubing shall be furnished when specified in the purchase order. Special clearance couplings shall conform to the dimensions (except *b*) and tolerances given in Tables 32 and 34. For marking and color identification, see Section 10. Unless otherwise specified, special clearance tubing couplings shall be beveled on both ends.

Table 30—Buttress Casing Requiring the Next Higher Grade Coupling for API Bulletin 5C2 Joint Strength

Designation	Weight Designation	
	Regular Coupling	Special Clearance Coupling
$4^1/_2$	—	13.5, heavier
5	21.4, heavier	15.0, heavier
$5^1/_2$	23.0	all
$6^5/_8$	—	all
7	32.0, heavier	all
7[a]	35.0, heavier	—
$7^5/_8$	—	29.7, heavier
$7^5/_8$[a]	42.8, heavier	—
$8^5/_8$	—	all
$9^5/_8$	—	all
$10^3/_4$	—	all
$11^3/_4$[a]	—	—
$13^3/_8$[a]	—	—

[a]For Grade Q125.

Table 31—Round Thread Casing Coupling Dimensions, Weights, and Tolerances—All Groups (Inches)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Outside Size Designation[a]	Outside Diameter, W^b	Minimum Length, N_L[c] Short	Minimum Length, N_L[c] Diameter Long	Diameter of Recess, Q^d	Width of Bearing Face b	Weight, lbs Short	Weight, lbs Long
$4^1/_2$	5.000	$6^1/_4$	7	$4^{19}/_{32}$	$^5/_{32}$	7.98	9.16
5	5.563	$6^1/_2$	$7^3/_4$	$5^3/_{32}$	$^3/_{16}$	10.27	12.68
$5^1/_2$	6.050	$6^3/_4$	8	$5^{19}/_{32}$	$^1/_8$	11.54	14.15
$6^5/_8$	7.390	$7^1/_4$	$8^3/_4$	$6^{23}/_{32}$	$^1/_4$	20.11	25.01
7	7.656	$7^1/_4$	9	$7^3/_{32}$	$^3/_{16}$	18.49	23.87
$7^5/_8$	8.500	$7^1/_2$	$9^1/_4$	$7^{25}/_{32}$	$^7/_{32}$	27.11	34.46
$8^5/_8$	9.625	$7^3/_4$	10	$8^{25}/_{32}$	$^1/_4$	35.79	47.77
$9^5/_8$	10.625	$7^3/_4$	$10^1/_2$	$9^{25}/_{32}$	$^1/_4$	39.75	56.11
$10^3/_4$	11.750	8	—	$10^{29}/_{32}$	$^1/_4$	45.81	—
$11^3/_4$	12.750	8	—	$11^{29}/_{32}$	$^1/_4$	49.91	—
$13^3/_8$	14.375	8	—	$13^{17}/_{32}$	$^7/_{32}$	56.57	—
16	17.000	9	—	$16^7/_{32}$	$^7/_{32}$	76.96	—
$18^5/_8$	20.000	9	—	$18^{27}/_{32}$	$^7/_{32}$	119.07	—
20	21.000	9	$11^1/_2$	$20^7/_{32}$	$^7/_{32}$	95.73	126.87

Note: See Figures 1 and 2.

[a]The size designation of the coupling is the same as the corresponding pipe size designation.

[b]Tolerance on outside diameter, W, for Groups 1, 2, and 3 is ±1 percent but not greater than $\pm^1/_8$ inch. For Group 4, tolerance on outside diameter, W, is ±1 percent but not greater than $+^1/_8$ inch, $-^1/_{16}$ inch.

[c]Short or long couplings available on Group 1 pipe, up to size $10^3/_4$. Sizes $10^3/_4$ and larger (except size 20) use only short couplings on all groups.

[d]Tolerance on diameter of recess, Q, for all groups is $Q + 0.031$ inch -0.

Table 32—Buttress Thread Casing Coupling Dimensions, Weights, and Tolerances—All Groups (Inches)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Outside Diameter					Weight, lbs	
Size Designation[a]	Regular, W^b	Special Clearance, Wc^c	Minimum Length, N_L	Diameter of Counterbore Q	Width of Bearing Face, b	Regular	Special Clearance
$4^1/_2$	5.000	4.875	$8^7/_8$	4.640	$^1/_8$	10.12	7.68
5	5.563	5.375	$9^1/_8$	5.140	$^5/_{32}$	13.00	8.82
$5^1/_2$	6.050	5.875	$9^1/_4$	5.640	$^5/_{32}$	14.15	9.85
$6^5/_8$	7.390	7.000	$9^5/_8$	6.765	$^1/_4$	24.49	12.46
7	7.656	7.375	10	7.140	$^7/_{32}$	23.24	13.84
$7^5/_8$	8.500	8.125	$10^3/_8$	7.765	$^5/_{16}$	34.88	20.47
$8^5/_8$	9.625	9.125	$10^5/_8$	8.765	$^3/_8$	45.99	23.80
$9^5/_8$	10.625	10.125	$10^5/_8$	9.765	$^3/_8$	51.05	26.49
$10^3/_4$	11.750	11.250	$10^5/_8$	10.890	$^3/_8$	56.74	29.52
$11^3/_4$	12.750	—	$10^5/_8$	11.890	$^3/_8$	61.80	—
$13^3/_8$	14.375	—	$10^5/_8$	13.515	$^3/_8$	70.03	—
16[d]	17.000	—	$10^5/_8$	16.154	$^3/_8$	88.81	—
$18^5/_8$[d]	20.000	—	$10^5/_8$	18.779	$^3/_8$	138.18	—
20[d]	21.000	—	$10^5/_8$	20.154	$^3/_8$	110.45	—

Note: See Figure 3.

[a]The size designation of the coupling is the same as the corresponding pipe size designation.

[b]For Groups 1, 2, and 3, the tolerance on outside diameter, W, is ±1 percent but not greater than $\pm^1/_8$ inch. For Group 4, the tolerance on outside diameter, W, is ±1 percent but not greater than $+^1/_8$ inch, $-^1/_{16}$ inch.

[c]For Groups 1, 2, and 3, the tolerance on outside diameter, Wc, is $+^1/_{32}$ inch, $-^1/_{64}$ inch.

[d]Available on Group 1 only.

8.8 COMBINATION COUPLINGS

Combination couplings with different types of threads of the same specified size designation shall be furnished when specified on the purchase order. The minimum length and minimum OD of combination couplings shall be sufficient to accommodate the specified size and type of threads.

8.9 REDUCING COUPLINGS

8.9.1 Groups 1, 2, and 3

Reducing couplings are used to connect two pipes of different OD size designations with the same or different types of thread on the two ends and shall be furnished when specified on the purchase order. The minimum length and minimum OD of reducing couplings shall be sufficient to accommodate the specified size and type of threads.

8.9.2 Group 4

Reducing couplings are not allowed.

8.10 SEAL-RING COUPLINGS

Seal-ring couplings conforming to the requirements of SR13 in Appendix B shall be furnished when specified on the purchase order.

8.11 SPECIAL-BEVEL COUPLINGS—GROUPS 1, 2, AND 3

Special-bevel couplings conforming to the requirements of Tables 33 and 34 shall be furnished for nonupset and external-upset tubing when specified on the purchase order. Unless otherwise specified, special-bevel couplings shall be beveled 20 degrees on both ends.

8.12 THREADING

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

8.13 SURFACE INSPECTION

8.13.1 General Requirements—All Groups

8.13.1.1 Couplings shall be visually inspected after finish machining and before any inside or outside surface plating or coating and shall be free of all visible seams, cracks (see note), and porosity except as permitted in 8.13.2.

Note: Visible seams or cracks are those that can be seen without the aid of magnetic particle inspection, dye penetrants, or other nondestructive methods of inspection.

8.13.1.2 Finished couplings shall be free of all imperfections on the inside that break the continuity of the thread.

8.13.1.3 Finished couplings with grip marks, pits, round or sharp bottom gouges, and similar imperfections are not cause for rejection unless the depth of the imperfections exceeds those listed in Table 35.

8.13.2 Surface Inspection—Specific Requirements

8.13.2.1 Group 1 (Grades H40, J55, and K55)

When specified on the purchase order, couplings shall be inspected in accordance with SR14 in Appendix B.

Table 33—Nonupset Tubing Coupling Dimensions, Weights, and Tolerances—Groups 1, 2, and 3 (Inches)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Group	Size Designation[a]	Outside Diameter W^b	Minimum Length N_L	Diameter of Recess Q	Width of Bearing Face b	Maximum Bearing Face Diameter, Special Bevel B_f	Weight (lbs)
1, 2	1.050[c]	1.313	3 3/16	1.113	1/16	1.181	0.51
1, 2	1.315	1.660	3 1/4	1.378	3/32	1.488	0.84
1, 2	1.660	2.054	3 1/2	1.723	1/8	1.857	1.29
1, 2	1.900	2.200	3 3/4	1.963	1/16	2.050	1.23
1, 2, 3	2 3/8	2.875	4 1/4	2.438	3/16	2.625	2.82
1, 2, 3	2 7/8	3.500	5 1/8	2.938	3/16	3.188	5.15
1, 2, 3	3 1/2	4.250	5 5/8	3.563	3/16	3.875	8.17
1, 2	4	4.750	5 3/4	4.063	3/16	4.375	9.58
1, 2	4 1/2	5.200	6 1/8	4.563	3/16	4.850	10.77

Note: See Figure 4.

[a]The size designation of the coupling is the same as the corresponding pipe size designation.

[b]The tolerance on outside diameter, W, is ±1 percent.

[c]For information only. Marking with the API Specification 5CT designation or the API monogram is not permitted.

Table 34—Upset Tubing Coupling Dimensions, Weights, and Tolerances—Groups 1, 2, and 3 (Inches)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		Outside Diameter								
Group	Size Designation[a]	Regular and Special Bevel W^b	Special Clearance Wc^c	Minimum Length N_L	Diameter of Recess Q	Width of Bearing Face Regular b	Maximum Bearing Face Diameter, B_f Special Bevel	Special Clearance	Weight, lb Regular	Special Clearance
1, 2	1.050	1.660	—	$3^1/_4$	1.378	$^3/_{32}$	1.488	—	0.84	—
1, 2	1.315	1.900	—	$3^1/_2$	1.531	$^3/_{32}$	1.684	—	1.26	—
1, 2	1.660	2.200	—	$3^3/_4$	1.875	$^1/_8$	2.006	—	1.49	—
1, 2	1.900	2.500	—	$3^7/_8$	2.156	$^1/_8$	2.297	—	1.85	—
1, 2, 3	$2^3/_8$	3.063	2.910	$4^7/_8$	2.656	$^5/_{32}$	2.828	2.752	3.43	2.35
1, 2, 3	$2^7/_8$	3.668	3.460	$5^1/_4$	3.156	$^7/_{32}$	3.381	3.277	5.30	3.42
1, 2, 3	$3^1/_2$	4.500	4.180	$5^3/_4$	3.813	$^1/_4$	4.125	3.965	9.03	5.24
1, 2	4	5.000	—	6	4.313	$^1/_4$	4.625	—	10.63	—
1, 2	$4^1/_2$	5.563	—	$6^1/_4$	4.813	$^1/_4$	5.156	—	13.33	—

Note: See Figure 5.

[a]The size designation of the coupling is the same as the corresponding pipe size designation.

[b]Tolerance on outside diameter W, ±1 percent.

[c]Tolerance on outside diameter Wc, ±0.015 inch.

8.13.2.2 Group 1 (Grades J55 and K55)

For couplings impact tested at or below 32°F that demonstrate 80 percent or greater shear area and exceed the minimum absorbed energy requirements, linear imperfections on the OD surface are acceptable with a depth up to 5 percent of the critical thickness as defined in 6.2.3.

8.13.2.3 Group 1 (Grade N80) and Groups 2, 3, and 4

Inspection shall be by the wet fluorescent magnetic particle method or by another nondestructive method of equal sensitivity as demonstrated to the purchaser. The inspection shall exclude the dry magnetic method. The inspection shall encompass both inside and outside surfaces with a circumferentially oriented magnetic field. The threaded surfaces shall be visually inspected after plating or coating.

Linear imperfections on the OD surface are acceptable with a depth up to 5 percent of the critical thickness as defined in 6.2.3.1.

Indications of nonmetallic inclusions shall not be considered defects unless they are demonstrated to have a depth in excess of 0.035-inch; longitudinal discontinuities that do not exceed $^1/_2$-inch in length need not be probed by the manufacturer.

8.14 MEASUREMENT OF IMPERFECTION

The depth of imperfection shall be measured from the normal surface or contour of the coupling extended over the imperfection. The outside diameter of the finished coupling shall be measured across the finished surface or contour of the coupling (i.e., initial surface or grind contour resulting from the removal of an imperfection or defect). The outside diameter shall not be measured at the base of an acceptable pit.

8.15 REPAIR AND REMOVAL OF IMPERFECTIONS AND DEFECTS

Repair welding is not permitted. All seams, cracks, or pits may be removed, and all other imperfections and defects may be removed or reduced to acceptable limits by machining or grinding on the outer surface provided the outside diameter of the finished coupling is within the tolerances when measured at the point the defect is removed. The machining or grinding must be approximately faired into the outer contour of the coupling.

8.16 THREAD PLATING—GROUP 4

Thread plating shall be as specified on the purchase order.

8.17 COUPLINGS AND COUPLING BLANK PROTECTION—GROUP 4

All loose couplings and all coupling blanks that have been machined to their final outside diameter shall be boxed to prevent contact with one another during shipment. All other coupling blanks shall be boxed to prevent nicks and gouges that will not be removed by subsequent machining. Boxes are to be manufactured from wood and designed to be easily handled by forklift. Boxes shall be limited to 4 feet in width to facilitate truck transport.

Table 35—Permissible Depth of Imperfections (Inches)

Coupling for Pipe Sizes	Group 1, Group 2 (L80 and C95), and Group 3		Group 2 (C90 and T95) and Group 4
	Pits and Round Bottom Gouges	Grip Marks and Sharp Bottom Gouges	All
Tubing			
Smaller than $3^1/_2$	0.030	0.025	0.030
$3^1/_2$ and larger	0.045	0.030	0.035
Casing			
Smaller than $6^5/_8$	0.035	0.030	0.030
$6^5/_8$ to $7^5/_8$, incl.	0.045	0.040	0.035
Larger than $7^5/_8$	0.060	0.040	0.035

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

9.2.1.1 Groups 1, 2, and 3

When requested by the purchaser, the manufacturer shall furnish a report giving the heat analysis of each heat of steel used in the manufacture of pipe and couplings furnished on the purchase order. Upon request, the purchaser shall also be furnished the results of quantitative analyses of other elements normally used by the manufacturer to control mechanical properties.

9.2.1.2 Group 4

The manufacturer shall furnish a report giving the heat analysis of each heat of steel used in the manufacture of pipe and couplings furnished on the purchase order. The report shall include quantitative analyses of other elements normally used by the manufacturer to control mechanical properties.

9.2.2 Product Analyses (See Note)

Two tubular products from each heat shall be analyzed for product analyses of all groups.

Note: For couplings, pup joints, and connectors, the analyses required in 9.2.2 may be furnished by the steel manufacturer.

9.2.2.1 Groups 1, 2, and 3

The results of the product analyses shall be available to the purchaser on request. Product analyses shall include the results of quantitative determination of all elements listed in Table 2 plus any other elements normally used by the manufacturer to control mechanical properties.

9.2.2.2 Group 4

Product analyses of each heat used shall be made by the manufacturer on the finished tubular product. The results of the product analyses shall be provided to the purchaser. Product analyses shall include the results of quantitative determinations of all elements listed in Table 2 plus any other elements used by the manufacturer to control mechanical properties.

9.2.2.3 Recheck Product Analyses—All Groups (See Note)

If the product analyses of any lengths of tubular product representing the lot fail to conform to the specified requirements, testing shall be performed in accordance with 9.10.1 of this specification.

Note: For couplings, pup joints, and connectors, the analyses required in 9.2.2 may be furnished by the steel manufacturer.

9.3 TESTING OF MECHANICAL PROPERTIES

9.3.1 Lot Definition

9.3.1.1 Pipe (Except Coupling Blanks, Pup Joints, or Connectors Heat Treated After Cutting to Blank or Individual Length)

9.3.1.1.1 Group 1, Group 2 (Grade M65, Grade L80 Type 1, and Grade C95) and Group 3

A lot is defined as all those lengths of pipe with the same specified dimension and grade which are either as rolled or heat treated as part of the continuous operation (or batch), and are from a single heat of steel; or from different heats that are grouped according to a documented procedure that will ensure that the appropriate requirements of this specification are met.

9.3.1.1.2 Group 2 (Grades L80 Type 9Cr, L80 Type 13Cr, C90, and T95) and Group 4

A lot is defined as all those lengths of pipe with the same specified dimensions and grade from the same heat of steel that are heat treated as part of a continuous operation (or batch).

9.3.1.2 Coupling Blanks, Pup Joints, or Connectors Heat Treated After Cutting to Blank or Individual Length

9.3.1.2.1 All Groups

A lot of coupling blanks, pup joints, or connectors heat treated after cutting to blank or individual lengths is defined as that group of pieces with the same specified dimensions and grade from the same heat of steel that are (a) batch heat treated concurrently in the same heat-treating furnace unit, or (b) heat treated in sequential loads to the same cycle without interruption in an integral quench furnace unit equipped with a recording controller to provide documentation of heat-treating control through the run, or (c) individually heat treated on a unit in a continuous process run within 8 hours or less of continuous operation.

9.3.1.2.2 Additional Requirements for Group 2 (Grades C90 and T95) and Group 4

When individually heat treated on a unit in a continuous process run, the pieces within the lot shall be sequentially numbered in the order in which they are treated. A lot shall not exceed 30 couplings, pup joints, or connectors for sizes $9^5/_8$ and larger casing, or 50 couplings, pup joints, or connectors for smaller sizes of individually heat treated pieces.

9.3.2 Frequency of Testing

9.3.2.1 Tensile Tests

9.3.2.1.1 Mill Control Tensile Tests—Groups 1, 2, and 3

One tensile test shall be made as a control on each heat of steel used by the manufacturer for the production of pipe under this specification. For electric 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 mill control tests shall be available to the purchaser.

9.3.2.1.2 Casing and Tubing

9.3.2.1.2.1 Group 1

One tensile test shall be made on a length of pipe from each lot of 400 lengths or less of each size smaller than $6^5/_8$ and from each lot of 200 lengths or less of each size $6^5/_8$ and larger. For multiple-length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length.

9.3.2.1.2.2 Group 2

One tensile test shall be made on a length of tubing from each lot of 200 lengths or less and from each lot of 100 lengths or less of casing. For multiple-length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length.

9.3.2.1.2.3 Group 3

One tensile test shall be made on a length of pipe from each lot of 200 lengths or less of each size smaller than $6^5/_8$ and from each lot of 100 lengths or less of each size $6^5/_8$ and larger. For multiple-length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length.

9.3.2.1.2.4 Group 4

The tensile test specimens shall be taken at the frequency of three joints per lot. The joints for testing shall be selected at random provided the selection procedure provides samples representing the start and end of the heat treat cycle and alternate ends of the tubes.

9.3.2.1.3 Couplings, Pup Joints, and Connectors

9.3.2.1.3.1 Group 1, Group 2 (Grades L80 and C95) and Group 3

One tensile test shall be made on each heat of steel from which couplings are produced as specified in 9.3.3.1.1. Also, for couplings made from seamless pipe, one tensile test shall be made on one tube from each lot of 100 tubes used for casing couplings and from each lot of 200 tubes used for tubing couplings. For forged couplings, centrifugally cast couplings, and couplings made from seamless pipe but heat treated in blank form, one tensile test shall be made for each heat treating lot or one from each 400 couplings, whichever is less.

For pup joints and connectors heat treated separately from casing or tubing at least one test shall be made from each heat of steel. When batch heat treated, one test shall also be made from each lot of 100 pup joints or 400 connectors; and for continuous heat-treating, one test shall be made for each lot. For pup joints and connectors manufactured from heavy wall tubes or bar stock, one tensile test shall be made on each heat of steel from which pup joints or connectors are produced. Test specimens from bar stock shall be taken from a location corresponding to midwall of the final product for connectors. Also, one tensile test shall be made on one tube or bar from each lot of 100 tubes or bars used for casing pup joints or connectors and from each lot of 200 tubes or bars used for tubing pup joints or connectors.

No test is required for pup joints or connectors manufactured from the appropriate grade of casing or tubing, provided the pup joints or connectors are not subsequently heat treated.

9.3.2.1.3.2 Group 2 (Grades C90 and T95) and Group 4

Tensile test specimens for coupling, pup joint, or connector material heat treated in tube length shall be removed from locations shown in Figure 12 at the following frequencies:

a. For coupling, pup joints, or connector material heat treated in tube length, one end of each tube of material shall be tested to verify conformance to tensile requirements (approximately 50 percent each end).
b. For couplings, pup joints, or connectors heat treated in coupling blank or individual length, one piece from each lot shall be tested to verify conformance.

No test is required for pup joints or connectors manufactured from a length of casing, tubing, or coupling stock previously tested, provided there is no subsequent heat treatment.

9.3.2.2 Flattening Tests

Flattening tests shall be made for all electric welded pipe with *D/t* ratios as shown in Table 19.

9.3.2.2.1 Group 1—Non-Full Body Heat Treated Pipe Except Pup Joints

Flattening tests shall be performed as follows:

a. The leading end of the first pipe of each coil shall have 2 specimens flattened.
b. Two test specimens shall be flattened from an intermediate pipe of each coil.
c. The trailing end of the last pipe of each coil shall have 2 test specimens flattened.
d. When a weld stop condition occurs during production of a multiple length, 2 flattening tests shall be made from the crop ends resulting from each side of the weld stop.

9.3.2.2.2 Group 1 and Group 2—Full Body Heat Treated Pipe Except Pup Joints

For electric-welded pipe that is full-body normalized, including pipe that is processed through a hot stretch mill in accordance with the requirements of 5.2.1, the manufacturer has the option of performing flattening tests at the same frequency as non-full body heat treated pipe, or performing flattening tests in lots, as follows:

a. Casing—one test from each lot of 20 lengths or less of each size.
b. Tubing—one test from each lot of 100 lengths or less of each size.

9.3.2.2.3 Group 3 and Group 4—Casing and Tubing

See SR11 for mandatory requirements.

9.3.2.2.4 Group 1 and Group 2—Pup Joints

For pup joints heat treated separately from casing or tubing, at least one test shall be made from each heat of steel. In addition to the heat test, one test shall be made from each lot of 100 pup joints or 400 connectors, when batch heat treated; and for continuous heat treating, one test shall be made from each lot. For pup joints manufactured from electric welded pipe, one flattening test shall be made on each heat of steel from which the pup joints are produced. Also, one flattening test shall be made on one length from each lot of 100 lengths of electric welded pipe used for casing pup joints and one length from each lot of 200 lengths of electric welded pipe used for tubing pup joints.

9.3.2.2.5 Group 3 and Group 4—Pup Joints

Flattening tests, when required, shall be performed on each end of each pup joint. See SR11 for mandatory requirements.

9.3.2.3 Hardness Tests

9.3.2.3.1 Mill Control Hardness Test—Group 2 (Grade M65 and Grade L80)

Each control tensile test specimen (see 9.3.1.1.1) shall be hardness tested to verify conformance to hardness requirements.

9.3.2.3.2 Product Hardness Tests

9.3.2.3.2.1 Group 2 (Grade M65 and Grade L80)

On pipe, coupling stock, and connector material, hardness testing shall be performed at the same frequency as tensile testing for each of these products.

Additional hardness testing of the OD surface and through wall hardness testing of upsets may be performed as agreed by the manufacturer and the purchaser. Test procedures for this additional testing will be as agreed upon by the manufacturer and purchaser.

9.3.2.3.2.2 Group 2 (Grade C90 and T95)

For nonupset pipe, a test ring shall be cut from one end of each pipe. Approximately 50 percent of these test rings shall be cut from the front end and approximately 50 percent from the back ends of the pipe. Rockwell C hardness (HRC) impressions shall be made in one quadrant of each ring as shown in Figure 13.

For upset pipe, the pipe body of each length tensile tested as required by 9.3.2.1.2 shall also be hardness tested in all four quadrants to verify conformance to the requirements. The test frequency of the upset shall be one in every 20 lengths within each lot. One ring shall be cut from the section of the upset with the maximum wall thickness. Hardness impressions shall be taken on each ring in accordance with

Figure 13 to provide three hardness values per quadrant in each of four quadrants.

In addition to the through-wall (transverse) hardness tests, an external surface Brinell or HRC test shall be made on the pipe body and the upset of each length. If the Brinell or HRC reading does not exceed 255 or 25.4 respectively, the length is acceptable. If any of the readings are over 255 BHN or 25.4 HRC, two additional tests may be made in the immediate area. If either of the second tests exceeds 255 BHN or 25.4 HRC, the length shall be rejected.

By agreement between the purchaser and the manufacturer, hardness test frequencies other than required above may be specified.

By agreement between the purchaser and the manufacturer, the maximum hardness values may be altered from those stated above based on sulfide-stress corrosion cracking tests specified in 9.8.6.

For couplings, two test rings, one from each end, shall be taken from each tube used for couplings. Hardness tests shall be taken on each ring in accordance with Figure 13 and shall include three locations in each of four quadrants.

9.3.2.3.2.3 Group 4 (Grade Q125)

Hardness test specimens for casing and coupling, pup joint, or connector material heat treated in tube length shall be removed from locations shown in Figure 12, as follows:

a. Casing. The hardness test specimens shall be taken at the frequency of three lengths per lot. The lengths for testing shall be selected at random provided the selection procedure provides samples representing the start and end of the heat-treat cycle and alternate ends of the tubes.
b. Coupling, pup joint, or connector material heat treated in tube length. One end of each tube of material shall be tested to verify conformance to hardness requirements (approximately 50 percent each end).
c. Couplings, pup joints, or connectors heat treated in coupling blank or individual length. One piece from each lot shall be tested to verify conformance to hardness requirements. The test specimen shall be removed from the piece as illustrated in Figure 12.

No test is required for pup joints or connectors manufactured from a length of Q125 casing or coupling stock previously tested, provided there is no subsequent heat treatment.

9.3.2.4 Hardenability Test—Group 2 (Grades C90 and T95)

The sample ring shall be tested with nine Rockwell C impressions in each of four quadrants as shown in Figure 13. The minimum frequency of this test will be one per production run or heat treatment practice. Samples shall be taken at the beginning of each order and thereafter whenever a size or weight change occurs or the austenitization and quenching process conditions change significantly. The average of three readings on an arc constitute a hardness value.

9.3.2.5 Grain Size Determination—Group 2 (Grades C90 and T95)

The frequency of testing for grain size shall be a minimum of once per heat-treat run. The grain size determination shall be made on the as-quenched hardenability test sample.

9.3.2.6 Impact Test

9.3.2.6.1 Groups 1, 2, and 3

One test shall be taken from one length from each lot.

9.3.2.6.2 Group 4

For casing, three lengths per lot shall be tested. The lengths for testing shall be selected at random provided the selection procedure provides samples representing the start and end of the heat treat cycle and alternate ends, as processed, of the casing.

For couplings, pup joints, or connector material heat treated in tube length, one end of each length shall be tested. Alternate ends, as processed, shall be tested on an approximately 50 percent basis.

For couplings, pup joints, or connector material heat treated in coupling blank or individual length, one length from each lot shall be tested.

See SR11.3 for mandatory requirements for electric welded casing.

9.3.2.7 Metallographic Evaluation—EW Group 3

A metallographic evaluation shall be performed at the beginning of the welding process for each size of tubular, at least each 4 hours during the welding and after any substantial interruption of the welding process. The samples shall be obtained prior to heat treatment.

The manufacturer shall have objective criteria to evaluate the acceptability of the EW zone.

9.3.3 Test Specimens

9.3.3.1 Tensile Test

9.3.3.1.1 General—All Groups

Pipe body tensile test specimens shall be either full-section specimens, strip specimens, or round bar specimens, as shown in Figure 11, at the option of the manufacturer. Strip specimens from seamless pipe may be taken from any location about the pipe circumference at the option of the manufacturer. Round bar specimens shall be taken from the midwall. Strip specimens and round bar specimens from welded pipe shall be taken approximately 90 degrees 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. Tensile test specimens for heat treated pipe shall be removed from pipe subsequent to final heat treatment on the production line.

All strip specimens shall be approximately $1^1/_2$-inches wide in the gauge length if suitable curved face testing grips are used or if the ends of the specimen are machined or cold flattened to reduce the curvature in the grip area; otherwise they shall be approximately $^3/_4$-inch wide for pipe sizes smaller than 4, approximately 1-inch wide for pipe sizes 4 through $7^5/_8$, and approximately $1^1/_2$-inches wide for pipe sizes larger than $7^5/_8$.

All pipe body tensile specimens shall represent the full wall thickness of the pipe from which the specimen was cut, except for round bar tensile specimens and shall be tested without flattening. When round bar specimens are used, the 0.500-inch diameter round bar specimens shall be used when the pipe size allows, and the 0.350-inch diameter round bar specimen shall be used for other sizes. For pipe sizes too small to allow a 0.350-inch specimen, round bar tensile specimens are not permitted.

9.3.3.1.2 Additional: Casing and Tubing

9.3.3.1.2.1 Group 2 (Grade T95)

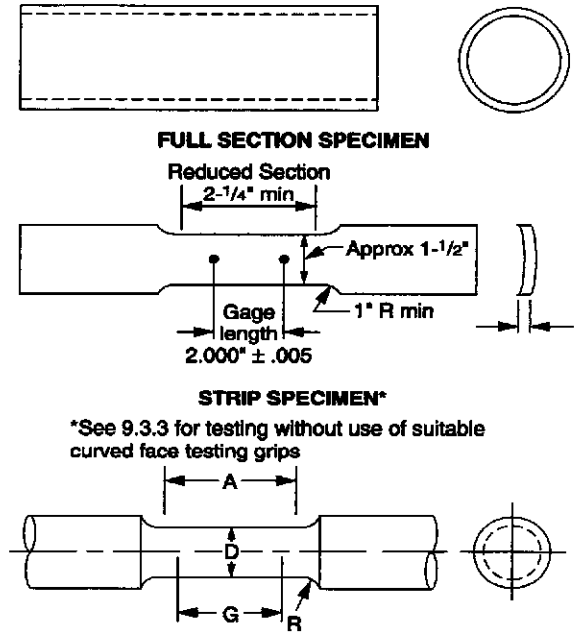
Test specimens are to be removed from the material that has been processed on the production line only.

9.3.3.1.2.2 Group 3

For electric welded pipe, see the requirements in SR11.

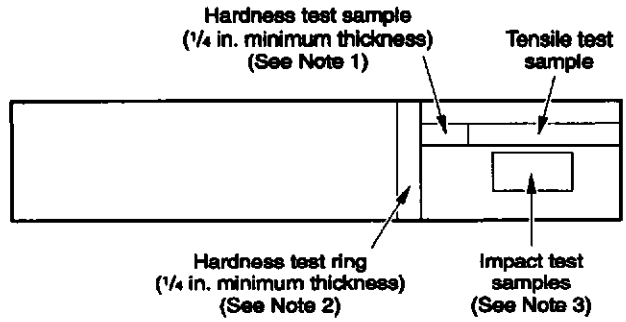
9.3.3.1.2.3 Group 4

For upset casing, see the requirements in SR10.2. For electric welded pipe, see the requirements in SR11.



	500" Specimen in.	350" Specimen in.
G Gage Length	2.000 ± 0.005	1.400 ±0.005
D Diameter	0.500 ±0.010	0.350 ±0.007
R Radius of fillet, min	$^3/_8$	$^1/_4$
A Length of reduced section, min	$2^-1/_4$	$1^-3/_4$

Figure 11—Tensile Test Specimens



Notes:
1. Remove hardness test sample from tensile test sample prior to the tensile test specimen preparation.
2. Hardness test ring shall be removed from mid-length position of individual heat-treated coupling blank. See Figure 13 for details.
3. See Figures 14 and 15 for details.

Figure 12—Typical Location of Test Samples Removed From Pipe, Coupling Stock, and Connector Material

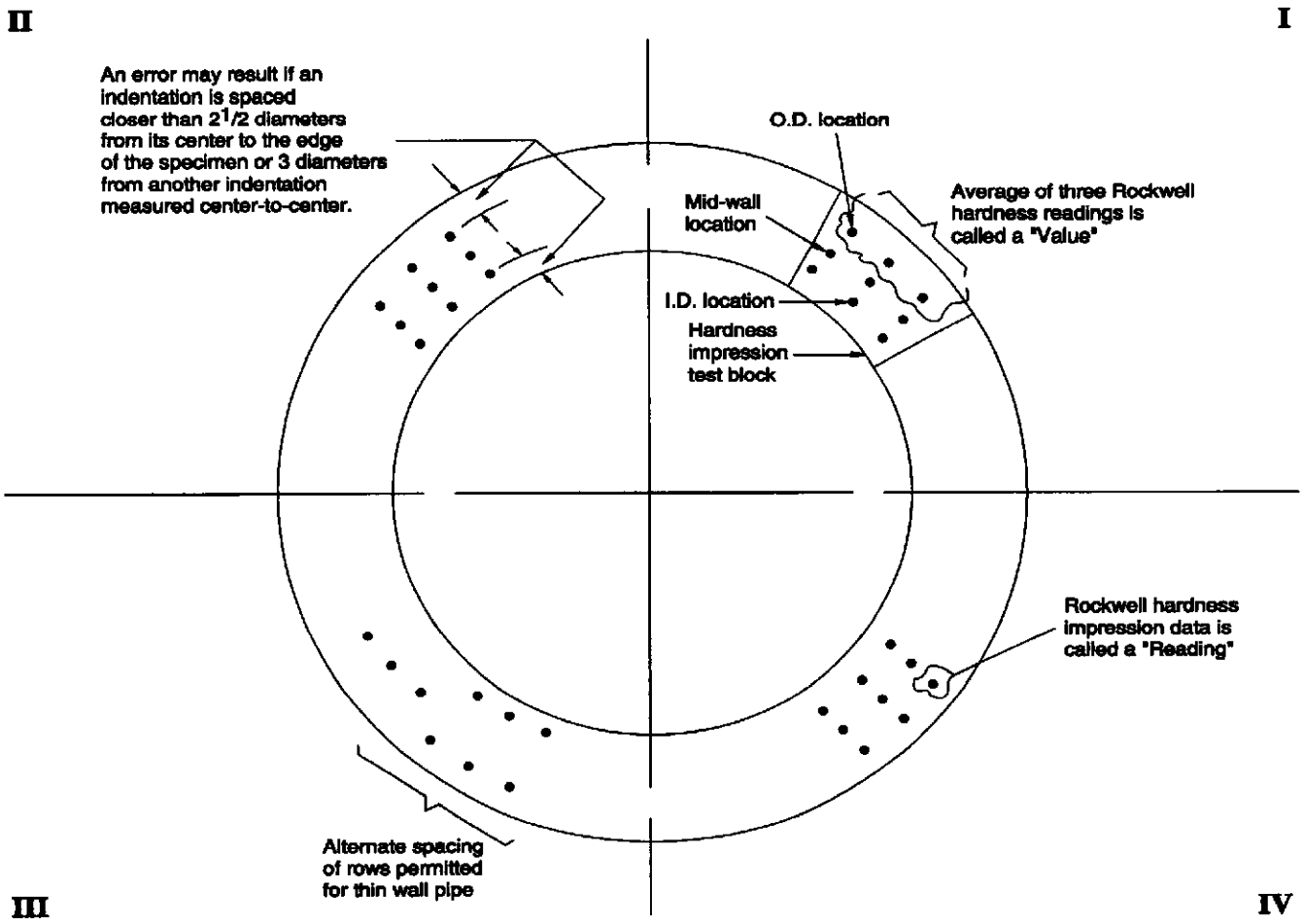


Figure 13—Through Wall Hardness Test

9.3.3.1.3 Couplings, Pup Joints, and Connectors—Group 4

In addition to the requirements in 9.3.3.1.1, longitudinal tensile test specimens shall be removed from coupling, pup joint or connector material, and individually heat treated coupling blanks, pup joints, or connectors subsequent to final heat treatment. Tensile test specimens shall be either strip specimens or, if the wall thickness of the tubular is over $^3/_4$-inch, an ASTM A 370 round specimen 0.500-inch in diameter may be used as shown in Figure 11.

Round specimens may be used for coupling stock at the option of the manufacturer. Tensile test specimens for coupling, pup joint, or connector material heat treated in coupling blank or individual lengths shall be removed from the piece as illustrated in Figure 12. Reduced section strip specimens may be used by agreement between the purchaser and the manufacturer.

9.3.3.2 Flattening Test Specimens—All Groups of Electric Welded Pipe

Flattening test specimens shall be rings or crop ends not less than 2-$^1/_2$ inches long. If the pipe is to be upset, the test specimens shall be taken from the tube prior to upsetting.

The test specimens may be cut before heat treating and given the same type heat treatment as the pipe represented. If lot testing is used, precaution shall be taken so that the test specimens can be identified with respect to the length of pipe from which they are cut. Each heat in each lot shall be tested.

For electric-welded pipe that is to be full-body normalized, including pipe that is processed through a hot mill in accordance with the requirements of 5.2.1, flattening test specimens shall be obtained either prior to or after such treatment, at the option of the manufacturer.

9.3.3.3 Hardness Test

9.3.3.3.1 Hardness test specimens (blocks or rings) shall be taken as shown in Figure 12 and tested as shown in Figure 13.

9.3.3.3.2 Hardness test surfaces shall be ground parallel and smooth.

9.3.3.4 Impact Test

Impact test specimens shall not be machined from flattened tubulars.

For orientation of longitudinal and transverse specimens, see Figure 14.

The surface of the finish machined transverse test specimens may contain the OD curvature of the original tubular product provided the requirements of Figure 15 are met. These specimens shall be used only to permit the use of a transverse specimen of maximum thickness (T).

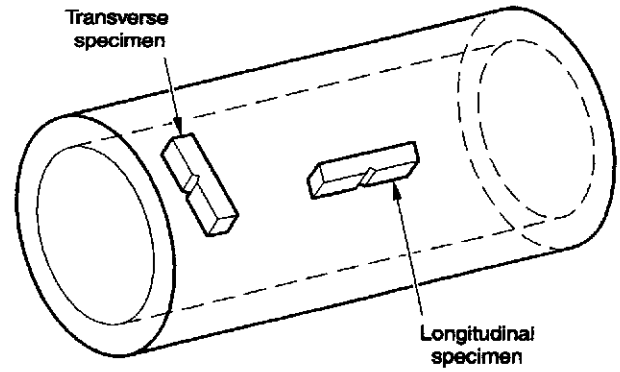


Figure 14—Impact Test Specimen Orientation

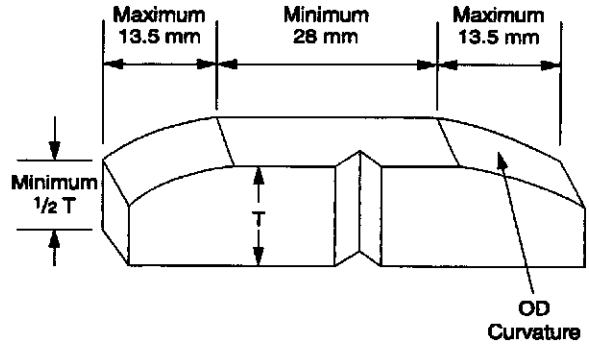


Figure 15—Impact Test Specimen Outside Diameter Curvature Allowance

9.4 HYDROSTATIC TEST

9.4.1 Hydrostatic Test Procedures

Each length of casing, tubing, liners, and pup joints shall be tested full length subsequent to upsetting and subsequent to final heat treatment (as applicable) to at least the hydrostatic pressure specified in 9.4.2.1 without leakage. The test shall be held for not less than 5 seconds at full pressure. For electric weld pipe, the pipe seam shall be inspected for leaks and sweats while under full test pressure. The facility (pipe mill, processor, or threader) performing the threading, shall hydrostatically test (or arrange for such a test) the full length of casing, tubing, liners, and pup joints unless previously tested full length to at least the pressure required for the final end condition. The test shall be performed in one of the following conditions:

a. Plain-end nonupset, provided no upsetting or further heat treatment is to be performed.

b. Plain-end nonupset after heat treatment.

c. Plain-end after upsetting, provided no further heat treatment is to be performed. If such pipe has been tested full length to the threaded-and-coupled test pressure in the plain-end condition prior to upsetting, the test of the upset portion

may be made after upsetting through the use of an end tester that seals behind the portion of the pipe end that was heated for upsetting.

d. Plain-end upset after heat treatment.

e. Threaded without couplings applied.

f. Threaded and coupled with couplings applied power-tight.

Pup joints, after finish machining and any heat treatment, shall be tested either plain-end or threaded.

For material requiring heat treatment, the test shall take place after the final heat treatment. The test pressure shall be at least the threaded-and-coupled test pressure for all material sold with threaded ends. Pipe furnished with extreme-line end finish shall have been hydrotested to at least the extreme-line test pressure in one of the above conditions.

The tester shall be equipped with devices for assuring the specified test pressure and time interval requirements are met. The test pressure measuring device shall be calibrated by means of a deadweight tester, or equivalent, within 4 months prior to each use. Calibration and verification records retention shall be as specified in 13.4.

Notes:

1. Martensitic chromium steels are sensitive to galling. Special precautions may be necessary for thread surface treatment and/or lubrication to minimize galling during hydrostatic testing (plug application and removal).

2. There are various types of hydrotest systems available. The facility performing the hydrotest is responsible for establishing a test procedure that minimizes the potential for damage to the pipe and threads of both the pipe and coupling.

9.4.2 Hydrostatic Test Requirements

Pipe must comply with the test requirements for the particular designation, grade, and end finish shown in Tables 36 through 53. (See note.)

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

9.4.2.1 Casing and Tubing

9.4.2.1.1 Threaded and Coupled

The production hydrostatic test pressures for threaded pipe shall be standard pressures listed in Table 36 through 53, or a higher test pressure as agreed upon by the purchaser and the entity performing the threading.

(Text continues on page 76)

Table 36—Hydrostatic Test Pressure for Grade H40 Casing

(1)	(2)	(3)	(4)	(5)
Designation		Test Pressure, psi		
			Round Thread	
Size	Weight	Plain-End	Short Thread Coupling	Long Thread Coupling
$4^{1}/_{2}$	9.50	2,900	2,900	—
$5^{1}/_{2}$	14.00	2,800	2,800	—
$6^{5}/_{8}$	20.00	2,800	2,800	—
7	17.00	2,100	2,100	—
7	20.00	2,500	2,500	—
$7^{5}/_{8}$	24.00	2,500	2,500	—
$8^{5}/_{8}$	28.00	2,300	2,300	—
$8^{5}/_{8}$	32.00	2,600	2,600	—
$9^{5}/_{8}$	32.30	2,100	2,100	—
$9^{5}/_{8}$	36.00	2,300	2,300	—
$10^{3}/_{4}$	32.75	1,200	1,200	—
		(1,700)	(1,700)	—
$10^{3}/_{4}$	40.50	1,600	1,600	—
		(2,100)	(2,100)	—
$11^{3}/_{4}$	42.00	1,400	1,400	—
		(1,800)	(1,800)	—
$13^{3}/_{8}$	48.00	1,200	1,200	—
		(1,600)	(1,600)	—
16	65.00	1,100	1,100	—
$18^{5}/_{8}$	87.50	1,100	1,100	—
20	94.00	1,100	1,100	1,100

Note: Standard test pressures are given in regular type; alternative pressures are shown in parentheses.

Table 37—Hydrostatic Test Pressure for Grade J55 and Grade K55 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Test Pressure,[a] psi						
					Buttress Thread			
Designation			Round Thread		Regular Coupling		Special Clearance Coupling	
Size	Weight	Plain-End and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Grades J55 & K55	Grade L80	Grades J55 & K55	Grade L80
4 1/2	9.50	3000	3000	—	—	—	—	—
		(4000)	(4000)	—	—	—	—	—
4 1/2	10.50	3000	3000	—	3000	3000	3000	3000
		(4400)	(4400)	—	(4400)	(4400)	(4400)	(4400)
4 1/2	11.60	3000	3000	3000	3000	3000	3000	3000
		(4900)	(4900)	(4900)	(4900)	(4900)	(4400)	(4900)
5	11.50	3000	3000	—	—	—	—	—
		(3900)	3900	—	—	—	—	—
5	13.00	3000	3000	3000	3000	3000	3000	3000
		(4500)	(4500)	(4500)	(4500)	(4500)	(4100)	(4500)
5	15.00	3000	3000	3000	3000	3000	3000	3000
		(5200)	(5200)	(5200)	(5200)	(5200)	(4100)	(5200)
5 1/2	14.00	3000	3000	—	—	—	—	—
		(3900)	(3900)	—	—	—	—	—
5 1/2	15.50	3000	3000	3000	3000	3000	3000	3000
		(4400)	(4400)	(4400)	(4400)	(4400)	(3800)	(4400)
5 1/2	17.00	3000	3000	3000	3000	3000	3000	3000
		(4900)	(4900)	(4900)	(4900)	(4900)	(3800)	(4900)
6 5/8	20.00	3000	3000	3000	3000	3000	3000	3000
		(3800)	(3800)	(3800)	(3800)	(3800)	(3200)	(3800)
6 5/8	24.00	3000	3000	3000	3000	3000	3000	3000
		(4700)	(4700)	(4700)	(4700)	(4700)	(3200)	(4700)
7	20.00	3000	3000	—	—	—	—	—
		3400	3400	—	—	—	—	—
7	23.00	3000	3000	3000	3000	3000	3000	3000
		(4000)	(4000)	(4000)	(4000)	(4000)	(3200)	(4000)
7	26.00	3000	3000	3000	3000	3000	3000	3000
		(4600)	(4600)	(4600)	(4600)	(4600)	(3200)	(4600)
7 5/8	26.40	3000	3000	3000	3000	3000	3000	3000
		(3800)	(3800)	(3800)	(3800)	(3800)	(3600)	(3800)
8 5/8	24.00	2700	2700	—	—	—	—	—
8 5/8	32.00	3000	3000	3000	3000	3000	3000	3000
		(3600)	(3600)	(3600)	(3600)	(3600)	(3200)	(3600)
8 5/8	36.00	3000	3000	3000	3000	3000	3000	3000
		(4100)	(4100)	(4100)	(4100)	(4100)	(3200)	(4100)
9 5/8	36.00	3000	3000	3000	3000	3000	2900	3000
		(3200)	(3200)	(3200)	(3200)	(3200)	(2900)	(3200)
9 5/8	40.00	3000	3000	3000	3000	3000	2900	3000
		(3600)	(3600)	(3600)	(3600)	(3600)	(2900)	(3600)
10 3/4	40.50	2100	2100	—	2100	2100	2100	2100
		(2900)	(2900)	—	(2900)	(2900)	(2900)	(2900)
10 3/4	45.50	2500	2500	—	2500	2500	2500	2500
		(3300)	(3300)	—	(3300)	(3300)	(2600)	(3300)
10 3/4	51.00	2800	2800	—	2800	2800	2600	2800
		(3700)	(3700)	—	(3700)	(3700)	(2600)	(3700)
11 3/4	47.00	2100	2100	—	2100	2100	—	—
		(2800)	(2800)	—	(2800)	(2800)	—	—

Table 37—Hydrostatic Test Pressure for Grade J55 and Grade K55 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Test Pressure,[a] psi						
					Buttress Thread			
Designation			Round Thread		Regular Coupling		Special Clearance Coupling	
Size	Weight	Plain-End and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Grades J55 & K55	Grade L80	Grades J55 & K55	Grade L80
11 3/4	54.00	2400	2400	—	2400	2400	—	—
		(3300)	(3300)	—	(3300)	(3300)	—	—
11 3/4	60.00	2700	2700	—	2700	2700	—	—
		(3700)	(3700)	—	(3700)	(3700)	—	—
13 3/8	54.50	1900	1900	—	1900	1900	—	—
		(2500)	(2500)	—	(2500)	(2500)	—	—
13 3/8	61.00	2100	2100	—	2100	2100	—	—
		(2800)	(2800)	—	(2800)	(2800)	—	—
13 3/8	68.00	2400	2400	—	2400	2400	—	—
		(3200)	(3200)	—	(3200)	(3200)	—	—
16	75.00	1800	1800	—	1800	1800	—	—
16	84.00	2000	2000	—	2000	2000	—	—
18 5/8	87.50	1500	1500	—	1500	1500	—	—
20	94.00	1400	1400	1400	1400	1400	—	—
20	106.50	1600	1600	1600	1600	1600	—	—
20	133.00	2100	2100	2100	2100	2100	—	—

[a]Standard test pressures are given in regular type; alternative pressures are shown in parentheses.

Table 38—Hydrostatic Test Pressure for Grade M65 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Test Pressure, psi			
Designation[b]			Round Thread[b]		Buttress Thread[b]	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
4 1/2	9.50	4700	4700	—	—	—
4 1/2	10.50	5200	5200	—	5200	5200
4 1/2	11.60	5800	5800	5800	5800	5800
4 1/2	13.50	6700	—	6700	6700	6400
5	11.50	4600	4600	—	—	—
5	13.00	5300	5300	5300	5300	5300
5	15.00	6200	6200	6200	6200	6000
5	18.00	7500	—	7500	7500	6000
5	21.40	9100	—	8700	7900	6000
5 1/2	14.00	4600	4600	—	—	—
5 1/2	15.50	5200	5200	5200	5200	5200
5 1/2	17.00	5700	5700	5700	5700	5500
5 1/2	20.00	6800	—	6800	6800	5500
5 1/2	23.00	7800	—	7000	7200	5500
6 5/8	20.00	4500	4500	4500	4500	4500
6 5/8	24.00	5500	5500	5500	5500	4700
6 5/8	28.00	6500	—	6500	6500	4700

Table 38—Hydrostatic Test Pressure for Grade M65 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Designation[b]			Test Pressure, psi			
			Round Thread[b]		Buttress Thread[b]	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
7	20.00	4000	4000	—	—	—
7	23.00	4700	4700	4700	4700	4600
7	26.00	5400	5400	5400	5400	4600
7	29.00	6100	—	6100	6100	4600
7	32.00	6700	—	6700	6700	4600
7 5/8	26.40	4500	4500	4500	4500	4500
7 5/8	29.70	5100	—	5100	5100	5100
7 5/8	33.70	5900	—	5900	5900	5200
8 5/8	24.00	3200	3200	—	—	—
8 5/8	32.00	4200	4200	4200	4200	4200
8 5/8	36.00	4800	4800	4800	4800	4700
8 5/8	40.00	5400	—	5400	5400	4700
8 5/8	44.00	6000	—	6000	6000	4700
9 5/8	36.00	3800	3800	3800	3800	3800
9 5/8	40.00	4300	4300	4300	4300	4300
9 5/8	43.50	4700	—	4700	4700	4300
9 5/8	47.00	5100	—	5100	5100	4300
10 3/4	40.50	3400	3400	—	3400	3400
10 3/4	45.50	3900	3900	—	3900	3800
10 3/4	51.00	4400	4400	—	4400	3800
10 3/4	55.50	4800	4800	—	4800	3800
11 3/4	47.00	3300	3300	—	3300	—
11 3/4	54.00	3900	3900	—	3900	—
11 3/4	60.00	4300	4300	—	4300	—
13 3/8	54.50	3000	3000	—	3000	—
13 3/8	61.00	3300	3300	—	3300	—
13 3/8	68.00	3700	3700	—	3700	—
16	75.00	2800	2800	—	2800	—
16	84.00	3200	3200	—	3200	—
18 5/8	87.50	2400	2400	—	2400	—
20	94.00	2300	2100	2100	2300	—
20	106.50	2600	2100	2100	2300	—

[a]Plain-end pipe is tested to 3000 psi maximum except by agreement between the purchaser and the manufacturer. See 9.4.2.1.
[b]Grade M65 casing is furnished with I80 couplings. (Changes in columns 5 and 7 based on 12-28-97 letter from J. Casnes).

Table 39—Hydrostatic Test Pressure for Grade N80 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Buttress Thread			
Designation			Round Thread		Regular Coupling		Special Clearance Coupling	
Size	Weight	Plain-End and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Grade N80	Grade P110	Grade N80	Grade P110
4 1/2	11.60	7,100	—	7,100	7,100	7,100	6,400	7,100
4 1/2	13.50	8,200	—	8,200	7,800	8,200	6,400	8,200
5	15.00	7,600	—	7,600	7,600	7,600	6,000	7,600
5	18.00	9,300	—	8,700	7,900	9,300	6,000	8,200
5	21.40	10,000	—	8,700	7,900	10,000	6,000	8,200
5	23.20	10,000	—	8,700	7,900	10,000	6,000	8,200
5	24.10	10,000	—	8,700	7,900	10,000	6,000	8,200
5 1/2	17.00	7,100	—	7,100	7,100	7,100	5,500	7,100
5 1/2	20.00	8,400	—	7,900	7,200	8,400	5,500	7,600
5 1/2	23.00	9,700	—	7,900	7,200	9,700	5,500	7,600
6 5/8	24.00	6,800	—	6,800	6,800	6,800	4,700	6,500
6 5/8	28.00	8,100	—	8,100	7,900	8,100	4,700	6,500
6 5/8	32.00	9,200	—	8,500	7,900	9,200	4,700	6,500
7	23.00	5,800	—	5,800	5,800	5,800	4,600	5,800
7	26.00	6,600	—	6,600	6,600	6,600	4,600	6,300
7	29.00	7,500	—	7,400	6,800	7,500	4,600	6,300
7	32.00	8,300	—	7,400	6,800	8,300	4,600	6,300
7	35.00	9,100	—	7,400	6,800	9,100	4,600	6,300
7	38.00	9,900	—	7,400	6,800	9,300	4,600	6,300
7 5/8	26.40	5,500	—	5,500	5,500	5,500	5,200	5,500
7 5/8	29.70	6,300	—	6,300	6,300	6,300	5,200	6,300
7 5/8	33.70	7,200	—	7,200	7,200	7,200	5,200	7,200
7 5/8	39.00	8,400	—	8,400	7,800	8,400	5,200	7,200
7 5/8	42.80	9,400	—	8,400	7,800	9,400	5,200	7,200
7 5/8	45.30	10,000	—	8,400	7,800	10,000	5,200	7,200
7 5/8	47.10	10,000	—	8,400	7,800	10,000	5,200	7,200
7 3/4	46.10	9,800	—	—	—	—	—	—
8 5/8	36.00	5,900	—	5,900	5,900	5,900	4,700	5,900
8 5/8	40.00	6,700	—	6,700	6,700	6,700	4,700	6,300
8 5/8	44.00	7,400	—	7,400	7,400	7,400	4,700	6,300
8 5/8	49.00	8,300	—	8,300	7,800	8,300	4,700	6,300
9 5/8	40.00	5,300	—	5,300	5,300	5,300	4,300	5,100
9 5/8	43.50	5,800	—	5,800	5,800	5,800	4,300	5,100
9 5/8	47.00	6,300	—	6,300	6,300	6,300	4,300	5,100
9 5/8	53.50	7,200	—	7,200	7,100	7,200	4,300	5,100
9 5/8	58.40	7,700	—	7,700	7,100	7,900	4,300	5,100
10 3/4	51.00	5,400	5,400	—	5,400	5,400	3,800	4,200
10 3/4	55.50	5,900	5,900	—	5,900	5,900	3,800	4,200

Table 39—Hydrostatic Test Pressure for Grade N80 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					Buttress Thread			
Designation			Round Thread		Regular Coupling		Special Clearance Coupling	
Size	Weight	Plain-End and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Grade N80	Grade P110	Grade N80	Grade P110
11 3/4	60.00	5,300	5,300	—	5,300	5,300	—	—
13 3/8	68.00	4,600	4,600	—	4,600	4,600	—	—
13 3/8	72.00	4,900	4,600	—	4,900	4,900	—	—
16	109.00	5,300	—	—	—	—	—	—

Note: Plain-end pipe is tested to 3000 psi maximum except by agreement between the purchaser and the manufacturer. See 9.4.2.1.

Table 40—Hydrostatic Test Pressure for Grade J55 Plain-End Liners

(1)	(2)	(3)	(4)
Designation		Test Pressure, psi	
Size	Weight	Standard	Alternative
3 1/2	9.91	3000	7300
4	11.34	3000	6300
4 1/2	13.04	3000	5700
5	17.93	3000	6400
5 1/2	19.81	3000	5800
6 5/8	27.65	3000	5500

Table 41—Hydrostatic Test Pressure for Grade L80 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Test Pressure, psi			
Designation[b]			Round Thread[b]		Buttress Thread[b]	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
4 1/2	11.60	7,100	—	7,100	7,100	6,400
4 1/2	13.50	8,200	—	8,200	7,800	6,400
5	15.00	7,600	—	7,600	7,600	6,000
5	18.00	9,300	—	8,700	7,900	6,000
5	21.40	10,000	—	8,700	7,900	6,000
5	23.20	10,000	—	8,700	7,900	6,000
5	24.10	10,000	—	8,700	7,900	6,000
5 1/2	17.00	7,100	—	7,100	7,100	5,500
5 1/2	20.00	8,400	—	7,900	7,200	5,500
5 1/2	23.00	9,700	—	7,900	7,200	5,500
6 5/8	24.00	6,800	—	6,800	6,800	4,700
6 5/8	28.00	8,100	—	8,100	7,900	4,700
6 5/8	32.00	9,200	—	8,500	7,900	4,700
7	23.00	5,800	—	5,800	5,800	4,600
7	26.00	6,600	—	6,600	6,600	4,600

Table 41—Hydrostatic Test Pressure for Grade L80 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Test Pressure, psi			
Designation[b]			Round Thread[b]		Buttress Thread[b]	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
7	29.00	7,500	—	7,400	6,800	4,600
7	32.00	8,300	—	7,400	6,800	4,600
7	35.00	9,100	—	7,400	6,800	4,600
7	38.00	9,900	—	7,400	6,800	4,600
$7^5/_8$	26.40	5,500	—	5,500	5,500	5,200
$7^5/_8$	29.70	6,300	—	6,300	6,300	5,200
$7^5/_8$	33.70	7,200	—	7,200	7,200	5,200
$7^5/_8$	39.00	8,400	—	8,400	7,800	5,200
$7^5/_8$	42.80	9,400	—	8,400	7,800	5,200
$7^5/_8$	45.30	10,000	—	8,400	7,800	5,200
$7^5/_8$	47.10	10,000	—	8,400	7,800	5,200
$7^3/_4$	46.10	9,800	—	—	—	—
$8^5/_8$	36.00	5,900	—	5,900	5,900	4,700
$8^5/_8$	40.00	6,700	—	6,700	6,700	4,700
$8^5/_8$	44.00	7,400	—	7,400	7,400	4,700
$8^5/_8$	49.00	8,300	—	8,300	7,800	4,700
$9^5/_8$	40.00	5,300	—	5,300	5,300	4,300
$9^5/_8$	43.50	5,800	—	5,800	5,800	4,300
$9^5/_8$	47.00	6,300	—	6,300	6,300	4,300
$9^5/_8$	53.50	7,200	—	7,200	7,100	4,300
$9^5/_8$	58.40	7,700	—	7,700	7,100	4,300
$10^3/_4$	51.00	5,400	5,400	—	5,400	3,800
$10^3/_4$	55.50	5,900	5,900	—	5,900	3,800
$11^3/_4$	60.00	5,300	5,300	—	5,300	—
$13^3/_8$	68.00	4,600	4,600	—	4,600	—
$13^3/_8$	72.00	4,900	4,600	—	4,900	—
16	109.00	5,300	—	—	—	—

Note: Martensitic chromium steels are sensitive to galling. Special precautions may be necessary for thread surface treatment and/or lubrication to minimize galling during hydrostatic testing (plug application and removal).

[a]Plain-end pipe is tested to 3,000 psi maximum except by agreement between purchaser and manufacturer. See 9.4.2.1.

[b]Designations (columns 1 and 2) are shown for the purpose of identification in ordering. The densities of martensitic chromium steels (L80, Types 9Cr and 13Cr) are different from carbon steels. The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

Table 42—Hydrostatic Test Pressure for Grade C90 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Designation		Test Pressure, Plain-End[a] (psi)	Test Pressure, psi			
			Round Thread		Buttress Thread	
Size	Weight		Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
4 1/2	11.60	8,000	—	8,000	8,000	7,200
4 1/2	13.50	9,300	—	9,300	8,800	7,200
5	15.00	8,500	—	8,500	8,500	6,700
5	18.00	10,000	—	9,700	8,900	6,700
5	21.40	10,000	—	9,700	8,900	6,700
5	23.20	10,000	—	9,700	8,900	6,700
5	24.10	10,000	—	9,700	8,900	6,700
5 1/2	17.00	8,000	—	8,000	8,000	6,200
5 1/2	20.00	9,000	—	8,900	8,100	6,200
5 1/2	23.00	10,000	—	8,900	8,100	6,200
5 1/2	26.80	10,000	—	—	—	—
5 1/2	29.70	10,000	—	—	—	—
5 1/2	32.60	10,000	—	—	—	—
5 1/2	35.30	10,000	—	—	—	—
5 1/2	38.00	10,000	—	—	—	—
5 1/2	40.50	10,000	—	—	—	—
5 1/2	43.10	10,000	—	—	—	—
6 5/8	24.00	7,700	—	7,700	7,700	5,300
6 5/8	28.00	9,100	—	9,100	8,800	5,300
6 5/8	32.00	10,000	—	9,600	8,800	5,300
7	23.00	6,500	—	6,500	6,500	5,200
7	26.00	7,400	—	7,400	7,400	5,200
7	29.00	8,400	—	8,300	7,600	5,200
7	32.00	9,300	—	8,300	7,600	5,200
7	35.00	10,000	—	8,300	7,600	5,200
7	38.00	10,000	—	8,300	7,600	5,200
7	42.70	10,000	—	—	—	—
7	46.40	10,000	—	—	—	—
7	50.10	10,000	—	—	—	—
7	53.60	10,000	—	—	—	—
7	57.10	10,000	—	—	—	—
7 5/8	26.40	6,200	—	6,200	6,200	5,900
7 5/8	29.70	7,100	—	7,100	7,100	5,900
7 5/8	33.70	8,100	—	8,100	8,100	5,900
7 5/8	39.00	9,400	—	9,400	8,800	5,900
7 5/8	42.80	10,000	—	—	—	—
7 5/8	45.30	10,000	—	—	—	—
7 5/8	47.10	10,000	—	—	—	—
7 5/8	51.20	10,000	—	—	—	—
7 5/8	55.30	10,000	—	—	—	—
7 3/4	46.10	10,000	—	—	—	—

Table 42—Hydrostatic Test Pressure for Grade C90 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Designation		Test Pressure, Plain-End[a] (psi)	Test Pressure, psi			
			Round Thread		Buttress Thread	
Size	Weight		Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
$8^5/_8$	36.00	6,700	—	6,700	6,700	5,300
$8^5/_8$	40.00	7,500	—	7,500	7,500	5,300
$8^5/_8$	44.00	8,300	—	8,300	8,300	5,300
$8^5/_8$	49.00	9,300	—	9,300	8,800	5,300
$9^5/_8$	40.00	5,900	—	5,900	5,900	4,800
$9^5/_8$	43.50	6,500	—	6,500	6,500	4,800
$9^5/_8$	47.00	7,100	—	7,100	7,100	4,800
$9^5/_8$	53.50	8,200	—	8,200	7,900	4,800
$9^5/_8$	58.40	8,500	—	8,500	8,000	4,800
$9^5/_8$	59.40	9,100	—	—	—	—
$9^5/_8$	64.90	10,000	—	—	—	—
$9^5/_8$	70.30	10,000	—	—	—	—
$9^5/_8$	75.60	10,000	—	—	—	—
$10^3/_4$	51.00	6,000	6,000	—	6,000	4,100
$10^3/_4$	55.50	6,600	6,600	—	6,600	4,100
$10^3/_4$	60.70	7,300	6,900	—	7,500	4,100
$10^3/_4$	65.70	8,000	6,900	—	7,500	4,100
$10^3/_4$	73.20	9,000	—	—	—	—
$10^3/_4$	79.20	9,800	—	—	—	—
$10^3/_4$	85.30	10,000	—	—	—	—
$11^3/_4$	60.00	6,000	5,800	—	6,000	—
$13^3/_8$	68.00	5,200	4,600	—	4,900	—
$13^3/_8$	72.00	5,500	4,600	—	4,900	—

[a]Plain-end pipe is tested to 3,000 psi maximum except by agreement between purchaser and manufacturer. See 9.4.2.1.

Table 43—Hydrostatic Test Pressure for Grade C95 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Designation			Test Pressure, psi			
			Round Thread		Buttress Thread	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
4 1/2	11.60	8,400	—	8,400	8,400	7,600
4 1/2	13.50	9,800	—	9,800	9,300	7,600
5	15.00	9,000	—	9,000	9,000	7,100
5	18.00	10,000	—	10,000	9,400	7,100
5	21.40	10,000	—	10,000	9,400	7,100
5	23.20	10,000	—	10,000	9,400	7,100
5	24.10	10,000	—	10,000	9,400	7,100
5 1/2	17.00	8,400	—	8,400	8,400	6,500
5 1/2	20.00	10,000	—	9,400	8,500	6,500
5 1/2	23.00	10,000	—	9,400	8,500	6,500
6 5/8	24.00	8,100	—	8,100	8,100	5,600
6 5/8	28.00	9,600	—	9,600	9,300	5,600
6 5/8	32.00	10,000	—	10,000	9,300	5,600
7	23.00	6,900	—	6,900	6,900	5,500
7	26.00	7,900	—	7,900	7,900	5,500
7	29.00	8,900	—	8,800	8,000	5,500
7	32.00	9,800	—	8,800	8,000	5,500
7	35.00	10,000	—	8,800	8,000	5,500
7	38.00	10,000	—	8,800	8,000	5,500
7 5/8	26.40	6,500	—	6,500	6,500	6,200
7 5/8	29.70	7,500	—	7,500	7,500	6,200
7 5/8	33.70	8,600	—	8,600	8,600	6,200
7 5/8	39.00	10,000	—	10,000	9,300	6,200
7 5/8	42.80	10,000	—	10,000	9,300	6,200
7 5/8	45.30	10,000	—	10,000	9,300	6,200
7 5/8	47.10	10,000	—	10,000	9,300	6,200
7 3/4	46.10	10,000	—	—	—	—
8 5/8	36.00	7,000	—	7,000	7,000	5,600
8 5/8	40.00	7,900	—	7,900	7,900	5,600
8 5/8	44.00	8,800	—	8,800	8,800	5,600
8 5/8	49.00	9,800	—	9,800	9,300	5,600
9 5/8	40.00	6,200	—	6,200	6,200	5,100
9 5/8	43.50	6,900	—	6,900	6,900	5,100
9 5/8	47.00	7,500	—	7,500	7,500	5,100
9 5/8	53.50	8,600	—	8,500	8,400	5,100
9 5/8	58.40	9,400	—	8,500	8,400	5,100
10 3/4	51.00	6,400	6,400	—	6,400	4,200
10 3/4	55.50	7,000	6,900	—	7,000	4,200

Table 43—Hydrostatic Test Pressure for Grade C95 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Designation			Test Pressure, psi			
			Round Thread		Buttress Thread	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
11 3/4	60.00	6,300	5,800	—	6,300	—
13 3/8	68.00	5,500	4,600	—	4,900	—
13 3/8	72.00	5,800	4,600	—	4,900	—
16	109.00	6,200	—	—	—	—

[a]Plain-end pipe is tested to 3,000 psi maximum except by agreement between the purchaser and the manufacturer. See 9.4.2.1.

Table 44—Hydrostatic Test Pressure for Grade T95 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Designation			Test Pressure, psi			
			Round Thread		Buttress Thread	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
4 1/2	11.60	8,400	—	8,400	8,400	7,600
4 1/2	13.50	9,800	—	9,800	9,300	7,600
5	15.00	9,000	—	9,000	9,000	7,100
5	18.00	10,000	—	10,000	9,400	7,100
5	21.40	10,000	—	10,000	9,400	7,100
5	23.20	10,000	—	10,000	9,400	7,100
5	24.10	10,000	—	10,000	9,400	7,100
5 1/2	17.00	8,400	—	8,400	8,400	6,500
5 1/2	20.00	10,000	—	9,400	8,500	6,500
5 1/2	23.00	10,000	—	9,400	8,500	6,500
5 1/2	26.80	10,000	—	—	—	—
5 1/2	29.70	10,000	—	—	—	—
5 1/2	32.60	10,000	—	—	—	—
5 1/2	35.30	10,000	—	—	—	—
5 1/2	38.00	10,000	—	—	—	—
5 1/2	40.50	10,000	—	—	—	—
5 1/2	43.10	10,000	—	—	—	—
6 5/8	24.00	8,100	—	8,100	8,100	5,600
6 5/8	28.00	9,600	—	9,600	9,300	5,600
6 5/8	32.00	10,000	—	10,000	9,300	5,600
7	23.00	6,900	—	6,900	6,900	5,500
7	26.00	7,900	—	7,900	7,900	5,500
7	29.00	8,900	—	8,800	8,000	5,500
7	32.00	9,800	—	8,800	8,000	5,500

Table 44—Hydrostatic Test Pressure for Grade T95 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Designation			Test Pressure, psi			
			Round Thread		Buttress Thread	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling	Special Clearance Coupling
7	35.00	10,000	—	8,800	8,000	5,500
7	38.00	10,000	—	8,800	8,000	5,500
7	42.70	10,000	—	—	—	—
7	46.40	10,000	—	—	—	—
7	50.10	10,000	—	—	—	—
7	53.60	10,000	—	—	—	—
7	57.10	10,000	—	—	—	—
$7^5/_8$	26.40	6,500	—	6,500	6,500	6,200
$7^5/_8$	29.70	7,500	—	7,500	7,500	6,200
$7^5/_8$	33.70	8,600	—	8,600	8,600	6,200
$7^5/_8$	39.00	10,000	—	10,000	9,300	6,200
$7^5/_8$	42.80	10,000	—	—	—	—
$7^5/_8$	45.30	10,000	—	—	—	—
$7^5/_8$	47.10	10,000	—	—	—	—
$7^5/_8$	51.20	10,000	—	—	—	—
$7^5/_8$	55.30	10,000	—	—	—	—
$7^3/_4$	46.10	10,000	—	—	—	—
$8^5/_8$	36.00	7,000	—	7,000	7,000	5,600
$8^5/_8$	40.00	7,900	—	7,900	7,900	5,600
$8^5/_8$	44.00	8,800	—	8,800	8,800	5,600
$8^5/_8$	49.00	9,800	—	9,800	9,300	5,600
$9^5/_8$	40.00	6,200	—	6,200	6,200	5,100
$9^5/_8$	43.50	6,900	—	6,900	6,900	5,100
$9^5/_8$	47.00	7,500	—	7,500	7,500	5,100
$9^5/_8$	53.50	8,600	—	8,500	8,400	5,100
$9^5/_8$	58.40	9,400	—	8,500	8,400	5,100
$9^5/_8$	59.40	9,600	—	—	—	—
$9^5/_8$	64.90	10,000	—	—	—	—
$9^5/_8$	70.30	10,000	—	—	—	—
$9^5/_8$	75.60	10,000	—	—	—	—
$10^3/_4$	51.00	6,400	6,400	—	6,400	4,200
$10^3/_4$	55.50	7,000	6,900	—	7,000	4,200
$10^3/_4$	60.70	7,700	6,900	—	7,500	4,200
$10^3/_4$	65.70	8,400	6,900	—	7,500	4,200
$10^3/_4$	73.20	9,500	—	—	—	—
$10^3/_4$	79.20	10,000	—	—	—	—
$10^3/_4$	85.30	10,000	—	—	—	—
$11^3/_4$	60.00	6,300	5,800	—	6,300	—
$13^3/_8$	68.00	5,500	4,600	—	4,900	—
$13^3/_8$	72.00	5,800	4,600	—	4,900	—

[a]Plain-end pipe is tested to 3,000 psi maximum except by agreement between the purchaser and the manufacturer. See 9.4.2.1.

Table 45—Hydrostatic Test Pressure for Grade P110 Casing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Test Pressure, psi						
					Buttress Thread			
Designation			Round Thread		Regular Coupling		Special Clearance Coupling	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	P110	Q125	P110	Q125
4 1/2	11.60	9,800	—	9,800	9,800	9,800	8,800	9,800
4 1/2	13.50	10,000	—	10,000	10,000	10,000	8,800	10,000
		(11,300)	—	(11,300)	(10,800)	(11,300)	(8,800)	(10,000)
4 1/2	15.10	10,000	—	10,000	10,000	10,000	8,800	10,000
		(13,200)	—	(11,700)	(10,800)	(12,200)	(8,800)	(10,000)
5	15.00	10,000	—	10,000	10,000	10,000	8,200	9,300
		(10,400)	—	(10,400)	(10,400)	(10,400)	(8,200)	(9,300)
5	18.00	10,000	—	10,000	10,000	10,000	8,200	9,300
		(12,700)	—	(11,900)	(10,900)	(12,700)	(8,200)	(9,300)
5	21.40	10,000	—	10,000	10,000	10,000	8,200	9,300
		(15,400)	—	(11,900)	(10,900)	(12,400)	(8,200)	(9,300)
5	23.20	10,000	—	10,000	10,000	10,000	8,200	9,300
		(16,800)	—	(11,900)	(10,900)	(12,400)	(8,200)	(9,300)
5	24.10	10,000	—	10,000	10,000	10,000	8,200	9,300
		(17,600)	—	(11,900)	(10,900)	(12,400)	(8,200)	(9,300)
5 1/2	17.00	9,700	—	9,700	9,700	9,700	7,600	8,600
5 1/2	20.00	10,000	—	10,000	9,900	10,000	7,600	8,600
		(11,600)	—	(10,900)	(9,900)	(11,200)	(7,600)	(8,600)
5 1/2	23.00	10,000	—	10,000	9,900	10,000	7,600	8,600
		(13,300)	—	(10,900)	(9,900)	(11,200)	(7,600)	(8,600)
6 5/8	24.00	9,400	—	9,400	9,400	9,400	6,500	7,400
6 5/8	28.00	10,000	—	10,000	10,000	10,000	6,500	7,400
		(11,100)	—	(11,100)	(10,800)	(11,100)	(6,500)	7,400
6 5/8	32.00	10,000	—	10,000	10,000	10,000	6,500	7,400
		(12,600)	—	(11,700)	(10,800)	(12,300)	(6,500)	7,400
7	26.00	9,100	—	9,100	9,100	9,100	6,300	7,200
7	29.00	10,000	—	9,500	9,300	10,000	6,300	7,200
		(10,300)	—	(9,500)	(9300)	(10,300)	(6,300)	7,200
7	32.00	10,000	—	9,500	9,300	10,000	6,300	7,200
		(11,400)	—	(9,500)	(9,300)	(10,600)	(6,300)	7,200
7	35.00	10,000	—	9,500	9,300	10,000	6,300	7,200
		(12,500)	—	(9,500)	(9,300)	(10,600)	(6,300)	7,200
7	38.00	10,000	—	9,500	9,300	10,000	6,300	7,200
		(13,600)	—	(9,500)	(9,300)	(11,800)	(6,300)	7,200
7 5/8	29.70	8,700	—	8,700	8,700	8,700	7,200	8,000
7 5/8	33.70	9,900	—	9,900	9,900	9,900	7,200	8,000
7 5/8	39.00	10,000	—	10,000	10,000	10,000	7,200	8,000
		(11,500)	—	(11,500)	(10,800)	(11,500)	(7,200)	8,000
7 5/8	42.80	10,000	—	10,000	10,000	10,000	7,200	8,000
		(13,000)	—	(11,500)	(10,800)	(12,200)	(7,200)	(8,000)
7 5/8	45.30	10,000	—	10,000	10,000	10,000	7,200	8,000
		(13,700)	—	(11,800)	(10,800)	(12,200)	(7,200)	(8,000)
7 5/8	47.10	10,000	—	10,000	10,000	10,000	7,200	8,000
		(14,400)	—	(11,500)	(10,800)	(12,200)	(7,200)	(8,000)
7 3/4	46.10	10,000	—	—	—	—	—	—
8 5/8	40.00	9,200	—	9,200	9,200	9,200	6,300	6,300

Table 45—Hydrostatic Test Pressure for Grade P110 Casing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Test Pressure, psi						
					Buttress Thread			
Designation			Round Thread		Regular Coupling		Special Clearance Coupling	
Size	Weight	Plain-End[a] and Extreme-Line	Short Thread Coupling	Long Thread Coupling	P110	Q125	P110	Q125
8 5/8	44.00	10,000	—	10,000	10,000	10,000	6,300	6,300
		(10,200)	—	(10,200)	(10,200)	(10,200)	(6,300)	(6,300)
8 5/8	49.00	10,000	—	10,000	10,000	10,000	6,300	6,300
		(11,400)	—	(10,200)	(10,700)	(11,200)	(6,300)	(6,300)
9 5/8	43.50	8,000	—	8,000	8,000	8,000	5,100	5,100
9 5/8	47.00	8,600	—	8,600	8,600	8,600	5,100	5,100
9 5/8	53.50	10,000	—	9,700	9,200	9,200	5,100	5,100
9 5/8	58.40	10,000	—	9,700	9,200	9,200	5,100	5,100
		(10,900)	—	(9,700)	(9,200)	(9,200)	(5,100)	(5,100)
10 3/4	51.00	7,400	7,400	—	7,400	7,400	4,200	4,200
10 3/4	55.50	8,100	7,900	—	7,500	7,500	4,200	4,200
10 3/4	60.70	8,900	7,900	—	7,500	7,500	4,200	4,200
10 3/4	65.70	9,700	7,900	—	7,500	7,500	4,200	4,200
11 3/4	60.00	7,300	6,700	—	6,300	6,300	—	—
13 3/8	68.00	6,300	5,200	—	4,900	4,900	—	—
13 3/8	72.00	6,800	5,200	—	4,900	4,900	—	—
16	109.00	7,200	—	—	—	—	—	—

Note: Standard test pressures are given in regular type; alternative pressures are shown in parentheses.

[a]Plain-end pipe is tested to 3,000 psi maximum except by agreement between purchaser and manufacturer. See 9.4.2.1.

Table 46—Hydrostatic Test Pressure for Grade Q125 Casing

(1)	(2)	(3)	(4)	(5)	(6)
Designation			Test Pressure, psi		
			Round Thread		Buttress Thread
Size	Weight	Plain-End and Extreme-Line	Short Thread Coupling	Long Thread Coupling	Regular Coupling Grade Q125
$4^1/_2$	15.10	10,000	—	10,000	10,000
		(15,000)	—	(13,300)	(12,200)
5	18.00	10,000	—	10,000	10,000
		(14,500)	—	(13,500)	(12,400)
5	21.40	10,000	—	10,000	10,000
		(17,500)	—	(13,500)	(12,400)
5	23.20	10,000	—	10,000	10,000
		(19,100)	—	(13,500)	(12,400)
5	24.10	10,000	—	10,000	10,000
		(20,000)	—	(13,500)	(12,400)
$5^1/_2$	23.00	10,000	—	10,000	10,000
		(15,100)	—	(12,300)	(11,200)
$6^5/_8$	32.00	10,000	—	10,000	10,000
		(14,300)	—	(11,800)	(12,300)
7	35.00	10,000	—	9,500	10,000
		(14,200)	—	—	(10,600)
7	38.00	10,000	—	9,500	10,000
		(15,400)	—	—	(10,600)
$7^5/_8$	39.00	10,000	—	10,000	10,000
		(13,100)	—	(11,800)	(12,200)
$7^5/_8$	42.80	10,000	—	10,000	10,000
		(14,700)	—	(11,800)	(12,200)
$7^5/_8$	45.30	10,000	—	10,000	10,000
		(15,600)	—	(11,800)	(12,200)
$7^5/_8$	47.10	10,000	—	10,000	10,000
		(16,400)	—	(11,800)	(12,200)
$7^5/_8$	46.10	10,000	—	—	—
$8^5/_8$	49.00	10,000	—	10,000	10,000
		(12,900)	—	(10,400)	(11,200)
$9^5/_8$	47.00	9,800	—	9,700	9,200
$9^5/_8$	53.50	10,000	—	9,700	9,200
		(11,300)	—	(9,700)	(9,200)
$9^5/_8$	58.40	10,000	—	9,700	9,200
		(12,400)	—	(9,700)	(9,200)
$10^3/_4$	60.70	10,000	7,900	—	7,500
		(10,100)	(7,900)	—	(7,500)
$10^3/_4$	65.70	10,000	7,900	—	7,500
		(11,100)	(7,900)	—	(7,500)
$11^3/_4$	60.00	8,300	6,700	—	6,300
$13^3/_8$	72.00	7,700	5,200	—	4,900
16	109.00	8,200	—	—	—

Note: Standard test pressures are given in regular type; alternative pressures are listed in parentheses.

Table 47—Hydrostatic Test Pressure for Grade H40 Tubing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Test Pressure, psi					
						External-Upset			
	Weight Designation						Special Clearance Coupling		
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End	Nonupset T & C	Regular Coupling	Grade H40	Grade J55	Integral Joint
1.050	1.14	1.20	—	3,000	3,000	3,000	—	—	—
				(6,900)	(6,900)	(6,900)	—	—	—
1.050	—	1.54	—	3,000	—	3,000	—	—	—
				(9,400)	—	(9,400)	—	—	—
1.315	1.70	1.80	1.72	3,000	3,000	3,000	—	—	3,000
				(6,500)	(6,500)	(6,500)	—	—	(6,500)
1.315	—	2.24	—	3,000	—	3,000	—	—	—
				(8,700)	—	(8,700)	—	—	—
1.660	—	—	2.10	3,000	—	—	—	—	3,000
				(4,800)	—	—	—	—	(4,800)
1.660	2.30	2.40	2.33	3,000	3,000	3,000	—	—	3,000
				(5,400)	(5,400)	(5,400)	—	—	(5,400)
1.660	—	3.07	—	3,000	—	3,000	—	—	—
				(7,400)	—	(7,400)	—	—	—
1.900	—	—	2.40	3,000	—	—	—	—	3,000
				(4,200)	—	—	—	—	(4,200)
1.900	2.75	2.90	2.76	3,000	3,000	3,000	—	—	3,000
				(4,900)	(4,900)	(4,900)	—	—	(4,900)
1.900	—	3.73	—	3,000	—	3,000	—	—	—
				(6,700)	—	(6,700)	—	—	—
2.063	—	—	3.25	3,000	—	—	—	—	3,000
				(4,800)	—	—	—	—	(4,800)
2.063	4.50	—	—	3,000	—	—	—	—	—
				(7,000)	—	—	—	—	—
$2^3/_8$	4.00	—	—	3,000	3,000	—	—	—	—
				(4,500)	(4,500)	—	—	—	—
$2^3/_8$	4.60	4.70	—	3,000	3,000	3,000	3,000	3,000	—
				(5,100)	(5,100)	(5,100)	(4,600)	(5,100)	—
$2^7/_8$	6.40	6.50	—	3,000	3,000	3,000	3,000	3,000	—
				(4,800)	(4,800)	(4,800)	(4,400)	(4,800)	—
$3^1/_2$	7.70	—	—	3,000	3,000	—	—	—	—
				(3,900)	(3,900)	—	—	—	—
$3^1/_2$	9.20	9.30	—	3,000	3,000	3,000	3,000	3,000	—
				(4,600)	(4,600)	(4,600)	(4,300)	(4,600)	—
$3^1/_2$	10.20	—	—	3,000	3,000	—	—	—	—
				(5,300)	(5,300)	—	—	—	—
4	9.50	—	—	3,000	3,000	—	—	—	—
				(3,600)	(3,600)	—	—	—	—
4	—	11.00	—	3,000	—	3,000	—	—	—
				(4,200)	—	(4,200)	—	—	—
$4^1/_2$	12.60	12.75	—	3,000	3,000	3,000	—	—	—
				(3,900)	(3,900)	(3,900)	—	—	—

Note: Standard test pressures are given in regular type; alternative pressures are listed in parentheses.

Table 48—Hydrostatic Test Pressure for Grade J55 Tubing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Test Pressure, psi					
						External-Upset			
							Special Clearance Coupling		
	Weight Designation								
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End	Nonupset T & C	Regular Coupling	Grade H40	Grade J55	Integral Joint
1.050	1.14	1.20	—	3,000	3,000	3,000	—	—	—
				(9,500)	(9,500)	(9,500)	—	—	—
1.050	—	1.54	—	3,000	—	3,000	—	—	—
				(10,000)	—	(10,000)	—	—	—
1.315	1.70	1.80	1.72	3,000	3,000	3,000	—	—	3,000
				(8,900)	(8,900)	(8,900)	—	—	(8,900)
1.315	—	2.24	—	3,000	—	3,000	—	—	—
				(10,000)	—	(10,000)	—	—	—
1.660	—	—	2.10	3,000	—	—	—	—	3,000
				(6,600)	—	—	—	—	(6,600)
1.660	2.30	2.40	2.33	3,000	3,000	3,000	—	—	3,000
				(7,400)	(7,400)	(7,400)	—	—	(7,400)
1.660	—	3.07	—	3,000	—	3,000	—	—	—
				(10,000)	—	(10,000)	—	—	—
1.900	—	—	2.40	3,000	—	—	—	—	3,000
				(5,800)	—	—	—	—	(5,800)
1.900	2.75	2.90	2.76	3,000	3,000	3,000	—	—	3,000
				(6,700)	(6,700)	(6,700)	—	—	(6,700)
1.900	—	3.73	—	3,000	—	3,000	—	—	—
				(9,300)	—	(9,300)	—	—	—
2.063	—	—	3.25	3,000	—	—	—	—	3,000
				(6,700)	—	—	—	—	(6,700)
2.063	4.50	—	—	3,000	3,000	—	—	—	—
				(9,600)	(9,600)	—	—	—	—
$2^3/_8$	4.00	—	—	3,000	3,000	—	—	—	—
				(6,200)	(6,200)	—	—	—	—
$2^3/_8$	4.60	4.70	—	3,000	3,000	3,000	3,000	3,000	—
				(7,000)	(7,000)	(7,000)	6,300	7,000	—
$2^7/_8$	6.40	6.50	—	3,000	3,000	3,000	3,000	3,000	—
				(6,600)	(6,600)	(6,600)	6,100	6,600	—
$3^1/_2$	7.70	—	—	3,000	3,000	—	—	—	—
				(5,400)	(5,400)	—	—	—	—
$3^1/_2$	9.20	9.30	—	3,000	3,000	3,000	3,000	3,000	—
				(6,400)	(6,400)	(6,400)	5,900	6,400	—
$3^1/_2$	10.20	—	—	3,000	3,000	—	—	—	—
				(7,300)	(7,300)	—	—	—	—
4	9.50	—	—	3,000	3,000	—	—	—	—
				(5,000)	(5,000)	—	—	—	—
4	—	11.00	—	3,000	—	3,000	—	—	—
				(5,800)	—	(5,800)	—	—	—
$4^1/_2$	12.60	12.75	—	3,000	3,000	3,000	—	—	—
				(5,300)	(5,300)	(5,300)	—	—	—

Note: Standard test pressures are given in regular type; alternative pressures are shown in parentheses.

Table 49—Hydrostatic Test Pressure for Grade N80 Tubing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				Test Pressure, psi					
						External-Upset			
	Weight Designation						Special Clearance Coupling		
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End	Nonupset T & C	Regular Coupling	Grade H40	Grade J55	Integral Joint
1.050	1.14	1.20	—	10,000	10,000	10,000	—	—	—
1.050	1.48	1.54	—	10,000	—	10,000	—	—	—
1.315	1.70	1.80	1.72	10,000	10,000	10,000	—	—	10,000
1.315	2.19	2.24	—	10,000	—	10,000	—	—	—
1.660	2.30	2.40	2.33	10,000	10,000	10,000	—	—	10,000
1.660	3.03	3.07	—	10,000	10,000	10,000	—	—	—
1.900	2.75	2.90	2.76	9,800	9,800	9,800	—	—	9,800
1.900	3.65	3.73	—	10,000	—	10,000	—	—	—
2.063	—	—	3.25	9,600	—	—	—	—	9,600
2.063	4.50	—	—	10,000	—	—	—	—	—
2 3/8	4.00	—	—	9,000	9,000	—	—	—	—
2 3/8	4.60	4.70	—	10,000	10,000	10,000	9,100	10,000	—
2 3/8	5.80	5.95	—	10,000	10,000	10,000	9,100	10,000	—
2 7/8	6.40	6.50	—	9,700	9,700	9,700	8,800	9,700	—
2 7/8	7.80	7.90	—	10,000	10,000	10,000	8,800	10,000	—
2 7/8	8.60	8.70	—	10,000	10,000	10,000	8,800	10,000	—
3 1/2	7.70	—	—	7,900	7,900	—	—	—	—
3 1/2	9.20	9.30	—	9,300	9,300	9,300	8,500	9,300	—
3 1/2	10.20	—	—	10,000	10,000	—	—	—	—
3 1/2	12.70	12.95	—	10,000	10,000	10,000	8,500	10,000	—
4	9.50	—	—	7,200	7,200	—	—	—	—
4	—	11.00	—	8,400	—	8,400	—	—	—
4 1/2	12.60	12.75	—	7,700	7,700	7,700	—	—	—

Note: Plain-end pipe is tested to 3000 psi maximum except by agreement between purchaser and manufacturer. See 9.4.2.1.

Table 50—Hydrostatic Test Pressure for Grade L80 Tubing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Test Pressure, psi				
	Weight Designation[a]					External-Upset		
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End[a]	Nonupset T & C	Regular Coupling	Special Clearance Coupling	Integral Joint
1.050	1.14	1.20	—	10,000	10,000	10,000	—	—
1.050	1.48	1.54	—	10,000	10,000	10,000	—	—
1.315	1.70	1.80	1.72	10,000	10,000	10,000	—	10,000
1.315	2.19	2.24	—	10,000	10,000	10,000	—	—
1.660	2.30	2.40	2.33	10,000	10,000	10,000	—	10,000
1.660	3.03	3.07	—	10,000	10,000	10,000	—	—
1.900	2.75	2.90	2.76	9,800	9,800	9,800	—	9,800
1.900	3.65	3.73	—	10,000	10,000	10,000	—	—
1.900	4.42	—	—	10,000	—	—	—	—
1.900	5.15	—	—	10,000	—	—	—	—
2.063	—	—	3.25	9,600	—	—	—	9,600
2.063	4.50	—	—	10,000	10,000	—	—	—
2 3/8	4.00	—	—	9,000	9,000	—	—	—
2 3/8	4.60	4.70	—	10,000	10,000	10,000	9,100	—
2 3/8	5.80	5.95	—	10,000	10,000	10,000	9,100	—
2 3/8	6.60	—	—	10,000	10,000	—	—	—
2 3/8	7.35	7.45	—	10,000	10,000	10,000	9,100	—
2 7/8	6.40	6.50	—	9,700	9,700	9,700	8,800	—
2 7/8	7.80	7.90	—	10,000	10,000	10,000	8,800	—
2 7/8	8.60	8.70	—	10,000	10,000	10,000	8,800	—
2 7/8	9.30	9.45	—	10,000	10,000	10,000	8,800	—
2 7/8	10.50	—	—	10,000	—	—	—	—
2 7/8	11.50	—	—	10,000	—	—	—	—
3 1/2	7.70	—	—	7,900	7,900	—	—	—
3 1/2	9.20	9.30	—	9,300	9,300	9,300	8,500	—
3 1/2	10.20	—	—	10,000	10,000	—	—	—
3 1/2	12.70	12.95	—	10,000	10,000	10,000	8,500	—
3 1/2	14.30	—	—	10,000	—	—	—	—
3 1/2	15.50	—	—	10,000	—	—	—	—
3 1/2	17.00	—	—	10,000	—	—	—	—
4	9.50	—	—	7,200	7,200	—	—	—
4	—	11.00	—	8,400	—	8,400	—	—
4	13.20	—	—	10,000	—	—	—	—
4	16.10	—	—	10,000	—	—	—	—
4	18.90	—	—	10,000	—	—	—	—
4	22.20	—	—	10,000	—	—	—	—
4 1/2	12.60	12.75	—	7,700	7,700	7,700	—	—
4 1/2	15.20	—	—	9,600	—	—	—	—
4 1/2	17.00	—	—	10,000	—	—	—	—

Table 50—Hydrostatic Test Pressure for Grade L80 Tubing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Test Pressure, psi				
	Weight Designation[a]					External-Upset		
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End[a]	Nonupset T & C	Regular Coupling	Special Clearance Coupling	Integral Joint
$4^1/_2$	18.90	—	—	10,000	—	—	—	—
$4^1/_2$	21.50	—	—	10,000	—	—	—	—
$4^1/_2$	23.70	—	—	10,000	—	—	—	—
$4^1/_2$	26.10	—	—	10,000	—	—	—	—

Note: Martensitic chromium steels are sensitive to galling. Special precautions may be necessary for thread surface treatment and/or lubrication to minimize galling during hydrostatic testing (plug application and removal).

[a]The densities of martensitic chromium steel (L80, Types 9Cr and 13Cr) are different from carbon steels. The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

[b]Plain-end pipe is tested to 3,000 psi maximum except by agreement between purchaser and manufacturer. See 9.4.2.1.

Table 51—Hydrostatic Test Pressure for Grade C90 Tubing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weight Designation			Test Pressure, psi			
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End[a]	Nonupset T & C	External-Upset Regular Coupling	Integral Joint
1.050	1.14	1.20	—	10,000	10,000	10,000	—
1.050	1.48	1.54	—	10,000	10,000	10,000	—
1.315	1.70	1.80	1.72	10,000	10,000	10,000	10,000
1.315	2.19	2.24	—	10,000	10,000	10,000	—
1.660	2.30	2.40	2.33	10,000	10,000	10,000	10,000
1.660	3.03	3.07	—	10,000	10,000	10,000	—
1.900	2.75	2.90	2.76	10,000	10,000	10,000	10,000
1.900	3.65	3.73	—	10,000	10,000	10,000	—
1.900	4.42	—	—	10,000	—	—	—
1.900	5.15	—	—	10,000	—	—	—
2.063	—	—	3.25	10,000	—	—	10,000
2.063	4.50	—	—	10,000	—	—	—
$2^3/_8$	4.00	—	—	10,000	10,000	—	—
$2^3/_8$	4.60	4.70	—	10,000	10,000	10,000	—
$2^3/_8$	5.80	5.95	—	10,000	10,000	10,000	—
$2^3/_8$	6.60	—	—	10,000	10,000	—	—
$2^3/_8$	7.35	7.45	—	10,000	10,000	10,000	—
$2^7/_8$	6.40	6.50	—	10,000	10,000	10,000	—
$2^7/_8$	7.80	7.90	—	10,000	10,000	10,000	—
$2^7/_8$	8.60	8.70	—	10,000	10,000	10,000	—
$2^7/_8$	9.35	9.45	—	10,000	10,000	10,000	—
$2^7/_8$	10.50	—	—	10,000	—	—	—
$2^7/_8$	11.50	—	—	10,000	—	—	—

Table 51—Hydrostatic Test Pressure for Grade C90 Tubing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weight Designation			Test Pressure, psi			
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End[a]	Nonupset T & C	External-Upset Regular Coupling	Integral Joint
3 1/2	7.70	—	—	8,900	8,900	—	—
3 1/2	9.20	9.30	—	10,000	10,000	10,000	—
3 1/2	10.20	—	—	10,000	10,000	—	—
3 1/2	12.70	12.95	—	10,000	10,000	10,000	—
3 1/2	14.30	—	—	10,000	—	—	—
3 1/2	15.50	—	—	10,000	—	—	—
3 1/2	17.00	—	—	10,000	—	—	—
4	9.50	—	—	8,100	8,100	—	—
4	—	11.00	—	9,400	—	9,400	—
4	13.20	—	—	10,000	—	—	—
4	16.10	—	—	10,000	—	—	—
4	18.90	—	—	10,000	—	—	—
4	22.20	—	—	10,000	—	—	—
4 1/2	12.60	12.75	—	8,700	8,700	8,700	—
4 1/2	15.20	—	—	10,000	—	—	—
4 1/2	17.00	—	—	10,000	—	—	—
4 1/2	18.90	—	—	10,000	—	—	—
4 1/2	21.50	—	—	10,000	—	—	—
4 1/2	23.70	—	—	10,000	—	—	—
4 1/2	26.10	—	—	10,000	—	—	—

Note: Plain-end pipe is tested to 3,000 psi maximum except by agreement between the purchaser and the manufacturer. See 9.4.2.1.

Table 52—Hydrostatic Test Pressure for Grade T95 Tubing

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weight Designation			Test Pressure, psi			
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End[a]	Nonupset T & C	External-Upset Regular Coupling	Integral Joint
1.050	1.14	1.20	—	10,000	10,000	10,000	—
1.050	1.48	1.54	—	10,000	10,000	10,000	—
1.315	1.70	1.80	1.72	10,000	10,000	10,000	10,000
1.315	2.19	2.24	—	10,000	10,000	10,000	—
1.660	2.30	2.40	2.33	10,000	10,000	10,000	10,000
1.660	3.03	3.07	—	10,000	10,000	10,000	—
1.900	2.75	2.90	2.76	10,000	10,000	10,000	10,000
1.900	3.65	3.73	—	10,000	10,000	10,000	—
1.900	4.42	—	—	10,000	—	—	—
1.900	5.15	—	—	10,000	—	—	—
2.063	—	—	3.25	10,000	—	—	10,000
2.063	4.50	—	—	10,000	—	—	—

Table 52—Hydrostatic Test Pressure for Grade T95 Tubing (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Weight Designation			Test Pressure, psi			
Size Designation	Nonupset T & C	External-Upset T & C	Integral Joint	Plain-End[a]	Nonupset T & C	External-Upset Regular Coupling	Integral Joint
$2^3/_8$	4.00	—	—	10,000	10,000	—	—
$2^3/_8$	4.60	4.70	—	10,000	10,000	10,000	—
$2^3/_8$	5.80	5.95	—	10,000	10,000	10,000	—
$2^3/_8$	6.60	—	—	10,000	10,000	—	—
$2^3/_8$	7.35	7.45	—	10,000	10,000	10,000	—
$2^7/_8$	6.40	6.50	—	10,000	10,000	10,000	—
$2^7/_8$	7.80	7.90	—	10,000	10,000	10,000	—
$2^7/_8$	8.60	8.70	—	10,000	10,000	10,000	—
$2^7/_8$	9.35	9.45	—	10,000	10,000	10,000	—
$2^7/_8$	10.50	—	—	10,000	—	—	—
$2^7/_8$	11.50	—	—	10,000	—	—	—
$3^1/_2$	7.70	—	—	9,400	9,400	—	—
$3^1/_2$	9.20	9.30	—	10,000	10,000	10,000	—
$3^1/_2$	10.20	—	—	10,000	10,000	—	—
$3^1/_2$	12.70	12.95	—	10,000	10,000	10,000	—
$3^1/_2$	14.30	—	—	10,000	—	—	—
$3^1/_2$	15.50	—	—	10,000	—	—	—
$3^1/_2$	17.00	—	—	10,000	—	—	—
4	9.50	—	—	8,600	8,600	—	—
4	—	11.00	—	10,000	—	10,000	—
4	13.20	—	—	10,000	—	—	—
4	16.10	—	—	10,000	—	—	—
4	18.90	—	—	10,000	—	—	—
4	22.20	—	—	10,000	—	—	—
$4^1/_2$	12.60	12.75	—	9,200	9,200	9,200	—
$4^1/_2$	15.20	—	—	10,000	—	—	—
$4^1/_2$	17.00	—	—	10,000	—	—	—
$4^1/_2$	18.90	—	—	10,000	—	—	—
$4^1/_2$	21.50	—	—	10,000	—	—	—
$4^1/_2$	23.70	—	—	10,000	—	—	—
$4^1/_2$	26.10	—	—	10,000	—	—	—

Note: Plain-end pipe is tested to 3,000 psi maximum except by agreement between the purchaser and the manufacturer. See 9.4.2.1.

Table 53—Hydrostatic Test Pressure for Grade P110 Tubing

(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Test Pressure,[a] psi			
	Weight Designation				External-Upset	
Size Designation	Nonupset T & C	External-Upset T & C	Plain-End[b]	Nonupset T & C	Regular Coupling	Special Clearance Coupling
1.050	1.48	1.54	10,000	—	10,000	—
			(25,800)	—	(20,900)	—
1.315	2.19	2.24	10,000	—	10,000	—
			(24,000)	—	(22,500)	—
1.660	3.03	3.07	10,000	—	10,000	—
			(20,300)	—	(18,000)	—
1.900	3.65	3.73	10,000	—	10,000	—
			(18,300)	—	(16,600)	—
2.063	4.50	—	10,000	—	—	—
			(19,200)	—	—	—
2 3/8	4.60	4.70	10,000	10,000	10,000	10,000
			(14,100)	(14,100)	(14,100)	(12,600)
2 3/8	5.80	5.95	10,000	10,000	10,000	10,000
			(18,800)	(17,700)	(16,300)	(12,600)
2 7/8	6.40	6.50	10,000	10,000	10,000	10,000
			(13,300)	(13,300)	(13,300)	(12,100)
2 7/8	7.80	7.90	10,000	10,000	10,000	10,000
			(16,900)	(16,900)	(16,400)	(12,100)
2 7/8	8.60	8.70	10,000	10,000	10,000	10,000
			(18,900)	(18,300)	(16,400)	(12,100)
3 1/2	9.20	9.30	10,000	10,000	10,000	10,000
			(12,800)	(12,800)	(12,800)	(11,700)
3 1/2	12.70	12.95	10,000	10,000	10,000	10,000
			(18,900)	(18,000)	(17,200)	(11,700)

[a]Standard test pressures are given in regular type; alternative pressures are shown in parentheses.
[b]Plain-end pipe is tested to 3,000 psi maximum except by agreement between the purchaser and the manufacturer. See 9.4.2.1.

9.4.2.1.2 Plain-End Except Q125

The hydrostatic test pressures for plain-end pipe other than Q125 shall be the pressures listed in Tables 36 through 53, or a higher pressure as agreed upon between the purchaser and manufacturer. The test pressure may be limited to 3,000 psi for plain-end pipe when so indicated in the table. It is recognized that the maximum hydrostatic test pressure of 3,000 psi and 10,000 psi are imposed due to limitations of test equipment. This does not preclude conducting subsequent hydrostatic tests at a fiber stress not exceeding 80% of the specified minimum yield strength in accordance with the formulas listed below. Failure to pass this hydrostatic test without leakage is basis for rejection.

9.4.2.1.3 All Plain-End Grade Q125

Plain-end Q125 pipe shall be tested as agreed upon by the purchaser and manufacturer.

9.4.2.2 Connectors and Pup Joints

Testing is not required on connectors and Group 4 pup joints except by special agreement between the purchaser and the manufacturer. (See note.)

Note: The user should be aware that API couplings with special clearance or standard outside diameter may leak at a pressure less than the API alternative test pressure for the plain-end or threaded-and-coupled tube due to inadequate bearing pressure between the coupling and pin.

9.4.2.3 Test Pressure Calculation

The hydrostatic test pressures specified herein are based on the following formula and rounded to the nearest 100 psi or to a maximum of either 3000 psi or 10,000 psi, depending on the grade of the product:

$$P = 2(f \times Y_p \times t)/D$$

where:

P = hydrostatic test pressure (psi).

f = a factor of 0.6 or 0.8, as shown in Table 54.

Y_p = specified yield strength for the pipe body (psi).

t = specified wall thickness, in.

D = specified outside diameter, in.

The hydrostatic test pressures for threaded-and-coupled pipe are calculated from the above formula, except where a lower pressure is required to avoid leakage due to insufficient coupling strength or interface pressure between pipe and coupling threads. The lower pressures are based on formulas given in API Bulletin 5C3.

9.5 DIMENSIONAL TESTING

9.5.1 Wall Thickness

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 $^1/_4$-inch diameter. The end of the pin contacting the inside surface of the pipe shall be rounded to a maximum radius of $1^1/_2$-inches for sizes $6^5/_8$ and larger and a maximum radius of d/4 for pipe sizes less than $6^5/_8$ with a minimum radius of $^1/_8$-inch. 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 $1^1/_2$-inches.

9.5.2 Drift Test

All drift testing shall be performed with a drift mandrel containing a cylindrical portion conforming to the requirements shown in Table 55. The ends of the drift mandrel extending beyond the specified cylindrical portion shall be shaped to permit easy entry into the pipe. The drift mandrel shall pass freely through pipe by the use of a manual or power drift procedure. In case of dispute, the manual drift procedure shall be used. 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.

9.5.3 Length

When pipe is furnished with threads and couplings, the length shall be measured to the outer face of the coupling, or if measured without couplings, proper allowance shall be made to include the length of coupling. For extreme-line casing and integral joint tubing, the length shall be measured to the outer face of the box end. For pup joints and connectors, the length shall be measured from end to end.

Table 54—Hydrostatic Test Pressure Factors

	Factor f		
	Standard Test Pressures		
Grade	Sizes Smaller than $10^3/_4$	Sizes $10^3/_4$ and Larger	Alternative Test Pressures All Sizes
H40	0.8	0.6	0.8
J55, K55	0.8	0.6	0.8
M65	0.8	0.8	—
L80, N80	0.8	0.8	—
C90	0.8	0.8	—
C95, T95	0.8	0.8	—
P110	0.8	0.8	0.8
Q125	0.8	0.8	0.8

Table 55—Drift Mandrel Dimensions

	Minimum Drift Mandrel	
Product and Size	Length (in.)	Diameter (in.)
Casing[a] and liners		
Smaller than $9^5/_8$	6	$d - ^1/_8$
$9^5/_8$ to $13^3/_8$, incl.	12	$d - ^5/_{32}$
Larger than $13^3/_8$	12	$d - ^3/_{16}$
Tubing[b]		
$2^7/_8$ and smaller	42	$d - ^3/_{32}$
Larger than $2^7/_8$	42	$d - ^1/_8$

[a]The minimum diameter of the drift mandrel for extreme-line casing shall be as shown in Table 22, columns 12 and 13.
[b]Integral-joint tubing shall be tested before upsetting with a drift mandrel as shown, and shall also be drift tested at the pin end, after upsetting with a cylindrical drift mandrel 42 inches in length and –0.015 inches in diameter (see Table 24, column 6).

9.5.4 Weight Determination

Each length of casing and each length of tubing in sizes 1.660 and larger shall be weighed separately. Lengths of tubing in sizes smaller than 1.660 shall be weighed either individually or in convenient bundles. The pipe manufacturer applying the markings (see Section 10 and Appendix D) to the pipe body shall be responsible for weighing the pipe to determine conformance with weight tolerance. The pipe may be weighed plain-end, upset, nonupset, threaded, or threaded and coupled. Threaded-and-coupled pipe may be weighed with the couplings screwed on or without the weight of couplings. Threaded-and-coupled pipe, integral joint pipe, and pipe shipped without couplings shall be weighed with or without thread protectors if proper allowances are made for the weight of the thread protectors. Weighing of pipe by a threader is not mandatory.

Note: The densities of martensitic chromium steels (L80,Types 9Cr and 13Cr) are different from carbon steels. The weights shown are

therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

9.5.5 Straightness

All pipe shall be visually examined and shall be reasonably straight. Pipe size $4^1/_2$ and larger shall be checked for straightness when necessary by using a straight edge or taut string (wire). Deviation from straight or chord height shall not exceed the requirements in 7.8.

Measurement of the deviation shall not be made in the plane of the upset, the upset fade-away, or the coupling.

9.5.6 Diameter

The manufacturer shall demonstrate conformance in a single diametric plane at a minimum frequency of one pipe per one hundred. If any pipe fails to meet this requirement, the provisions of 9.10.6 shall apply.

The manufacturer shall measure the diameter of both ends of pipe ordered plain end at a minimum frequency of one pipe per one hundred.

In case of dispute, measurement using a micrometer shall govern. Three measurements shall be made in the non conforming area and averaged. The average of the three readings shall be used to determine the conformance of the diameter.

Note: Once the pipe has proceeded past the last manufacturing quality control point for diameter, some deviations in the maximum and minimum diameter can occur due to handling and storage and should not be cause for rejection provided the average diameter as measured by diameter tape is within the diameter tolerances.

9.6 VISUAL INSPECTION

9.6.1 Visual Inspection of the Pipe Body (Excluding Pipe Ends)

Each pipe shall be visually inspected for defects on the entire outside surface.

9.6.2 Visual Inspection of Pipe Ends

9.6.2.1 Pipe ends shall be visually inspected on the outside surface for a minimum distance of 18 inches.

9.6.2.2 Pipe ends shall be visually inspected on the inside surface for the following minimum distance:

a. For nonupset products, 2.5 × D or 18 inches (whichever is less).

b. For upset products, the length of upset including run-out interval.

9.6.2.3 If another inspection method is applied with demonstrated capability of detecting defects as defined in 7.12, visual inspection of the ends is not required.

9.6.2.4 If cropping is performed as specified in 9.7.12.2, the inside surface shall again be inspected in accordance with 9.6.2.2.

9.7 NONDESTRUCTIVE INSPECTION

9.7.1 General

Sections 9.6 and 9.7 establish requirements for the nondestructive inspection (including visual inspection) and disposition of pipe covered in this specification.

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

9.7.2 Inspection Requirements

9.7.2.1 Pipe Body Inspection

The manufacturer shall inspect the pipe body using the methods required by Table 56 in accordance with the standard practices referenced in 9.7.6, or by other inspection methods that can demonstrate the capability of detecting inside and outside surface defects as defined in 7.12. The location of the equipment shall be at the discretion of the manufacturer; however, nondestructive inspection (excluding the visual method) shall take place after all heat-treating and rotary straightening operations, except for certain kinds of pup joints as provided in 9.7.2.2. When more than one nondestructive inspection method (excluding visual) is required, one of these may take place before heat-treating and/or rotary straightening operations. When one of these methods is ultrasonic inspection, the ultrasonic inspection shall be performed after all heat-treating and rotary straightening.

Table 56—Pipe Body Inspection Methods

(1)	(2)	(3)	(4)	(5)
Grade	Visual	EMI	UT	MPI (Circular Field)
H40, J55, K55, N80 (N, N & T)	R	N	N	N
M65, N80 (Q & T), L80, C95	R	A	A	A
P110	R	A	A	—
C90, T95, Q125	R	B	C	B

Note:
R = required as specified in 9.6.
N = not required.
A = one method or any combination of methods shall be used.
— = not applicable.
B = at least one method (excluding the visual method) shall be used in addition to UT to inspect the outside surface.
C = UT shall be used to inspect the inside and outside surface.

9.7.2.2 Pup Joints

9.7.2.2.1 For pup joints made from full length casing or tubing, the required inspection (see 9.7.2.1) for inside and outside surface defects shall take place either before or after cutting into final length, provided there is no subsequent upsetting or heat treatment.

9.7.2.2.2 For pup joints machined from pipe or bar stock, the required inspection (see 9.7.2.1) shall take place either before or after machining to final product dimensions; however, the outside surface shall be visually inspected subsequent to being machined to final product dimensions.

9.7.2.2.3 For all other pup joints, except for those round thread pup joints in 9.7.2.2.4, the required inspection shall be performed according to 9.7.2.1.

9.7.2.2.4 For API round thread pup joints in size designations listed in Table A-3 in Group 1, Group 2 Grades L80 and C95, and Group 3, the required inspections, unless otherwise agreed upon between the purchaser and manufacturer, are as follows:

a. Pipe body outside surface and end area. The required outside surface and end area inspection shall be performed following any upset process and final heat treatment. For Group 3 pup joints, magnetic particle inspection for longitudinal and transverse defects may be substituted for the required outside surface inspection.

b. Inside surface. The required pipe body inside inspection may take place before or after cutting to individual lengths, any upset process, or final heat treatment.

9.7.3 Pipe Inspection Coverage

9.7.3.1 Pipe Body

All pipe requiring nondestructive inspection (excluding the visual method) shall be inspected full length (end to end) for outside and inside surface defects.

9.7.3.2 End Areas

When an automated ultrasonic or electromagnetic inspection system (combined equipment, operating procedures, and personnel) is applied to meet the requirements of 9.7.3.1, end areas that are not covered by the automated inspection system shall be inspected for defects by the magnetic particle method or other inspection method with demonstrated capability of detecting defects as defined in 7.12. Such end area inspection shall be performed after final heat treatment and any rotary straightening; however, it need only be performed once. The combination of the inspection methods shall inspect 100 percent of the outside and inside surfaces.

9.7.3.3 Pipe Upsets

Forged upsets (including the upset runout interval) on all grades except H40, J55, and K55 shall be inspected for transverse, outside and inside surface defects by any of the inspection methods listed in 9.7.6 (excluding ASTM E 273) and shall take place after all heat treating.

9.7.4 Pipe Body Wall Thickness Verification

All seamless casing, tubing, liners, and pup joints requiring electromagnetic or ultrasonic inspection as specified in Table 56 shall have the wall thickness verified in a helical or longitudinal path over the length of the pipe, excluding end areas not covered by automated systems. The location and procedure of this verification process shall be at the discretion of the manufacturer.

9.7.5 Inspection of Weld Seam

The weld seam of all welded pipe furnished to this specification shall be inspected full length (end to end) for defects either electromagnetically or ultrasonically, except Grade P110 and Q125 pipe shall have its weld seam ultrasonically inspected full length in accordance with SR11.

The weld seam inspection shall take place after final heat treating and subsequent rotary straightening operations on all pipe receiving a quench and temper heat treatment. On all pipe not receiving a quench and temper heat treatment, the location of the weld seam inspection equipment shall be at the manufacturer's discretion.

Inspection equipment shall be capable of inspecting the entire wall thickness $^1/_{16}$-inch on both sides of the weld line.

9.7.6 Standard Practices for Inspection

For other than wall thickness verification and visual inspection, the inspections shall be performed, as a minimum, in accordance with the applicable ASTM (or equivalent) standards, as follows:

a. Electromagnetic (flux leakage)	E 570
b. Electromagnetic (eddy-current)	E 309
c. Ultrasonic	E 213
d. Ultrasonic (weld seam)	E 273
e. Magnetic particle	E 709
f. Liquid penetrant	E 165

9.7.7 Reference Standards

Ultrasonic and electromagnetic inspection systems for other than wall thickness verification shall use reference standards containing notches or holes as shown in Table 57 to verify equipment response from artificial reference indicators.

The manufacturer may use any documented procedures to establish the reject threshold for ultrasonic or electromagnetic inspection, provided the artificial reference indicators

described in Table 57 can be detected dynamically under normal operating conditions. Such detection capability shall be demonstrated dynamically. At the option of the manufacturer, this may be performed either on-line or off-line.

Table 57 lists the reference indicators for manufacturers to use in establishing thresholds for sorting pipe that may contain defects as defined in 7.12. The reference indicators, used during automated ultrasonic or electromagnetic inspection, are not to be construed as being the defect sizes, defined in 7.12, or be used by those other than the manufacturer as the only basis for rejection.

9.7.8 Automated Inspection System Signal Evaluation

All indicators that are equal to or greater than the reject threshold shall be considered defects unless it can be demonstrated that the imperfection causing the indication is not a defect as described in 7.12. Pipe with defects shall be given a disposition in accordance with 9.7.12.

9.7.9 Records Verifying System Capability

Inspection system records shall be maintained to verify the system capabilities in detecting reference indicators as stated in 9.7.7. These records shall include calibration and operating procedures, equipment description, personnel qualifications, and dynamic test data demonstrating the system capabilities for detecting the reference indicators.

9.7.10 Certification and Qualification of Personnel

As a minimum, ASNT Recommended Practice SNT-TC-1A (or equivalent) shall be the basis of certification for nondestructive testing (NDT) personnel. Inspections (excluding the visual method) shall be conducted by Level I, II, or III certified inspectors.

9.7.11 Evaluation of Indications (Prove-Up)

The manufacturer has the option of evaluating an indication, which is equal to or greater than the reject threshold, in accordance with this paragraph or of disposing of the indication as a defect as specified in 9.7.12. Evaluation of indications shall be performed by Level I certified inspectors under the supervision of Level II or III certified inspectors or by Level II or Level III certified inspectors. Evaluation of indications shall be performed in accordance with written procedures. For the evaluation of an indicated imperfection, the depth shall be measured to determine if it is a defect in accordance with 7.12. This measurement shall be performed as follows:

a. The imperfection's depth may be measured using a mechanical measuring device (for example, pipe gauge, calipers, etc.). Removal of material by grinding or other means to facilitate measurement shall not reduce the remaining wall below 87.5 percent of the specified wall thickness. Abrupt changes in wall thickness caused by probe grinding shall be removed.

Table 57—Artificial Reference Indicators

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Notch Location		Notch Orientation[a]		Notch Dimensions			Radially Drilled Hole
Grade	OD	ID	Long.	Trans.	Depth[b]	Length[c]	Width[c]	Diameter[d]
Pipe body								
M65, N80 (Q & T), L80, C95	R	R	R	N	12.5	2.0	0.040	1/8
C90, T95, P110, Q125	R	R	R	R	5.0	2.0	0.040	1/16
P110 to SR16	R	R	R	R	12.5	2.0	0.040	1/8
Weld seam								
Q125 and P110	R	R	R	N	5.0	2.0	0.040	1/16
All other grades	R	R	R	N	10.0	2.0	0.040	1/8

Note: R = required when using notches; N = not required.

[a]Notches shall be rectangular or U-shaped as specified in Figure 2 of ASTM E 213. For seamless pipe, at the option of the manufacturer, notches may be oriented at such an angle as to optimize detection of anticipated defects.

[b]Depth as a percent of specified wall thickness. The depth tolerance shall be ±15 percent of the calculated notch depth with a minimum notch depth of 0.012 inch, ±0.002 inch. For the weld seam inspection required for ERW, Groups 3 and 4, see Figure B-1 of SR11 for notch tolerances.

[c]Maximum, in inches, at full depth.

[d]Drilled hole diameter (through the pipe wall) shall be based on drill bit size in inches. When calibrating EMI equipment using drilled holes, the inspection system shall be capable of producing signals from both ID and OD notches that are equal to or greater than the reject threshold established using the drilled hole. This system capability shall be recorded as specified in 9.7.9.

b. The imperfection's depth may be measured by ultrasonic techniques (time- and/or amplitude-based or other capable techniques). Verification of the ultrasonic technique shall be documented and show a capability of differentiating imperfection sizes larger and smaller than the appropriate defect size stated in 7.12.1 and 7.12.2.

c. If the purchaser and manufacturer do not agree on the evaluation test results, either party may require destructive evaluation of the material; after which, disposition shall be as described in C.4 of Appendix C.

d. Imperfections that have been evaluated and found to be defects shall be given a disposition in accordance with 9.7.12.

9.7.12 Disposition

Imperfections that satisfy the material requirements and are less than the defect size stated in 7.12 are allowed to remain in the pipe. Repair welding is not permitted. Pipe containing defects shall be given one of the dispositions listed in 9.7.12.1–9.7.12.3.

9.7.12.1 Grinding or Machining

Defects shall be completely removed by grinding or machining, provided the remaining wall thickness is within specified limits. Generous radii shall be used to preclude abrupt changes in wall thickness. Where the depth of the grind exceeds 10 percent of the specified wall thickness, the remaining wall thickness shall be verified in accordance with 9.5.1. After removal of the defect, the affected area shall be reinspected by one or more of the nondestructive inspection methods specified in 9.7.6 to verify complete removal of the defect. The manufacturer's documented prove-up procedures shall address the possibility that there may be other coincident defects in the affected area.

9.7.12.2 Cutoff

The section of pipe containing the defect shall be cut off within the limits of the requirements on length of the intended product.

9.7.12.3 Rejected

The pipe shall be rejected.

9.8 TEST METHODS AND RESULTS

9.8.1 Chemical Analysis

Chemical analysis 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. All chemical analyses shall be made in accordance with ASTM A 751, *Test Methods, Practices and Terminology for Chemical Analysis of Steel Products.*

9.8.2 Tensile Tests

9.8.2.1 Procedures

Tensile properties shall be determined by tests on longitudinal specimens conforming to the requirements of 9.3.3.1 and the latest edition of ASTM A 370, *Mechanical Testing of Steel Products*, Annex II. 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 the latest edition of ASTM A 370.

9.8.2.2 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.* Extensometers shall be calibrated within 15 months preceding any test in accordance with the procedures of ASTM E 83, *Practice for Verification and Classification of Extensometers.* Records retention shall be in accordance with 13.3.

9.8.3 Flattening Test

9.8.3.1 Group Non-Full Body Heat Treated Pipe

Test specimens shall be flattened between parallel plates. From each pair of flattening test specimens, one shall be flattened in the 90° position and one in the 0° position. Test specimens shall be flattened until opposite walls of the pipe meet. No cracks or breaks shall occur anywhere in the specimen until the distance between the plates is less than that specified in Table 19; nor shall evidence of poor texture, incomplete fusion in the weld, laminations, burnt metal, or extruded metal develop during the entire flattening process.

9.8.3.2 Group 1 and Group 2—Full Body Heat Treated Pipe

Test specimens shall be flattened between parallel plates with the weld at 90° position and, at the discretion of the inspector, separate flattening tests shall be made also with the weld located at the 0° position. Test specimens shall be flattened until opposite walls of the pipe meet. No cracks or breaks shall occur anywhere in the specimen until the distance between the plates is less than that specified in Table 19; nor shall evidence of poor texture, incomplete fusion in the weld, laminations, burnt metal, or extruded metal develop during the entire flattening process.

If the electric-welded pipe is to be full-body normalized, including pipe that is processed through a hot stretch mill in accordance with the requirements of 5.2.1, the test specimens shall be flattened either prior to or after such treatment, at the option of the manufacturer.

Notes:
90° position, the weld is positioned at 3 or 9 o'clock.
0° position, the weld is positioned at 12 or 6 o'clock.

9.8.3.3 Group 3 and Group 4—All Pipe

See SR11 for mandatory requirements.

9.8.4 Hardness Test

9.8.4.1 Hardness tests shall be made in accordance with ASTM E 18, *Test Methods for Rockwell Hardness and Rockwell Superficial Hardness of Metallic Materials,* and ASTM E 10, *Test Methods for Brinell Hardness of Metallic Materials,* as appropriate.

9.8.4.2 Conversions shall be made in accordance with ASTM A 370. The use of the Rockwell B hardness (HRB) scale is permissible at hardness levels below HRC 20. Although hardness readings below Rockwell C hardness (HRC) 20 may not be precise, they may be used for the calculation of hardness values. Exercise care when evaluating those hardness readings and values below HRC 20. The laboratory HRC hardness test shall be used as a referee method in case of disagreement.

9.8.4.3 Calibration shall be checked at the beginning and end of a continuous run and at such times during the run as required to assure the manufacturer and the purchaser or his representative that the testing machine is in calibration. In any case, calibration shall be checked at least once per 8-hour shift.

9.8.4.4 Calibration shall be made on a certified test block in the range of 25 to 35 HRC for Group 4, and a range of 20 to 25 HRC for Group 2 products. Rockwell hardness readings and values shall be reported to the nearest tenth to minimize conflict as to the hardness and acceptance or rejection of the material.

9.8.4.4.1 OD and ID readings shall be taken between 0.100 to 0.150-inches from the applicable surface. Hardness impressions shall not be made closer to the OD or ID surfaces than specified in Figure 13. When the specified wall thickness is less than 0.300-inches, one hardness value (three impressions) made at the midwall shall be acceptable. Hardness surveys performed on ring specimens shall be made in one quadrant of each ring. The three hardness readings taken at each position (OD, midwall, and ID) shall be averaged to give one hardness value for each position.

9.8.4.4.2 Hardness values shall be reported (actual or converted) as HRC values.

9.8.4.4.3 All hardness impressions shall be at least three diameters apart as specified in Figure 13.

9.8.4.4.4 The first impression on each hardness block or ring quadrant may be disregarded in order to reduce the probability of errors.

9.8.5 Grain Size Determination—Group 2 (Grades C90 and T95)

Grain size shall be determined by metallurgical evaluations such as the McQuaid-Ehn Test or other methods as specified in the latest edition of ASTM E 112. The method used to determine the grain size shall be reported.

9.8.6 Sulfide Stress Cracking Test—Group 2 (Grades C90 and T95)

The latest edition of NACE test method TM-01-77 shall be used to determine the sulfide stress cracking resistance of Grade C90 and T95 products. The level of resistance to sulfide stress cracking NACE Test Method TM-01-77-90 shall be used to determine the sulfide stress cracking resistance of Grade C90 and T95 products. The level of resistance to sulfide stress cracking shall be measured using the Method A, Tensile; Method B, Bent Beam; or Method D, DCB test methods. For Method A, full size tensile test specimens shall be used except where subsize tensile specimens are necessitated because of pipe geometry constraints.

9.8.7 Impact Test

9.8.7.1 General Procedures

Charpy V-notch Type A impact tests shall be conducted as specified in ASTM A 370 and ASTM E 23.

9.8.7.2 Test Temperature

The test temperature shall be +32°F for all groups except Group 1 (Grades J55 and K55) products, which shall be tested at +70°F. A lower alternate test temperature may be specified on the purchase order or selected by the manufacturer for any grade. The tolerance on the test temperature shall be ±15°F.

9.8.7.3 Subsize Test Temperature Reduction—Group 1 (Grades J55 and K55)

A test temperature reduction may be required when subsize test specimens are used. The test temperature reduction depends on the critical thickness of the connection and the size of the impact test specimen. The test temperature reduction specified in Table 58 shall be used when applicable.

9.8.7.4 Rounding Procedures

For purposes of determining conformance with these requirements, an observed value shall be rounded off to the nearest whole number in accordance with the rounding method of ASTM E 29. Further, limiting values as specified or calculated shall be expressed as whole numbers, rounded if necessary.

Table 58—Test Temperature Reduction for Subsize Specimens—Group 1, Grades J and K Only

(1)	(2)	(3)
Specimen Size	Critical Thickness Of Connection (in.)	Temperature Reduction (°F)
10 mm × 7.5 mm	greater than 0.394	5
10 mm × 5.0 mm	greater than 0.394	20
10 mm × 5.0 mm	0.295 to 0.394	15
10 mm × 5.0 mm	0.262 to 0.294	10
10 mm × 5.0 mm	0.236 to 0.261	5

9.9 INVALIDATION OF TESTS

9.9.1 Tensile Test

If any tensile specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted. A retest shall be allowed 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 gauge length as indicated by scribe scratches on the specimen before testing.

9.9.2 Hardness Test

If any hardness specimen shows defective machining or develops flaws, it may be discarded and another specimen substituted.

9.9.3 Impact Test

Any test specimen that shows defective preparation or material imperfections unrelated to the intent of the test, whether observed before or after testing, may be discarded and be replaced by another specimen from the same product length. Specimens shall not be judged defective simply because they failed to exhibit the minimum absorbed energy requirement.

9.10 RETESTS

9.10.1 Chemical Composition Recheck Product Analyses—All Groups (See Note)

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

Note: For couplings, pup joints, and connectors, the analyses required in 9.2.2 may be furnished by the steel manufacturer.

9.10.2 Tensile Retests

9.10.2.1 All Groups

If a tensile test specimen representing a lot of pipe fails to conform to the specified requirements, the manufacturer may elect to make retests on three additional lengths from the same lot. If all of the 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 more than one of the original test specimens fails or one or more 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 specified in 9.3.3.1.1. Pipe and coupling pup joint or connector material from the same heat of steel that has been rejected by one or more of the above criteria may be re-heat treated and retested since by definition they are then a new lot of pipe.

9.10.2.2 Group 2 (Grades C90 and T95) and Group 4

9.10.2.2.1 Couplings, Pup Joints or Connector Materials Treated in Tube Lengths

If a tensile specimen fails to conform to the specified requirements, the manufacturer shall either make tests on both ends of the pipe in question to verify the property in question or reject the material. No additional testing will be allowed to qualify a piece of coupling, pup joint, or connector material.

9.10.2.2.2 Coupling, Pup Joints, and Connectors Heat Treated in Coupling Blank or Individual Lengths

If a tensile specimen fails to conform to the specified requirements, the manufacturer shall either re-heat treat the lot in question or make three additional tests from the lot in question. If one or more of them fails, the lot shall be rejected. The manufacturer may elect to re-heat treat and retest the lot.

9.10.3 Flattening Retests

If either test specimen representing a single length of pipe fails to meet the requirements specified, the manufacturer may elect to make additional tests 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 percent of its length after the initial cropping. If any test specimen from a length of pipe representing a lot fails to conform to the requirements specified, 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 the test. If any of the retest specimens fails to pass the specified requirements, the manufacturer may elect to test specimens cut from the individual lengths remaining in the lot. Specimens for retests shall be taken in the same manner as specified in 9.3.3.2. At the option of the manufacturer, any lot of pipe may be re-heat treated and retested.

9.10.4 Hardness Retests

9.10.4.1 Group 2 (Grade M65 and Grade L80)

Retest in accordance with 9.3.2.3.2.

9.10.4.2 Group 2 (Grades C90 and Grade T95)

If any hardness value falls between 25.4 and 27.0 HRC inclusive, one more hardness value shall be taken in the immediate area (three readings required). If the new hardness value does not exceed 25.4 HRC, the new hardness value will be accepted. If the new hardness value exceeds 25.4 HRC, the piece shall be rejected.

9.10.4.3 Group 4

If the maximum hardness variation as specified in Table 3 is exceeded on a specimen, the surface in that quadrant may (at the option of the manufacturer) be reground below the initial hardness impressions and retested. Only one regrind and retest is allowed for each specimen. Pipe and coupling blanks that fail to comply with Table 3 shall be rejected.

9.10.4.3.1 Casing

If more than one of the initial three lengths required to qualify a lot of casing is rejected, the manufacturer may elect to test each of the remaining lengths in the lot as specified in 9.8.4 or to reprocess the lot. Retests of these lengths would only be allowed as specified in 9.8.4.

If only one of the initial three lengths required to qualify a lot of casing is rejected as specified, then an additional three lengths may be tested as specified in 9.8.4 to attempt to qualify the lot of casing. Retests of the additional lengths would only be allowed as specified in 9.10.4.3. If any of the additional three lengths required to qualify a lot of casing is rejected, then the manufacturer may elect to test each of the remaining lengths in the lot or to reprocess the lot (i.e., five of the six lengths tested must meet the requirements of 6.2.6 and Table 3 to qualify the casing on a lot basis).

9.10.4.3.2 Couplings, Pup Joints, and Connectors

In the case of couplings, pup joints, or connectors heat treated in coupling blank or individual lengths, if the maximum hardness variation as specified in 6.2.6 and Table 3 is exceeded, at the option of the manufacturer, three more lengths from the lot in question may be sampled or the lot re-heat treated. If a specimen from any one of the three lengths fails to meet the maximum hardness variations, the lot shall be rejected. The manufacturer may elect to re-heat treat and retest the lot.

9.10.5 Impact Retests

9.10.5.1 Retest of a Length—All Groups

If more than one specimen is below the specified minimum absorbed energy requirement or if one value is below two-thirds of the specified minimum absorbed energy requirement, a retest of three additional specimens shall be made from the same length. The impact energy of each of the retest specimens shall equal or exceed the specified minimum absorbed energy requirement, or the length is rejected.

9.10.5.2 Replacement of a Rejected Length—All Groups

If the results of a test do not meet the requirements of 6.2.3 and do not qualify for retest as specified in 9.10.5.1, an additional three test specimens shall be removed from each of three additional lengths from the lot. If all the additional lengths tested conform to the requirements, the lot shall be qualified except for the length that was initially rejected. If one or more of the additional lengths tested fails to conform to the specified requirements, the manufacturer may elect to test individually the remaining lengths in the lot or re-heat treat and retest the lot.

9.10.5.3 Multiple Length Rejection—Group 4

If more than one of the initial three lengths required to qualify a lot of casing is rejected, retesting to qualify the lot is not permitted. The manufacturer may elect to test each of the remaining pieces in the lot, or to re-heat treat and retest the lot.

9.10.6 Diameter Retests

If any pipe fails to meet the specified diameter requirements, the manufacturer may elect to make measurements on three additional pipe from the same lot of material. If all retest measurements conform to the specified diameter

requirements, all lengths in the lot shall be accepted except the length initially selected for measurement. If any of the retest specimens fails to pass the specified requirements the manufacturer may elect to measure the individual lengths remaining in the lot. Individual lengths which fail to pass the specified requirements may be cut back and measured again for conformance. At the option of the manufacturer, any lot of pipe may be reprocessed and measured again.

10 Marking

10.1 GENERAL

10.1.1 Products 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 this specification. The policy describing use of the monogram is contained in Appendix D. No other use of the monogram is permitted. Licensees may mark products in conformance with Section 10 or Appendix D, and nonlicensees may mark products in conformance with Section 10.

10.1.2 For all manufacturers, except threaders, the marking instructions in this section, except those in 10.6 are applicable. For threaders, the marking instructions in 10.5, 10.6, and Table 59 are applicable. Processors shall remove any identity which is not indicative of the new condition of the product as a result of heat treating (for example, prior grade identity, original pipe manufacturer's name or logo).

10.1.3 Products shall be color coded as specified in 10.4.

10.1.4 Products shall be marked by stenciling, or a combination of stenciling and stamping, at the option of the manufacturer, as stipulated with two exceptions:

a. By agreement between the purchaser and manufacturer, stamping can be required, in which case a combination of stamping and stencil markings shall be used.

b. At the option of the manufacturer, hot-rolled or hot-stamped markings on pipe and couplings may be substituted for die-stamped markings and are permitted at intervals along the length.

10.1.5 Requirements for optional stamp marking are specified in 10.2 and stencil markings are specified in 10.3. Marking instructions and sequence of markings are specified in Table 59, which includes only those items that are stamped or stenciled for product identification. Examples of recommended markings are shown in Figure 16. Markings shall not overlap and shall be applied in such a manner as not to injure the pipe.

10.1.6 Additional markings including those for compatible standards following the specification marking "5CT", are allowed and may be applied as desired by the manufacturer or as requested by the purchaser.

10.1.7 In a circumstance where it is necessary to remark pipe with the original marking information, the accuracy and traceability of the transferred markings shall be the responsibility of the entity remarking the pipe. The transferred markings shall induce the words "transferred by."

10.2 OPTIONAL STAMP MARKING REQUIREMENTS

10.2.1 Methods

Methods of stamp marking are as follows:

Number	Method
1.	Hot-rolled or hot-stamped markings.
2.	Cold die stamping with standard dies.
3.	Cold die stamping with interrupted dot face dies.
4.	Cold die stamping with rounded face dies.
5.	Vibratory method.

After stamp marking, Group 2 and 4 products may require subsequent heat treatment as specified in 10.2.5. Such heat treatment shall be in accordance with 5.2. Sequence of stamp markings shall be as shown in Table 59.

10.2.2 Size

Sizes of stamp markings shall be as shown in Table 59.

10.2.3 Location

Placement of these markings on casing, liners and tubing sizes 1.660 and larger shall be on the outside surface of each length within 12 inches from the coupling or box, either end of plain-end pipe or either end of pin-by-pin threaded pipe. The optional stamp marking on sizes smaller than 1.660 may be either on a metal tag affixed to each length, or for bundled tubing, stamped on a metal tag affixed to each bundle.

10.2.4 Group 1 and 3

When specified on the purchase order, products shall be stamped by either one or more of the methods in 10.2.1 at the option of the manufacturer.

10.2.5 Group 2 and 4

When specified on the purchase order, products may be stamped by one or more of the methods in 10.2.1 at the option of the manufacturer.

Group 2 (except Grades C-90 and T-95) products shall be heat treated subsequent to use of method 2 in 10.2.1.

Group 2 (Grades C-90 and T-95 only) and Group 4 products shall be heat treated subsequent to the use of methods 2 and 4 in 10.2.1, with the following exceptions:

a. The make-up triangle mark.

b. When the stamp markings are removed to a depth not less than twice the depth of the stamping by grinding, machining, threading or by cropping.

c. When not removing the stamping is by agreement between the purchaser and the manufacturer.

10.2.6 Make-Up Triangle Mark

For buttress casing in all sizes and grades and round thread casing in sizes 16 and larger in grades H, J, K and M, the make-up triangle shall be stamped on the outside of each length on both ends. Unless otherwise specified on the purchase order, the triangle mark may be replaced with a transverse white paint band $^3/_8$-inch wide by 3-inches-long. To assist in locating the triangle or transverse white paint band on buttress casing, a 1-inch-wide by 24-inch-long longitudinal white paint stripe shall be placed adjacent to the triangle or transverse paint band on the field end; additionally, a 1-inch-wide by 4-inches-long longitudinal white paint stripe shall be placed adjacent to the triangle or transverse paint band on the mill end.

For Groups 1 and 3, the triangle shall be stamped by methods 2 or 4 only.

For Group 2, Grades C90 and T95 only, the triangle shall be stamped by method 3 only.

For Group 4 and Group 2 (except Grades C-90 and T-95), the triangle shall be stamped by methods 3 or 4 only.

10.3 STENCIL MARKING REQUIREMENTS

Stenciled markings shall be placed on the outside surface of each length of pipe starting not less than 2 feet from the coupling or box or from either end of plain-end pipe or either end of pin by pin threaded pipe. For connectors and pup joints less than 6 feet in length, the required stencil markings may be placed on a decal attached to the outside surface within 12-inches of the end. These markings shall be separated by a dash or shall be adequately spaced.

Sequence of stencil markings shall be as shown in Table 5B. except the thread marking shall be at a location convenient to the manufacturer.

10.4 COLOR CODE IDENTIFICATION

10.4.1 Method

Each product shall be color coded unless otherwise specified on the purchase order. Such color coding shall be by one or more of the following methods:

a. For pipe and pup joints 6 feet or longer use one or more of the following methods:

1. Paint band encircling the pipe at a distance not greater than 2 feet from the coupling or box or either end of plain-end or pin by pin threaded pipe.
2. Paint the entire outside surface of the coupling including the appropriate coupling color bands.
3. If the pipe is furnished with special clearance couplings or if the pipe and couplings are of a different grade (except Grades H-40, J-55 and K-55 couplings applied as allowed in 8.1.1), paint both the pipe and couplings as specified in subitems 1 and 2 above.

b. For loose couplings paint the entire outside surface of the coupling including the appropriate color bands.

c. For pup joints and connectors shorter than 6 feet in length, paint the entire outside surface, except the threads, including the appropriate color bands.

d. Special clearance couplings shall be painted the colors indicative of the steel grade from which the couplings are manufactured and shall also be painted with a black band around the center.

10.4.2 Grade Color Codes

The colors and number of bands for each grade shall be as shown in Table 61.

10.5 THREAD MARKING—ALL GROUPS

For manufacturers, thread identification shall be stenciled on casing with round, buttress, or extreme-line threads. For threaders, thread identification is required on casing and tubing as shown in Table 62.

10.6 PIPE THREADER MARKING REQUIREMENTS—ALL GROUPS

Pipe threaded by a facility other than the original pipe manufacturer shall be identified consistent with 10.1, 10.2, and 10.3 adjacent to the threads with the threader's name or mark, the specification mark, and size and type of thread as listed in 10.5.

The threader shall mark on the body of the pipe the hydrostatic test pressure, if higher than the standard test pressure. The markings applied to the body of the pipe by the original pipe manufacturer shall not be removed or altered.

Use of the letters "API" to identify or certify that threads on tubular goods comply with API Standard 5B is not permitted.

Table 59—Marking Requirements and Sequence

Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
1. Manufacturer's name or mark	____	D,P	D,P	P	P
2. Specification marking	"5CT"	D,P	D,P	P	P
Compatible Standards	____	As Specified	As Specified	As Specified	As Specified
3. Unthreaded pipe or end finish not detailed herein, if applicable (place symbol after specification marking)	"UF"	D,P		P	
4. Size Designation (fill-in size designation from column 1 of Tables 20–25):	____	P		P	
5. Weight Designation (fill-in size designation from Tables 20-25)					
Casing and Tubing		D,P		P	
Liner		D,P			
6. Grade of Pipe					
H40	"H"				
J55	"J"				
K55	"K"				
M65	"M"				
N80	"N"				
L80 Type 1	"L"				
L80 Type 9CR	"L9"				
L80 Type 13CR	"L13"				
C90 Type 1	"C90-1"				
C90 Type 2	"C90-2"				
T-95 Type 1	"T1"				
T-95 Type 2	"T2"				
C-95	"C95"				
P-110	"P"				
Q-125 Type 1	"Q1"				
Q-125 Type 2	"Q2"				
Q-125 Type 3	"Q3"				
Q-125 Type 4	"Q4				
All size designations		D,P	D,P	P	P
7. Reduced alternate impact test temperature, if applicable:					
Couplings and female connectors (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F		P		P
Group 4 pipe (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F			P	
8. Heat treatment, if applicable:					
J-55, K-55, or M65 Normalized	"Z"	P	P		
J-55, K-55, M65 or N-80 Quenched & Tempered	"Q"	P	P		

Table 59—Marking Requirements and Sequence (Continued)

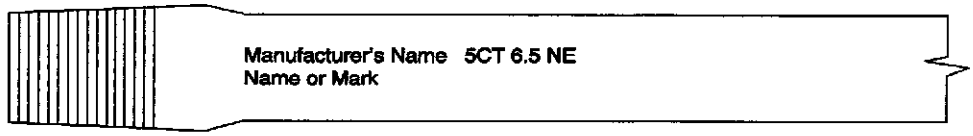
Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
9. Process of manufacture:					
Seamless	"S"				
Electric-Welded	"E"				
All size designations		D,P		P	
10. Supplemental requirements, if applicable					
SR 1	"S1"	P		P	
SR 2	"S2"	P		P	
SR 9 (fill-in type)	"S9 Q ____"				P
SR 13	"S13"		D,P		P
SR 14	"S14"		P		
SR 16 (fill-in minimum full size energy absorption requirement in ft-lbs and test temperature including ± symbol and °F)	"S16 ____ F"	P		P	
11. Hydrostatic Test Pressure					
1. Standard Test Pressure	"ST"				
2. Alternate Test Pressure	"AT"				
3. Agreed on pressure greater than standard test pressure	"HP" ____				
4. Test pressure is 3000 psi and the standard test pressure is greater than 3000 psi	"3K"				
For all size designations		P		P	
12. Type of casing thread, if applicable:					
Casing buttress, extreme-line or round threads (fill-in type of thread from table 61)	____	P		P	
13. Size of drift test:					
Standard Casing	"D"				
Standard Tubing	"DT"				
Alternate Casing	"Dxx"				
Alternate Tubing (where xx is the size of the alternate drift)	"Dtxx"				
For casing specified (per Table 28) for tubing service	"DT 42"	"			
14. Serialization of Grades C-90, T-95 and Q-125				D,P	D,P
15. Tin plating of couplings, if applicable	"T"		P		P

Notes:
1. D is for optional (die) stamping; P is a requirement for (paint) stenciling. Optional marking is permitted as specified in 10.1 and 10.2.
2. A blank space, "____", indicates information to be filled-in.

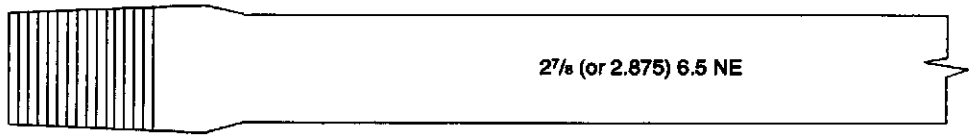
Example 1 — Tubing

Tubing: size 2⅞, weight 6.5, Grade N80, normalized, electric weld, external upset, threaded pin-by-pin without couplings.

Stamp Marking (within 12" of either externally threaded end)



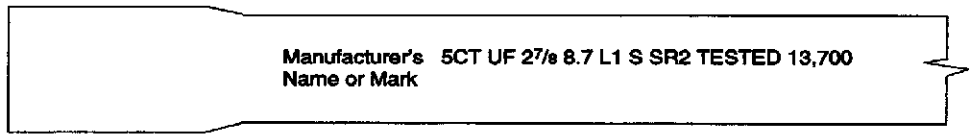
Stencil Marking (at least 2 feet from either externally threaded end)



Example 2 — Tubing

Tubing: size 2⅞, weight 8.7, Grade L80, Type 1, seamless, external upset, for special end finish plain end. Additional requirements include hydrostatic testing to 13,700 psi and inspection to SR2.

Stencil Marking (at least 2 feet from either end)



Example 3 — Casing

Casing: size 7, weight 35, Grade C90, Type 2, seamless, plain end, serial number 201. Supplementary Requirement 16 (SR16) for test at +14°F.

Stencil Marking (at least 2 feet from either end)

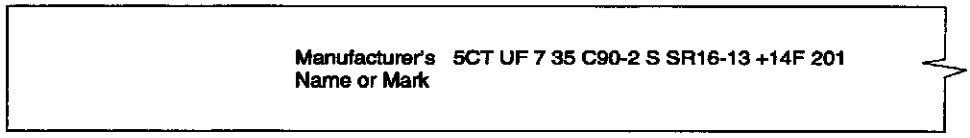
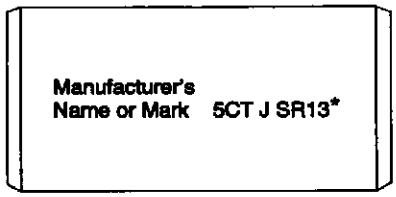


Figure 16—Examples of Marking Requirements and Sequence

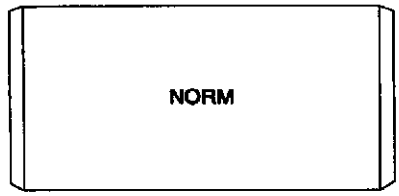
Example 4 — Coupling

Tubing coupling for size 2⅞, Grade J55, normalized upset (or nonupset) tubing, to supplementary requirement SR13.

Stamp Marking



Stencil Marking



Note: Marking in center of coupling may be stamped in either the longitudinal or transverse direction.

* "SR-13" shall be stamped or stenciled at the manufacturer's option.

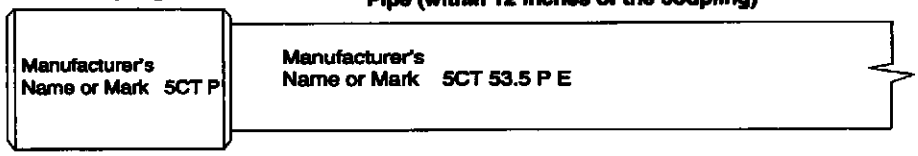
Example 5 — Casing With Couplings

Buttress casing: size 9⅝, weight 53.5, Grade P110, electric weld; supplementary requirements are SR16 for test at 0°F and 8.500 inch drift test. Coupling is tin plated.

Stamp Marking

Coupling

Pipe (within 12 inches of the coupling)

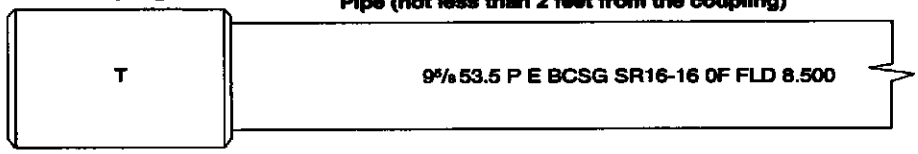


Marking in the center of the coupling may be in either the longitudinal or transverse direction.

Stencil Marking

Coupling

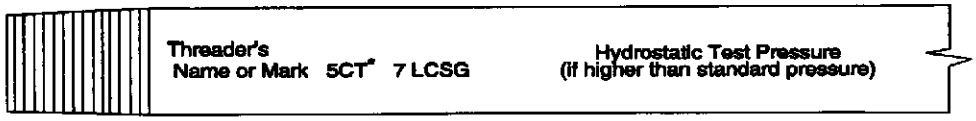
Pipe (not less than 2 feet from the coupling)



Example 6 — Threader

Casing: size 7, long round thread.

Stencil Marking (adjacent to the threads)



*For Groups 1 and 3, the threader's name or mark and "5CT" shall be stamped instead of stenciled.

Figure 16—Examples of Marking Requirements and Sequence (Continued)

Table 60—Size of Stamp Markings

Product	Size of Product (in.)	Markings (in.)
Pipe	Smaller than $4^1/_2$	$^3/_{16}$
Pipe	$4^1/_2$ and over	$^1/_4$
Coupling	For pipe sizes smaller than $4^1/_2$	$^1/_4$
Coupling	For pipe sizes $4^1/_2$ to, but not including $7^5/_8$	$^3/_8$
Coupling	For pipe sizes $7^5/_8$ and over	$^1/_2$

Table 61—Grade Color Codes

Grade	Pipe & Pup Joints 6 Feet and Longer	Couplings
H-40	No marking or black band at Manufacturer's option	Same as Pipe
J-55 Tubing	One bright green band	Entire coupling bright green
J-55 Casing	One bright green band	Entire coupling bright green and one white band
K-55	Two bright green bands	Entire coupling bright green
M65	One bright green and one blue band	Entire coupling red with one brown band
N-80	One red band	Entire coupling red
L-80 Type 1	One red, one brown band	Entire coupling red with one brown band
L-80 Type 9CR	One red, one brown, two yellow bands	Entire coupling red with two yellow bands
L-80 Type 13CR	One red, one brown, one yellow band	Entire coupling red with one yellow band
C-90 Type 1	One purple band	Entire coupling purple
C-90 Type 2	One purple, one yellow band	Entire coupling purple and one yellow band
T-95 Type 1	One silver band	Entire coupling silver
T-95 Type 2	One silver, one yellow band	Entire coupling silver and one yellow band
C-95	One brown band	Entire coupling brown
P-110	One white band	Entire coupling white
Q-125 Type 1	One orange band	Entire coupling orange
Q-125 Type 2	One orange, one yellow band	Entire coupling orange and one yellow band
Q-125 Type 3	One orange, one green band	Entire coupling orange and one green band
Q-125 Type 4	One orange, one brown band	Entire coupling orange and one brown band

Table 62—Thread Type Markings

Thread Type	Symbol
Casing (short round thread)	STC
Casing (long round thread)	LC
Casing (buttress thread)	BC
Casing (extreme-line)	XC
Tubing (nonupset)	NU
Tubing (external-upset)	EU
Tubing (integral-joint)	IJ

11 Coating and Protection

11.1 COATINGS—ALL GROUPS

Unless otherwise specified on the purchase order, pipe and couplings shall be given an external coating for protection from rust while in transit. An attempt should be made to make these coatings smooth, hard to the touch, and with minimum sags (see Notes 1 and 2).

Notes:
1. 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 specific 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.
2. Type 13Cr tubulars have shown a tendency toward localized pitting corrosion when stored in moist environments. Special precautions during coating, shipping, and storage are worthwhile.

11.2 THREAD PROTECTORS

11.2.1 General

The facility performing the threading shall apply external and internal thread protectors of such design, material, and mechanical strength to protect the thread and end of the pipe from damage under normal handling and transportation conditions. External thread protectors shall cover the full length of the thread on the pipe, and internal thread protectors shall cover the equivalent total pipe thread length of the internal thread. Thread protectors shall be of such design and material to inhibit infiltration of dust and water to the threads during transportation and the normal storage period. The normal storage period shall be considered as approximately 1 year. The thread forms in protectors shall be such that the product threads are not damaged by the protectors. Thread protectors are not required for pup joints and connectors provided they are packaged in a manner that protects the threads.

11.2.2 Material

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 to +150°F.

11.2.3 Special Group 2 (Types 9Cr and 13Cr)

Bare steel thread protectors shall not be used on Types 9Cr and 13Cr tubulars.

12 Minimum Facility Requirements for Various Categories of Manufacturers

12.1 PIPE MILL

A pipe mill shall operate one or more pipe making facilities capable of producing products as described in Section 5 of this specification.

A pipe mill shall also have facilities for conducting all required tests and inspections. Alternatively, and at the option of the pipe mill, any of these tests or inspections may be provided by a third party and may be located off-site. In the event that a third party performs any of these services, the conduct of such inspections and tests shall be controlled and monitored by the pipe mill in accordance with a documented procedure. The pipe mill shall possess suitable equipment for, and be responsible for, weighing and marking pipe.

12.2 PROCESSOR

A processor shall operate heat treating facilities capable of heat treating full lengths of pipe. A processor shall also have facilities for conducting all required tests and inspections. Alternatively, and at the option of the processor, any of these tests or inspections may be provided by a third party and may be located off site. In the event that a third party performs any of these services, the conduct of such inspections and tests shall be controlled and monitored by the processor in accordance with a documented procedure. The processor shall possess suitable equipment for, and be responsible for, weighing and marking pipe.

12.3 THREADER

A pipe threader shall operate one or more threading machines capable of threading pipe ends to the dimensions and tolerances specified in API Standard 5B. He shall also have access to master plug and ring gauges, as well as the required working gauges, for each size and type of thread marked by him with the API monogram or "5CT."

A threader shall also have facilities for (a) applying couplings to specified makeup, (b) hydrostatic testing the entire length to the pressure required for finished pipe, (c) drift testing the ends after threading and coupling in accordance with specification requirements, and (d) measuring length.

A threader shall not change or alter the markings on the pipe body or certify that the pipe body complies with any API specification. When third-party work is performed for the threader, it shall be the responsibility of the threader to see that such work complies with the requirements of the specification.

12.4 COUPLING, PUP JOINT, AND CONNECTOR MANUFACTURER

A coupling, pup joint, or connector manufacturer shall operate equipment capable of machining and threading products in accordance with the dimensions and tolerances provided in the applicable specifications. He shall also have access to master plug and ring gauges, as well as the required working gauges, for each size and type of thread produced on products marked by him according to Section 10 or Appendix D.

Manufacturers authorized to use the monogram on pup joints shall also have facilities for (a) hydrostatic testing and

(b) drift testing finished products in accordance with specification requirements.

Coupling manufacturers authorized under API Specification 5CT, Groups 2, 3, and 4, shall be capable of inspecting couplings by the magnetic particle method or other adequate nondestructive testing method.

13 Documents

13.1 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.

A Material Test Report, Certificate of Compliance or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of this specification and conform to any existing EDI agreement between the purchaser and supplier.

Where additional information is required, including the results of mechanical testing, SR15 shall be specified in the purchase order.

13.2 CERTIFICATION REQUIREMENTS—GROUP 4

A certification shall be provided by the manufacturer for all pipe shipped meeting Group 4 requirements. This shall include the results of all the tests required in this specification for Group 4 and any other special provisions as required by the purchaser on the purchase order.

A Material Test Report, Certificate of Compliance or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of this specification and conform to any existing EDI agreement between the purchaser and supplier.

13.3 RETENTION OF RECORDS

Tests and inspections requiring retention of records in this specification are shown in Table 63. Such records shall be retained by the manufacturer and shall be available to the purchaser on request for a period of 3 years after the date of purchase from the manufacturer.

Table 63—Retention of Records

Requirement	Reference
Chemical properties	
Heat analysis	9.2.1
Product analysis	9.2.2
Mechanical properties	
Tensile tests	6.2.1, 9.8.2.2
Control tests	9.3.2.1.1
Impact tests	9.8.7
Couplings	8.4
Hardness tests	9.8.4.4
Hardenability test (Group 2, C90 and T95)	9.3.2.4
Hydrostatic tests	
Tester recorder charts	9.4.1
Testing	9.4.1
Manufacturer certification	
Results of all required tests (Group 4)	13.2
Sulfide-stress cracking test, (Group 2, C90 and T95)	6.2.1.2, 9.8.6
Calibration	Various

APPENDIX A—LIST OF API CASING AND TUBING (NORMATIVE)

Previous page is blank

Table A-1—API Casing List

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Type of End Finish[a]							
Designation[b]		Outside Diameter	Wall Thickness	Grade H40	Grade J55 K55	Grade M65	Grade L80 C95	Grade N80	Grade C90[d] T95[d]	Grade P110	Grade Q125
Size	Weight[c]	(in.)	(in.)								
4 1/2	9.50	4.500	0.205	PS	PS	PS	—	—	—	—	—
4 1/2	10.50	4.500	0.224	—	PSB	PSB	—	—	—	—	—
4 1/2	11.60	4.500	0.250	—	PSLB	PLB	PLB	PLB	PLB	PLB	—
4 1/2	13.50	4.500	0.290	—	—	PLB	PLB	PLB	PLB	PLB	—
4 1/2	15.10	4.500	0.337	—	—	—	—	—	—	PLB	PLB
5	11.50	5.000	0.220	—	PS	PS	—	—	—	—	—
5	13.00	5.000	0.253	—	PSLB	PSLB	—	—	—	—	—
5	15.00	5.000	0.296	—	PSLBE	PLB	PLBE	PLBE	PLBE	PLBE	
5	18.00	5.000	0.362	—	—	PLB	PLBE	PLBE	PLBE	PLBE	PLBE
5	21.40	5.000	0.437	—	—	PLB	PLB	PLB	PLB	PLB	PLB
5	23.20	5.000	0.478	—	—	—	PLB	PLB	PLB	PLB	PLB
5	24.10	5.000	0.500	—	—	—	PLB	PLB	PLB	PLB	PLB
5 1/2	14.00	5.500	0.244	PS	PS	PS	—	—	—	—	—
5 1/2	15.50	5.500	0.275	—	PSLBE	PSLB	—	—	—	—	—
5 1/2	17.00	5.500	0.304	—	PSLBE	PLB	PLBE	PLBE	PLBE	PLBE	—
5 1/2	20.00	5.500	0.361	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—
5 1/2	23.00	5.500	0.415	—	—	PLB	PLBE	PLBE	PLBE	PLBE	PLBE
5 1/2	26.80	5.500	0.500	—	—	—	—	—	P	—	—
5 1/2	29.70	5.500	0.562	—	—	—	—	—	P	—	—
5 1/2	32.60	5.500	0.625	—	—	—	—	—	P	—	—
5 1/2	35.30	5.500	0.687	—	—	—	—	—	P	—	—
5 1/2	38.00	5.500	0.750	—	—	—	—	—	P	—	—
5 1/2	40.50	5.500	0.812	—	—	—	—	—	P	—	—
5 1/2	43.10	5.500	0.875	—	—	—	—	—	P	—	—
6 5/8	20.00	6.625	0.288	PS	PSLB	PSLB	—	—	—	—	—
6 5/8	24.00	6.625	0.352	—	PSLBE	PLB	PLBE	PLBE	PLBE	PLBE	—
6 5/8	28.00	6.625	0.417	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—
6 5/8	32.00	6.625	0.475	—	—	—	PLBE	PLBE	PLBE	PLBE	PLBE
7	17.00	7.000	0.231	PS	—	—	—	—	—	—	—
7	20.00	7.000	0.272	PS	PS	PS	—	—	—	—	—
7	23.00	7.000	0.317	—	PSLBE	PLB	PLBE	PLBE	PLBE	—	—
7	26.00	7.000	0.362	—	PSLBE	PLB	PLBE	PLBE	PLBE	PLBE	—
7	29.00	7.000	0.408	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—
7	32.00	7.000	0.453	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—
7	35.00	7.000	0.498	—	—	—	PLBE	PLBE	PLBE	PLBE	PLBE
7	38.00	7.000	0.540	—	—	—	PLBE	PLBE	PLBE	PLBE	PLBE
7	42.70	7.000	0.625	—	—	—	—	—	P	—	—
7	46.40	7.000	0.687	—	—	—	—	—	P	—	—
7	50.10	7.000	0.750	—	—	—	—	—	P	—	—
7	53.60	7.000	0.812	—	—	—	—	—	P	—	—
7	57.10	7.000	0.875	—	—	—	—	—	P	—	—
7 5/8	24.00	7.625	0.300	PS	—	—	—	—	—	—	—
7 5/8	26.40	7.625	0.328	—	PSLBE	PSLB	PLBE	PLBE	PLBE	—	—
7 5/8	29.70	7.625	0.375	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—

Previous page is blank

Table A-1—API Casing List (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Type of End Finish[a]							
Designation[b]		Outside Diameter	Wall Thickness	Grade H40	Grade J55 K55	Grade M65	Grade L80 C95	Grade N80	Grade C90[d] T95[d]	Grade P110	Grade Q125
Size	Weight[c]	(in.)	(in.)								
7 5/8	33.70	7.625	0.430	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—
7 5/8	39.00	7.625	0.500	—	—	—	PLBE	PLBE	PLBE	PLBE	PLBE
7 5/8	42.80	7.625	0.562	—	—	—	PLB	PLB	PLB	PLB	PLB
7 5/8	45.30	7.625	0.595	—	—	—	PLB	PLB	PLB	PLB	PLB
7 5/8	47.10	7.625	0.625	—	—	—	PLB	PLB	PLB	PLB	PLB
7 5/8	51.20	7.625	0.687	—	—	—	—	—	P	—	—
7 5/8	55.30	7.625	0.750	—	—	—	—	—	P	—	—
7 3/4	46.10	7.750	0.595	—	—	—	P	P	P	P	P
8 5/8	24.00	8.625	0.264	—	PS	PS	—	—	—	—	—
8 5/8	28.00	8.625	0.304	PS	—	PS	—	—	—	—	—
8 5/8	32.00	8.625	0.352	PS	PSLBE	PSLB	—	—	—	—	—
8 5/8	36.00	8.325	0.400	—	PSLBE	PSLB	PLBE	PLBE	PLBE	—	
8 5/8	40.00	8.625	0.450	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—
8 5/8	44.00	8.625	0.500	—	—	—	PLBE	PLBE	PLBE	PLBE	—
8 5/8	49.00	8.625	0.557	—	—	—	PLBE	PLBE	PLBE	PLBE	PLBE
9 5/8	32.30	9.625	0.312	PS	—	—	—	—	—	—	—
9 5/8	36.00	9.625	0.352	PS	PSLB	PSLB	—	—	—	—	—
9 5/8	40.00	9.625	0.395	—	PSLBE	PSLB	PLBE	PLBE	PLBE	—	—
9 5/8	43.50	9.625	0.435	—	—	PLB	PLBE	PLBE	PLBE	PLBE	—
9 5/8	47.00	9.625	0.472	—	—	PLB	PLBE	PLBE	PLBE	PLBE	PLBE
9 5/8	53.50	9.625	0.545	—	—	—	PLBE	PLBE	PLBE	PLBE	PLBE
9 5/8	58.40	9.625	0.595	—	—	—	PLB	PLB	PLB	PLB	PLB
9 5/8	59.40	9.625	0.609	—	—	—	—	—	P	—	—
9 5/8	64.90	9.625	0.672	—	—	—	—	—	P	—	—
9 5/8	70.30	9.625	0.734	—	—	—	—	—	P	—	—
9 5/8	75.60	9.625	0.797	—	—	—	—	—	P	—	—
10 3/4	32.75	10.750	0.279	PS	—	—	—	—	—	—	—
10 3/4	40.50	10.750	0.350	PS	PSB	PSB	—	—	—	—	—
10 3/4	45.50	10.750	0.400	—	PSBE	PSB	—	—	—	—	—
10 3/4	51.00	10.750	0.450	—	PSBE	PSB	PSBE	PSBE	PSBE	PSBE	—
10 3/4	55.50	10.750	0.495	—	—	PSB	PSBE	PSBE	PSBE	PSBE	—
10 3/4	60.70	10.750	0.545	—	—	—	—	—	PSBE	PSBE	PSBE
10 3/4	65.70	10.750	0.595	—	—	—	—	—	PSB	PSB	PSB
10 3/4	73.20	10.750	0.672	—	—	—	—	—	P	—	—
10 3/4	79.20	10.750	0.734	—	—	—	—	—	P	—	—
10 3/4	85.30	10.750	0.797	—	—	—	—	—	P	—	—
11 3/4	42.00	11.750	0.333	PS	—	—	—	—	—	—	—
11 3/4	47.00	11.750	0.375	—	PSB	PSB	—	—	—	—	—
11 3/4	54.00	11.750	0.435	—	PSB	PSB	—	—	—	—	—
11 3/4	60.00	11.750	0.489	—	PSB	PSB	PSB	PSB	PSB	PSB	PSB
11 3/4	65.00	11.750	0.534	—	—	—	P	P	P	P	P
11 3/4	71.00	11.750	0.582	—	—	—	P	P	P	P	P

Table A-1—API Casing List (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				Type of End Finish[a]							
Designation[b]		Outside Diameter	Wall Thickness	Grade H40	Grade J55 K55	Grade M65	Grade L80 C95	Grade N80	Grade C90[d] T95[d]	Grade P110	Grade Q125
Size	Weight[c]	(in.)	(in.)								
$13^3/_8$	48.00	13.375	0.330	PS	—	—	—	—	—	—	—
$13^3/_8$	54.50	13.375	0.380	—	PSB	PSB	—	—	—	—	—
$13^3/_8$	61.00	13.375	0.430	—	PSB	PSB	—	—	—	—	—
$13^3/_8$	68.00	13.375	0.480	—	PSB	PSB	PSB	PSB	PSB	PSB	—
$13^3/_8$	72.00	13.375	0.514	—	—	—	PSB	PSB	PSB	PSB	PSB
16	65.00	16.000	0.375	PS	—	—	—	—	—	—	—
16	75.00	16.000	0.438	—	PSB	PSB	—	—	—	—	—
16	84.00	16.000	0.495	—	PSB	PSB	—	—	—	—	—
16	109.00	16.000	0.656	—	P	—	P	P	—	P	P
$18^5/_8$	87.50	18.625	0.435	PS	PSB	PSB	—	—	—	—	—
20	94.00	20.000	0.438	PSL	PSLB	PSLB	—	—	—	—	—
20	106.50	20.000	0.500	—	PSLB	PSLB	—	—	—	—	—
20	133.00	20.000	0.635	—	PSLB	—	—	—	—	—	—

[a]P = plain-end; S = short round thread; L = long round thread; B = buttress thread; E = extreme-line.

[b]Designations (columns 1 and 2) are shown for the purpose of identification in ordering.

[c]The densities of martensitic chromium steels (L80 types 9Cr and 13Cr) are different from carbon steels. The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

[d]Grade C90 and Grade T95 casing shall be furnished in sizes, weights, and wall thicknesses listed above or as shown on the purchase order.

Table A-2—API Plain-End Casing Liner List

(1)	(2)	(3)	(4)	(5)
Designation		Outside Diameter	Wall Thickness	
Size	Weight	(in.)	(in.)	Grade
$3^1/_2$	9.92	3.500	0.289	J
4	11.35	4.000	0.286	J
$4^1/_2$	13.05	4.500	0.290	J
5	17.95	5.000	0.362	J
$5^1/_2$	19.83	5.500	0.361	J
$6^5/_8$	27.67	6.625	0.417	J

Table A-3—API Tubing List

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Weight Designation[a,b]					Type of End Finish[c,d]						
Desig-nation[a]	Nonupset T & C[e]	External-Upset T & C	Integral Joint	Outside Diameter (in.)	Wall Thickness (in.)	Grade H40	Grade J55	Grade L80	Grade N80	Grade C90[f]	Grade T95[f]	Grade P110
1.050	1.14	1.20	—	1.050	0.113	PNU	PNU	PNU	PNU	PNU	PNU	—
1.050	1.48	1.54	—	1.050	0.154	PU	PU	PU	PU	PU	PU	PU
1.315	1.70	1.80	1.72	1.315	0.133	PNUI	PNUI	PNUI	PNUI	PNUI	PNUI	—
1.315	2.19	2.24	—	1.315	0.179	PU	PU	PU	PU	PU	PU	PU
1.660	—	—	2.10	1.660	0.125	PI	PI	—	—	—	—	—
1.660	2.30	2.40	2.33	1.660	0.140	PNUI	PNUI	PNUI	PNUI	PNUI	PNUI	—
1.660	3.03	3.07	—	1.660	0.191	PU	PU	PU	PU	PU	PU	PU
1.900	—	—	2.40	1.900	0.125	PI	PI	—	—	—	—	—
1.900	2.75	2.90	2.76	1.900	0.145	PNUI	PNUI	PNUI	PNUI	PNUI	PNUI	—
1.900	3.65	3.73	—	1.900	0.200	PU	PU	PU	PU	PU	PU	PU
1.900	4.42	—	—	1.900	0.250	—	—	P	—	P	P	—
1.900	5.15	—	—	1.900	0.300	—	—	P	—	P	P	—
2.063	—	—	3.25	2.063	0.156	PI	PI	PI	PI	PI	PI	—
2.063	4.50	—	—	2.063	0.225	P	P	P	P	P	P	P
2 3/8	4.00	—	—	2.375	0.167	PN	PN	PN	PN	PN	PN	—
2 3/8	4.60	4.70	—	2.375	0.190	PNU	PNU	PNU	PNU	PNU	PNU	PNU
2 3/8	5.80	5.95	—	2.375	0.254	—	—	PNU	PNU	PNU	PNU	PNU
2 3/8	6.60	—	—	2.375	0.295	—	—	P	—	P	P	—
2 3/8	7.35	7.45	—	2.375	0.336	—	—	PU	—	PU	PU	—
2 7/8	6.40	6.50	—	2.875	0.217	PNU	PNU	PNU	PNU	PNU	PNU	PNU
2 7/8	7.80	7.90	—	2.875	0.276	—	—	PNU	PNU	PNU	PNU	PNU
2 7/8	8.60	8.70	—	2.875	0.308	—	—	PNU	PNU	PNU	PNU	PNU
2 7/8	9.35	9.45	—	2.875	0.340	—	—	PU	—	PU	PU	—
2 7/8	10.50	—	—	2.875	0.392	—	—	P	—	P	P	—
2 7/8	11.50	—	—	2.875	0.440	—	—	P	—	P	P	—
3 1/2	7.70	—	—	3.500	0.216	PN	PN	PN	PN	PN	PN	—
3 1/2	9.20	9.30	—	3.500	0.254	PNU	PNU	PNU	PNU	PNU	PNU	PNU
3 1/2	10.20	—	—	3.500	0.289	PN	PN	PN	PN	PN	PN	—
3 1/2	12.70	12.95	—	3.500	0.375	—	—	PNU	PNU	PNU	PNU	PNU
3 1/2	14.30	—	—	3.500	0.430	—	—	P	—	P	P	—
3 1/2	15.50	—	—	3.500	0.476	—	—	P	—	P	P	—
3 1/2	17.00	—	—	3.500	0.530	—	—	P	—	P	P	—
4	9.50	—	—	4.000	0.226	PN	PN	PN	PN	PN	PN	—
4	—	11.00	—	4.000	0.262	PU	PU	PU	PU	PU	PU	—
4	13.20	—	—	4.000	0.330	—	—	P	—	P	P	—
4	16.10	—	—	4.000	0.415	—	—	P	—	P	P	—
4	18.90	—	—	4.000	0.500	—	—	P	—	P	P	—
4	22.20	—	—	4.000	0.610	—	—	P	—	P	P	—
4 1/2	12.60	12.75	—	4.500	0.271	PNU	PNU	PNU	PNU	PNU	PNU	—
4 1/2	15.20	—	—	4.500	0.337	—	—	P	—	P	P	—

Table A-3—API Tubing List (Continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Weight Designation[a,b]					Type of End Finish[c,d]						
Desig-nation[a]	Nonupset T & C[e]	External-Upset T & C	Integral Joint	Outside Diameter (in.)	Wall Thickness (in.)	Grade H40	Grade J55	Grade L80	Grade N80	Grade C90[f]	Grade T95[f]	Grade P110
$4^1/_2$	17.00	—	—	4.500	0.380	—	—	P	—	P	P	—
$4^1/_2$	18.90	—	—	4.500	0.430	—	—	P	—	P	P	—
$4^1/_2$	21.50	—	—	4.500	0.500	—	—	P	—	P	P	—
$4^1/_2$	23.70	—	—	4.500	0.560	—	—	P	—	P	P	—
$4^1/_2$	26.10	—	—	4.500	0.630	—	—	P	—	P	P	—

[a]Designations (columns 1–4) are shown for the purpose of identification in ordering.

[b]The densities of martensitic chromium steels (L80 types 9Cr and 13Cr) are different from carbon steels. The weights shown are therefore not accurate for martensitic chromium steels. A weight correction factor of 0.989 may be used.

[c]P = plain-end; N = nonupset T & C; U = external-upset T & C; I = integral joint.

[d]Items designated plain end (P) only have been added as standard to provide the industry with a list of standardized heavy wall thicknesses. Although API has not standardized on a thread for this thickness, a nominal T & C weight designation is listed for identification. See 10.3.a.5 and b.5 and Appendix D, D.3.a.5 and b.5.

[e]Nonupset tubing is available with regular couplings or special-bevel couplings. External-upset tubing is available with regular, special-bevel, or special clearance couplings.

[f]Grade C90 and T95 tubing shall be furnished in sizes, weights, and wall thicknesses as listed above, or as shown on the purchase order.

APPENDIX B—SUPPLEMENTARY REQUIREMENTS (NORMATIVE)

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

SR1 Supplementary Nondestructive Inspection for Grades H40, J55, K55, and N80 (N and N and T)

By agreement between the purchaser and the manufacturer and when specified on the purchase order, the specified casing and tubing shall be inspected for imperfections that are greater than 12.5 percent of the specified wall thickness or that reduce the net effective wall thickness below 87.5 percent of the specified wall thickness. These imperfections shall be considered defects and shall be given a disposition in accordance with 9.7.12. The inspection or inspections, including forged upsets, shall be performed to the minimum requirements stated in Section 9 for Grades M65, N80, (Q and T), L80, and C95.

SR2 Supplementary Nondestructive Inspection for Grades H40, J55, K55, M65, N80, L80, and C95

By agreement between the purchaser and the manufacturer and when specified on the purchase order, the specified casing and tubing shall be inspected for imperfections that are greater than 5 percent of the specified wall thickness or that reduce the net effective wall thickness below 87.5 percent of the specified wall thickness. These imperfections shall be considered defects and shall be given a disposition in accordance with 9.7.12. The inspection or inspections, including forged upsets, shall be performed to the minimum requirements listed in Section 9 for grade P110.

SR9 Coupling Blanks—Group 4 Only

SR9.1 DEFINITION

Coupling blanks are coupling material produced to the requirements of this specification and provided to the purchaser in an unthreaded condition.

SR9.2 COUPLING BLANK SIZE

Coupling blank dimensions shall be adequate to yield a fully machined cylinder with uniform wall thickness with an outside diameter (OD), inside diameter (ID), and length as specified on the purchase order. The coupling blanks shall be provided fully machined by the manufacturer only when specified on the purchase order.

SR9.3 DIMENSIONAL LIMITATION

For fully machined coupling blanks, the tolerance on the OD shall be $+^{3}/_{32}$-inch, –0, and the tolerance on the ID shall be +0, $-^{3}/_{32}$-inch unless otherwise agreed between the purchaser and the manufacturer. Coupling blanks ordered with as-rolled OD surface shall have an OD tolerance of ±1 percent, but not greater than $+^{1}/_{8}$-inch, $-^{1}/_{16}$-inch.

SR9.4 IMPERFECTIONS

Coupling blanks that will not be fully machined by either the manufacturer or the purchaser shall be inspected and meet the same requirements as finished couplings. Coupling blanks that will be fully machined by either the manufacturer or the purchaser may have imperfections on the as-rolled surface; however, the machined surface must meet the specified dimensions and the surface inspection criteria of 8.13.

SR9.5 MARKING

All coupling blanks meeting the requirements of SR9 shall be marked "Q125-SR9."

SR10 Upset Casing—Group 4 Only

SR10.1 DIMENSIONS

By agreement between the purchaser and the manufacturer or processor and when specified on the purchase order, Q125 grade casing shall be provided with upset end(s). Dimensions of the upset, if other than extreme line (including tolerances), shall be specified on the purchase order.

SR10.2 MATERIAL PROPERTIES

Tensile, impact, and hardness properties of the pipe and upset shall comply with the requirements of Section 6. The allowable hardness variation of the upset shall be based on the specified wall thickness of the upset specified on the purchase order. The tensile test specimens for the upset shall be the largest ASTM A 370 round specimen feasible. The size to be used will be agreed to by the manufacturer and the purchaser prior to testing.

SR10.3 HEAT TREATMENT

Upset pipe shall be heat treated full length after upsetting.

SR10.4 OTHER TESTING CONSIDERATIONS

The frequency of testing, retest provisions, identification, and other testing conditions for both the pipe body and the upset material shall be as specified in Section 9.

Previous page is blank

SR10.5 END AREA INSPECTION

The outside and inside surfaces of the ends of upset pipe shall be inspected before threading for transverse and longitudinal defects by the magnetic particle method after final heat treatment.

SR10.6 SURFACE INSPECTION OF EXTREME-LINE CASING

The machined surface of extreme-line casing shall be visually examined for imperfections. The maximum permissible depth of imperfection measured from the surface shall be as follows:

a. Pin end:
   1. External surface—12½ percent of the specified pipe body wall thickness.
   2. Internal surface, from the end of the pipe to the plane of the external shoulder (bored)—0.015-inch.
   3. Internal surface, from the plane of the external shoulder to the upset runout—12½ percent of the specified pipe body wall thickness.

b. Box end:
   1. External surface, from the end of the pipe to a plane 4¾-inches from the end of pipe sizes 7⅝ and smaller and 6½-inches from the end of pipe sizes 8⅝ and larger—0.010-inch.
   2. External surface, from a plane 4¾-inches from the end for pipe sizes 7⅝ and smaller and 6½-inches from the end for pipe sizes 8⅝ and larger to the upset runout—12½ percent of specified pipe body wall thickness.
   3. Internal surface—12½ percent of specified pipe body wall thickness.

c. All machined surfaces of the box shall be free of seams and cracks. All threads and seals shall be free of any imperfections that break the continuity.

d. The minimum wall thickness in the upset runout interval shall not be less than 87½ percent of the specified pipe body wall thickness. (See Figure 8.)

SR10.7 DIMENSIONS AND WEIGHTS

Dimensions and weights for extreme-line casing are shown in Tables 20 and 22.

SR11 Electric Welded Casing—Groups 3 & 4 and Electric Welded Tubing Group 3

SR11.1 GENERAL

Casing (Group 3 & 4) and tubing (Group 3) may be produced by the electric welded process only when detailed quality control provisions are jointly agreed to by the manufacturer and the user prior to the manufacture of the pipe. Tensile, impact, and hardness testing must be performed as frequently as required for seamless casing.

SR11.2 FLATTENING TEST REQUIREMENTS

SR11.2.1 Flattening Test Frequency

Flattening tests shall be performed on each end of each length of pipe. On one end, flattening tests shall be made with weld at 6 o'clock and on the other end with weld at 3 o'clock. All inspection shall be performed and imperfections removed (cut backs made) prior to removing flattening test specimens.

SR11.2.2 Flattening Tests

Test specimens shall be rings or crop ends not less than 2½-inches long cut from each end of each length of pipe. Precaution shall be taken so that the test specimens can be identified with respect to the lengths of pipe from which they are cut. Flattening tests shall be conducted with the weld line located at the 6 or 3 o'clock position. Minimum acceptable flattening without cracking at any location shall be as shown in Table B-1 or 0.85 D, whichever requires the greater flattening.

No cracks or breaks shall occur anywhere in the specimen until the distance between the plates is less than that specified above; nor shall evidence of poor texture, incomplete fusion in the weld, or laminations develop during the entire flattening process.

SR11.3 OTHER MATERIAL PROPERTIES

Electric welded casing shall meet the same tensile, impact, and hardness requirements as the seamless pipe. The impact test specimen shall be machined with the notch at the weld line. The frequency of testing, retest provisions, identification, and other testing conditions shall be as specified in Section 9.

SR11.4 INSPECTION AND REJECTION

SR11.4.1 Nonweld Area Inspection

The pipe body shall be inspected the same as seamless product as specified in Section 9.

Table B-1—Distance Between Plates for Flattening Tests

(1)	(2)	(3)
Grade	D/t[a] Ratio	Maximum Distance Between Plates (in.)
P110	All	$D(1.086 - 0.0163D/t)$
Q125	All	$D(1.092 - 0.0140D/t)$

[a] D = specified outside diameter of pipe, in inches; t = specified wall thickness of pipe, in inches.

SR11.4.2 Nondestructive Inspection of Weld Seam

The weld seam of pipe furnished to this specification shall be inspected nondestructively full length (100 percent) by ultrasonic methods. The inspection shall be performed after all heat treatment and any subsequent rotary straightening operation.

SR11.4.3 Equipment

Any equipment utilizing the ultrasonic principles 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 SR11.4.4 at least once every working turn to demonstrate the effectiveness of the inspection equipment and procedures. The equipment shall be adjusted to produce well-defined indications when the reference standard is scanned by the inspection unit in a manner simulating the inspection of the product and shall be capable of inspecting $^1/_{16}$-inch on either side of the weld line for the entire wall thickness.

SR11.4.4 Reference Standards

A reference standard having the same specified diameter and thickness as the product being inspected shall be used to demonstrate the effectiveness of the inspection equipment and procedures at least once every working turn. 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 two notches, one on the outside surface and one on the inner surface as specified in Figure B-1. The $^1/_{16}$-inch 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.

SR11.4.5 Rejection Limits

Any imperfection that produces a signal as great as 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 SR11.4.6.

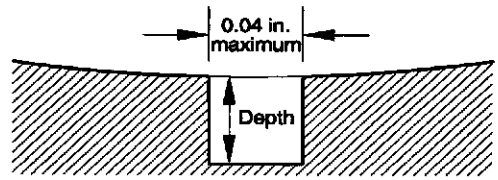
SR11.4.6 Disposition

Imperfections revealed by magnetic particle inspection and determined to be greater in depth than 5 percent but not greater than $12^1/_2$ percent of the specified wall thickness shall be removed by grinding or machining or the pipe shall be rejected. All imperfections classified as defects by the ultrasonic or electromagnetic equipment that do not exceed $12^1/_2$ percent of the specified wall thickness in depth shall be removed by grinding or machining or the pipe shall be rejected. Pipe with defects, the removal of which requires grinding or machining to a depth in excess of $12^1/_2$ percent of the specified wall thickness, shall be disposed of in accordance with 9.7.12. Where grinding or machining is done, generous radii shall be used to prevent abrupt changes in wall thickness and such areas shall be reinspected by one of the nondestructive testing methods specified herein to verify complete removal of the defect.

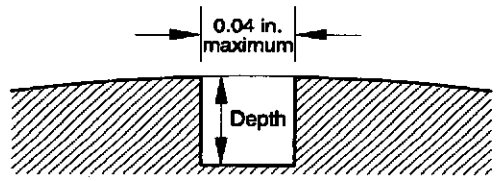
SR12 Statistical Impact Testing

SR12.1 GENERAL

This supplementary requirement specifies a statistical approach to testing. It is applicable only to those items that are accepted or rejected on a lot basis. The frequency of testing is based on standard statistical techniques for properties

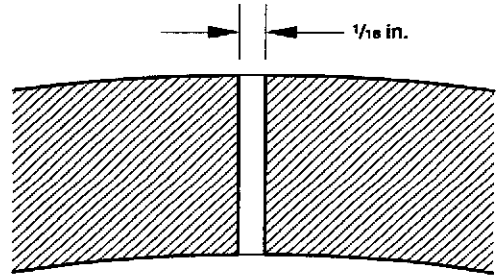


N5 NOTCH—INNER SURFACE
(see notes)



N5 NOTCH—OUTER SURFACE
(see notes)

Notes:
1. Depth: 5%t, ±15% with minimum of 0.012 in., ±0.002 in.
2. Length:
   For eddy current, 1.5 in. maximum total length.
   For ultrasonic, 2 in. maximum at full depth.
   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 ensure reproducibility.



DRILLED HOLE

Figure B-1—Reference Standard

that have a normal distribution and where the standard deviation for a particular manufacturer, size, chemistry, etc., are not well established. The statistical acceptance and rejection procedures are required only for impact properties; however, the tensile and hardness properties shall be measured on all tubulars where impact samples are taken. Tensile, impact, and hardness requirements are as required in Section 6. The basis of the testing procedure is explained in SR12.6.

SR12.2 FREQUENCY OF TESTING

Every length of casing shall be numbered uniquely. This number shall be used for all subsequent identification. Tensile, impact and hardness test specimens for casing shall be taken at the same frequency from locations shown in Figure 2. The sample size for each lot of casing shall be selected by the manufacturer from Table B-2.

The F factor shown for the sample size selected shall be used in SR12.4 to determine acceptance or rejection of a lot based on the transverse impact requirements of this specification. The number of samples is not dependent on the size of the lot. The lengths for testing shall be selected at random provided the selection procedure provides samples representing at least the start and end of the heat treat cycle and both ends of the tubes (approximately 50 percent each end).

By agreement between manufacturer and user an F factor of 3.090 may be used in lieu of the values given in Table B-2 provided the standard deviation of the new lot of material is consistent with past experience.

Note: Explanation of Testing Frequency

Since a string of casing consists of more than one length of pipe, analysis should consider the probability that the string includes one or more lengths whose impact properties do not meet the desired minimum.

Table B-3 gives the probability of a pipe string of 100 lengths including one or more unacceptable lengths. If the probability of any length being unacceptable is 1 in 1,000, then there is a 10 percent chance that the pipe string will include one or more unacceptable lengths. If the probability of any length being unacceptable is 1 in 10,000, then there is a 1 percent chance that the pipe string will include one or more unacceptable lengths. The statistical model used for the inspection frequency is designed to yield an individual tube reliability of 99.9 percent. A typical confidence limit of 95 percent is used with a tolerance interval approach since the standard deviation is neither well established nor expected to be consistent for all manufacturers, product sizes, heat treatments, chemistries, etc.

The tolerance interval approach assumes that the standard deviation is not well known. The *F* factor is large because it includes variations that can be expected in the standard deviation. For example, if the impact requirement is 20 ft-lb, 5 lengths are sampled and the standard deviation is determined to be 3.0 then the F factor is 7.501. For the lot to be acceptable, the average transverse impact value must exceed 20 + 7.501 × 3.0 or 42.5 ft-lb. If 10 lengths had been sampled and the standard deviation was still 3.0, the average impact value must exceed 20 + 5.203 × 3.0 or 35.6 ft-lb. If the standard deviation from a mill is well known, the F factor is taken for an infinite number of samples of $F = 3.090$. Assuming the standard deviation for an infinite number of samples from a given size tubular and one mill is 3.0, then the average impact value must exceed 20 + 3.09 × 3.0 or 29.3 ft-lb.

The procedure of SR12 is taken from the National Bureau of Standards, *Handbook 91*, U.S. Department of Commerce, Experimental Statistics. Table B-2 comes from Table A-7 in the above. The procedure for calculating the mean and standard deviation for the average transverse impact strength for the lot comes from the above, Chapter 1, "Basic Statistical Concepts and Preliminary Considerations," Sections 1–6.

SR12.3 RETEST

If a tensile test specimen fails to conform to the specified requirements, the manufacturer shall make an additional test on each end of the tubular. If impact test specimens fail to conform to the specified requirements the manufacturer shall follow the retest provision of 9.10.5. If a hardness test specimen fails to conform to the specified requirements the manufacturer shall follow the retest provisions of 9.10.4.3.

If any pipe is rejected from a lot due to failure to demonstrate acceptable tensile, impact, or hardness requirements, then the pipe tempered immediately before and after the length rejected shall be tested on the same end as the pipe that was rejected. If one or both of the additional test lengths fail to conform to the specified requirements, the manufacturer may elect to test individually all remaining lengths in the lot, in which case determinations are required only for the particular requirement with which the specimens failed to comply in the preceding tests (i.e., a lot that meets the hardness and impact criteria but has been rejected due to low elongation must be retested to verify tensile properties). Specimens for all retests shall be taken in the same manner as the initial test specimen. Tubulars that fail to meet the requirements of Section 6 shall be rejected.

SR12.4 ACCEPTABLE IMPACT STRENGTH FOR ANY LOT OF CASING

Subsequent to impact testing, the mean and standard deviation shall be calculated for the average transverse impact values. This calculation shall be made including the data for all lengths rejected due to low impact strength. The lot minimum impact strength shall be estimated (based on the sample data) as follows:

$$C_v \text{ lot minimum} = \text{lot mean} - F \times \text{lot standard deviation}$$

where:

F is determined in Table B-2.

Table B-2—Inspection Lot Sample Sizes Versus F Factor

Sample Size	F	Sample Size	F
3	13.857	16	4.534
4	9.215	18	4.415
5	7.501	20	4.319
6	6.612	25	4.143
7	6.061	30	4.022
8	5.686	35	3.937
9	5.414	40	3.866
10	5.203	45	3.811
12	4.900	50	3.766
14	4.690	∞	3.090

Table B-3—Probability of Defective Pipes

Probability That One Length is Defective	Probability That One or More Defective Lengths is Included in a String of 100 Pipes
$^1/_{10}$	0.99997 (or 100 percent)
$^1/_{100}$	0.634 (or 63 percent)
$^1/_{1,000}$	0.095 (or 10 percent)
$^1/_{10,000}$	0.00995 (or 1 percent)

SR12.5 LOT ACCEPTANCE AND REJECTION

The lot shall be accepted provided C_v lot minimum is greater than or equal to C_v determined in 4.3. If C_v lot minimum is less than C_v, then additional random joints may be selected for testing. The lot mean, lot standard deviation, and C_v lot minimum shall be determined as above based on all the data and the new F value. The new C_v lot minimum shall exceed C_v determined in 6.2.4.2, or the lot shall be rejected. Additional random samples may be taken from additional pipes as many times as necessary. If the casing is rejected as a lot, then each length may be tested to demonstrate that it meets the minimum transverse impact requirements of 6.2.4.2.

SR13 Seal-Ring Couplings

SR13.1 SEAL-RING GROOVE

Seal-ring couplings shall be grooved in accordance with dimensions and tolerance specified in Figures B-2 through B-5 (see note). Grooves may be cut before or after threading at manufacturer's option. Grooves and threads shall be free of fins, wickers and ribbons that are loose or can become loose and fold into the thread form. Couplings shall be inspected after final machining of the groove. The inspection shall be by the wet fluorescent magnetic particle method, using a circumferentially oriented magnetic field, or by another nondestructive method of equal sensitivity as demonstrated to the purchaser. The inspection shall encompass both the inside and outside surfaces. The inspection shall exclude the dry magnetic particle method.

SR13.2 NONMETALLIC RING

Dimensions and tolerances of nonmetallic rings for seal-ring couplings shall be as specified in Figures B-2 through B-5 (see note). Rings shall be made from virgin polytetrafluoroethylene (PTFE) with 25 percent fiberglass filler. Starting PTFE shall be free of filler.

Note: The API seal-ring and groove dimensions are not the same as those used historically, and may not be interchangeable with them.

SR13.3 MARKING REQUIREMENTS

All couplings that meet the requirements of SR13 shall be marked "SR13."

SR14 Coupling Inspection

SR14.1 SURFACE INSPECTION

SR14.1.1 Couplings shall be inspected after finish machining and before any inside or outside surface plating, coating or painting. Inspection shall be by the wet fluorescent magnetic particle method or by other nondestructive method of equal sensitivity as demonstrated to the purchaser. The inspection shall exclude the dry magnetic particle method. The inspection shall encompass both inside and outside surfaces with a circumferentially oriented magnetic field. The threaded surfaces shall be visually inspected after plating or coating.

SR14.1.2 Finished couplings shall be free of all seams, cracks, and porosity.

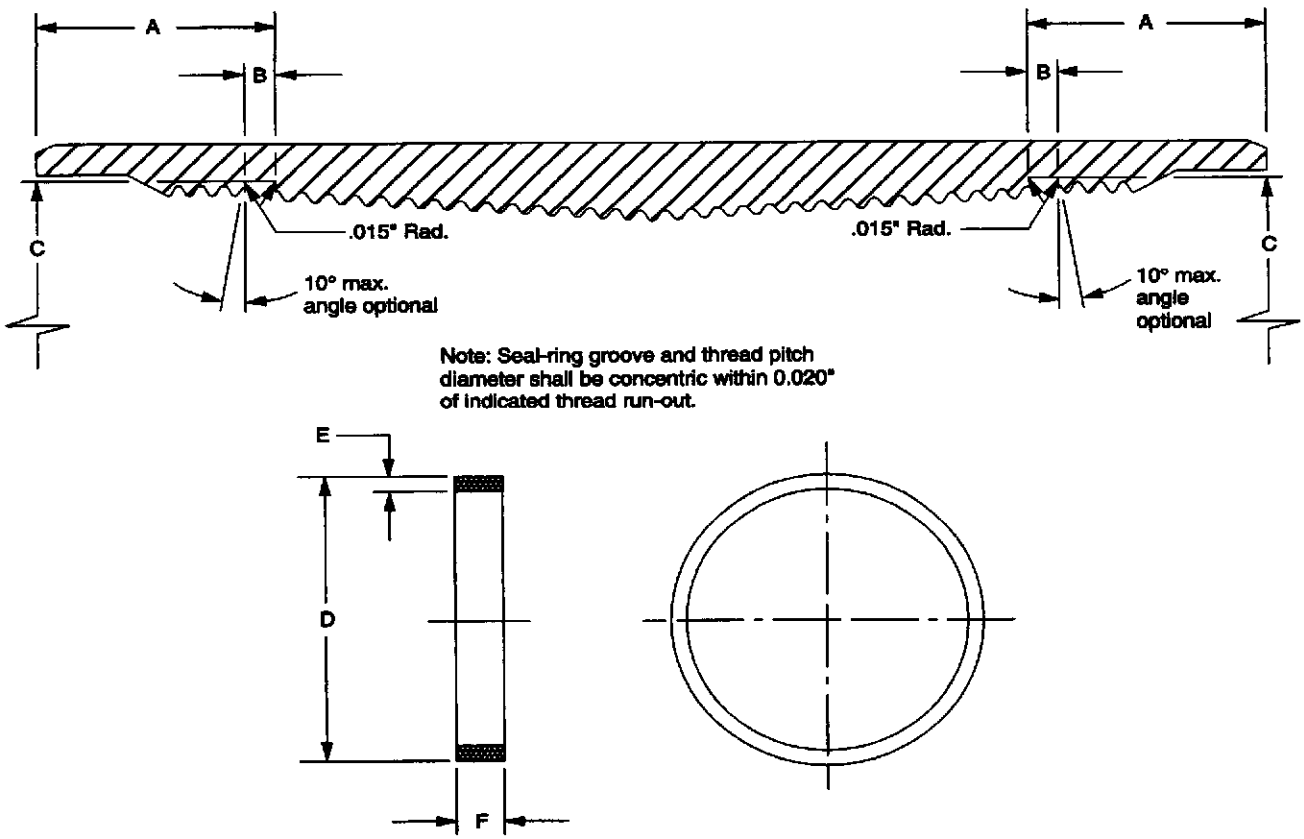
SR14.1.3 Finished couplings with pits, round-bottom gouges, and similar imperfections are not cause for rejection unless the depth of the imperfection exceeds that listed in Table B-4.

SR14.1.4 Finished couplings with grip marks, sharp bottom gouges, and similar imperfections are not cause for rejection unless the depth of the imperfection exceeds that listed in Table B-5.

SR14.1.5 Couplings shall be free of imperfections on the inside that break the continuity of the thread.

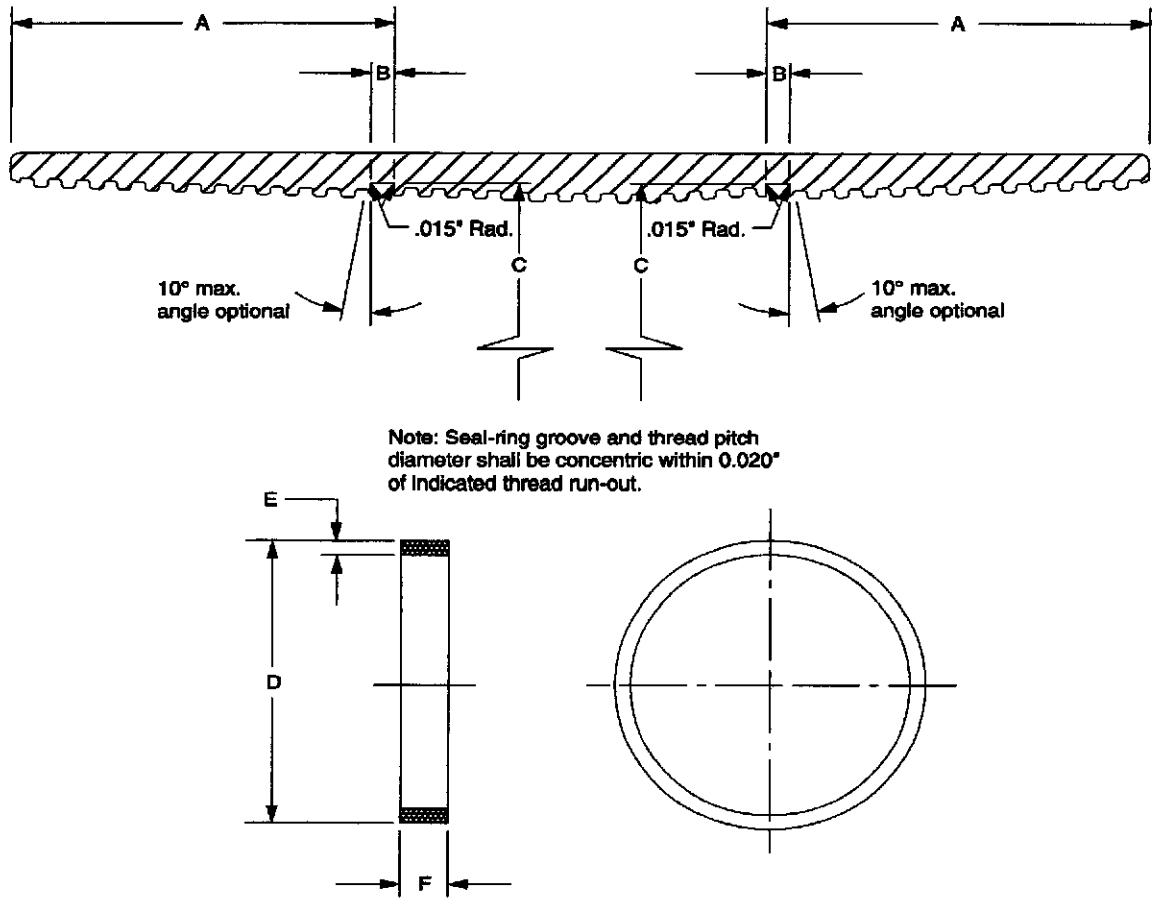
Table B-4—Pits and Round-Bottom Gouges

Coupling for Pipe Size Designation	Permissible Depth of Imperfection (in.)
Tubing	
Smaller than $3^1/_2$	0.030
$3^1/_2$ and larger	0.045
Casing	
Smaller than $6^5/_8$	0.035
$6^5/_8$ to $7^5/_8$ incl.	0.045
Larger than $7^5/_8$	0.060



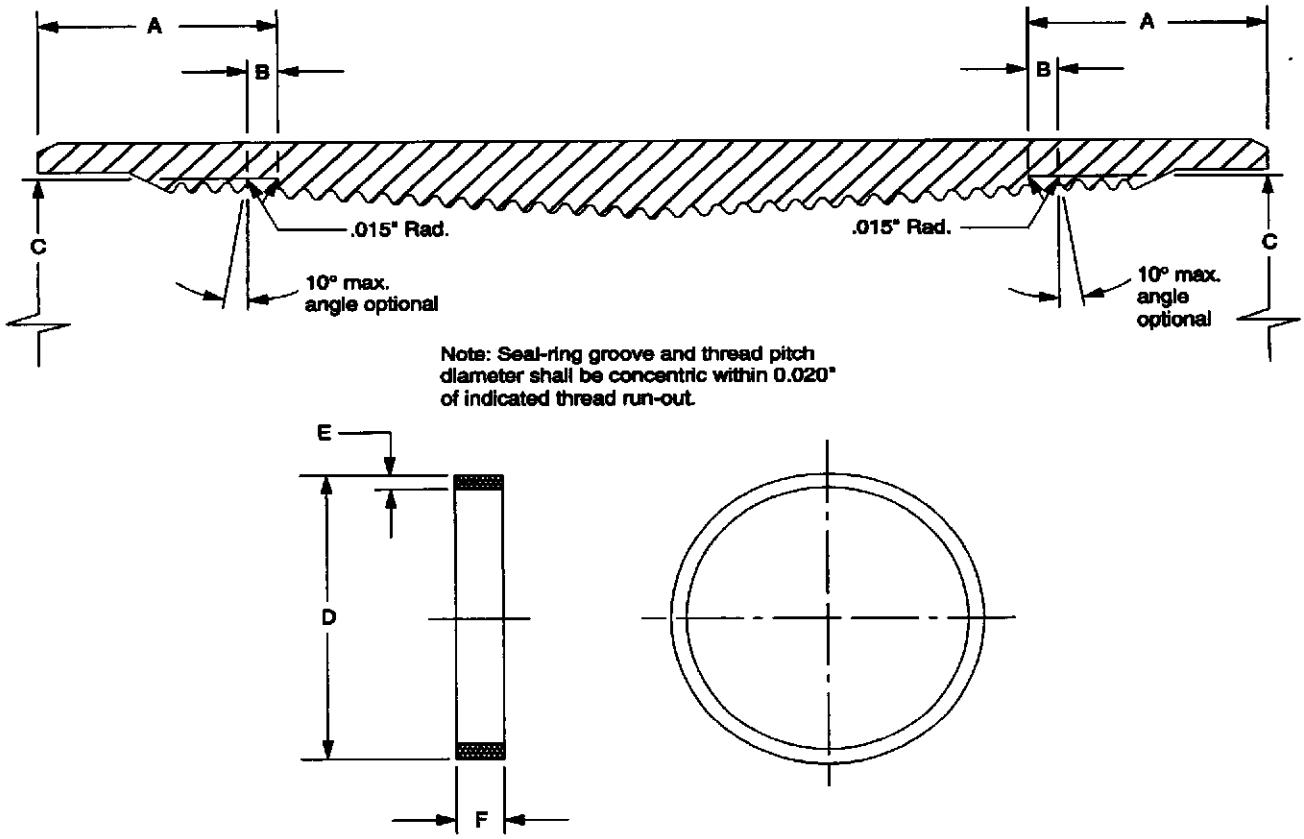
8RD Casing Size Designation	Coupling Dimensions (in.) A ±.125	B ±.005	C ±.010	Ring Dimensions (in.) D ±.015	E +.010 −.000	F +.015 −.000
4 1/2	1.375	.188	4.513	4.538	.100	.156
5	1.500	.188	5.005	5.030	.100	.156
5 1/2	1.500	.188	5.505	5.530	.100	.156
6 5/8	1.750	.188	6.614	6.639	.100	.156
7	1.750	.188	6.989	7.014	.100	.156
7 5/8	1.750	.188	7.610	7.635	.100	.156
8 5/8	1.875	.188	8.603	8.628	.100	.156
9 5/8	1.875	.188	9.603	9.628	.100	.156
10 3/4	1.750	.188	10.735	10.760	.100	.156
11 3/4	1.875	.188	11.728	11.753	.100	.156
13 3/8	2.250	.188	13.329	13.354	.100	.156
16	2.750	.188	15.923	15.948	.100	.156
18 5/8	2.750	.188	18.548	18.573	.100	.156
20	2.750	.188	19.923	19.948	.100	.156

Figure B-2—API Seal-Ring Coupling and Nonmetallic Ring for Round Thread Casing



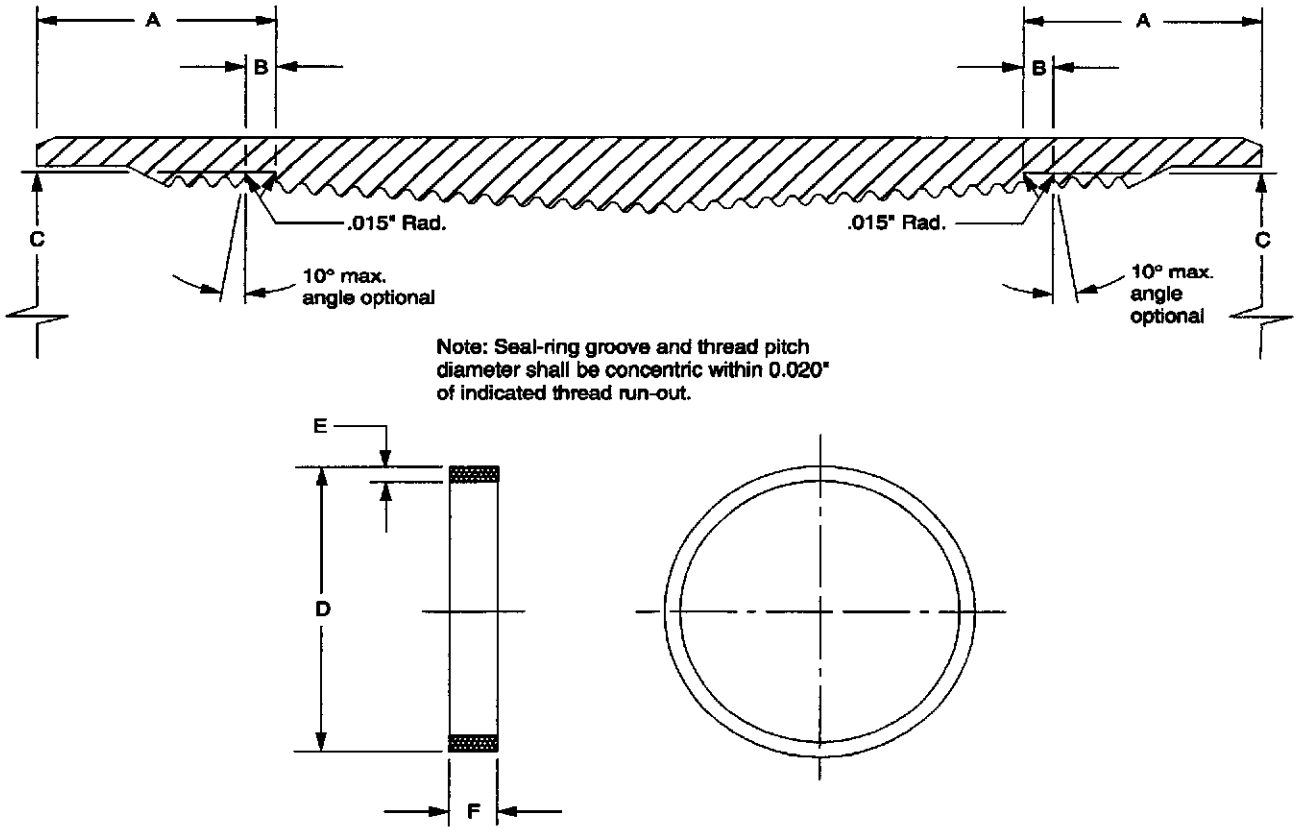
Buttress Casing Size Designation	Coupling Dimensions (in.) A ±.125	B ±.005	C ±.010	Ring Dimensions (in.) D ±.015	E +.010 −.000	F +.015 −.000
4 1/2	3.000	0.188	4.536	4.561	0.100	0.156
5	3.188	0.188	5.018	5.043	0.100	0.156
5 1/2	3.188	0.188	5.518	5.543	0.100	0.156
6 5/8	3.188	0.188	6.643	6.668	0.100	0.156
7	3.250	0.188	7.014	7.039	0.100	0.156
7 5/8	3.375	0.188	7.632	7.657	0.100	0.156
8 5/8	3.375	0.188	8.632	8.657	0.100	0.156
9 5/8	3.375	0.188	9.632	9.657	0.100	0.156
10 3/4	3.375	0.188	10.757	10.782	0.100	0.156
11 3/4	3.500	0.188	11.749	11.774	0.100	0.156
13 3/8	3.750	0.188	13.358	13.383	0.100	0.156

Figure B-3—API Seal-Ring Coupling and Nonmetallic Ring for Buttress Thread Casing



Nonupset Tubing Size Designation	Coupling Dimensions (in.) A ±.125	B ±.005	C ±.010	Ring Dimensions (in.) D ±.0075	E +.015 −.000	F +.015 −.000
1.050	0.813	0.156	1.081	1.098	0.080	0.125
1.315	0.813	0.156	1.346	1.363	0.080	0.125
1.660	0.813	0.156	1.691	1.708	0.080	0.125
1.900	1.000	0.188	1.919	1.937	0.080	0.156
$2^3/_8$	1.000	0.188	2.394	2.412	0.080	0.156
$2^7/_8$	1.000	0.188	2.894	2.912	0.080	0.156
$3^1/_2$	1.000	0.188	3.519	3.537	0.080	0.156
4	1.125	0.188	4.028	4.046	0.100	0.156
$4^1/_2$	1.125	0.188	4.528	4.546	0.100	0.156

Figure B-4—API Seal-Ring Coupling and Nonmetallic Ring for Nonupset Tubing



EUE Tubing Size Designation	Coupling Dimensions (in.) A ±.125	B ±.005	C ±.010	Ring Dimensions (in.) D ±.0075	E +.005 −.000	F +.015 −.005
1.050	0.875	0.156	1.342	1.360	0.080	0.125
1.315	0.875	0.156	1.496	1.513	0.080	0.125
1.660	0.875	0.188	1.840	1.857	0.080	0.156
1.900	0.875	0.188	2.121	2.138	0.080	0.156
$2^{3}/_{8}$	1.125	0.188	2.622	2.640	0.100	0.156
$2^{7}/_{8}$	1.125	0.188	3.122	3.140	0.100	0.156
$3^{1}/_{2}$	1.125	0.188	3.778	3.796	0.100	0.156
4	1.125	0.188	4.278	4.296	0.100	0.156
$4^{1}/_{2}$	1.125	0.188	4.778	4.796	0.100	0.156

Figure B-5—API Seal-Ring Coupling and Nonmetallic Ring for Upset Tubing

Table B-5—Grip Marks and Sharp Bottom Gouges

Coupling for Pipe Size Designation	Permissible Depth of Imperfection (in.)
Tubing	
Smaller than $3^1/_2$	0.025
$3^1/_2$ and larger	0.030
Casing	
$5^1/_2$ and smaller	0.030
Larger than $5^1/_2$	0.040

SR14.2 MEASUREMENT OF IMPERFECTIONS

The depth of imperfection shall be measured from the normal surface or contour of the coupling extended over the imperfection. The outside diameter of the coupling shall be measured from the normal surface or contour of the coupling and not from the base of an acceptable pit.

SR14.3 REPAIR AND REMOVAL OF DEFECTS

Repair welding of defects is not permitted. All seams or cracks may be removed, and all other defects may be removed or reduced to acceptable limits, by machining or grinding on the outer surface, provided the outside diameter of the finished coupling, after machining or grinding, is within the tolerances specified in Tables 31 through 34. The machining or grinding must be approximately faired into the outer contour of the coupling.

SR14.4 MARKING REQUIREMENTS

All couplings that meet the requirements detailed in SR14 shall be marked "SR14."

SR15 Test Certificates for Oil Country Tubular Goods (OCTG)

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 revision date thereof, to which pipe was manufactured.

a. Specified diameter, wall thickness, grade, process of manufacture, and type of heat treatment.

b. Chemical analyses (heat, product, and recheck) showing the weight 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, elongation. The type, size, and orientation of specimens shall be shown.

d. Impact test results [including the test criteria and the size, location, and orientation of the test specimen, the nominal test temperature (i.e., actual test temperature including the subsize temperature reduction, if applicable) the absorbed energy measured for each test specimen, the percent shear area, and the average absorbed energy for each test] where such testing is required by the specification.

e. Hardness test results (including test type and criterion, and specimen location and orientation), where such testing is required.

f. Minimum hydrostatic test pressure and duration.

g. For welded pipe for which nondestructive inspection of the weld seam is required by this specification, the method of nondestructive inspection employed (ultrasonic, electromagnetic, and/or magnetic particle), and the type of reference standard.

h. For seamless pipe for which nondestructive inspection is specified by the purchaser (either in the base specification, supplementary requirements, or the purchase order), the method of inspection employed (ultrasonic, electromagnetic, or magnetic particle) and the type and size of the reference standard used.

i. For electric welded pipe, the minimum temperature for heat treatment of the weld seam. Where such heat treatment is not performed, "No Seam Heat Treatment" shall be stated on the certificate.

j. 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 SR15. 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.

SR15.3 A Material Test Report, Certificate of Compliance or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of this specification and conform to any existing EDI agreement between the purchaser and supplier.

SR16 Impact Testing (Charpy V-Notch) for Pipe in Groups 1, 2, and 3

SR16.1 CHARPY V-NOTCH (CVN)—GENERAL REQUIREMENTS

A test shall consist of three specimens from a pipe taken from each lot as specified in 9.3.1. The average of the three impact specimens shall equal or exceed the absorbed energy requirement specified in SR16.2. In addition, not more than one impact specimen may exhibit an absorbed energy below the absorbed energy requirement, and in no case shall an individual impact specimen exhibit an absorbed energy below two-thirds of the absorbed energy requirement.

SR16.1.1 Specimen Size

Table B-6 provides the calculated wall thickness required to machine full size, 3/4 size, and 1/2 size transverse impact test specimens. Table B-7 provides the same information for longitudinal impact test specimens. The impact test specimen size that shall be selected from Tables B-6 or B-7 is the largest impact test specimen having a calculated wall thickness that is less than the specified wall thickness for the pipe tested.

When full size (10 mm by 10 mm) transverse test specimens are not possible, the largest possible subsize transverse test specimen listed in Table B-8 shall be used. When it is not possible (or allowed per SR16.1.4) to test using any of these transverse test specimens, the largest possible longitudinal test specimen listed in Table B-8 shall be used.

When the OD or wall thickness precludes machining longitudinal impact test specimens 1/2 size or larger, the pipe need not be tested; however, the manufacturer must use a chemical composition and processing that is documented and demonstrated to result in impact energy absorption in excess of the minimum specified requirement.

Table B-6—Transverse Impact Specimen Size Required

(1)	(2)	(3)	(4)
	Calculated Wall Thickness (inches) Required to Machine Transverse Charpy Impact Specimens		
Pipe Outside Diameter (Inches)	Full Size	3/4 Size	1/2 Size
3.500	0.809	0.710	0.612
4.000	0.752	0.654	0.555
4.500	0.711	0.613	0.514
5.000	0.680	0.582	0.483
5.500	0.656	0.557	0.459
6.625	0.616	0.517	0.419
7.000	0.605	0.507	0.409
7.625	0.591	0.492	0.394
7.750	0.588	0.490	0.391
8.625	0.572	0.473	0.375
9.625	0.557	0.459	0.360
10.750	0.544	0.445	0.347
11.750	0.534	0.436	0.337
13.375	0.522	0.423	0.325
16.000	0.507	0.409	0.310
18.625	0.497	0.398	0.300
20.000	0.492	0.394	0.296

Notes:
1. The wall thicknesses in columns 2, 3, and 4 that are in excess of the maximum specified API wall thickness are provided for information only.
2. The above provides a 0.020-inch ID and a 0.020-inch OD machining allowance.

Table B-7—Longitudinal Impact Specimen Size Required

(1)	(2)	(3)	(4)
	Calculated Wall Thickness (inches) Required to Machine Longitudal Charpy Impact Specimens		
Pipe Outside Diameter (Inches)	Full Size	3/4 Size	1/2 Size
1.050	0.472	0.374	0.275
1.315	0.464	0.365	0.267
1.660	0.457	0.359	0.261
1.900	0.454	0.356	0.257
2.063	0.453	0.354	0.256
2.375	0.450	0.352	0.253
2.875	0.447	0.349	0.250
3.500	0.445	0.346	0.248
4.000	0.443	0.345	0.247
4.500	0.442	0.344	0.245
5.000	0.441	0.343	0.245
5.500	0.441	0.342	0.244
6.625	0.440	0.341	0.243
7.000	0.439	0.341	0.242
7.625	0.439	0.340	0.242
7.750	0.439	0.340	0.242
8.625	0.438	0.340	0.241
9.625	0.438	0.339	0.241
10.750	0.437	0.339	0.240
11.750	0.437	0.339	0.240
13.375	0.437	0.338	0.240
16.000	0.436	0.338	0.239
18.625	0.436	0.337	0.239
20.000	0.436	0.337	0.239

Notes:
1. The wall thicknesses in columns 2, 3, and 4 that are in excess of the maximum API wall thicknesses are provided for information only.
2. The above provides a 0.020-inch ID and a 0.020-inch OD machining allowance.

SR16.1.2 Hierarchy of Test Specimens

The hierarchy of test specimen orientation and size is as specified in Table B-9.

SR16.1.3 Alternate Size Impact Test Specimens

At the manufacturer's option, alternate size impact test specimens, listed on Table B-8, may be used in lieu of the minimum size specified in the tables referenced in SR16.1.a. However, the alternate test specimen shall be higher on the hierarchy table (Table B-9) than the specified size, and the absorbed energy requirement shall be adjusted consistent with the impact specimen orientation and size selected.

Table B-8—Acceptable Size Impact Specimens and Absorbed Energy Reduction Factor

(1) Test Specimen Size	(2) Specimen Dimensions	(3) Reduction Factor
Full size	10.0 mm × 10.0 mm	1.00
3/4	10.0 mm × 7.5 mm	0.80
1/2	10.0 mm × 5.0 mm	0.55

Table B-9—Hierarchy of Test Specimen Orientation and Size

(1) Choice	(2) Orientation	(3) Size
1st	Transverse	Full
2nd	Transverse	3/4
3rd	Transverse	1/2
4th	Longitudinal	Full
5th	Longitudinal	3/4
6th	Longitudinal	1/2

SR16.1.4 Absorbed Energy Requirement for Subsize Test Specimens

The minimum Charpy V-Notch absorbed energy requirement for subsize test specimens shall be that specified for a full size test specimen multiplied by the reduction factor in Table B-8; however, in no event shall a subsize test specimen be used if the reduced absorbed energy requirement is less than 8 ft-lbs.

SR16.1.5 Reference Information

The 6th Edition of API Bulletin 5C3 will include reference information on fracture mechanics and equations used in preparing these requirements.

SR16.2 CHARPY V-NOTCH—IMPACT REQUIREMENTS FOR PIPE AND FOR EXTERNALLY THREADED CONNECTOR MATERIAL—GROUPS 1, 2, AND 3

SR16.2.1 Group 1 (Grade H40 Only)

The minimum full size transverse CVN absorbed energy requirement is 12 ft-lbs for all wall thicknesses. The minimum full size longitudinal CVN absorbed energy requirement is 15 ft-lbs for all wall thicknesses.

SR16.2.2 Group 1 (Grades J55 and K55 Only)

The minimum full size transverse CVN absorbed energy requirement is 15 ft-lbs for all wall thicknesses. The minimum full size longitudinal CVN absorbed energy requirement is 20 ft-lbs for all wall thicknesses.

SR16.2.3 Group 1 (Grade N80 Only) and Groups 2 and 3

In these equations in SR16.2.3.1 and SR16.2.3.2, the following is applicable:

S = the minimum specified yield strength in ksi for the grade evaluated.

t = the specified wall thickness in inches.

SR16.2.3.1 Transverse Requirement

The minimum full size transverse CVN absorbed energy requirement shall be as specified in Table B-10 based on the grade and the specified wall thickness. Table B-10 is based on the following:

CVN (ft-lbs) = $S(0.152t + 0.064)$ or

= 15 ft-lbs, whichever is greater for grade P110, or

= 10 ft-lbs, whichever is greater for lower strength grades.

SR16.2.3.2 Longitudinal Requirement

The minimum full size longitudinal CVN absorbed energy requirement shall be as specified in Table B-11 based on the grade and the specified wall thickness. Table B-11 is based on the following:

CVN (ft-lbs) = $S(0.304t + 0.128)$ or

= 30 ft-lbs whichever is greater for grade P110, or

= 20 ft-lbs whichever is greater for lower strength grades.

SR16.3 IMPACT TEST PROCEDURES

SR16.3.1 General Procedures

Charpy V-Notch Type A impact tests shall be conducted as specified in ASTM A 370 and ASTM E 23. When transverse impact test specimens are used for EW pipe, the test specimen shall be machined with the notch at the weld line. When longitudinal impact test specimens are used for EW pipe, the test specimens shall be taken from a location approximately 90 degrees from the weld. Impact test specimens shall not be machined from flattened tubulars.

SR16.3.2 Specimen Orientation

See Figure 14 for specimen orientation.

Table B-10—Transverse Charpy Absorbed Energy Requirements

(1)	(2)	(3)	(4)	(5)
Maximum Specified Wall Thickness (inches)				Minimum Transverse Absorbed Energy (ft-lb)
L80 N80	C90	C95 T95	P110	
0.442	0.346	0.306	—	10
0.525	0.420	0.375	—	11
0.607	0.493	0.445	—	12
0.689	0.566	0.514	—	13
0.771	0.639	0.583	—	14
0.854	0.712	0.652	0.506	15
0.936	0.785	0.722	0.566	16
1.018	0.858	0.791	0.626	17
—	0.931	0.860	0.685	18
—	1.004	0.929	0.745	19
—	—	0.999	0.805	20
—	—	—	0.865	21
—	—	—	0.925	22
—	—	—	0.984	23
—	—	—	1.044	24

Note: The round-off procedures were followed in the preparation of this table.

SR16.3.3 Specimen Allowance for OD Curvature

The surface of the finished machined transverse test specimens may contain the OD curvature of the original tubular product provided that the requirements of Figure B-6 are met. These specimens shall be used only to permit the use of a transverse specimen of maximum thickness (T).

SR16.3.4 Test Temperature (See Note)

The test temperature shall be specified by the purchaser as follows:

a. +70°F, or

b. +32°F, or

c. 14°F, or

d. Other temperature as specified on the purchase order.

The tolerance on the test temperature shall be ±5°F.

Note: The H, J, and K grades are low strength steels considered to be loading rate sensitive. Increasing the loading rate from that generally occurring in the use of the product to the loading rate occurring in the impact testing of the Charpy specimens results in shifting the fracture transition temperature to higher temperatures. Thus, the fracture transition behavior of the product would be expected to occur at temperatures less than those obtained with Charpy testing. In most applications, testing Grades H40, J55, and K55 at +70°F and higher strength grades at +32°F should be adequate. When the pipe will be handled at temperatures below 0°F, lower impact test temperature may be appropriate.

Table B-11—Longitudinal Charpy Absorbed Energy Requirements

(1)	(2)	(3)	(4)	(5)
Maximum Specified Wall Thickness (inches)				Minimum Longitudinal Absorbed Energy (ft-lb)
L80 N80	C90	C95 T95	P110	
0.422	0.328	0.289	—	20
0.463	0.365	0.323	—	21
0.504	0.401	0.358	—	22
0.545	0.438	0.393	—	23
0.586	0.474	0.427	—	24
0.627	0.511	0.462	—	25
0.669	0.548	0.497	—	26
0.710	0.584	0.531	—	27
0.751	0.621	0.566	—	28
0.792	0.657	0.600	—	29
0.833	0.694	0.635	0.491	30
0.874	0.730	0.670	0.521	31
0.915	0.767	0.704	0.551	32
0.956	0.803	0.739	0.581	33
0.998	0.840	0.774	0.611	34
1.039	0.876	0.808	0.641	35
—	0.913	0.843	0.670	36
—	0.950	0.877	0.700	37
—	0.986	0.912	0.730	38
—	1.023	0.947	0.760	39
—	—	0.981	0.790	40
—	—	1.016	0.820	41
—	—	—	0.850	42
—	—	—	0.880	43
—	—	—	0.910	44
—	—	—	0.940	45
—	—	—	0.969	46
—	—	—	0.999	47
—	—	—	1.029	48

Note: The round-off procedures were followed in the preparation of this table.

SR16.3.5 Defective Specimens

Any test specimen that shows defective preparation or material imperfections unrelated to the intent of the test, whether observed before or after testing, may be discarded and be replaced by another specimen from the same length of pipe. Specimens shall not be judged defective simply because they failed to exhibit the minimum absorbed energy requirement.

SR16.3.6 Subsize Test Temperature Reduction—Group 1 (Grades H40, J55, and K55 Only)

A test temperature reduction may be required when subsize test specimens are used. The test temperature reduction depends on the thickness of the pipe and the size of the impact test specimen. The test temperature reduction specified in Table B-12 shall be used when applicable.

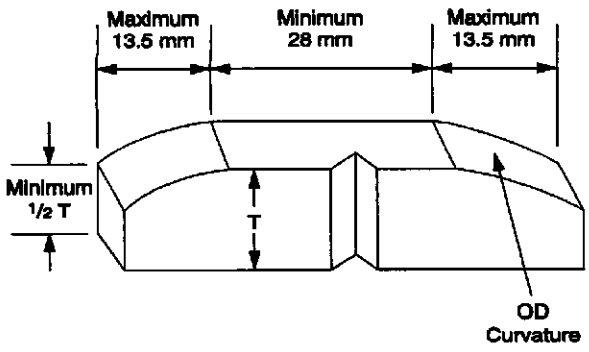


Figure B-6—Impact Test Specimen OD Curvature Allowance

SR16.3.7 Frequency of Testing—Groups 1, 2, and 3

One test shall be taken from one pipe from each lot.

SR16.3.8 Impact Retests—Groups 1, 2, and 3.

SR16.3.8.1 Retest of a Pipe

If more than one specimen is below the specified minimum absorbed energy requirement or if one value is below two thirds of the specified minimum absorbed energy requirement a retest of three additional specimens shall be made from the same pipe. The impact energy of each of the retest specimens shall equal or exceed the specified minimum absorbed energy requirement or the pipe is rejected.

Table B-12—Test Temperature Reduction for Subsize Specimens—Grades H, J, and K Only

(1)	(2)	(3)
Specimen Size	Specified Pipe Wall Thickness (in.)	Temperature Reduction (°F)
10 mm × 7.5 mm	greater than 0.394	5
10 mm × 5.0 mm	greater than 0.394	20
10 mm × 5.0 mm	0.295 to 0.394	15
10 mm × 5.0 mm	0.262 to 0.294	10
10 mm × 5.0 mm	0.236 to 0.261	5

SR16.3.8.2 Replacement of a Rejected Pipe

If the results of a test do not meet the requirements of SR16.1 and do not qualify for retest per SR16.3.8.1, then an additional three test specimens shall be removed from each of three additional pipes from the lot. If all the additional pipe tested conform to the requirements, then the lot shall be qualified except for the pipe that was initially rejected. If one or more of the additional test pipes fail to conform to the specified requirements, the manufacturer may elect to test individually the remaining pipe in the lot or reheat treat and retest the lot.

SR16.3.9 Rounding Procedures

For purposes of determining conformance with these requirements, an observed value shall be rounded off to the nearest whole number in accordance with the rounding off method of ASTM E 29. Further, limiting values as specified or calculated shall be expressed as whole numbers, rounded if necessary.

SR16.4 REPORTING

The following shall be reported to the purchaser:

a. Size and orientation of the test specimen (for example, full size, 3/4 size, or 1/2 size).
b. Actual test temperature (for example, specified temperature less the test temperature reduction that may be applicable for grades H, J, and K).
c. Results of the individual specimens (for example, the impact energy absorption in ft-lbs and the percent shear).
d. Average absorbed energy.

SR16.5 MARKING

Pipe tested in accordance with this supplementary requirement shall be marked to indicate SR16, the minimum full size energy absorption requirement, and the specified test temperature (not including the test temperature reduction that may be applicable for Grades H, J, and K) preceded by a positive or negative sign. This marking shall be paint stenciled after the grade designation. The following is an example:

SR16-20 +14F

APPENDIX C—PURCHASER INSPECTION (NORMATIVE)

C.1 Inspection Notice

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

C.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 him 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.

C.3 Compliance

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

C.4 Rejection

Unless otherwise provided, material that shows defects on inspection or subsequent to acceptance at the manufacturer's works, or 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 that is proven to have not 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 D—MARKING INSTRUCTIONS FOR API LICENSEES (NORMATIVE)

D.1 General

D.1.1 Products manufactured in conformance with this specification may be marked by the API licensee as specified in Section 10 or as specified herein. Products to which the monogram is applied shall be marked per this appendix.

D.1.2 For all manufacturers, except threaders, the marking instructions in this appendix, except those in D.6 are applicable. For threaders, the marking instructions in D.5, D.6 and Table D-1 are applicable. Processors shall remove any identity which is not indicative of the new condition of the product as a result of heat treating (for example, prior grade identity, original pipe manufacturer's name or logo).

D.1.3 Products shall be color coded as specified in D.4.

D.1.4 Products shall be marked by stenciling, or a combination of stenciling and stamping, at the option of the manufacturer, as stipulated with two exceptions:

a. By agreement between the purchaser and manufacturer, stamping can be required, in which case a combination of stamping and stencil markings shall be used

b. At the option of the manufacturer, hot-rolled or hot-stamped markings on pipe and couplings may be substituted for die-stamped markings and are permitted at intervals along the length.

D.1.5 Requirements for optional stamp marking are specified in D.2 and stencil markings are specified in D.3. Marking instructions and sequence of markings are specified in Table D-1, which includes only those items that are stamped or stencilled for product identification. Examples of recommended markings are shown in Figure D-1. Markings shall not overlap and shall be applied in such a manner as not to injure the pipe.

D.1.6 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.

D.1.7 The complete monogram consists of the following: "5CT", license number of the plant doing the manufacturing, the API monogram and the date of manufacture. The date of manufacture is defined as a minimum of a two digit number representing the last digit of the year and the calendar quarter the monogram is applied.

D.1.8 In a circumstance where it is necessary to remark pipe with the original marking information, the accuracy and traceability of the transferred markings shall be the responsibility of the entity remarking the pipe. The transferred markings shall include the words "transferred by."

D.2 Optional Stamp Marking Requirements

D.2.1 METHODS

Methods of stamp marking are as follows:

Number	Method
1.	Hot-rolled or hot-stamped markings.
2.	Cold die stamping with standard dies.
3.	Cold die stamping with interrupted dot face dies.
4.	Cold die stamping with rounded face dies.
5.	Vibratory method.

After stamp marking, Group 2 and 4 products may require subsequent heat treatment as specified in D.25. Such heat treatment shall be in accordance with 5.2. Sequence of stamp markings shall be as shown in Table D-1.

D.2.2 SIZE

Sizes of stamp markings shall be as shown in Table D-2.

D.2.3 LOCATION

Placement of these markings on casing, liners and tubing sizes 1.660 and larger shall be on the outside surface of each length within 12 inches from the coupling or box, either end of plain-end pipe or either end of pin-by-pin threaded pipe. The optional stamp marking on sizes smaller than 1.660 may be either on a metal tag affixed to each length, or for bundled tubing, stamped on a metal tag affixed to each bundle.

D.2.4 GROUP 1 AND 3

When specified on the purchase order, products shall be stamped by either one or more of the methods in D.2.1 at the option of the manufacturer.

D.2.5 GROUP 2 AND 4

When specified on the purchase order, products may be stamped by one or more of the methods in D.2.1 at the option of the manufacturer.

Group 2 (except Grades C-90 and T-95) products shall be heat treated subsequent to use of method 2.

Group 2 (C-90 and T-95 only) and Group 4 products shall be heat treated subsequent to the use of methods 2 and 4, with the following exceptions:

a. The make-up triangle mark.

b. When the stamp markings are removed to a depth not less than twice the depth of the stamping by grinding, machining, threading or by cropping.

c. When not removing the stamping is by agreement between the purchaser and the manufacturer.

Previous page is blank

Table D-1—Marking Requirements and Sequence

Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
1. Licensed manufacturer's name or mark (optional; neither is required)	____	D,P	D,P	P	P
2. Monogram marking:					
Mark "5CT" and manufacturer's	"5CT"				
API license number	____	D,P	D,P	P	P
API Monogram and date of manufacture as in D.1.7	____	D,P	D,P	P	P
Compatible Standards	____	As Specified	As Specified	As Specified	As Specified
3. Unthreaded pipe or end finish not detailed herein, if applicable (place symbol after specification marking)	"UP"	D,P		P	
4. Size Designation (fill-in size designation from column 1 of Tables 20–25):	____	P		P	
5. Weight Designation (fill-in size designation from Tables 20–25)					
Casing and Tubing		D,P		P	
Liner		D,P		P	
6. Grade of Pipe					
H40	"H"				
J55	"J"				
K55	"K"				
M65	"M"				
N80	"N"				
L80 Type 1	"L"				
L80 Type 9CR	"L9"				
L80 Type 13CR	"L13"				
C90 Type 1	"C90-1"				
C90 Type 2	"C90-2"				
T-95 Type 1	"T1"				
T-95 Type 2	"T2"				
C-95	"C95"				
P-110	"P"				
Q-125 Type 1	"Q1"				
Q-125 Type 2	"Q2"				
Q-125 Type 3	"Q3"				
Q-125 Type 4	"Q4				
All size designations		D,P	D,P	P	P
7. Reduced alternate impact test temperature, if applicable:					
Couplings and female connectors (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F		P		P
Group 4 pipe (fill-in specified test temperature for full size specimens, including ± symbol and °F)	____ F			P	

Table D-1—Marking Requirements and Sequence (Continued)

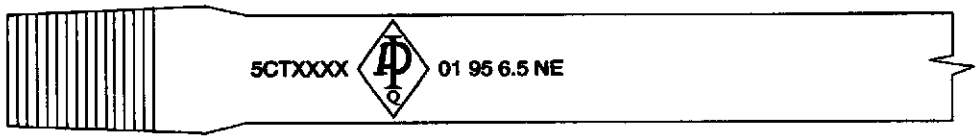
Marking Sequence	Mark or Symbol (see Note 2)	Stencil and/or Stamp Marking Requirements (see Note 1)			
		Groups 1 and 3		Groups 2 and 4	
		Pipe and Pup Joints	Couplings and Connectors	Pipe and Pup Joints	Couplings and Connectors
8. Heat treatment, if applicable:					
J-55, K-55 or M65 Normalized	"Z"	P	P		
J-55, K-55, M65 or N-80 Quenched & Tempered	"Q"	P	P		
9. Process of manufacture:					
Seamless	"S"				
Electric-Welded	"E"				
All size designations		D,P		P	
10. Supplemental requirements, if applicable					
SR 1	"S1"	P		P	
SR 2	"S2"	P		P	
SR 9 (fill in type)	"S9 Q ____"				P
SR 13	"S13"		D,P		P
SR 14	"S14"		P		
SR 16 (fill-in minimum full size absorption requirement in ft-lbs and test temperature including ± symbol and °F)	"S16 ____ F"	P		P	
11. Hydrostatic Test Pressure					
1. Standard Test Pressure	"ST"				
2. Alternate Test Pressure	"AT"				
3. Agreed on pressure greater than standard test pressure	"HP" ____				
4. Test pressure is 3000 psi and the standard test pressure is greater than 3000 psi	"3K"				
For all size designations		P		P	
12. Type of casing thread, if applicable:					
Casing buttress, extreme-line or round threads (fill-in type of thread from Table 62)	____	P		P	
13. Size of drift test:					
Standard Casing	"D"				
Standard Tubing	"DT"				
Alternate Casing	"Dxx"				
Alternate Tubing (where xx is the size of the alternate drift)	"Dtxx"				
For casing specified (per Table 29) for tubing service	"DT 42"	"			
14. Serialization of Grades C-90, T-95 and Q-125				D,P	D,P
15. Tin plating of couplings, if applicable	"T"		P		P

Notes:
1. D is for optional (die) stamping; P is a requirement for (paint) stenciling. Optional marking is permitted as specified in 10.1 and 10.2.
2. A blank space, "____", indicates information to be filled in.

Example 1 — Tubing

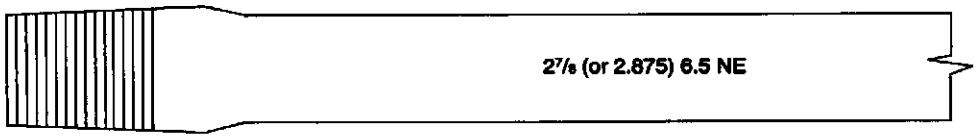
Tubing: size 2⁷/₈, weight 6.5, Grade N80, normalized, electric weld, external upset, threaded pin-by-pin without couplings; monogrammed in January 1995.

Stamp Marking (within 12 inches of either externally threaded end)



Note: For Groups 1 and 3, the marking "5CT" and the license number shall be stamped or stenciled at the option of the manufacturer.

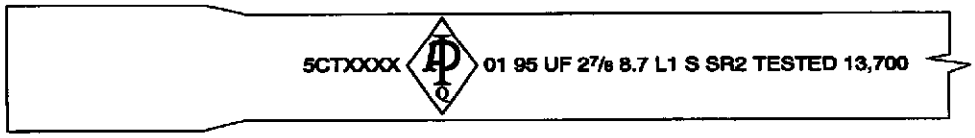
Stencil Marking (at least 2 feet from either externally threaded end)



Example 2 — Tubing

Tubing: size 2⁷/₈, weight 8.7, Grade L80, Type 1, seamless, external upset for special end finish plain end. Additional requirements include hydrostatic testing to 13,700 psi and inspection to SR2; monogrammed in January 1995.

Stencil Marking (at least 2 feet from either end)



Example 3 — Casing

Casing: size 7, weight 35, Grade C90, Type 2 seamless, plain end, serial number 201. Supplementary Requirement 16 (SR16) for test at +14°F; monogrammed n February 1995.

Stencil Marking (at least 2 feet from either end)

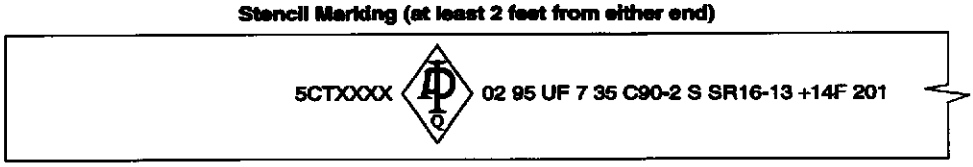


Figure D-1—Examples of Marking Requirements and Sequence

Example 4 — Coupling

Tubing coupling for size 2⅞, Grade J55, normalized upset (or nonupset) tubing, to supplementary requirement SR13; monogrammed in November 1995.

Stamp Marking

5CTXXXX API Q 11 95 J SR13*

Stencil Marking

NORM

Note: Marking in center of coupling may be stamped in either the longitudinal or transverse direction.

*For Groups 1 and 3, the marking "5CT," the license number, and "SR13" shall be stamped or stenciled at the manufacturer's option.

Example 5 — Casing With Couplings

Buttress casing: size 9⅝, weight 53.5, Grade P110, electric weld; additional requirements are SR16 test at 0°F and 8.500 drift test; monogrammed in December 1996. Couplings are tin plated; monogrammed in December 1995.

Stamp Marking

Coupling

5CTXXXX API Q 12 95 P

Pipe (within 12 inches of the coupling)

5CTXXXX API Q 12 96 53.5 P E

Note: Marking in the center of the coupling may be in either the longitudinal or transverse direction.

Stencil Marking

Coupling

T

Pipe (not less than 2 feet from the coupling)

9⅝ 53.5 P E BCSG SR16-16 0F FLD 8.500

Example 6 — Threader

Casing: size 7, long round thread; monogrammed in January 1995.

Stencil Marking (adjacent to the threads)

5CTXXXX* API Q 01 95 7 LCSG

Hydrostatic Test Pressure (if higher than standard pressure)

*For Groups 1 and 3, the marking "5CT" and the license number shall be stamped or stenciled at the manufacturer's option, and the month and year of manufacture shall be stamped instead of stenciled.

Figure D-1—Examples of Marking Requirements and Sequence (Continued)

D.2.6 MAKE-UP TRIANGLE MARK

For buttress casing in all sizes and grades and round thread casing in sizes 16 and larger in grades H, J and K, the make-up triangle shall be stamped on the outside of each length on both ends. Unless otherwise specified on the purchase order, the triangle mark may be replaced with a transverse white paint band $^3/_8$-inch-wide by 3-inches-long. To assist in locating the triangle or transverse white paint band on buttress casing, a 1-inch-wide by 24-inch-long longitudinal white paint stripe shall be placed adjacent to the triangle or transverse paint band on the field end; additionally, a 1-inch-wide by 4-inches-long longitudinal white paint stripe shall be placed adjacent to the triangle or transverse paint band on the mill end.

For Groups 1 and 3, the triangle shall be stamped by methods 2 of 4 only.

For Group 2, Grades C90 and T95 only, the triangle shall be stamped by method 3 only.

For Group 4 and Group 2 (except Grades C-90 and T-95), the triangle shall be stamped by methods 3 or 4 only.

D.3 Stencil Marking Requirements

Stenciled markings shall be placed on the outside surface of each length of pipe starting not less than 2 feet from the coupling or box or from either end of plain-end pipe or either end of pin by pin threaded pipe. For connectors and pup joints less than 6 feet in length, the required stencil markings may be placed on a decal attached to the outside surface within 12 inches of the end. These markings shall be separated by a dash or shall be adequately spaced.

Sequence of stencil markings shall be as shown in Table D-1, except the thread marking shall be at a location convenient to the manufacturer.

D.4 Color Code Identification

D.4.1 METHOD

Each product shall be color coded unless otherwise specified on the purchase order. Such color coding shall be by one or more of the following methods:

a. For pipe and pup joints 6 feet or longer use one or more of the following methods:

1. Paint band encircling the pipe at a distance not greater than 2 ft. from the coupling or box or either end of plain end or pin by pin threaded pipe.
2. Paint the entire outside surface of the coupling including the appropriate coupling color bands.

b. If the pipe is furnished with special clearance couplings or if the pipe and couplings are of a different grade (except Grades H-40, J-55 and K-55 couplings applied as allowed in B.1.1), paint both the pipe and couplings as specified in subitems 1 and 2 above.

c. For loose couplings paint the entire outside surface of the coupling including the appropriate color bands.

d. For pup joints and connectors shorter than 6 feet in length, paint the entire outside surface, except the threads, including the appropriate color bands.

e. Special clearance couplings shall be painted the colors indicative of the steel grade from which the couplings are manufactured and shall also be painted with a black band around the center.

D.4.2 GRADE COLOR CODES

The colors and number of bands for each grade shall be as shown in Table D-3.

D.5 Thread Marking—All Groups

For manufacture's, thread identification shall be stenciled on casing with round, buttress or extreme-line threads as shown in Table D-4.

For threaders, thread identification is required on casing and tubing as shown in Table D-4.

D.6 Pipe Threader Marking Requirements—All Groups

Pipe threaded by an API-licensed threader other than the original pipe manufacturer shall be identified consistent with D-1 and D-3 adjacent to the threads with the threader's name or mark, the API monogram, and size and type of thread as listed in D-5.

The threader shall mark on the body of the pipe the hydrostatic test pressure, if higher than the standard test pressure. The markings applied to the body of the pipe by the original pipe manufacturer shall not be removed or altered.

Use of the letters "API" to identify or certify that threads on tubular goods comply with API Standard 5B is not permitted.

Table D-2—Size of Stamp Markings

Product	Size of Product (in.)	Markings (in.)
Pipe	Smaller than $4^1/_2$	$^3/_{16}$
Pipe	$4^1/_2$ and over	$^1/_4$
Coupling	For pipe sizes smaller than $4^1/_2$	$^1/_4$
Coupling	For pipe sizes $4^1/_2$ to, but not including $7^5/8$	$^3/_8$
Coupling	For pipe sizes $7^5/8$ and over	$^1/_2$

Table D-3—Grade Color Codes

Grade	Pipe & Pup Joints 6 Feet and Longer	Couplings
H-40	No marking or black band at Manufacturer's option	Same as Pipe
J-55 Tubing	One bright green band	Entire coupling bright green
J-55 Casing	One bright green band	Entire coupling bright green and one white band
K-55	Two bright green bands	Entire coupling bright green
M65	One bright green and one blue band	Entire coupling red with one brown band
N-80	One red band	Entire coupling red
L-80 Type 1	One red, one brown band	Entire coupling red with one brown band
L-80 Type 9CR	One red, one brown, two yellow bands	Entire coupling red with two yellow bands
L-80 Type 13CR	One red, one brown, one yellow band	Entire coupling red with one yellow band
C-90 Type 1	One purple band	Entire coupling purple
C-90 Type 2	One purple, one yellow band	Entire coupling purple and one yellow band
T-95 Type 1	One silver band	Entire coupling silver
T-95 Type 2	One silver, one yellow band	Entire coupling silver and one yellow band
C-95	One brown band	Entire coupling brown
P-110	One white band	Entire coupling white
Q-125 Type 1	One orange band	Entire coupling orange
Q-125 Type 2	One orange, one yellow band	Entire coupling orange and one yellow band
Q-125 Type 3	One orange, one green band	Entire coupling orange and one green band
Q-125 Type 4	One orange, one brown band	Entire coupling orange and one brown band

Table D-4—Thread Type Markings

Thread Type	Symbol
Casing (short round thread)	STC
Casing (long round thread)	LC
Casing (buttress thread)	BC
Casing (extreme-line)	XC
Tubing (nonupset)	NU
Tubing (external-upset)	EU
Tubing (integral-joint)	IJ

The American Petroleum Institute provides additional resources and programs to industry which are based on API Standards. For more information, contact:

• Training and Seminars	Ph: 202-682-8490 Fax: 202-682-8222
• Inspector Certification Programs	Ph: 202-682-8161 Fax: 202-962-4739
• American Petroleum Institute Quality Registrar	Ph: 202-962-4791 Fax: 202-682-8070
• Monogram Licensing Program	Ph: 202-962-4791 Fax: 202-682-8070
• Engine Oil Licensing and Certification System	Ph: 202-682-8233 Fax: 202-962-4739
• Petroleum Test Laboratory Accreditation Program	Ph: 202-682-8064 Fax: 202-962-4739

In addition, petroleum industry technical, patent, and business information is available online through API EnCompass™. Call 212-366-4040 or fax 212-366-4298 to discover more.

To obtain a free copy of the API Publications, Programs, and Services Catalog, call 202-682-8375 or fax your request to 202-962-4776. Or see the online interactive version of the catalog on our World Wide Web site – http://www.api.org.

American Petroleum Institute

Helping You Get The Job Done Right.

Additional copies available from API Publications and Distribution:
(202) 682-8375

Information about API Publications, Programs and Services is available on the World Wide Web at: http://www.api.org

American Petroleum Institute

1220 L Street, Northwest
Washington, D.C. 20005-4070
202-682-8000

Order No. G05CT6