Work Item Number	2390
Title of Work Item	Add Grade C125 to 5CT
Ballot Revision Level	Initial Ballot (January 2024)
Type of Ballot (Initial, Comment, Comment resolution (reference API ballot#), 1st Re-ballot, 2nd Re-ballot, etc.)	Initial
Submitter Name(s)	Brian Chambers
API Document Modified	API 5CT
API Document, API Modifying Document(s) and Revision Level(s)	11th. Ed.
Revision Key	Text in 11th Ed. for reference (not to be modified) changes from Ballot text

Work Item Charge: New higher-strength limited sour performance grade C125 addition to API 5CT.
Ballot Rationale: Consensus of WI2390 group incorporated into 5CT 11th edition with updated changes from Comment Ballot from WI2390 that was circulated in Fall 2023.

Initial Ballot changes:
Add C125 to 5CT primarily following quality requirements associated with grade C110. Sulfide stress cracking tests and requirements differ from other grades and reflect consensus of the working group. Mechanical properties and QA/QC requirements follow logically from grades C110 and Q125 with some modifications agreed by consensus of the working group.

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1 Scope

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1.3 Applicability—Grades

The products to which this standard is applicable include the following grades: H40, J55, K55, N80 (all types), L80 (all types), C90, R95, T95, P110, C110, C125, and Q125. In this standard, when the symbol L80 is used alone, it is applicable to Grades L80 Type 1, L80 3Cr, L80 9Cr, and L80 13Cr; when the symbol N80 is used alone, it is applicable to Grades N80 Type 1 and N80Q.

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4 Information to be Supplied by the Purchaser

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4.2 Casing

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4.2.2 When applicable in a purchase order, the optional requirements in Table 2 shall apply.

Table 2 – Optional Requirements Specified by the Purchaser (Casing)

Requirement	Reference
Traceability for Grades other than C110, C125, and Q125	
SSC test method(s) and test solution(s) for Grade C125	6.14, 9.10

4.2.3 Upon agreement between the purchaser and the manufacturer, the additional casing requirements in Table 3 shall apply.

Table 3 – Purchaser / Manufacturer Agreement (Casing)

Requirement	Reference
SSC test Method D requirement for Grades C110 and C125 product over 50.8 mm (2.0 in.) wall thickness	6.14.4, Table 13
Number of specimens for NACE Method A Grades C90, T95, ~~and~~ C110, and C125	9.10.2
SSC test solution(s), and K_{ISSC} requirements for Grade C125, if Method D is selected	6.14, 9.10

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4.4 Coupling Stock, Coupling Material, and Accessory Material

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4.4.3 Upon agreement between the purchaser and the manufacturer, the following requirement regarding coupling stock and material and accessory material shall apply:
— SSC test Method D requirement for Grades C110 and C125 product over 50.8 mm (2.0 in.) wall thickness according to 6.14.4 (Table 13).

Table 7 – Purchaser-supplied Information (Coupling Stock and Material and Accessory Material)

Requirement	Reference
Traceability for Grades other than C110, C125, and Q125	5.4.1

SSC test method(s), test solution(s), and K_{ISSC} requirements for Grade C125	6.14, 9.10

Table 8 – Optional Requirements Specified by the Purchaser (Coupling Stock and Material and Accessory Material)

Requirement	Reference
Number of specimens for NACE Method A Grades C90, T95, ~~and~~ C110, and C125	9.10.2

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5 Process of Manufacture

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5.2 Heat Treatment

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5.2.3 Grades L80, C90, T95, ~~and~~ C110, and C125

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.

Tempering Grade L80 13Cr at a temperature below 620 °C (1150 °F) shall be permitted only if all product satisfies 6.3, 6.4.4, 6.5.2, and 9.7.

5.3 Straightening

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5.3.4 Grades C90, T95, ~~and~~ C110, and C125

When straightening is necessary, product may be hot rotary straightened or cold straightened. If hot rotary straightened, the minimum temperature at the exit of rotary straightening shall not be more than 165 °C (300 °F) below the final specified tempering temperature. If cold rotary straightened, then the product shall be stress relieved after straightening. The stress relief temperature shall be 30 °C to 55 °C (50 °F to 100 °F) below the final specified tempering temperature. For gag straightening, see 5.3.6.

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5.4 Traceability

5.4.1 General

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

For C110, C125, Q125, and for other Grades when specified in the purchase agreement, the procedures shall provide a means of tracing the product to the proper heat and lot and to all applicable chemical and mechanical test results.

5.4.2 Serialization of Grades C90, T95, C110, C125, and Q125

The serial number shall be marked on products as specified below. Identification of the material shall be maintained until it is received by the purchaser.

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6 Material Requirements

6.1 Chemical Composition

Product shall conform to the requirements specified in Table C.4 or Table E.4 for the grade and type specified.

For Grades C90, T95, ~~and~~ C110, and C125 the manufacturer shall inform the purchaser at the time of inquiry of the minimum and maximum concentrations for all elements intentionally added to each heat, regardless of the purpose of the addition.

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6.2 Tensile Properties

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6.2.3 Yield Strength

The yield strength shall be the tensile stress required to produce the elongation under load (EUL) specified in Table C.5 or Table E.5 as determined by an extensometer.

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6.2.4 Statistical Tensile Testing—Grades C90, T95, ~~and~~ C110, and C125

By agreement between the purchaser and the manufacturer, the SRs for statistical tensile testing of Grades C90, T95, ~~and~~ C110, and C125 in A.10 (SR 38) shall apply.

6.3 Charpy V-notch Test—General Requirements

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6.3.3 Shear Area

For all Grades other than C110 and C125, shear area is not required unless the purchase agreement specifies A.16 (SR 44).

For Grades C110 and C125, either:

a) the minimum shear area shall be 75 %, in accordance with ASTM E23; or

b) the manufacturer shall use a documented procedure (taking into account, as a minimum, variations in chemical composition, diameter, and wall thickness) together with the impact test results to demonstrate that the upper shelf behavior is achieved.

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6.4.4 Grades N80, R95, L80, C90, T95, P110, C110, C125, and Q125

The minimum absorbed energy requirements, C_V, for full-size test specimens shall be calculated based on the equations in Table 9,

where

Y_{Smax} is the specified maximum yield strength for the grade evaluated, in megapascals (thousand pounds per square inch);

t is the critical wall thickness, in millimeters (inches), based on the specified dimensions for couplings.

Table 9—Full-size Test Specimen Minimum Absorbed Energy Requirements (Grades N80, R95, L80, C90, T95, P110, C110, C125, and Q125)

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6.5.3 Grades C110, C125, and Q125

The requirements shall be calculated based on the equations given in Table 11,

where

Y_{Smax} is the specified maximum yield strength, in megapascals (thousand pounds per square inch);

t is the specified wall thickness, in millimeters (inches).

Table 11—Full-size Test Specimen Minimum Absorbed Energy Requirements (Grades C110, C125, and Q125)

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6.5.5 Testing Conditions

For Grades C110, C125, and Q125 pipe, impact testing shall be performed in accordance with 9.7. For other grades, except Grades H40, J55, and K55 (which have no mandatory impact requirements for pipe), conformance with the requirements of 6.5.2 may be qualified by a

documented procedure in lieu of testing, at the manufacturer's option, unless A.9 (SR 16) is specified in the purchase agreement, in which case testing shall be performed as specified in 9.7. Pipe qualified by a documented procedure that fails to show conformance to the specified impact energy requirements after shipment shall be rejected.

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6.7 Maximum Hardness

6.7.1 Grades L80, C90, T95, ~~and~~ C110, and C125

a) Grades L80, C90, T95, ~~and~~ C110, and C125—Through-wall hardness.

The mean hardness numbers obtained shall conform to the requirements in Table C.5 or Table E.5. In addition, the following shall apply.

1) For L80, any mean hardness number not exceeding 23.0 HRC (Rockwell hardness C-scale) shall be acceptable. If any hardness number from a single indentation exceeds 24.0 HRC, the length or piece shall be rejected.

2) For Grades C90 and T95, any mean hardness number not exceeding 25.4 HRC shall be acceptable. If any hardness number from a single indentation exceeds 27.0 HRC, the length or piece shall be rejected. Products with mean hardness numbers between 25.4 HRC and 27.0 HRC shall be retested.

3) For Grade C110, any mean hardness number not exceeding 29.0 HRC shall be acceptable. If any hardness number from a single indentation exceeds 31.0 HRC, the length or piece shall be rejected. Products with mean hardness numbers between 29.0 HRC and 31.0 HRC shall be retested.

4) For Grade C125, any mean hardness number not exceeding 34.0 HRC shall be acceptable. If any hardness number from a single indentation exceeds 36.0 HRC the length or piece shall be rejected. Products with mean hardness numbers between 34.0 HRC and 36.0 HRC shall be retested.

b) Grades C90, T95, ~~and~~ C110, and C125 —Surface hardness (when required in accordance with 9.6).

For Grades C90 and T95, the Brinell or Rockwell C-scale hardness number shall not exceed 255 HBW (Brinell hardness) or 25.4 HRC, respectively. If any of the hardness numbers are over 255 HBW or 25.4 HRC, two additional indentations may be made in the immediate area. If either of the second test hardness numbers exceeds 255 HBW or 25.4 HRC, the length or piece shall be rejected.

For Grade C110, the Brinell or Rockwell C-scale hardness number shall not exceed 279 HBW or 29.0 HRC, respectively. If any of the hardness numbers are over 279 HBW or 29.0 HRC, two additional indentations may be made in the immediate area. If either of the second test hardness numbers exceeds 279 HBW or 29.0 HRC, the piece shall be rejected.

For Grade C125, the Brinell or Rockwell C-scale hardness number shall not exceed 319 HBW or 34.0 HRC respectively.. If any of the hardness numbers are over 319 HBW or 34.0 HRC two additional indentations may be made in the immediate area. If either of the second test hardness numbers exceeds 319 HBW or 34.0 HRC the piece shall be rejected.

c) Grades C90 and T95—Alternative maximum hardness requirements.

By agreement between the purchaser and the manufacturer, the maximum mean hardness numbers may be altered from those stated above, based on sulfide stress corrosion cracking tests specified in 6.14.

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6.8 Hardness Variation—Grades C90, T95, C110, C125, and Q125

Material shall conform to the hardness variation requirements of Table C.5 or Table E.5. Hardness variation is defined as the difference between any two mean hardness numbers within one quadrant. This criterion shall not apply between specimens.

6.9 Process Control—Grades C90, T95, C110, C125, and Q125

All individually heat-treated coupling blanks, pup joints, or accessory material shall be surface hardness tested to verify process control. For Grades C90, T95, ~~and~~ C110, and C125, the surface hardness test results shall be used in the selection of the pieces for through-wall hardness testing. The process-control hardness test results need not be provided by the manufacturer or processor unless specified in the purchase agreement.

6.10 Hardenability—Minimum Percentage Martensite for Quenched and Tempered Products

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6.10.3 Grades C110 and C125

For each size, mass, chemical composition, and austenitize-and-quench combination, a through-wall hardness test shall be made after quenching and prior to tempering for each production run. These tests shall be made on the body of products or, in the case of accessory material, shall be made in the design area of greatest wall thickness. Mean hardness numbers shall equal or exceed the hardness corresponding to 95 % minimum martensite as determined by Equation (6):

$$HRC_{min} = [59 \times (\%\ carbon)] + 29 \quad (6)$$

NOTE Equation (6) was derived from data in Reference [10]. Based on these data, Equation (6) is valid from 0.15 % carbon to 0.50 % carbon.

Alternative hardenability requirements shall be permitted for thick-walled Grades C110 and C125 as defined in 6.10.5

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6.10.5 Validation Requirements for Thick-walled Grades C90, T95, ~~and~~ C110, and C125

6.10.5.1 General

Alternative hardenability requirements for thick-walled Grades C90, T95, ~~and~~ C110, and C125, defined as tubular product with a wall thickness of 30 mm (1.181 in.) or larger, shall be permitted. Alternative hardness requirements shall be qualified through validation testing of specific samples according to NACE TM0177-2016 and the chemical, mechanical, and SSC test requirements according to API 5CT [grade, SR (as applicable) and SSC test method(s)]. The validation report number and revision shall be reported in the certification of the material. The validation report shall be available to the purchaser upon request.

For product with wall thickness 30 mm (1.181 in.) or larger, the criteria for a passing validation shall be based on the SSC testing, lowest mean hardenability hardness result for the product chemical composition, lowest carbon content, and austenitize-and-quench combination in the validation.

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6.11 Grain Size—Grades C90, T95, ~~and~~ C110, and C125

Prior austenitic grain size shall be ASTM 5 or finer for Grades C90 and T95, and ASTM 6 or finer for Grades C110 and C125 (determined in accordance with ISO 643 or ASTM E112).

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6.14 Sulfide Stress Cracking Test—Grades C90, T95, ~~and~~ C110, and C125

6.14.1 General Guidance

The purchaser should refer to NACE MR0175/ISO 15156-1 and ISO 15156-2 for guidance on the usage of Grades C90, T95, and C110. Particular attention should be given to the application of Grade C110 in NACE MR0175/ISO 15156-2 SSC Regions 2 or 3, as this material is not suitable for all sour (hydrogen sulfide- containing) service applications. C125 is not listed in NACE MR0175/ISO 15156-1 and ISO 15156-2 and should be qualified for particular ranges of service by the purchaser or user.

NOTE The SSC test is for quality control purposes only and does not qualify the material for any specific sour service application; it is the product user's responsibility to ensure that the product is suitable for the intended application.

6.14.2 SSC Test Methods—Grades C90, T95, ~~and~~ C110, and C125

The level of resistance to sulfide stress cracking shall satisfy the requirements in 6.14.4 using one or more of the following test methods as specified by the purchaser:

a) For Grades C90 and T95:

1) uniaxial tensile method (Method A);

2) bent-beam method (Method B);

3) DCB method (Method D).

b) For Grades C110 and C125:

1) uniaxial tensile method (Method A);

2) DCB method (Method D).

--where C110 shall be tested for a minimum duration of 14 days
--where C125 shall be tested for a minimum duration of 17 days

6.14.3 Test Solution

The following solutions shall be used for the tests identified in 6.14.2 for Grades C90, T95, and C110:

a) Method A: NACE TM0177-2016, Solution A;

b) Method B: NACE TM0177-2016, Section 9.3.1; or

NOTE The solution used for Method B is similar to Solution A for Method A but without the addition of NaCl.

c) Method D: NACE TM0177-2016, Solution A.

~~Where NACE TM0177-2016 requires documented validation of test solution saturation, then analysis stall be done using the iodometric titration procedure in NACE TM0177-2016—Appendix C or other validated and documented method.~~

An additional informative Method D (DCB) test may be specified according to A.11 (SR39) using NACE TM0177-2016 Solution D.

The following solutions shall be used for the tests identified in 6.14.2 for Grade C125:

Method A: NACE TM0177-2016 Solution B modified such that it is saturated with 3% H_2S, balance N_2 gas instead of chemically pure H_2S

Method D: Options of Solutions to test per NACE TM0177-2016:

-Solution D

-Solution B modified such that it is saturated with 3% H_2S, balance N_2 gas instead of chemically pure H_2S

Where NACE TM0177-2016 requires documented validation of test solution saturation, then analysis shall be done using the iodometric titration procedure in NACE TM0177-2016 Appendix C or other validated and documented method.

6.14.4 Minimum SSC Requirements

As specified by 9.2, for each lot of Grades C90, T95, and C110, manufacturers shall demonstrate that the product meets or exceeds the minimum SSC requirements described herein. If the purchaser requires an SSC requirement more stringent than the minimum, then agreement shall be reached between the purchaser and the manufacturer.

a) NACE TM0177-2016 Method A, Uniaxial Tensile.

For Method A, standard tensile test specimens shall be used except where subsize tensile specimens are required because of product dimensional constraints, when loaded to a stress level according to Table 12.

Table 12—NACE Method A Requirements for Tensile Test Specimens

Specimen Size	Yield Strength Percentage	Minimum Applied Stress
Standard (6.35 mm [0.250 in.] diameter) specimen	85 % of YS_{min}	644 MPa (93,500 psi) for C110 733 MPa (106,250 psi) for C125
Subsize (3.81 mm [0.150 in.] diameter) specimen	76 % of YS_{min}	576 MPa (83,600 psi) for C110 655 MPa (95,000 psi) for C125

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c) NACE TM0177-2016 Method D (DCB).
For Method D, standard specimens shall be used except where subsize DCB specimens can only be machined due to product dimensions. Acceptance criteria for standard specimens are stated in Table 13 except for C125 which shall be agreed by purchaser and manufacturer. When Method D subsize or alternative specimens are required, acceptance criteria shall be agreed upon by the purchaser and the manufacturer.

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7 Dimensions, Masses, Tolerances, Product Ends, and Defects

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7.12 Product Ends

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7.12.5 Workmanship of Ends

The inside and outside edges of the ends of all product shall be free of burrs.
For Grades C110 and C125, the pin and box threads shall be abrasive-blasted, unless processed by any appropriate technique, including the threading process, which has been agreed upon between the purchaser and the manufacturer to be sufficient to avoid the presence of material susceptible to detaching or causing galling during connection make-up.

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8 Couplings

8.1 General Requirements

Couplings shall:
a) be seamless;

b) be of the same grade and type as the pipe body, except as provided in 8.2;

c) be given the same heat treatment as the pipe body, except as provided in 8.2;

d) meet the same SR as the pipe body, when the SR is also applicable to couplings (see Table A.1).

Couplings shall be machined from coupling blanks made from coupling stock, coupling material, or hot forgings, except Grades C110, C125, and Q125 couplings that shall not be made from hot forgings.
For Grades C110 and C125 coupling blanks heat-treated individually, only method 9.2.3 c) shall be used.

See A.4 (SR 9) for optional requirements for Grades C110, C125, and Q125 coupling blanks.

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8.9 Special Bevel Tubing Regular Couplings—All Grades Except C110, C125, and Q125

When specified in the purchase agreement, special bevel tubing RCs conforming to the requirements of Tables C.29 and C.30 or Tables E.29 and E.30 shall be furnished for NU and EU tubing. Unless otherwise specified, special bevel tubing RCs shall be beveled on both ends as shown in Figures D.4 and D.5. The inside and outside edges of the bearing face shall be rounded or broken as shown in Figures D.4 and D.5. The root faces of the couplings shall be faced at right angles to the axis.

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8.11 Surface Inspection

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8.11.7 Couplings shall not be rejected for imperfections less than 5 % of the critical wall thickness detected on subsequent reinspection outside the manufacturer's facility based on the following:

a) for Grades J55 and K55 material that is impact-tested at or below 0 °C (32 °F), that demonstrates a shear area greater than 80 %, and that exceeds the minimum absorbed energy requirements;

b) Grades N80, R95, L80, C90, T95, C110, P110, C125, and Q125 material; the critical thickness is defined in 6.3.2.

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8.15 Couplings and Coupling Blank Protection—Grades C90, T95, C110, C125, and Q125

Loose couplings and coupling blanks that have been machined to its final outside diameter shall be boxed to prevent contact with one another during shipment. Other coupling blanks shall be boxed to prevent nicks and gouges that will not be removed by subsequent machining. Boxes shall be manufactured from suitable materials that prevent damage to the material surfaces during transportation and shall be designed to be easily handled by a forklift

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9 Inspection and Testing

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9.2 Lot Definition for Testing of Mechanical Properties

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9.2.2 Grades L80 9Cr, L80 13Cr, C90, T95, C110, C125, and Q125—Coupling Stock, Coupling Material, Accessory Material, and Pipe (Except Coupling Blanks, Pup Joints, or Accessory Material Heat-treated after Cutting to Blank or Individual Length)

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

9.2.3 Coupling Blanks, Pup Joints, or Accessory Material Heat-treated after Cutting to Blank or Individual Length

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In addition, for Grades C90, T95, C110, C125, and Q125, a lot shall not exceed 30 coupling blanks, pup joints, or accessory material for Label 1: 9 5/8 and larger casing, or 50 coupling blanks, pup joints, or accessory material for smaller sizes of individually heat-treated pieces.

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9.3 Testing of Chemical Composition

9.3.1 Heat Analyses

For Grades H40, J55, K55, N80, R95, L80, C90, T95, and P110, the manufacturer shall furnish a report giving the heat analysis of each heat of steel used in the manufacture of product specified in the purchase agreement. In addition, the purchaser, upon request, shall be furnished the results of quantitative analyses for other elements used by the manufacturer to control mechanical properties.

For Grades C110, C125, and Q125, the manufacturer shall furnish a report giving the heat analysis of each heat of steel used in the manufacture of product specified in the purchase agreement. The report shall include quantitative analyses for other elements used by the manufacturer to control mechanical properties.

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9.4 Tensile Tests

9.4.1 Stress-relief Temperature—All Grades

For the purpose of tensile test frequency, stress-relief of tempered products shall not be considered “heat treatment” provided the stress-relief temperature is at least 55 °C (100 °F) below the final tempering temperature.

For Grades L80 13Cr, C90 T95, C110, C125, and Q125, the stress relief of tempered products shall not be considered “heat treatment” provided the stress relief temperature is at least 30 °C (50 °F) below the final tempering temperature.

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9.4.4 Frequency of Testing and Test Specimen Location—Coupling Stock, Coupling Material, Coupling Blanks, Pup Joints, and Accessory Material

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For Grades C90, T95, C110, C125, and Q125, tensile test specimens for coupling stock, coupling material, coupling blanks, pup joint, or accessory material heat-treated in tube length shall be removed from locations shown in Figure D.9.

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9.4.6 Test Specimens—Additional Requirements for Coupling Blanks, Coupling Stock, Coupling Material, Pup Joints, and Accessory Materials—Grades C110, C125, and Q125

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9.4.7 Test Method

Tensile properties shall be determined by tests on longitudinal specimens conforming to the requirements of 9.4.5, ISO 6892-1 or ASTM A370, and 9.4.6 for Grades C110, C125, and Q125 products covered therein. 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 ISO 6892-1 or ASTM A370.

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9.4.9 Retests—All Products (Except Coupling Blanks, Coupling Stock, Coupling Material, Pup Joints, or Accessory Material—Grades C90, T95, C110, C125, and Q125)

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9.4.10 Retests—Coupling Blanks, Coupling Stock, Coupling Material, Pup Joints, or Accessory Material in Grades C90, T95, C110, C125, and Q125

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9.6 Hardness Test

9.6.1 Frequency of Testing—General

The frequency of hardness testing for all products shall be as specified in Table C.35 or Table E.35. When more than one test is required, the test specimens shall be from different lengths, except for a single piece lot where the test specimens may be taken from both ends of one length.

Additional hardness testing on the outside surface and through-wall hardness testing of pipe and upsets may be carried out as agreed upon between the purchaser and the manufacturer. Test procedures for this additional testing shall be agreed upon between the purchaser and the manufacturer.

No test is required for pup joints, coupling blanks, or accessory material manufactured from a length of Grades L80, C90, T95, C110, C125, or Q125 pipe, coupling stock, coupling material, or accessory material previously tested, provided there is no subsequent heat treatment.

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9.6.4 Frequency of Testing and Test Specimen Location—Non-upset Pipe—Grades C90, T95, ~~and~~ C110, and C125

a) For Grades C90 and T95, one through-wall hardness test in one quadrant shall be made from one end of each length. Approximately 50 % of these test rings shall be cut from the front ends and approximately 50 % from the back ends of the pipe.

b) For Grade C110 and C125, one through-wall hardness test in one quadrant shall be made on both ends of each length. If the manufacturer applies a process control plan that has been demonstrated to the satisfaction of the purchaser to be sufficient to ensure that the entire length of the pipe has homogeneous hardness properties, the testing frequency may be reduced to the frequency applicable for Grades C90 and T95 in a).

NOTE See A.19 (SR 47) for optional frequency of hardness testing for non-upset, Grades C90 and T95.

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9.6.6 Frequency of Testing and Test Specimen Location—Coupling Blanks, Coupling Stock, Coupling Material, Pup Joints, and Accessory Material—Grades C90, T95, ~~and~~ C110, and C125

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9.6.9 Test Method

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For Grades L80, C90, T95, ~~and~~ C110, and C125, the through-wall hardness test shall only be made using hardness testers with digital readout (one or more decimal places).

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If two or more hardness indentations at a location (same outside-wall, mid-wall, or inside-wall in a quadrant) are greater than 20 HRC, and if the difference between the highest and lowest indentations at that location is greater than 2.5 HRC, then three additional indentations in the same location shall be taken. In such case, the mean hardness number shall be based on the three additional indentations. The test report shall indicate that additional indentations were made, and the original test data shall be available upon request. Additional indentations are not allowed if any Rockwell hardness number is over 27.0 HRC for Grades C90 or T95, ~~or~~ over 31.0 HRC for Grade C110, or over 36.0 HRC for Grade C125.

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9.6.11 Periodic Checks of Hardness-testing Machines

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For through-wall hardness testing of Grades L80, C90, T95, ~~and~~ C110, and C125, the standardized test block shall have a maximum nonuniformity of 0.4 HRC. For all other grades and hardenability tests, the standardized test block shall have a maximum nonuniformity of 1.0 HRC. The nonuniformity of the standardized test block shall be determined by the difference between the highest and lowest indentation number stated in the standardized test block certificate.

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The testing machine shall be checked at the beginning and completion of a continuous run of testing and at such times as are required to assure the operator of the equipment and the purchaser (or representative) that the machine is satisfactory. In any event, checks should be made at least once every 8 h of a continuous run of testing. Checks shall be made on standardized test blocks within the following hardness ranges:

a) Grades L80, C90, and T95: 20 HRC to 27 HRC;

b) Grade C110: 24 HRC to 32 HRC;

c) Grades C125 and Q125: 24 HRC to ~~35~~ 36 HRC;

d) all hardenability tests: 35 HRC to 55 HRC.

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In cases of disagreement, for Grades C90, T95, ~~and~~ C110, and C125, one standardized test block shall be within 20 HRC to 26 HRC and another standardized test block shall be within 30 HRC to 46 HRC to confirm accuracy and linearity using a two-block verification. The standardized test blocks shall have a maximum nonuniformity of 0.4 HRC (difference between the highest and lowest indentation number stated in the standardized test block certificate). The error shall not exceed ±0.5 HRC (determined by the certified mean hardness numb

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9.6.14 Retests—Grades C90, T95, ~~and~~ C110, and C125 Products Except for Coupling Blanks, Pup Joints, or Accessory Material Heat-treated after Cutting to Individual Lengths

For Grades C90 and T95, if any mean hardness number falls between 25.4 HRC and 27.0 HRC inclusive, three additional indentations shall be made in the immediate area to determine a new mean hardness number. If the new mean hardness number does not exceed 25.4 HRC, the piece shall be accepted. If the new mean hardness number exceeds 25.4 HRC, the piece shall be rejected.

For Grade C110, if any mean hardness number falls between 29.0 HRC and 31.0 HRC inclusive, three additional indentations shall be made in the immediate area to determine a new mean hardness number. If the new mean hardness number does not exceed 29.0 HRC, the piece shall be accepted. If the new mean hardness number exceeds 29.0 HRC, the piece shall be rejected.

For Grade C125, if any mean hardness number falls between 34.0 HRC and 36.0 HRC inclusive, three additional indentations shall be made in the immediate area to determine a new mean hardness number. If the new mean hardness number does not exceed 34.0 HRC, the piece shall be accepted. If the new mean hardness number exceeds 34.0 HRC, the piece shall be rejected.

9.6.15 Retests—Grades C90, T95, ~~and~~ C110, and C125 Coupling Blanks, Pup Joints, or Accessory Material Heat-treated after Cutting to Individual Lengths

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9.6.19 Rejected Lots—Grades L80, C90, T95, C110, C125, and Q125

For all products, rejected lots may be reprocessed (that is, heat-treated again) and hardness-tested again as new lots.

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9.7 Impact Test

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9.7.9 Sampling—Grades N80, R95, L80, C90, T95, C110, ~~and~~ P110, and C125

For pipe, when impact testing is required, one set of test specimens shall be taken from each lot.
For accessory material, when required in 6.6, and for coupling stock, coupling material, and coupling blanks, one set of test specimens shall be taken from each lot.
Frequency of testing is specified in Table C.16 or Table E.16.

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9.7.11 Test Method

CVN impact tests shall be conducted as specified in ASTM A370 and ASTM E23.

The shear area shall be measured and, for Grades C110 and C125 and A.16 (SR 44) products (see 12.3), shall be reported

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9.8 Grain Size Determination—Grades C90, T95, ~~and~~ C110, and C125

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9.9 Hardenability—Grades C90, T95, ~~and~~ C110, and C125

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9.10 Sulfide Stress Cracking (SSC) Test—Grades C90, T95, ~~and~~ C110, and C125

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NACE TM0177-2016 shall be used in conjunction with the requirements in 6.14 to determine the room temperature SSC resistance of Grades C90, T95, ~~and~~ C110, and C125 products.

9.10.2 Frequency of Testing

For Grades C90, T95, ~~and~~ C110, and C125, the level of resistance to SSC shall be evaluated with the requirements in 6.14 using one or more of the following as specified by the purchaser:

a) For Method A:

1) For Grades C90 and T95, one specimen per lot, as specified by 9.2, unless otherwise agreed. Also see requirements in A.18 (SR 46).

2) For Grades C110 and C125, three specimens per lot, as specified by 9.2, unless otherwise agreed. Specimens shall be taken from the ends of three different products selected from sublots composed of the front one-third, middle one-third, and back one-third of the lot.

3) By agreement between the purchaser and the manufacturer, the number of specimens for NACE Method A per lot can be modified as follows:

i) For Grades C90 and T95 may be increased up to three per lot.

ii) For Grade C110 may be reduced to one per lot with a qualified process control that is sufficient to ensure the product performance as described in 6.14.4.

b) For Method B:

1) For Grades C90 and T95, one sample per lot shall be tested, as specified by 9.2.

2) Samples shall be selected according to 9.10.4.

c) For Method D:

1) For Grades C90, T95, ~~and~~ C110, and C125, at least three valid specimens per lot, as specified by 9.2, taken from a single sample, shall be tested.

2) Samples shall be selected in accordance with 9.10.4.

9.10.3 Test Specimens—General

For Method A, standard NACE tensile test specimens [6.35 mm (0.250 in.)] shall be used, except where NACE subsize tensile specimens are required because of product dimensional constraints.
For Method D, standard DCB specimens [9.53 mm (0.375 in.)] shall be used, except where subsize DCB specimens are required because of product dimensional constraints.

When the outside diameter or wall thickness impedes the machining of subsize specimens, the manufacturer shall demonstrate that the chemical composition and processing manufacturing route used is documented to meet or exceed the minimum specified requirement on a larger OD and/or wall thickness product.

9.10.4 Test Specimens—Selection and Location

Where possible, based on product size and type of test specimen required, and unless otherwise specific by the purchaser, the SSC test specimens, for all test methods, shall be taken at mid-wall, from a length and end selected using one of the following criteria.

a) For all test methods, for Grades C90 and T95 a mean hardness of 24.4 HRC or higher, ~~or~~ for Grade C110 a mean hardness of 28.0 HRC or higher, or for C125 a mean hardness of 33.0 HRC or higher.

b) For all test methods, the highest mean hardness number based on preliminary hardness testing with a minimum of five lengths per lot and a frequency of not less than one length per 20 spaced uniformly in the sequence of the lot.

NOTE Preliminary hardness testing is intended to capture 5 % of the required hardness tests in order to expedite SSC testing; these lengths are part of the pipe required to be tested in 6.7.1.

c) For all test methods, specimens shall be taken from product representing the highest mean hardness for a particular lot. Or

d) For all test methods, when agreed upon by the purchaser, the manufacturer may use randomly selected samples provided prior documented validation test results or previous qualification of the manufacturing procedure (in accordance with NACE MR0175/ISO 15156) confirm that the manufacturing procedure results in products that meet the SSC requirements as described in 6.14.4.

Hardness data obtained on the SSC test specimens shall be for information only.

9.10.5 Retests—SSC Grades C90, T95, ~~and~~ C110, and C125

a) Grades C90 and T95: For Method A or Method B, retesting may be performed on two test specimens taken from an area of the product adjacent to where the initial failed test specimen was taken. If one or both of the retest specimens fails, the lot shall be rejected. Rejected lots may be re-heat treated and tested as new lots.

If retests conform to the requirements, the lot shall be accepted.
b) For Grades C110 and C125, Method A:

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9.10.7 Additional Testing Provisions for NACE TM0177-2016, Method D

Either non-pre-cracked or fatigue pre-cracked specimens may be used. If fatigue pre-cracking of specimens is employed, the maximum stress intensity factor during pre-cracking shall not exceed:
a) 29.7 MPa·$m^{1/2}$ (27.0 ksi·$in.^{1/2}$) for Grades C90 and T95; or

b) 20.4 MPa·$m^{1/2}$ (18.6 ksi·$in.^{1/2}$) for Grade C110.

The arm displacement values and maximum/minimum tolerances are shown in Table 19.

Table 19—Arm Displacement Values and Max/Min Tolerances

Grade	SI Units (+0.03mm / - 0.05mm)	USC Units (+0.001in / -0.002in)
C90	0.76mm	0.030 in
T95	0.71mm	0.028 in
C110	0.51mm	0.020 in
C125[1]	0.71mm	0.028 in
C125[2]	0.41mm	0.016 in

[1] For Method D tests on C125 conducted in Solution D (see 6.14.2)

[2] For Method D tests on C125 conducted in modified Solution B (see 6.14.2)

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9.13 Dimensional Testing

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9.13.4 Wall Thickness Measurement

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For Grades L80 13Cr, C90, T95, C110, C125, and Q125, wall thickness shall be measured over the full body, with a minimum coverage of 100 % of the surface area covered by the automatic system. The minimum measured wall thickness for each length shall be recorded. Traceability and/or reporting of each length is only required when specified in the purchase agreement.

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9.15 Nondestructive Examination

9.15.1 General

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For Grades C90, T95, ~~and~~ C110, and C125, the oblique angle inspected shall be stated on the certificate. In the case of material shipped directly to a processor from the seamless pipe mill, the pipe mill shall provide the processor documentation regarding the oblique angle to be inspected. The technical justification for the orientation shall be documented.

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9.15.9 Full-body, Full-length Nondestructive Examination of Casing and Tubing—Grades C90, T95, C110, C125, and Q125

9.15.9.1 Full-body, Full-length Nondestructive Examination of Casing and Tubing—Grades C90, T95, C110, C125, and Q125, Longitudinal and Transverse Inspection Requirements

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9.15.9.2 Full-body, Full-length Nondestructive Examination of Casing and Tubing—Grades C90, T95, ~~and~~ C110, and C125, Additional Oblique Inspection Requirements

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9.15.11 Nondestructive Examination of Coupling Stock (Except Grades L80 13Cr, C90, T95, C110, C125, and Q125), Accessory Material (Except Grades L80 13Cr, C90, T95, C110, C125, and Q125), and Pup Joints (All Grades)

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9.15.12 Nondestructive Examination of Coupling Stock and Accessory Material—Grades L80 13Cr, C90, T95, C110, C125, and Q125

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9.15.13 Untested Pipe Ends, Coupling Stock Ends, and Accessory Material Ends

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Grades C110 and C125 pipe, with the ends treated in accordance with 9.15.13 b), shall be inspected after end-finishing (and before coupling installation on threaded and coupled tubulars) using the wet magnetic particle method, or a method agreed upon between the purchaser and the manufacturer.

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10 Marking

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10.2 Stamp Marking Requirements

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10.2.1 Methods

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After stamp marking, Grades R95, L80, C90, T95, C110, C125, and Q125 products may require subsequent heat treatment as specified in 10.2.5. Such heat treatment shall be in accordance with 5.2. The sequence of stamp markings shall be as shown in Table C.43 or Table E.43.

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10.2.5 Grades R95, L80, C90, T95, C110, C125, and Q125

When specified in the purchase agreement, products shall be stamped by one or more of the methods in 10.2.1 at the option of the manufacturer. In addition, the following apply:

a) Products for Grades R95 and L80 shall be heat-treated subsequent to using method 2 in 10.2.1.

b) Products for Grades C90, T95, C110, C125, and Q125 shall be heat-treated subsequent to using methods 2 and 4 in 10.2.1, with the following exceptions:

1) when the stamp markings are removed by cropping or by grinding, machining, threading to a depth not less than twice the depth of the stamping;

2) by agreement between the purchaser and the manufacturer, the stamp marks may be left in the product.

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12 Documents

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12.3 Certification Content

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h) where impact testing is required by this standard, impact test results include the following: 1) acceptance test criteria;

2) size, location, and orientation of the test specimens;

3) nominal test temperature (i.e. actual test temperature);

4) absorbed energy measured for each test specimen;

5) average absorbed energy for each test; and

6) percent shear area for Grades C110 and C125 (see 6.3.3) and A.16 (SR 44) products.

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AnnexA
(normative)

Supplementary Requirements

A.1General

This annex describes supplementary requirements (SRs) that maybe specified by the purchase or agreed between the purchaser and the manufacturer. These requirements apply only when stated in the purchase agreement.

See Table A.1 for SRs applicable to couplings.

Table A.1—Supplementary Requirements Applicable to Couplings

Requirement	SR
Statistical impact testing	A.7 (SR 12)
Seal-ring couplings	A.8 (SR 13)
Statistical tensile testing, Grades C90, T95, ~~and~~ C110, and C125	A.10 (SR 38)
Alternative NACE TM0177-2016 Method D SSC test, Grade C110	A.11 (SR 39)
Yield strength, Grade Q125	A.15 (SR 43)
Charpy V-notch test properties (shear area) for Grades N80,L80 Type 1,L80 3Cr,C90,R95, T95, P110,and Q125	A.16 (SR 44)
Hardenability,minimum percentage martensite required for quenched and tempered products	A.17 (SR 45)
SSC test, Grades C90 and T95 (Method A of NACE TM0177-2016, 90 % Y_{Smin})	A.18 (SR 46)

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A.4 SR 9—Coupling Blanks—Grades C110, C125, and Q125

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A.10 SR 38—Statistical Tensile Testing—Grades C90, T95, ~~and~~ C110, and C125

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A.20 SR 48—NDE of Pipe Ends—All Grades Except C110 and C125 (9.15.13)

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AnnexC
(normative)

Tables in SI Units

Table C.1—API Casing List (Sizes, Masses, Wall Thickness, Grade, and Applicable End-finish)

Labels [a]		Outside Diameter	Nominal Linear Mass[b, c] T&C	Wall Thickness	Type of End-finish[d, e]								
1	**2**	*D* mm	kg/m	*t* mm	**H40**	**J55 K55**	**L80 R95**	**N80**	**C90 T95**	**C110**	**P110**	**C125**	**Q125**
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	~~*13*~~ *14*
4 1/2	9.50	114.30	14.38	5.21	PS	PS	—	—	—	—	—	—	—
4 1/2	10.50	114.30	15.73	5.69	—	PSB	—	—	—	—	—	—	—
4 1/2	11.60	114.30	17.38	6.35	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
4 1/2	13.50	114.30	19.87	7.37	—	—	PLB	PLB	PLB	P	PLB	P	—
4 1/2	15.10	114.30	22.69	8.56	—	—	—	—	—	—	PLB	—	PLB
5	11.50	127.00	17.19	5.59	—	PS	—	—	—	—	—	—	—
5	13.00	127.00	19.69	6.43	—	PSLB	—	—	—	—	—	—	—
5	15.00	127.00	22.69	7.52	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
5	18.00	127.00	27.19	9.19	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5	21.40	127.00	32.13	11.10	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5	23.20	127.00	34.76	12.14	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5	24.10	127.00	36.15	12.70	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5 1/2	14.00	139.70	20.91	6.20	PS	PS	—	—	—	—	—	—	—
5 1/2	15.50	139.70	23.48	6.98	—	PSLB	—	—	—	—	—	—	—
5 1/2	17.00	139.70	25.72	7.72	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
5 1/2	20.00	139.70	30.05	9.17	—	—	PLB	PLB	PLB	P	PLB	P	—
5 1/2	23.00	139.70	34.05	10.54	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5 1/2	26.80	139.70	40.15	12.70	—	—	—	—	P	P	—	P	—
5 1/2	29.70	139.70	44.47	14.27	—	—	—	—	P	P	—	P	—
5 1/2	32.60	139.70	48.74	15.88	—	—	—	—	P	P	—	P	—
5 1/2	35.30	139.70	52.80	17.45	—	—	—	—	P	P	—	P	—
5 1/2	38.00	139.70	56.82	19.05	—	—	—	—	P	P	—	P	—
5 1/2	40.50	139.70	60.64	20.62	—	—	—	—	P	P	—	P	—
5 1/2	43.10	139.70	64.41	22.22	—	—	—	—	P	P	—	P	—
6 5/8	20.00	168.28	29.76	7.32	PS	PSLB	—	—	—	—	—	—	—
6 5/8	24.00	168.28	35.72	8.94	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
6 5/8	28.00	168.28	41.67	10.59	—	—	PLB	PLB	PLB	P	PLB	P	—
6 5/8	32.00	168.28	47.62	12.06	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7	17.00	177.80	25.60	5.87	PS	—	—	—	—	—	—	—	—
7	20.00	177.80	29.91	6.91	PS	PS	—	—	—	—	—	—	—
7	23.00	177.80	34.67	8.05	—	PSLB	PLB	PLB	PLB	P	—	P	—
7	26.00	177.80	39.14	9.19	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
7	29.00	177.80	43.60	10.36	—	—	PLB	PLB	PLB	P	PLB	P	—
7	32.00	177.80	47.92	11.51	—	—	PLB	PLB	PLB	P	PLB	P	—
7	35.00	177.80	52.09	12.65	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7	38.00	177.80	56.10	13.72	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7	42.70	177.80	63.84	15.88	—	—	—	—	P	P	—	P	—
7	46.40	177.80	69.35	17.45	—	—	—	—	P	P	—	P	—
7	50.10	177.80	74.85	19.05	—	—	—	—	P	P	—	P	—
7	53.60	177.80	80.21	20.62	—	—	—	—	P	P	—	P	—
7	57.10	177.80	85.42	22.22	—	—	—	—	P	P	—	P	—

Table C.1—API Casing List (Sizes, Masses, Wall Thickness, Grade, and Applicable End-finish)

(continued)

Labels[a]		Outside Diameter	Nominal Linear Mass[b,c] T&C	Wall Thickness	Type of End-finish[d, e]								
1	2	*D* mm	kg/m	*t* mm	H40	J55K55	L80R95	N80	C90T95	C110	P110	C125	Q125
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*13 14*
7 5/8	24.00	193.68	35.72	7.62	PS	—	—	—	—	—	—	—	—
7 5/8	26.40	193.68	39.29	8.33	—	PSLB	PLB	PLB	PLB	P	—	P	—
7 5/8	29.70	193.68	44.20	9.52	—	—	PLB	PLB	PLB	P	PLB	P	—
7 5/8	33.70	193.68	50.15	10.92	—	—	PLB	PLB	PLB	P	PLB	P	—
7 5/8	39.00	193.68	58.04	12.70	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	42.80	193.68	63.69	14.27	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	45.30	193.68	67.41	15.11	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	47.10	193.68	70.09	15.88	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	51.20	193.68	76.19	17.45	—	—	—	—	P	P	—	P	—
7 5/8	55.30	193.68	82.30	19.05	—	—	—	—	P	P	—	P	—
7 3/4	46.10	196.85	68.60	15.11	—	—	P	P	P	P	P	P	P
8 5/8	24.00	219.08	35.72	6.71	—	PS	—	—	—	—	—	—	—
8 5/8	28.00	219.08	41.67	7.72	PS	—	—	—	—	—	—	—	—
8 5/8	32.00	219.08	47.62	8.94	PS	PSLB	—	—	—	—	—	—	—
8 5/8	36.00	219.08	53.57	10.16	—	PSLB	PLB	PLB	PLB	P	—	P	—
8 5/8	40.00	219.08	59.53	11.43	—	—	PLB	PLB	PLB	P	PLB	P	—
8 5/8	44.00	219.08	65.48	12.70	—	—	PLB	PLB	PLB	P	PLB	P	—
8 5/8	49.00	219.08	72.92	14.15	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	32.30	244.48	48.07	7.92	PS	—	—	—	—	—	—	—	—
9 5/8	36.00	244.48	53.57	8.94	PS	PSLB	—	—	—	—	—	—	—
9 5/8	40.00	244.48	59.53	10.03	—	PSLB	PLB	PLB	PLB	P	—	P	—
9 5/8	43.50	244.48	64.73	11.05	—	—	PLB	PLB	PLB	P	PLB	P	—
9 5/8	47.00	244.48	69.94	11.99	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	53.50	244.48	79.62	13.84	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	58.40	244.48	86.91	15.11	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	59.40	244.48	88.40	15.47	—	—	—	—	P	P	—	P	—
9 5/8	64.90	244.48	96.58	17.07	—	—	—	—	P	P	—	P	—
9 5/8	70.30	244.48	104.62	18.64	—	—	—	—	P	P	—	P	—
9 5/8	75.60	244.48	112.50	20.24	—	—	—	—	P	P	—	P	—
10 3/4	32.75	273.05	48.74	7.09	PS	—	—	—	—	—	—	—	—
10 3/4	40.50	273.05	60.27	8.89	PS	PSB	—	—	—	—	—	—	—
10 3/4	45.50	273.05	67.71	10.16	—	PSB	—	—	—	—	—	—	—
10 3/4	51.00	273.05	75.90	11.43	—	PSB	PSB	PSB	PSB	P	PSB	P	—
10 3/4	55.50	273.05	82.59	12.57	—	—	PSB	PSB	PSB	P	PSB	P	—
10 3/4	60.70	273.05	90.33	13.84	—	—	—	—	PSB	P	PSB	P	PSB
10 3/4	65.70	273.05	97.77	15.11	—	—	—	—	PSB	P	PSB	P	PSB
10 3/4	73.20	273.05	108.93	17.07	—	—	—	—	P	P	—	P	—
10 3/4	79.20	273.05	117.86	18.64	—	—	—	—	P	P	—	P	—
10 3/4	85.30	273.05	126.94	20.24	—	—	—	—	P	P	—	P	—
11 3/4	42.00	298.45	62.50	8.46	PS	—	—	—	—	—	—	—	—
11 3/4	47.00	298.45	69.94	9.53	—	PSB	—	—	—	—	—	—	—
11 3/4	54.00	298.45	80.36	11.05	—	PSB	—	—	—	—	—	—	—
11 3/4	60.00	298.45	89.29	12.42	—	PSB	PSB	PSB	PSB	P	PSB	P	PSB
11 3/4	65.00	298.45	96.73	13.56	—	—	P	P	P	P	P	P	P
11 3/4	71.00	298.45	105.66	14.78	—	—	P	P	P	P	P	P	P

Table C.1—API Casing List (Sizes, Masses, Wall Thickness, Grade, and Applicable End-finish)
(continued)

Labels[a]		Outside Diameter	Nominal Linear Mass[b, c] T&C	Wall Thickness		Type of End-finish[d, e]							
1	2	*D* mm	kg/m	t mm	H40	J55K55	L80R95	N80	C90T95	C110	P110	C125	Q125
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*~~13~~ ~~14~~*
13 3/8	48.00	339.72	71.43	8.38	PS	—	—	—	—	—	—	—	—
13 3/8	54.50	339.72	81.10	9.65	—	PSB	—	—	—	—	—	—	—
13 3/8	61.00	339.72	90.78	10.92	—	PSB	—	—	—	—	—	—	—
13 3/8	68.00	339.72	101.19	12.19	—	PSB	PSB	PSB	PSB	P	PSB	P	—
13 3/8	72.00	339.72	107.15	13.06	—	—	PSB	PSB	PSB	P	PSB	P	PSB
16	65.00	406.40	96.73	9.53	PS	—	—	—	—	—	—	—	—
16	75.00	406.40	111.61	11.13	—	PSB	—	—	—	—	—	—	—
16	84.00	406.40	125.01	12.57	—	PSB	—	—	—	—	—	—	—
16	109.00	406.40	162.21	16.66	—	P	P	P	—	—	P	—	P
18 5/8	87.50	473.08	130.21	11.05	PS	PSB	—	—	—	—	—	—	—
20	94.00	508.00	139.89	11.13	PSL	PSLB	—	—	—	—	—	—	—
20	106.50	508.00	158.49	12.70	—	PSLB	—	—	—	—	—	—	—
20	133.00	508.00	197.93	16.13	—	PSLB	—	—	—	—	—	—	—

NOTEB = buttress thread;L = long round thread;P =plain-end;S =shortround thread;T&C= threaded and coupled.

a Labels are for information and assistance in ordering.
b Nominal linear masses(column 4)are shown for information only.
C The densities of martensitic chromium steels (L80 Types 9Cr and 13Cr) are different from carbon steels. The masses shown are therefore not accurate for martensitic chromium steels. A mass correction factor of 0.989 may be used.
d Buttress casing is available with regular, special clearance couplings or special clearance couplings with special bevel.
e For casing with S, L, B connections, intermediate wall thicknesses are allowed in accordance with4.2.3 and 7.2 and API5B.

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Table C.3—Process of Manufacture and Heat Treatment

Grade	Type	Manufacturing Process [a]	Heat Treatment [e]	Tempering Temperature °C min
1	*2*	*3*	*4*	*5*
H40	—	S or EW	—	—
J55 [i]	—	S or EW	— [b]	—
K55	—	S or EW	— [b]	—
N80	1 [i]	S or EW	[c]	—
N80	Q	S or EW	Q [d]	—
R95 [i]	—	S or EW	Q	538
L80	1	S or EW	Q	566
L80	3Cr	S	Q	566
L80	9Cr [i]	S	Q [f]	593
L80	13Cr	S	Q [f]	593[j]
C90	—	S	Q	621
T95	—	S	Q	649
C110	—	S	Q	649
P110	—	S or EW [g, h]	Q	—
C125	—	S	Q	649
Q125	—	S or EW [h]	Q	—

[a] S = seamless process; EW = electric-welded process.

[b] Full-body, full-length normalized, normalized and tempered or quenched and tempered at the manufacturer's option or as specified in the purchase agreement (see 6.2.2).

[c] Full-body, full-length heat treatment is mandatory; At the manufacturer's option either normalized or normalized and tempered.

[d] Includes the method of interrupted quenching followed by controlled cooling.

[e] Q = quenched and tempered.

[f] Type 9Cr and 13Cr may be air-quenched.

[g] Special chemical requirements for electric-welded P110 pipe are specified in Table C.4.

[h] Products shall be heat-treated full-body, full-length; Special requirements unique to electric-welded P110 and Q125 are specified in A.6 (SR 11).

[i] Quenched and tempered product in large D/t ratio combinations and non-quenched and tempered product may exhibit ductile rupture values lower than internal yield values; See API 5C3/ISO 10400 calculated performance values in Columns 15 and 18 in Table K.1 and Table L.1.

j See 6.2.3

Table C.4—Chemical Composition, Mass Fraction (%)

Grade	Type	C		Mn		Mo		Cr		Nb	Ni	Cu	P	S	Si
		min	max	min	max	min	max	min	max	max	max	max	max	max	max
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
H40	—	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
J55	—	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
K55	—	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
N80	1	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
N80	Q	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
R95	—	—	0.45 c	—	1.90	—	—	—	—	—	—	—	0.030	0.030	0.45
L80	1	—	0.43 a	—	1.90	—	—	—	1.50	—	0.25	0.35	0.030	0.030	0.45
L80	3Cr	—	0.30	—	1.20	—	—	2.50	3.90	0.30	0.25	0.35	0.020	0.010	0.45
L80	9Cr	—	0.15	0.30	0.60	0.90	1.10	8.00	10.0	—	0.50	0.25	0.020	0.010	1.00
L80	13 Cr	0.15	0.22	0.25	1.00	—	—	12.0	14.0	—	0.50	0.25	0.020	0.010	1.00
C90	—	—	0.35	—	1.20	0.25 b	0.85	—	1.50	—	0.99	—	0.020	0.010	—
T95	—	—	0.35	—	1.20	0.25 d	0.85	0.40	1.50	—	0.99	—	0.020	0.010	—
C110	—	—	0.35	—	1.20	0.25	1.00	0.40	1.50	—	0.99	—	0.020	0.005	—
P110	—	—	—	—	—	—	—	—	—	—	—	—	0.030 e	0.030 e	—
C125	—	—	0.45	—	1.00	0.50	1.75	0.40	1.50	—	0.99	—	0.020	0.005	—
Q125	—	—	0.35	—	1.35	—	0.85	—	1.50	—	—	—	0.020	0.010	—

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Table C.5—Tensile and Hardness Requirements

Grade	Type	Total Elongation Under Load %	Yield Strength MPa		Tensile Strength min MPa	Hardness [a,c] max		Specified Wall Thickness	Allowable Hardness Variation [b]
			min	max		HRC	HBW	mm	HRC
1	2	3	4	5	6	7	8	9	10
C110	—	0.7	758	828	793	29.0	279	≤12.70	3.0
								12.71 to 19.04	4.0
								19.05 to 25.39	5.0
								≥ 25.40	6.0
C125	—	0.75	862	931	896	34.0	319	≤12.70	3.0
								12.71 to 19.04	4.0
								19.05 to 25.39	5.0
								≥ 25.40	6.0
P110	—	0.6	758	965	862	—	—	—	—
Q125	—	0.65	862	1034	931	[b]	—	≤12.70	3.0
								12.71 to 19.04	4.0
								≥19.05	5.0

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

[b] No hardness limits are specified, but the maximum variation is restricted as a manufacturing control in accordance with 7.8 and 7.9.

[c] For through-wall hardness tests of Grades L80, C90, T95 ~~and~~ C110, and C125, the requirements stated in HRC scale are for maximum mean hardness number.

Table C.6—Elongation Table

Tensile Test Specimen				Minimum Elongation in 50.8 mm%								
				Grade								
				H40	J55	K55 L80	N80 C90	R95 T95	C110	P110	C125	Q125
Specimen Area mm2	Specified Wall Thickness mm			Specified Minimum Tensile Strength MPa								
	Specimen Width 19 mm	Specimen Width 25 mm	Specimen Width 38 mm	414	517	655	689	724	793	862	896	931
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*~~12~~ 13*
490	≥ 25.53	≥ 19.41	≥ 12.77	30	24	20	19	18	16	15	15	14
480	25.00–25.52	19.00–19.40	12.51–12.76	29	24	19	19	18	16	15	15	14
470	24.48–24.99	18.61–18.99	12.24–12.50	29	24	19	19	18	16	15	15	14
460	23.95–24.47	18.20–18.60	11.98–12.23	29	24	19	18	18	16	15	15	14
450	23.43–23.94	17.81–18.19	11.72–11.97	29	24	19	18	18	16	15	15	14
440	22.90–23.42	17.40–17.80	11.45–11.71	29	24	19	18	18	16	15	14	14
430	22.37–22.89	17.01–17.39	11.19–11.44	29	24	19	18	17	16	15	14	14
420	21.85–22.36	16.60–17.00	10.93–11.18	29	23	19	18	17	16	15	14	14
410	21.32–21.84	16.21–16.59	10.66–10.92	29	23	19	18	17	16	15	14	14
400	20.79–21.31	15.80–16.20	10.40–10.65	28	23	19	18	17	16	15	14	14
390	20.27–20.78	15.41–15.79	10.14–10.39	28	23	19	18	17	16	15	14	14
380	19.74–20.26	15.00–15.40	9.87–10.13	28	23	19	18	17	16	15	14	14
370	19.22–19.73	14.61–14.99	9.61–9.86	28	23	19	18	17	16	14	14	13
360	18.69–19.21	14.20–14.60	9.35–9.60	28	23	18	18	17	16	14	14	13
350	18.16–18.68	13.81–14.19	9.08–9.34	28	23	18	17	17	15	14	14	13
340	17.64–18.15	13.40–13.80	8.82–9.07	28	23	18	17	17	15	14	14	13
330	17.11–17.63	13.01–13.39	8.56–8.81	27	22	18	17	17	15	14	14	13
320	16.58–17.10	12.60–13.00	8.29–8.55	27	22	18	17	16	15	14	14	13
310	16.06–16.57	12.21–12.59	8.03–8.28	27	22	18	17	16	15	14	13	13
300	15.53–16.05	11.80–12.20	7.77–8.02	27	22	18	17	16	15	14	13	13
290	15.01–15.52	11.41–11.79	7.51–7.76	27	22	18	17	16	15	14	13	13
280	14.48–15.00	11.00–11.40	7.24–7.50	26	22	18	17	16	15	14	13	13
270	13.95–14.47	10.61–10.99	6.98–7.23	26	22	17	17	16	15	14	13	13
260	13.43-13.94	10.20–10.60	6.72–6.97	26	21	17	16	16	15	13	13	13
250	12.90–13.42	9.81–10.19	6.45–6.71	26	21	17	16	16	14	13	13	12
240	12.37–12.89	9.40–9.80	6.19–6.44	26	21	17	16	16	14	13	13	12
230	11.85–12.36	9.01–9.39	5.93–6.18	25	21	17	16	15	14	13	13	12
220	11.32–11.84	8.60–9.00	5.66–5.92	25	21	17	16	15	14	13	13	12
210	10.79–11.31	8.21–8.59	5.40–5.65	25	20	17	16	15	14	13	12	12
200	10.27–10.78	7.80–8.20	5.14–5.39	25	20	16	16	15	14	13	12	12
190	9.74–10.26	7.41–7.79	4.87–5.13	24	20	16	15	15	14	13	12	12
180	9.22–9.73	7.00–7.40	4.61–4.86	24	20	16	15	15	13	13	12	12
170	8.69–9.21	6.61–6.99	4.35–4.60	24	20	16	15	14	13	12	12	12

Table C.6—Elongation Table (continued)

Tensile Test Specimen				Minimum Elongation in 50.8 mm%								
				Grade								
				H40	J55	K55 L80	N80 C90	R95 T95	C110	P110	C125	Q125
Specimen Area mm2	Specified Wall Thickness mm			Specified Minimum Tensile Strength MPa								
	Specimen Width 19 mm	Specimen Width 25 mm	Specimen Width 38 mm	414	517	655	689	724	793	862	896	931
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*~~12~~ 13*
160	8.16–8.68	6.20–6.60	4.08–4.34	24	19	16	15	14	13	12	12	11
150	7.64–8.15	5.81–6.19	3.82–4.07	23	19	15	15	14	13	12	12	11
140	7.11–7.63	5.40–5.80	3.56–3.81	23	19	15	15	14	13	12	11	11
130	6.58–7.10	5.01–5.39	3.29–3.55	23	19	15	14	14	13	12	11	11
120	6.06–6.57	4.60–5.00	3.03–3.28	22	18	15	14	14	12	12	11	11
110	5.53–6.05	4.21–4.59	2.77–3.02	22	18	15	14	13	12	11	11	11
100	5.01–5.52	3.80–4.20	2.51–2.76	22	18	14	14	13	12	11	11	10
90	4.48–5.00	3.41–3.79	2.24–2.50	21	17	14	13	13	12	11	11	10
80	3.95–4.47	3.00–3.40	1.98–2.23	21	17	14	13	12	11	11	10	10
70	3.43–3.94	2.61–2.99	1.72–1.97	20	16	13	13	12	11	10	10	9.5
60	2.90–3.42	2.20–2.60	1.45–1.71	19	16	13	12	12	11	10	9.5	9.5
50	2.37–2.89	1.81–2.19	1.19–1.44	19	15	12	12	11	10	9.5	9.5	9

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Table C.12 — Minimum Absorbed Energy for Couplings, Coupling Stock, Coupling Material, and Coupling Blanks – Transverse Orientation (Joules)

Critical Thickness (mm)	L80 [a, b, c, d, e]	N80 [a, b, c, d]	C90 [a, b, c, d]	R95/T95 [a, b, c, d]	P110 [a, b, c, d]	C110 [a, b, c, d]	C125 [a, b, c, d]	Q125 [a, b, c, d]
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*~~8~~ 9*
≤ 12.7	27	27	27	27	27	27	30	34
15.2	27	27	27	27	30	27	30	34
17.8	27	27	27	27	32	28	31	35
20.3	27	28	27	27	35	30	34	38
22.9	27	30	29	30	38	33	37	41
25.4	28	32	31	32	41	35	40	44
27.9	30	35	33	35	44	38	43	47
30.5	32	37	35	37	47	40	45	50
33.0	34	39	37	39	50	43	48	53
35.6	36	41	39	41	53	45	51	56
38.1	38	44	42	44	56	48	54	60
40.6	40	46	44	46	58	50	56	63
43.2	42	48	46	48	61	53	60	66
45.7	44	50	48	50	64	55	62	69
48.3	46	53	50	53	67	58	65	72
50.8	48	55	53	55	70	60	68	75
53.3	49	57	55	57	73	62	70	78
55.9	51	60	57	60	76	65	73	81
58.4	53	62	59	62	79	67	76	84
61.0	55	64	61	64	82	70	79	87
63.5	57	66	63	66	84	72	81	90

[a] Values given are full size, average minimums; Refer to 6.3.1 for individual minimum values)).

[b] If transverse specimens of ½ size cannot be taken, refer to 9.7.1.

[c] For wall thicknesses not listed, the manufacturer has the option to utilize the applicable formula in accordance with 6.4.4 or the next higher wall in this table.

[d] For all grades except L80 13 Cr, wall thickness greater than 63.5 mm, refer to 4.2.1 or 4.3.1 or 4.4.3.

[e] For grade L80 13 Cr, wall thickness greater than 35.6 mm, refer to 4.2.1 or 4.3.1 or 4.4.3.

Table C.13 — Minimum Absorbed Energy for Couplings, Coupling Stock, Coupling Material, and Coupling Blanks – Longitudinal Orientation (Joules)

L80	N80	C90	R95 / T95	P110	C110	C125	Q125
1	2	3	4	5	6	8	~~7~~ 8
54	40	54	54	54	54	54	54

NOTE 1 Values given are full size, average minimums (Refer to 6.3.1 for individual minimum values).

NOTE 2 Longitudinal testing is only required if transverse testing is not possible. Coupling, coupling stock tested in the transverse direction does not need to be tested or demonstrate compliance to these values.

Table C.14 — Minimum Absorbed Energy for Pipe – Transverse Orientation (Joules)

Wall Thickness (mm)	L80 [a, b, c, d, e]	N80 [a, b, c, d]	C90 [a, b, c, d]	R95/T95 [a, b, c, d]	P110 [a, b, c, d]	C110 [a, b, c, d]	C125 [a, b, c, d]	Q125 [a, b, c, d]
1	*2*	*3*	*4*	*5*	*6*	*7*	8	~~*8*~~ *9*
≤ 17.8	20	20	20	20	27	27	31	34
20.3	20	20	23	24	28	30	34	38
22.9	22	22	25	26	30	33	37	41
25.4	23	23	26	28	32	35	39	44
27.9	25	25	28	30	35	38	43	47
30.5	27	27	30	32	37	40	45	50
33.0	28	28	32	34	39	43	48	53
35.6	30	30	34	36	41	45	51	56
38.1	32	32	36	38	44	48	54	60
40.6	33	33	38	40	46	50	56	63
43.2	35	35	39	42	48	53	60	66
45.7	37	37	41	44	50	55	62	69
48.3	38	38	43	46	53	58	65	72
50.8	40	40	45	48	55	60	67	75
53.3	42	42	47	49	57	62	70	78
55.9	43	43	49	51	60	65	73	81
58.4	45	45	51	53	62	67	75	84
61.0	47	47	52	55	64	70	79	87
63.5	48	48	54	57	66	72	81	90

a Values given are full size, average minimums (Refer to 6.3.1 for individual minimum values)).

b If transverse specimens of ½ size cannot be taken, refer to 9.7.1.

c For wall thicknesses not listed, the manufacturer has the option to utilize applicable formula in accordance with 6.5.2 and 6.5.3 or the next higher wall in this table.

d For all grades except L80 13 Cr, wall thickness greater than 63.5 mm, refer to 4.2.1 or 4.3.1 or 4.4.3.

e For grade L80 13 Cr, wall thickness greater than 35.6 mm, refer to 4.2.1 or 4.3.1 or 4.4.3.

Table C.15 — Minimum Absorbed Energy for Pipe – Longitudinal Orientation (Joules)

L80	N80	C90	R95 / T95	P110	C110	C125	Q125
1	2	3	4	5	6	8	~~7~~ 8
40	40	40	40	52	54	54	54

NOTE 1 Values given are full size, average minimums (Refer to 6.3.1 for individual minimum values)

NOTE 2 Longitudinal testing is only required if transverse testing is not possible. Pipe tested in the transverse direction does not need to be tested or demonstrate conformance to these values.

Table C.16 — Frequency of Charpy V-Notch Testing —Pipe, Coupling Stock, Coupling Material, Coupling Blanks, Couplings, and Accessory Material

Grade	Label 1	Number of Tests per Lot			
		Pipe	Coupling Stock / Material	Coupling Blanks / Couplings	Accessory Material
1	*2*	*3*	*4*	*5*	*6*
H40	All sizes	[d]	[d]	[d]	[d]
K55, J55	All sizes	N/A	1	1	1[b]
N80, R95	All sizes	1[a]	1	1	1[b]
L80	All sizes	1[a]	1	1	1[b]
C90, T95	All sizes	1[a]	1	1	1[b]
C110	All sizes	1	1	1	1
P110	All sizes	1[a]	1	1	1[b]
C125	All sizes	1	1	1	1
Q125 [c]	All sizes	3 [c]	Each length [c]	1	Each length [c]

[a] Testing is not mandatory when qualified by a documented procedure, see 6.5.5 for mandatory requirements.

[b] When required in 6.6.

[c] Refer to 9.7.10 for requirements.

[d] See A.9 (SR 16) when specified

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Table C.25—Maximum Permissible Depth of Linear Imperfections

Grade	Depth as % of Specified Wall Thickness	
	External Imperfections	Internal Imperfections
H40 – J55 – K55 – N80Q – L80 – R95 [P110 to A.9 (SR 16)]	12.5 %	12.5 %
N80 Type 1	10 %	10 %
C90 – T95 – C110 – P110 – C125 – Q125	5 %	5 %
[P110 to A.9 (SR 16) and A.3 (SR 2)]	5 %	5 %

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Table C.31—Permissible Depth of External Imperfections on Coupling

Coupling for Label 1		Grades H40, J55, K55, N80, R95, L80, and P110		Grades C90, T95, C110, C125, and Q125
		Pits and Round-bottom Gouges mm	Grip Marks and Sharp-bottom Gouges mm	Pits, Round-bottom Gouges, Sharp-bottom Gouges, Grip Marks mm
1	*2*	*3*	*4*	*5*
Tubing	< 3 1/2	0.76	0.64	0.76
	≥ 3 1/2 to ≤ 4 1/2	1.14	0.76	0.89
Casing [a]	< 6 5/8	0.89	0.76	0.76
	≥ 6 5/8 to ≤ 7 5/8	1.14	1.02	0.89
	>7 5/8	1.52	1.02	0.89

[a] Includes casing used as tubing.

Table C.32—Frequency of Tensile Tests—Casing and Tubing

Grade [e]	Label 1	Maximum Number of Pieces in a Lot	Number of Tests	
			per Lot	per Heat
1	*2*	*3*	*4*	*5*
H40, K55, J55, N80	< 6 5/8	400 [a, b]	1	1
	≥ 6 5/8	200 [a, b]	1	1
R95	≤ 4 1/2	200 [a, b]	2 [c]	1
	> 4 1/2	100 [a, b]	2 [c]	1
L80 Type 1, L80 3Cr	≤ 4 1/2	200 [a, b]	2 [c]	1
L80 9Cr, L80 13Cr	≤ 4 1/2	200 [b, d]	2 [c]	—
C90, T95	≤ 4 1/2	200 [b, d]	1	—
L80 Type 1, L80 3Cr	> 4 1/2	100 [a, b]	2 [c]	1
L80 9Cr, L80 13Cr	> 4 1/2	100 [b, d]	2 [c]	—
C90, T95	> 4 1/2	100 [b, d]	1	—
C110	All sizes	100 [b, d]	1	—
P110	< 6 5/8	200 [a, b]	1	1
	≥ 6 5/8	100 [a, b]	1	1
C125	All sizes	100 [b, d]	1	—
Q125	All sizes	— [d]	3 [c]	—

NOTE Table includes casing used as tubing.

[a] See 9.2.1.
[b] See 9.4.2.
[c] See 9.4.3.
[d] See 9.2.2.
[e] For all grades except Grade Q125 multiple-length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length, provided the pipe receives no additional heat treatment after being cut into individual lengths.

Table C.33—Frequency of Tensile Tests—Coupling Stock, Coupling Material, and Coupling Blanks

Grade	Material	Condition when Heat-treated	Maximum Number of Pieces in a Lot	Number of Tests	
				per Lot	per Heat
1	2	3	4	5	6
H40, J55, K55, N80, and P110	Coupling stock and coupling material	Coupling stock and coupling material for pipe ≤ Label 1: 4 1/2	200 [a]	1	1 [b]
		Coupling stock and coupling material for pipe > Label 1: 4 1/2	100 [a]	1	1 [b]
		Coupling blank	400 [c]	1	—
	Hot forging	Coupling blank	400 [c]	1	—
R95, L80 Type 1, L80 3Cr	Coupling stock and coupling material	Coupling stock and coupling material for pipe ≤ Label 1: 4 1/2	200 [a]	2 [d, e]	2 [d, e]
		Coupling stock and coupling material for pipe > Label 1: 4 1/2	100 [a]	2 [d, e]	2 [d, e]
		Coupling blank	400 [c]	2 [e]	—
	Hot forging	Coupling blank	400 [c]	2 [e]	—
L80 9Cr and L80 13Cr	Coupling stock and coupling material	Coupling stock and coupling material for pipe ≤ Label 1: 4 1/2	200 [d]	2 [d, e]	—
		Coupling stock and coupling material for pipe > Label 1: 4 1/2	100 [d]	2 [d, e]	—
		Coupling blank	400 [c]	2 [e]	—
	Hot forging	Coupling blank	400 [c]	2 [e]	—
C90 and T95	Coupling stock and coupling material	Coupling stock and coupling material for pipe Label 1: All sizes	1 [b]	1	—
		Coupling blank	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
	Hot forging	Coupling blank	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
C110, C125, and Q125	Coupling stock and coupling material	Coupling stock and coupling material for pipe Label 1: All sizes	1 [b]	1	—
		Coupling blank	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—

[a] See 9.2.1.

[b] Approximately 50 % from each end.

[c] See 9.2.3.

[d] See 9.2.2.

[e] When more than one test is required, the test specimens shall be from different lengths, except for a single piece lot where the test specimens may be taken from both ends of one length.

Table C.34—Frequency of Tensile Testing—Pup Joints and Accessory Material

Grade	Material and Heat Treatment Conditions [a]		Maximum Number of Pieces in a Lot	Number of Tests	
				per Lot	per Heat
1	*2*	*3*	*4*	*5*	*6*
H40, J55, K55, N80	Full-length standard tubing or casing from one or more heats		Label 1: < 6 5/8: 400 Label 1: ≥ 6 5/8: 200	1	1
P110	Full-length standard tubing or casing from one or more heats		Label 1: < 6 5/8: 200 Label 1: ≥ 6 5/8: 100	1	1
H40, J55, K55, N80, P110	Thick-wall mechanical tube or bar stock from a single heat		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	1	1
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	100 pup joints or 400 accessory material	1	—
		Heat-treated in sequential loads or continuous heat treatment	In accordance with 9.2.3	1	—
R95, L80 Type 1, L80 3Cr	Full-length standard tubing or casing from one or more heats		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	2 [a, b]
	Thick-wall mechanical tube or bar stock from a single heat		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	2 [a, b]
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	100 pup joints or 400 accessory material	2 [b]	—
		Heat-treated in sequential loads or continuous heat treatment	In accordance with 9.2.3	2 [b]	—
L80 9Cr, L80 13Cr	Full-length standard tubing or casing from one or more heats		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	—
	Thick-wall mechanical tube or bar stock from a single heat		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	—
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	100 pup joints or 400 accessory material	2 [b]	—
		Heat-treated in sequential loads or continuous heat treatment	In accordance with 9.2.3	2 [b]	—
C90 and T95	Full-length standard tubing or casing from one or more heats		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	1	—
	Thick-wall mechanical tube or bar stock from a single heat		1	1 [a]	—
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
		Heat-treated in sequential loads or continuous heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
C110, C125, and Q125	Full-length standard tubing or casing from one or more heats		In accordance with 9.2.3	3 [a, b]	—
	Thick-wall mechanical tube or bar stock from a single heat		1	1 [a]	—
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
		Heat-treated in sequential loads or continuous heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—

[a] Approximately 50 % from each end.

[b] When more than one test is required, the test specimens shall be from different lengths, except for a single piece lot where the test specimens may be taken from both ends of one length.

[c] Each lot shall be from the same heat of steel for Grades L80 9Cr, L80 13Cr, C90, T95, C110, and Q125; See 9.2.3.

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Table C.35—Frequency of Hardness Testing (Continued)

Grade	Material		Number of Tests per Lot	Maximum Number of Pieces in a Lot	Type of Test	Location
1	*2*		*3*	*4*	*5*	*6*
C110, C125	As-quenched product		1	Each production run or heat treatment practice	Through-wall, 4 quadrants	Design area of greatest thickness
	Non-upset pipe		2	One from each end	Through-wall, 1 quadrant	Each end of each piece
	Coupling blanks, coupling stock, coupling material, pup joints and accessory material	Tube length heat treatment	2 [a]	Each length	Through-wall, 4 quadrants	One from each end
		Individual heat treatment	1	Each piece	Surface—HRC or HBW	Each piece
			1	Label 1: < 9 $^{5}/_{8}$: 50 [c] Label 1: ≥ 9 $^{5}/_{8}$: 30 [c]	Through-wall, 4 quadrants	From a piece with the highest surface hardness number in the lot
Q125	Casing		3 [a]	Lot (see 9.2) [b, c]	Through-wall, 1 quadrant	Pipe body
	Coupling blanks, coupling stock, coupling material, pup joints and accessory material	Tube length heat treatment	1	Each length	Through-wall, 1 quadrant	Approximately 50 % from each end
		Individual heat treatment	1	Each piece	Surface—HRC or HBW	Each piece
			1	Label 1: < 9 $^{5}/_{8}$: 50 [c] Label 1: ≥ 9 $^{5}/_{8}$: 30 [c]	Through-wall, 1 quadrant	Randomly selected piece

[a] When more than one test is required, the test specimens shall be from different lengths, except for a single piece lot where the test specimens may be taken from both ends of one length.

[b] The lengths tested shall be selected randomly and represent the start and end of the heat treatment cycle.

[c] Each lot shall be from the same heat of steel for Grades L80 9Cr, L80 13Cr, C90, T95, and Q125.

[d] One upset approximately 50 % from each end if both ends are upset.

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Table C.37—Summary of NDE Methods for Seamless Pipe, Coupling Stock, Body of Welded Pipe, and Accessory Material (In Accordance with 9.15.9 and 9.15.11)

Product	Grade	Visual inspection (see 10.14)	Wall Thickness Verification	Ultrasonic Inspection	Flux Leakage Inspection	Eddy Current Inspection	Magnetic Particle Inspection [a]
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Pipe and accessory material	H40, J55, K55	R	N	N	N	N	N
	N80, L80, R95	R	R	A	A	A	A
	P110	R	R	A	A	A	NA
	Q125	R	R	C	B	B	B
Pipe	C90, T95, C110, C125	R	R	C (A) [b]	B (A) [b]	B (A) [b]	B (NA) [b]
Accessory Material	C90, T95, C110, C125	R	R	C (A) [b]	B (A) [b]	B (A) [b]	B (A) [b]
Coupling stock	H40, J55, K55	R	NA	N	N	N	N
	N80, L80, R95, P110, C90, T95, C110, C125, Q125	R	R	A	A	A	A

N = Not required
R = Required
A = One method or any combination of methods shall be used
B = At least one method shall be used in addition to ultrasonic inspection to inspect on the outside surface
C = Ultrasonic inspection shall be used to inspect the outside and inside surface
NA = Not applicable

[a] MPI is permitted for end-area inspection. MPI is permitted for pipe-body outside-surface inspection in combination with other methods of pipe body inspection. MPI is permitted for coupling stock outside surface inspection and coupling stock oblique inspection. Coupling stock receiving full-length MPI does not require full-length wall thickness verification, however, mechanical wall thickness measurement of each end is required; MPI is permitted for the pipe OD and ID when inspected on the ends of the pipe un-inspected area.

[b] Values in parenthesis () are specigic to oblique angled defects.

Table C.38—Acceptance (Inspection) Levels

Material	Grade		External imperfections			Internal imperfections		
			Longitudinal	Transverse	Oblique	Longitudinal	Transverse	Oblique
1	*2*		*3*	*4*	*5*	*6*	*7*	*8*
Pipe body [a]	N80 Type 1		L3	—	—	L3	—	—
	N80Q, L80, R95		L4	—	—	L4	—	—
	[P110 to A.9 (SR 16)]		L4	L4	—	L4	L4	—
	P110		L2	L2	—	L2	L2	—
	[P110 to A.9 (SR 16) and A.3 (SR 2)]		L2	L2	—	L2	L2	—
	Q125	UT	L2	L2	—	L2	L2	—
		Second method	L2	L2	—	—	—	—
	C90, T95, C110, C125	UT	L2	L2	L2 [b]	L2	L2	L2 [b]
		Second method	L2	L2	—	—	—	—
Coupling stock	All grades except C90, T95, ~~and~~ C110, and C125		L2	L2	—	N	N	—
	C90 and T95		L2	L2	L2	N	N	N
	C110, C125		L2	L2	L2	L3	L3	L3
Weld seam	P110, Q125		L2	N	—	L2	N	—
	All other grades		L3	N	—	L3	N	—
	All other grades to A.3 (SR 2)		L2	N	—	L2	N	—

N = not required; L*x* = acceptance (inspection) level.

[a] Accessory material shall be treated as pipe body.

[b] Flux leakage inspection or eddy current inspection may be used as alternative NDE methods for oblique inspection for pipe body; flux leakage inspection, eddy current inspection, or magnetic particle inspection may be used as alternative NDE methods for oblique inspection for accessory material.

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Table C.41—Grade Color Codes

Grade	Grade Type	Number and Color of Bands for Product [a] with Length ≥ 1.8 m	Color(s) for Couplings	
			Entire Coupling	Band(s) [b, c]
1	2	3	4	5
H40	—	None or black band at the manufacturer's option	None	Same as for pipe
J55 Tubing	—	One bright green	Bright green	None
J55 Casing	—	One bright green	Bright green	One white
K55	—	Two bright green	Bright green	None
N80	1	One red	Red	None
N80	Q	One red, one bright green	Red	Green
R95	—	One brown	Brown	None
L80	1	One red, one brown	Red	One brown
L80	3Cr	One red, one white	Red[d]	One white
L80	9Cr	One red, one brown, two yellow	None	Two yellow
L80	13Cr	One red, one brown, one yellow	None	One yellow
C90	—	One purple	Purple	None
T95	—	One silver	Silver	None
C110	—	One white, two brown	White	Two brown
P110	—	One white	White	None
C125	---	One orange, one brown	Orange	Brown
Q125	—	One orange	Orange	None

[a] In the case of coupling material, unless otherwise specified in the purchase agreement, the manufacturer's internal requirements shall govern.

[b] Special clearance couplings shall also have a black band.

[c] Seal-ring couplings shall also have a blue band.

[d] The painting of the entire coupling surface may be waived, see 10.4.

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Table C.43—Marking Requirements and Sequence

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80 , R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
1	Manufacturer's name or mark	«....»	D or P	D or P	P	P	P
2	API Spec 5CT	5CT [c]	D or P	D or P	P	P	P
	Manufacturer's option: licensed/registered industry mark	«....»	D or P	D or P	P	P	P
	Date of manufacture as in 10.1.8 or 10.1.9	«....»	D or P	D or P	P	P	P
3	Unthreaded pipe or special end-finish, if applicable (place symbol after specification marking):						
	— Unthreaded pipe either upset or non-upset	PE	D or P		P		
	— Pipe with special end-finish threaded by the pipe mill or processor	SF	D or P		P		
	— Couplings threaded with special end-finish	SF		D or P		P	
	— Coupling stock	CS					P
4	Size designation (fill in Label 1 designation from Column 1 of Table C.1 or C.2)	«....»	P		P		
	Specified diameter for coupling stock and other products with no mass designation						P
5	Mass designation (fill in Label 2 designation from Table C.1 or C.2)	«....»	D or P		P		
	Specified wall thickness for coupling stock and other products with no mass designation						P
6	Grade of product:						
	— H40	H					
	— J55	J					
	— K55	K					

Table C.43—Marking Requirements and Sequence (Continued)

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80 , R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
6	— N80 Type 1 — N80Q — R95 — L80 Type 1 — L80 3Cr — L80 9Cr — L80 13Cr — C90 — T95 — C110 — P110 --- C125 — Q125	N1 NQ R L L3CR L9 L13 C90T C110 P Q C125					
7	Sulfide cracking test [f] — C90 — T95 — C110, C125 All test method designations	A, AH [g], B, or D A, AH [g], B, or D A, D			P	P	P
8	Reduced alternative impact test temperature, if applicable. Fill in specified test temperature for full-size specimens, including ± symbol and °C	«....»C	P	P	P	P	
9	Heat treatment, if applicable: — J55 or K55 normalised — J55 or K55 normalised and tempered	Z N&T	P P	P P			P P

10	Process of manufacture:						
	— Seamless	S					
	— Electric-welded	E					
	All designations		D or P		P		

Table C.43—Marking Requirements and Sequence (Continued)

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80 , R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
11	Supplementary requirements, if applicable:						
	— A.2 (SR 1)	S1	P		P		
	— A.3 (SR 2)	S2	P		P		
	— A.4 (SR 9) (fill in type)	S9Q«....»				P	
	— A.8 (SR 13)	S13		D or P		P	
	— A.9 (SR 16) (fill in minimum full-size energy absorption requirement, in joules, and test temperature including ± symbol and °C)	S16«....»C	P		P		
	— A.13 (SR 41)	S41.1	P		P		
		S41.2	P		P		
	— A.14 (SR 42)	S42	P				
	— A.15 (SR 43)	S43			P	D[d] or P	
	— A.16 (SR 44)	S44			P	D[d] or P	
	— A.17 (SR 45)	S45			P	D[d] or P	
	— A.18 (SR 46)	S46	D or P	D or P	P		
	— A.19 (SR 47)	S47	P	D	P	D[d] or P	
	— A.20 (SR 48)	S48	P		P	D[d] or P	
	— A.21 (SR 49)	S49					
12	Hydrostatic test pressure [e] (fill in the actual test pressure, in MPa)						
	All designations	P«....»	P		P		
13	Type of thread, if applicable	«....» [h]	P	P	P	P	

Table C.43—Marking Requirements and Sequence (Continued)

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80 , R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
14	Full-length drift test, if applicable:						
	— Standard (casing or tubing)	D					
	— Alternative (casing or tubing) where « » is the size of the alternative drift	DA«....»					
	— For casing specified for tubing service and drift-tested in accordance with 7.10	DT42					
	All designations		P		P		
15	Serialization of Grades C90, T95, C110, and Q125				D [d] or P	D [d] or P	P
16	Tin plating of couplings, if applicable	T		P		P	
17	Couplings H40, J55, and K55 only visually inspected	V		P			
18	Additional markings (see 10.1.10)		D or P	D or P	D or P	P	P

NOTE See 10.4 for mandatory color code requirements.

[a] D = optional (die) stamping (for location see 10.2.3); P = requirement for (paint) stenciling (for location see 10.3);

[b] A blank space, «....», indicates information to be filled in.

[c] The manufacturer may include “API” before “5CT”.

[d] Stamp marking shall conform to the requirements of 10.2.

[e] Pipe can be identified as manufactured to SI units by the marked hydro-test pressure which will be less than 100 (MPa), while the pressure marked for pipe manufactured to USC units will be over 1000 (psi); This information is used to clearly identify the units used for CVN markings, which shall be in the same unit system as the pressure markings.

[f] “A” when tested using Method A (smooth tensile), “B” when tested using Method B (bent beam), “D” when tested using Method D (DCB). If more than one test method is required, then state the combination of the test method designations as above, in alphabetical order. For example, if purchaser requires Method A and D, then mark "AD”.

[g] For Grades C90 and T95, “AH” when tested at 90 % YS_{min}.

[h] See Table C.42 for thread type markings.

Table C.44—Retention of Records

Requirement	Sub-section Reference
Chemical Properties	
Heat analysis	9.3.1
Product analysis	9.3.2
Mechanical Properties	
Heat control tensile tests	9.4.2
Tensile tests on products	6.2, 9.4.7
Impact tests on products	6.4, 6.5, 6.6, 9.7
Hardness tests	6.7, 6.8, 6.9, 9.6
Hardenability tests	6.10, 9.9
Grain size (Grades C90, T95 ~~and~~ C110, and C125)	6.11, 9.8
Coupling tests	8.3
Hydrostatic Tests	
Tester recorder charts	9.12.1
Testing	9.12.1
Supplemental inspection when hydrostatic test pressure is limited, if applicable	A.13.1 (SR 41.1), A.13.2 (SR 41.2)
Manufacturer Certification	
Results of all required tests	12.3
Sulfide stress-cracking test (Grades C90, T95 ~~and~~ C110, and C125)	6.14, 9.10
Calibration	Various

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Annex E

(normative)

Tables in USC Units

Table E.1—API Casing List (sizes, masses, wall thickness, grade, and applicable end-finish)

Labels [a]		Outside Diameter	Nominal Linear Mass [b,c] T&C	Wall Thick-ness	Type of End-finish [d, e]								
1	2	*D* in.	lb/ft	*t* in.	H40	J55 K55	L80 R95	N80	C90 T95	C110	P110	C125	Q125
1	2	3	4	5	6	7	8	9	10	11	12	13	~~13~~14
4 1/2	9.50	4.500	9.70	0.205	PS	PS	—	—	—	—	—	—	—
4 1/2	10.50	4.500	10.60	0.224	—	PSB	—	—	—	—	—	—	—
4 1/2	11.60	4.500	11.70	0.250	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
4 1/2	13.50	4.500	13.30	0.290	—	—	PLB	PLB	PLB	P	PLB	P	—
4 1/2	15.10	4.500	15.30	0.337	—	—	—	—	—	—	PLB	—	PLB
5	11.50	5.000	11.60	0.220	—	PS	—	—	—	—	—	—	—
5	13.00	5.000	13.20	0.253	—	PSLB	—	—	—	—	—	—	—
5	15.00	5.000	15.30	0.296	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
5	18.00	5.000	18.30	0.362	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5	21.40	5.000	21.60	0.437	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5	23.20	5.000	23.40	0.478	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5	24.10	5.000	24.30	0.500	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5 1/2	14.00	5.500	14.00	0.244	PS	PS	—	—	—	—	—	—	—
5 1/2	15.50	5.500	15.80	0.275	—	PSLB	—	—	—	—	—	—	—
5 1/2	17.00	5.500	17.30	0.304	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
5 1/2	20.00	5.500	20.20	0.361	—	—	PLB	PLB	PLB	P	PLB	P	—
5 1/2	23.00	5.500	22.90	0.415	—	—	PLB	PLB	PLB	P	PLB	P	PLB
5 1/2	26.80	5.500	27.00	0.500	—	—	—	—	P	P	—	P	—
5 1/2	29.70	5.500	29.90	0.562	—	—	—	—	P	P	—	P	—
5 1/2	32.60	5.500	32.70	0.625	—	—	—	—	P	P	—	P	—
5 1/2	35.30	5.500	35.50	0.687	—	—	—	—	P	P	—	P	—
5 1/2	38.00	5.500	38.20	0.750	—	—	—	—	P	P	—	P	—
5 1/2	40.50	5.500	40.80	0.812	—	—	—	—	P	P	—	P	—
5 1/2	43.10	5.500	43.30	0.875	—	—	—	—	P	P	—	P	—
6 5/8	20.00	6.625	20.00	0.288	PS	PSLB	—	—	—	—	—	—	—
6 5/8	24.00	6.625	24.00	0.352	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
6 5/8	28.00	6.625	28.00	0.417	—	—	PLB	PLB	PLB	P	PLB	P	—
6 5/8	32.00	6.625	32.00	0.475	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7	17.00	7.000	17.20	0.231	PS	—	—	—	—	—	—	—	—
7	20.00	7.000	20.10	0.272	PS	PS	—	—	—	—	—	—	—
7	23.00	7.000	23.30	0.317	—	PSLB	PLB	PLB	PLB	P	—	P	—
7	26.00	7.000	26.30	0.362	—	PSLB	PLB	PLB	PLB	P	PLB	P	—
7	29.00	7.000	29.30	0.408	—	—	PLB	PLB	PLB	P	PLB	P	—
7	32.00	7.000	32.20	0.453	—	—	PLB	PLB	PLB	P	PLB	P	—
7	35.00	7.000	35.00	0.498	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7	38.00	7.000	37.70	0.540	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7	42.70	7.000	42.90	0.625	—	—	—	—	P	P	—	P	—
7	46.40	7.000	46.60	0.687	—	—	—	—	P	P	—	P	—
7	50.10	7.000	50.30	0.750	—	—	—	—	P	P	—	P	—

7	53.60	7.000	53.90	0.812	—	—	—	—	P	P	—	P	—
7	57.10	7.000	57.40	0.875	—	—	—	—	P	P	—	P	—

Table E.1—API Casing List (sizes, masses, wall thickness, grade, and applicable end-finish) (Continued)

Labels [a]		Outside Diameter	Nominal Linear Mass [b,c] T&C	Wall Thick-ness	Type of End-finish [d, e]								
1	2	*D* in.	lb/ft	*t* in.	H40	J55 K55	L80 R95	N80	C90 T95	C110	P110	C125	Q125
1	2	3	4	5	6	7	8	9	10	11	12	13	~~13~~14
7 5/8	24.00	7.625	24.00	0.300	PS	—	—	—	—	—	—	—	—
7 5/8	26.40	7.625	26.40	0.328	—	PSLB	PLB	PLB	PLB	P	—	P	—
7 5/8	29.70	7.625	29.70	0.375	—	—	PLB	PLB	PLB	P	PLB	P	—
7 5/8	33.70	7.625	33.70	0.430	—	—	PLB	PLB	PLB	P	PLB	P	—
7 5/8	39.00	7.625	39.00	0.500	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	42.80	7.625	42.80	0.562	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	45.30	7.625	45.30	0.595	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	47.10	7.625	47.10	0.625	—	—	PLB	PLB	PLB	P	PLB	P	PLB
7 5/8	51.20	7.625	51.20	0.687	—	—	—	—	P	P	—	P	—
7 5/8	55.30	7.625	55.30	0.750	—	—	—	—	P	P	—	P	—
7 3/4	46.10	7.750	46.10	0.595	—	—	P	P	P	P	P	P	P
8 5/8	24.00	8.625	24.00	0.264	—	PS	—	—	—	—	—	—	—
8 5/8	28.00	8.625	28.00	0.304	PS	—	—	—	—	—	—	—	—
8 5/8	32.00	8.625	32.00	0.352	PS	PSLB	—	—	—	—	—	—	—
8 5/8	36.00	8.625	36.00	0.400	—	PSLB	PLB	PLB	PLB	P	—	P	—
8 5/8	40.00	8.625	40.00	0.450	—	—	PLB	PLB	PLB	P	PLB	P	—
8 5/8	44.00	8.625	44.00	0.500	—	—	PLB	PLB	PLB	P	PLB	P	—
8 5/8	49.00	8.625	49.00	0.557	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	32.30	9.625	32.30	0.312	PS	—	—	—	—	—	—	—	—
9 5/8	36.00	9.625	36.00	0.352	PS	PSLB	—	—	—	—	—	—	—
9 5/8	40.00	9.625	40.00	0.395	—	PSLB	PLB	PLB	PLB	P	—	P	—
9 5/8	43.50	9.625	43.50	0.435	—	—	PLB	PLB	PLB	P	PLB	P	—
9 5/8	47.00	9.625	47.00	0.472	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	53.50	9.625	53.50	0.545	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	58.40	9.625	58.40	0.595	—	—	PLB	PLB	PLB	P	PLB	P	PLB
9 5/8	59.40	9.625	59.40	0.609	—	—	—	—	P	P	—	P	—
9 5/8	64.90	9.625	64.90	0.672	—	—	—	—	P	P	—	P	—
9 5/8	70.30	9.625	70.30	0.734	—	—	—	—	P	P	—	P	—
9 5/8	75.60	9.625	75.60	0.797	—	—	—	—	P	P	—	P	—
10 3/4	32.75	10.750	32.75	0.279	PS	—	—	—	—	—	—	—	—
10 3/4	40.50	10.750	40.50	0.350	PS	PSB	—	—	—	—	—	—	—
10 3/4	45.50	10.750	45.50	0.400	—	PSB	—	—	—	—	—	—	—
10 3/4	51.00	10.750	51.00	0.450	—	PSB	PSB	PSB	PSB	P	PSB	P	—
10 3/4	55.50	10.750	55.50	0.495	—	—	PSB	PSB	PSB	P	PSB	P	—
10 3/4	60.70	10.750	60.70	0.545	—	—	—	—	PSB	P	PSB	P	PSB
10 3/4	65.70	10.750	65.70	0.595	—	—	—	—	PSB	P	PSB	P	PSB
10 3/4	73.20	10.750	73.20	0.672	—	—	—	—	P	P	—	P	—
10 3/4	79.20	10.750	79.20	0.734	—	—	—	—	P	P	—	P	—
10 3/4	85.30	10.750	85.30	0.797	—	—	—	—	P	P	—	P	—
11 3/4	42.00	11.750	42.00	0.333	PS	—	—	—	—	—	—	—	—
11 3/4	47.00	11.750	47.00	0.375	—	PSB	—	—	—	—	—	—	—
11 3/4	54.00	11.750	54.00	0.435	—	PSB	—	—	—	—	—	—	—
11 3/4	60.00	11.750	60.00	0.489	—	PSB	PSB	PSB	PSB	P	PSB	P	PSB
11 3/4	65.00	11.750	65.00	0.534	—	—	P	P	P	P	P	P	P
11 3/4	71.00	11.750	71.00	0.582	—	—	P	P	P	P	P	P	P

Table E.1—API Casing List (sizes, masses, wall thickness, grade, and applicable end-finish) (Continued)

Labels [a]		Outside Diameter	Nominal Linear Mass [b,c] T&C	Wall Thick-ness	Type of End-finish [d, e]								
1	2	*D* in.	lb/ft	*t* in.	H40	J55 K55	L80 R95	N80	C90 T95	C110	P110	C125	Q125
1	2	3	4	5	6	7	8	9	10	11	12	13	~~13~~14
13 3/8	48.00	13.375	48.00	0.330	PS	—	—	—	—	—	—	—	—
13 3/8	54.50	13.375	54.50	0.380	—	PSB	—	—	—	—	—	—	—
13 3/8	61.00	13.375	61.00	0.430	—	PSB	—	—	—	—	—	—	—
13 3/8	68.00	13.375	68.00	0.480	—	PSB	PSB	PSB	PSB	P	PSB	P	—
13 3/8	72.00	13.375	72.00	0.514	—	—	PSB	PSB	PSB	P	PSB	P	PSB
16	65.00	16.000	65.00	0.375	PS	—	—	—	—	—	—	—	—
16	75.00	16.000	75.00	0.438	—	PSB	—	—	—	—	—	—	—
16	84.00	16.000	84.00	0.495	—	PSB	—	—	—	—	—	—	—
16	109.00	16.000	109.00	0.656	—	P	P	P	—	—	P	—	P
18 5/8	87.50	18.625	87.50	0.435	PS	PSB	—	—	—	—	—	—	—
20	94.00	20.000	94.00	0.438	PSL	PSLB	—	—	—	—	—	—	—
20	106.50	20.000	106.50	0.500	—	PSLB	—	—	—	—	—	—	—
20	133.00	20.000	133.00	0.635	—	PSLB	—	—	—	—	—	—	—

NOTE P = Plain-end, S = Short round thread, L = Long round thread, B = Buttress thread.

[a] Labels are for information and assistance in ordering.

[b] Nominal linear masses (Column 4) are shown for information only.

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

[d] Buttress casing is available with regular, special clearance couplings or special clearance couplings with special bevel.

[e] For casing with S, L, and B connections, intermediate wall thicknesses are allowed in accordance with 4.2.3 and 7.2 and API 5B.

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Table E.3—Process of Manufacture and Heat Treatment

Grade	Type	Manufacturing Process [a]	Heat Treatment [e]	Tempering Temperature °F min
1	*2*	*3*	*4*	*5*
H40	—	S or EW	—	—
J55 [i]	—	S or EW	— [b]	—
K55	—	S or EW	— [b]	—
N80	1 [i]	S or EW	c	—
N80	Q	S or EW	Q [d]	—
R95 [i]	—	S or EW	Q	1000
L80	1	S or EW	Q	1050
L80	3Cr	S	Q	1050
L80	9Cr [i]	S	Q [f]	1100
L80	13Cr	S	Q [f]	1100 [j]
C90	—	S	Q	1150
T95	—	S	Q	1200
C110	—	S	Q	1200
P110	—	S or EW [g, h]	Q	—
C125	---	S	Q	1200
Q125	—	S or EW [h]	Q	—

[a] S = seamless process; EW = electric-welded process.

[b] Full-body, full-length normalized, normalized and tempered or quenched and tempered at the manufacturer's option or as specified on the purchase agreement (see 5.2.2).

[c] Full-body, full-length heat treatment is mandatory. At the manufacturer's option, normalized or normalized and tempered.

[d] Includes the method of interrupted quenching followed by controlled cooling.

[e] Q = quenched and tempered.

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

[g] Special chemical requirements for electric-welded P110 pipe are specified in Table E.4.

[h] Products shall be heat-treated full-body, full-length. Special requirements unique to electric-welded P110 and Q125 are specified in A.6 (SR 11).

[i] Quenched and tempered product in large D/t ratio combinations and non-quenched and tempered product may exhibit ductile rupture values lower than internal yield values. See API 5C3/ISO 10400 calculated performance values in Columns 15 and 18 in Table K.1 and Table L.1.

[j] See 5.2.3

Table E.4—Chemical Composition, Mass Fraction (%)

Grade	Type	C		Mn		Mo		Cr		Nb	Ni	Cu	P	S	Si
		min	max	min	max	min	max	min	max	max	max	max	max	max	max
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
H40	—	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
J55	—	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
K55	—	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
N80	1	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
N80	Q	—	—	—	—	—	—	—	—	—	—	—	0.030	0.030	—
R95	—	—	0.45 c	—	1.90	—	—	—	—	—	—	—	0.030	0.030	0.45
L80	1	—	0.43 a	—	1.90	—	—	—	1.50	—	0.25	0.35	0.030	0.030	0.45
L80	3Cr	—	0.30	—	1.20	—	—	2.50	3.90	0.30	0.25	0.35	0.020	0.010	0.45
L80	9Cr	—	0.15	0.30	0.60	0.90	1.10	8.00	10.0	—	0.50	0.25	0.020	0.010	1.00
L80	13 Cr	0.15	0.22	0.25	1.00	—	—	12.0	14.0	—	0.50	0.25	0.020	0.010	1.00
C90	—	—	0.35	—	1.20	0.25 b	0.85	—	1.50	—	0.99	—	0.020	0.010	—
T95	—	—	0.35	—	1.20	0.25 d	0.85	0.40	1.50	—	0.99	—	0.020	0.010	—
C110	—	—	0.35	—	1.20	0.25	1.00	0.40	1.50	—	0.99	—	0.020	0.005	—
P110	—	—	—	—	—	—	—	—	—	—	—	—	0.030 e	0.030 e	—
C125	—	—	0.45	—	1.00	0.50	1.75	0.40	1.50	—	0.99	—	0.020	0.005	—
Q125	—	—	0.35	—	1.35	—	0.85	—	1.50	—	—	—	0.020	0.010	—

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Table E.5—Tensile and Hardness Requirements

Grade	Type	Total Elongation Under Load %	Yield Strength ksi		Tensile Strength min ksi	Hardness [a,c] max		Specified Wall Thickness	Allowable Hardness Variation [b]
			min	max		HRC	HBW	in.	HRC
1	2	3	4	5	6	7	8	9	10
H40	—	0.5	40	80	60	—	—	—	—
J55	—	0.5	55	80	75	—	—	—	—
K55	—	0.5	55	80	95	—	—	—	—
N80	1	0.5	80	110	100	—	—	—	—
N80	Q	0.5	80	110	100	—	—	—	—
R95	—	0.5	95	110	105	—	—	—	—
L80	1	0.5	80	95	95	23.0	241	—	—
L80	3Cr	0.5	80	95	95	23.0	241	—	—
L80	9Cr	0.5	80	95	95	23.0	241	—	—
L80	13Cr	0.5	80	95	95	23.0	241		
C90	—	0.5	90	105	100	25.4	255	≤ 0.500	3.0
								0.501 to 0.749	4.0
								0.750 to 0.999	5.0
								≥ 1.000	6.0
T95	—	0.5	95	110	105	25.4	255	≤ 0.500	3.0
								0.501 to 0.749	4.0
								0.750 to 0.999	5.0
								≥ 1.000	6.0
C110	—	0.7	110	120	115	29.0	279	≤ 0.500	3.0
								0.501 to 0.749	4.0
								0.750 to 0.999	5.0
								≥ 1.000	6.0
P110	—	0.6	110	140	125	—	—	—	—
C125	—	0.75	125	135	130	34.0	319	≤ 0.500	3.0
								0.501 to 0.749	4.0
								0.750 to 0.999	5.0
								≥ 1.000	6.0
Q125	—	0.65	125	150	135	[b]	—	≤ 0.500	3.0
								0.501 to 0.749	4.0
								≥ 0.750	5.0

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

[b] No hardness limits are specified, but the maximum variation is restricted as a manufacturing control in accordance with 6.8 and 6.9.

[c] For through-wall hardness tests of Grades L80, C90, T95 and C110, the requirements stated in HRC scale are for maximum mean hardness number.

Table E.6—Elongation Table

Tensile Test Specimen				Minimum Elongation in 2.0 in. % Grade								
				H40	J55	K55 L80	N80 C90	R95 T95	C110	P110	C125	Q125
Specimen Area in.^{2}	Specified Wall Thickness in.				Specified Minimum Tensile Strength ksi							
	Specimen Width $^3/_4$ in.	Specimen Width 1 in.	Specimen Width 1 $^1/_2$ in.	60	75	95	100	105	115	125	130	135
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	~~*1213*~~
0.750	≥ 0.994	≥ 0.746	≥ 0.497	30	24	20	19	18	16	15	15	14
0.740	0.980–0.993	0.735–0.745	0.490–0.496	29	24	19	19	18	16	15	15	14
0.730	0.967–0.979	0.726–0.734	0.484–0.489	29	24	19	19	18	16	15	15	14
0.720	0.954–0.966	0.715–0.725	0.477–0.483	29	24	19	19	18	16	15	15	14
0.710	0.941–0.953	0.706–0.714	0.471–0.476	29	24	19	18	18	16	15	15	14
0.700	0.927–0.940	0.695–0.705	0.464–0.470	29	24	19	18	18	16	15	15	14
0.690	0.914–0.926	0.686–0.694	0.457–0.463	29	24	19	18	18	16	15	14	14
0.680	0.900–0.913	0.675–0.685	0.450–0.456	29	24	19	18	18	16	15	14	14
0.670	0.887–0.899	0.666–0.674	0.444–0.449	29	24	19	18	17	16	15	14	14
0.660	0.861–0.873	0.646–0.654	0.431–0.436	29	24	19	18	17	16	15	14	14
0.650	0.847–0.860	0.635–0.645	0.424–0.430	29	23	19	18	17	16	15	14	14
0.640	0.847–0.860	0.635–0.645	0.424–0.430	29	23	19	18	17	16	15	14	14
0.630	0.834–0.846	0.626–0.634	0.417–0.423	29	23	19	18	17	16	15	14	14
0.620	0.820–0.833	0.615–0.625	0.410–0.416	28	23	19	18	17	16	15	14	14
0.610	0.807–0.819	0.606–0.614	0.404–0.409	28	23	19	18	17	16	15	14	14
0.600	0.794–0.806	0.595–0.605	0.397–0.403	28	23	19	18	17	16	15	14	14
0.590	0.781–0.793	0.586–0.594	0.391–0.396	28	23	19	18	17	16	15	14	14
0.580	0.767–0.780	0.575–0.585	0.384–0.390	28	23	19	18	17	16	15	14	14
0.570	0.754–0.766	0.566–0.574	0.377–0.383	28	23	18	18	17	16	14	14	13
0.560	0.740–0.753	0.555–0.565	0.370–0.376	28	23	18	18	17	16	14	14	13
0.550	0.727–0.739	0.546–0.554	0.364–0.369	28	23	18	18	17	15	14	14	13
0.540	0.714–0.726	0.535–0.545	0.357–0.363	28	23	18	17	17	15	14	14	13
0.530	0.701–0.713	0.526–0.534	0.351–0.356	28	23	18	17	17	15	14	14	13
0.520	0.687–0.700	0.515–0.525	0.344–0.350	27	22	18	17	17	15	14	14	13
0.510	0.674–0.686	0.506–0.514	0.337–0.343	27	22	18	17	17	15	14	14	13
0.500	0.660–0.673	0.495–0.505	0.330–0.336	27	22	18	17	16	15	14	14	13
0.490	0.647–0.659	0.486–0.494	0.324–0.329	27	22	18	17	16	15	14	14	13
0.480	0.634–0.646	0.475–0.485	0.317–0.323	27	22	18	17	16	15	14	13	13
0.470	0.621–0.633	0.466–0.474	0.311–0.316	27	22	18	17	16	15	14	13	13
0.460	0.607–0.620	0.455–0.465	0.304–0.310	27	22	18	17	16	15	14	13	13
0.450	0.594–0.606	0.446–0.454	0.297–0.303	27	22	18	17	16	15	14	13	13
0.440	0.580–0.593	0.435–0.445	0.290–0.296	27	22	18	17	16	15	14	13	13
0.430	0.567–0.579	0.426–0.434	0.284–0.289	26	22	17	17	16	15	14	13	13

Table E.6—Elongation Table (Continued)

Tensile Test Specimen				Minimum Elongation in 2.0 in. % Grade								
				H40	J55	K55 L80	N80 C90	R95 T95	C110	P110	C125	Q125
Specimen Area in.^{2}	Specified Wall Thickness in.				Specified Minimum Tensile Strength ksi							
	Specimen Width $^3/_4$ in.	Specimen Width 1 in.	Specimen Width 1 $^1/_2$ in.	60	75	95	100	105	115	125	130	135
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*~~1213~~*
0.420	0.554–0.566	0.415–0.425	0.277–0.283	26	22	17	17	16	15	14	14	13
0.410	0.541–0.553	0.406–0.414	0.271–0.276	26	21	17	17	16	15	14	14	13
0.400	0.527–0.540	0.395–0.405	0.264–0.270	26	21	17	16	16	15	13	13	13
0.390	0.514–0.526	0.386–0.394	0.257–0.263	26	21	17	16	16	14	13	13	12
0.380	0.500–0.513	0.375–0.385	0.250–0.256	26	21	17	16	16	14	13	13	12
0.370	0.487–0.499	0.366–0.374	0.244–0.249	26	21	17	16	16	14	13	13	12
0.360	0.474–0.486	0.355–0.365	0.237–0.243	26	21	17	16	15	14	13	13	12
0.350	0.461–0.473	0.346–0.354	0.231–0.236	25	21	17	16	15	14	13	13	12
0.340	0.447–0.460	0.335–0.345	0.224–0.230	25	21	17	16	15	14	13	13	12
0.330	0.420–0.433	0.315–0.325	0.210–0.216	25	21	17	16	15	14	13	13	12
0.320	0.420–0.433	0.315–0.325	0.210–0.216	25	20	16	16	15	14	13	13	12
0.310	0.407–0.419	0.306–0.314	0.204–0.209	25	20	16	16	15	14	13	13	12
0.300	0.394–0.406	0.295–0.305	0.197–0.203	25	20	16	16	15	14	13	13	12
0.290	0.381–0.393	0.286–0.294	0.191–0.196	24	20	16	15	15	14	13	13	12
0.280	0.367–0.380	0.275–0.285	0.184–0.190	24	20	16	15	15	14	13	13	12
0.270	0.354–0.366	0.266–0.274	0.177–0.183	24	20	16	15	15	13	12	12	12
0.260	0.340–0.353	0.255–0.265	0.170–0.176	24	20	16	15	14	13	12	12	12
0.250	0.327–0.339	0.246–0.254	0.164–0.169	24	19	16	15	14	13	12	12	11
0.240	0.314–0.326	0.235–0.245	0.157–0.163	24	19	16	15	14	13	12	12	11
0.230	0.301–0.313	0.226–0.234	0.151–0.156	23	19	15	15	14	13	12	12	11
0.220	0.287–0.300	0.215–0.225	0.144–0.150	23	19	15	15	14	13	12	12	11
0.210	0.274–0.286	0.206–0.214	0.137–0.143	23	19	15	14	14	13	12	12	11
0.200	0.260–0.273	0.195–0.205	0.130–0.136	23	19	15	14	14	13	12	12	11
0.190	0.247–0.259	0.186–0.194	0.124–0.129	22	18	15	14	14	13	12	12	11
0.180	0.234–0.246	0.175–0.185	0.117–0.123	22	18	15	14	13	12	11	11	11
0.170	0.221–0.233	0.166–0.174	0.111–0.116	22	18	15	14	13	12	11	11	11

Table E.6—Elongation Table (Continued)

Tensile Test Specimen				Minimum Elongation in 2.0 in. % Grade								
				H40	J55	K55 L80	N80 C90	R95 T95	C110	P110	C125	Q125
Specimen Area in.^{2}	Specified Wall Thickness in.				Specified Minimum Tensile Strength ksi							
	Specimen Width $^3/_4$ in.	Specimen Width 1 in.	Specimen Width 1 $^1/_2$ in.	60	75	95	100	105	115	125	130	135
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*
0.160	0.207–0.220	0.155–0.165	0.104–0.110	22	18	14	14	13	12	11	11	10
0.150	0.194–0.206	0.146–0.154	0.097–0.103	21	18	14	14	13	12	11	11	10
0.140	0.180–0.193	0.135–0.145	0.090–0.096	21	17	14	13	13	12	11	11	10
0.130	0.167–0.179	0.126–0.134	0.084–0.089	21	17	14	13	13	12	11	11	10
0.120	0.154–0.166	0.115–0.125	0.077–0.083	20	17	14	13	12	11	11	11	10
0.110	0.141–0.153	0.106–0.114	0.071–0.076	20	16	13	13	12	11	10	10	9.5
0.100	0.127–0.140	0.095–0.105	0.064–0.070	20	16	13	12	12	11	10	10	9.5
0.090	0.114–0.126	0.086–0.094	0.057–0.063	19	16	13	12	12	11	10	10	9.5
0.080	0.100–0.113	0.075–0.085	0.050–0.056	19	15	12	12	11	11	10	10	9

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Table E.12 — Minimum Absorbed Energy for Couplings, Coupling Stock, Coupling Material, and Coupling Blanks – Transverse Orientation (ft-lbs)

Critical Thickness (in)	L80 [a, b, c, d, e]	N80 [a, b, c, d]	C90 [a, b, c, d]	R95/T95 [a, b, c, d]	P110 [a, b, c, d]	C110 [a, b, c, d]	C125 [a, b, c, d]	Q125 [a, b, c, d]
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*~~89~~*
≤ 0.5	20	15	20	20	20	20	22	25
0.6	20	17	20	20	22	20	22	25
0.7	20	19	20	20	24	20	23	26
0.8	20	20	20	20	26	22	25	28
0.9	20	22	21	22	28	24	27	30
1.0	21	24	23	24	30	26	30	32
1.1	22	25	24	25	32	28	32	35
1.2	23	27	26	27	34	30	33	37
1.3	25	29	27	29	37	31	35	39
1.4	26	30	29	30	39	33	38	42
1.5	28	32	31	32	41	35	40	44
1.6	29	34	32	34	43	37	41	46
1.7	31	35	34	35	45	39	44	48
1.8	32	37	35	37	47	41	46	51
1.9	34	39	37	39	49	42	48	53
2.0	35	40	39	40	52	44	50	55
2.1	36	42	40	42	54	46	52	57
2.2	38	44	42	44	56	48	54	60
2.3	39	45	43	45	58	50	56	62
2.4	41	47	45	47	60	51	58	64
2.5	42	49	47	49	62	53	60	67

[a] Values given are full size, average minimums (refer to 6.3.1 for individual minimum values).

[b] If transverse specimens of ½ size cannot be taken, refer to 9.7.1.

[c] For wall thicknesses not listed, the manufacturer has the option to utilize the applicable formula in accordance with 6.4.4 or the next higher wall in this table.

[d] For all grades except L80 13 Cr, wall thickness greater than 2.5 inches, refer to 4.2.1 or 4.3.1 or 4.4.3.

[e] For grade L80 13 Cr, wall thickness greater than 1.4 inches, refer to 4.2.1 or 4.3.1 or 4.4.3.

Table E.13 — Minimum Absorbed Energy for Couplings, Coupling Stock, Coupling Material, and Coupling Blanks – Longitudinal Orientation (ft-lbs)

L80	N80	C90	R95 / T95	P110	C110	C125	Q125 [a, b, c, d]
1	2	3	4	5	6	*7*	*~~78~~*
40	30	40	40	40	40	40	50

NOTE 1 Values given are full size, average minimums (Refer to 6.3.1 for individual minimum values).

NOTE 2 Longitudinal testing is only required if transverse testing is not possible. Coupling, coupling stock tested in the transverse direction does not need to be tested or demonstrate compliance to these values.

Table E.14—Minimum Absorbed Energy for Pipe – Transverse Orientation (ft-lbs)

Wall Thickness (in)	L80 [a, b, c, d, e]	N80 [a, b, c, d]	C90 [a, b, c, d]	R95/T95 [a, b, c, d]	P110 [a, b, c, d]	C110 [a, b, c, d]	C125 [a, b, c, d]	Q125 [a, b, c, d]
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*~~9~~*
≤ 0.7	15	15	15	15	20	20	23	25
0.8	15	15	17	18	20	22	25	28
0.9	16	16	18	19	22	24	27	30
1.0	17	17	19	21	24	26	29	32
1.1	18	18	21	22	25	28	32	35
1.2	20	20	22	23	27	30	33	37
1.3	21	21	24	25	29	31	35	39
1.4	22	22	25	26	30	33	38	42
1.5	23	23	26	28	32	35	40	44
1.6	25	25	28	29	34	37	41	46
1.7	26	26	29	31	35	39	44	48
1.8	27	27	30	32	37	41	46	51
1.9	28	28	32	34	39	42	48	53
2.0	29	29	33	35	40	44	49	55
2.1	31	31	34	36	42	46	52	57
2.2	32	32	36	38	44	48	54	60
2.3	33	33	37	39	45	50	55	62
2.4	34	34	39	41	47	51	58	64
2.5	36	36	40	42	49	53	60	67

[a] Values given are full size, average minimums (refer to 6.3.1 for individual minimum values)).

[b] If transverse specimens of ½ size cannot be taken, refer to 9.7.1.

[c] For wall thicknesses not listed, the manufacturer has the option to utilize applicable formula in accordance with 6.5.2 and 6.5.3 or the next higher wall in this table.

[d] For all grades except L80 13 Cr, wall thickness greater than 2.5 inches, refer to 4.2.1 or 4.3.1 or 4.4.3.

[e] For grade L80 13 Cr, wall thickness greater than 1.4 inches, refer to 4.2.1 or 4.3.1 or 4.4.3.

Table E.15—Minimum Absorbed Energy for Pipe – Longitudinal Orientation (ft-lbs)

L80	N80	C90	R95 / T95	P110	C110	C125	Q125 [a, b, c, d]
1	2	3	4	5	6	*7*	*~~8~~*
30	30	30	30	38	40	40	40

NOTE 1 Values given are full size, average minimums (refer to 6.3.1 for individual minimum values)

NOTE 2 Longitudinal testing is only required if transverse testing is not possible. Pipe tested in the transverse direction does not need to be tested or demonstrate conformance to these values.

Table E.16—Frequency of Charpy V-Notch Testing—Pipe, Coupling Stock, Coupling Material, Coupling Blanks, Couplings, and Accessory Material

Grade	Label 1	Number of Tests per Lot			
		Pipe	Coupling Stock / Material	Coupling Blanks / Couplings	Accessory Material
1	*2*	*3*	*4*	*5*	*6*
H40	All sizes	[d]	[d]	[d]	[d]
K55, J55	All sizes	N/A	1	1	1[b]
N80, R95	All sizes	1[a]	1	1	1[b]
L80	All sizes	1[a]	1	1	1[b]
C90, T95	All sizes	1[a]	1	1	1[b]
C110	All sizes	1	1	1	1
P110	All sizes	1[a]	1	1	1[b]
C125	All sizes	1	1	1	1
Q125 [c]	All sizes	3 [c]	Each length [c]	1	Each length [c]

[a] Testing is not mandatory when qualified by a documented procedure, see 6.5.5 for mandatory requirements.

[b] When required in 6.6.

[c] Refer to 9.7.10 for requirements.

[d] See A.9 (SR 16) when specified

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Table E.25—Maximum Permissible Depth of Linear Imperfections

Grade	Depth as % of Specified Wall Thickness	
	External Imperfections	Internal Imperfections
H40 – J55 – K55 – N80Q – L80 – R95 [P110 to A.9 (SR 16)]	12.5 %	12.5 %
N80 Type 1	10 %	10 %
C90 – T95 – C110 – P110 – C125 – Q125	5 %	5 %
[P110 to A.9 (SR 16) and A.3 (SR 2)]	5 %	5 %

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Table E.31—Permissible Depth of External Imperfections on Coupling (Dimensions in Inches)

Coupling for Label 1		Grades H40, J55, K55, N80, R95, L80, and P110		Grades C90, T95, C110, C125, and Q125
		Pits and Round-bottom Gouges	Grip Marks and Sharp-bottom Gouges	Pits, Round-bottom Gouges, Sharp-bottom Gouges, Grip Marks
1	*2*	*3*	*4*	*5*
Tubing	$< 3\ ^{1}/_{2}$	0.030	0.025	0.030
	$\geq 3\ ^{1}/_{2}$ to $\leq 4\ ^{1}/_{2}$	0.045	0.030	0.035
Casing [a]	$< 6\ ^{5}/_{8}$	0.035	0.030	0.030
	$\geq 6\ ^{5}/_{8}$ to $\leq 7\ ^{5}/_{8}$	0.045	0.040	0.035
	$> 7\ ^{5}/_{8}$	0.060	0.040	0.035

[a] Includes casing used as tubing.

Table E.32—Frequency of Tensile Tests—Casing and Tubing

Grade [e]	Label 1	Maximum Number of Pieces in a Lot	Number of Tests	
			per Lot	per Heat
1	*2*	*3*	*4*	*5*
H40, K55, J55, N80	< 6 5/8	400 [a, b]	1	1
	≥ 6 5/8	200 [a, b]	1	1
R95	≤ 4 1/2	200 [a, b]	2 [c]	1
	> 4 1/2	100 [a, b]	2 [c]	1
L80 Type 1, L80 3Cr	≤ 4 1/2	200 [a, b]	2 [c]	1
L80 9Cr, L80 13Cr	≤ 4 1/2	200 [b, d]	2 [c]	—
C90, T95	≤ 4 1/2	200 [b, d]	1	—
L80 Type 1, L80 3Cr	> 4 1/2	100 [a, b]	2 [c]	1
L80 9Cr, L80 13Cr	> 4 1/2	100 [b, d]	2 [c]	—
C90, T95	> 4 1/2	100 [b, d]	1	—
C110	All sizes	100 [b, d]	1	—
P110	< 6 5/8	200 [a, b]	1	1
	≥ 6 5/8	100 [a, b]	1	1
C125	All sizes	100 [b, d]	1	—
Q125	All sizes	— [d]	3 [c]	—

NOTE Table includes casing used as tubing.

[a] See 9.2.1.
[b] See 9.4.2.
[c] See 9.4.3.
[d] See 9.2.2.
[e] For all grades except Grade Q125 multiple-length seamless pipe, a length shall be considered as all of the sections cut from a particular multiple length, provided the pipe receives no additional heat treatment after being cut into individual lengths.

Table E.33—Frequency of Tensile Tests—Coupling Stock, Coupling Material, and Coupling Blanks

Grade	Material	Condition when Heat-treated	Maximum Number of Pieces in a Lot	Number of Tests	
				per Lot	per Heat
1	2	3	4	5	6
H40, J55, K55, N80, and P110	Coupling stock and coupling material	Coupling stock and coupling material for pipe ≤ Label 1: 4 1/2	200 [a]	1	1 [b]
		Coupling stock and coupling material for pipe > Label 1: 4 1/2	100 [a]	1	1 [b]
		Coupling blank	400 [c]	1	—
	Hot forging	Coupling blank	400 [c]	1	—
R95, L80 Type 1, L80 3Cr	Coupling stock and coupling material	Coupling stock and coupling material for pipe ≤ Label 1: 4 1/2	200 [a]	2 [d, e]	2 [d, e]
		Coupling stock and coupling material for pipe > Label 1: 4 1/2	100 [a]	2 [d, e]	2 [d, e]
		Coupling blank	400 [c]	2 [e]	—
	Hot forging	Coupling blank	400 [c]	2 [e]	—
L80 9Cr and L80 13Cr	Coupling stock and coupling material	Coupling stock and coupling material for pipe ≤ Label 1: 4 1/2	200 [d]	2 [d, e]	—
		Coupling stock and coupling material for pipe > Label 1: 4 1/2	100 [d]	2 [d, e]	—
		Coupling blank	400 [c]	2 [e]	—
	Hot forging	Coupling blank	400 [c]	2 [e]	—
C90 and T95	Coupling stock and coupling material	Coupling stock and coupling material for pipe Label 1: All sizes	1 [b]	1	—
		Coupling blank	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
	Hot forging	Coupling blank	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
C110, C125, and Q125	Coupling stock and coupling material	Coupling stock and coupling material for pipe Label 1: All sizes	1 [b]	1	—
		Coupling blank	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—

[a] See 9.2.1.

[b] Approximately 50 % from each end.

[c] See 9.2.3.

[d] See 9.2.2.

[e] When more than one test is required, the test specimens shall be from different lengths. except for a single piece lot where the test specimens may be taken from both ends of the length.

Table E.34—Frequency of Tensile Testing—Pup Joints and Accessory Material

Grade	Material and Heat Treatment Conditions [a]		Maximum Number of Pieces in a Lot	Number of Tests	
				per Lot	per Heat
1	*2*	*3*	*4*	*5*	*6*
H40, J55, K55, N80	Full-length standard tubing or casing from one or more heats		Label 1: < 6 5/8: 400 Label 1: ≥ 6 5/8: 200	1	1
P110	Full-length standard tubing or casing from one or more heats		Label 1: < 6 5/8: 200 Label 1: ≥ 6 5/8: 100	1	1
H40, J55, K55, N80, P110	Thick-wall mechanical tube or bar stock from a single heat		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	1	1
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	100 pup joints or 400 accessory material	1	—
		Heat-treated in sequential loads or continuous heat treatment	In accordance with 9.2.3	1	—
R95, L80 Type 1, L80 3Cr	Full-length standard tubing or casing from one or more heats		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	2 [a, b]
	Thick-wall mechanical tube or bar stock from a single heat		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	2 [a, b]
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	100 pup joints or 400 accessory material	2 [b]	—
		Heat-treated in sequential loads or continuous heat treatment	In accordance with 9.2.3	2 [b]	—
L80 9Cr, L80 13Cr	Full-length standard tubing or casing from one or more heats		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	—
	Thick-wall mechanical tube or bar stock from a single heat		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	2 [a, b]	—
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	100 pup joints or 400 accessory material	2 [b]	—
		Heat-treated in sequential loads or continuous heat treatment	In accordance with 9.2.3	2 [b]	—
C90 and T95	Full-length standard tubing or casing from one or more heats		Label 1: ≤ 4 1/2: 200 Label 1: > 4 1/2: 100	1	—
	Thick-wall mechanical tube or bar stock from a single heat		1	1 [a]	—
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
		Heat-treated in sequential loads or continuous heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
C110, C125, and Q125	Full-length standard tubing or casing from one or more heats		In accordance with 9.2.3	3 [a, b]	—
	Thick-wall mechanical tube or bar stock from a single heat		1	1 [a]	—
	Heat-treated in individual lengths or hot forgings	Batch heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—
		Heat-treated in sequential loads or continuous heat treatment	Label 1: < 9 5/8: 50 [c] Label 1: ≥ 9 5/8: 30 [c]	1	—

[a] Approximately 50 % from each end.

[b] When more than one test is required, the test specimens shall be from different lengths, except for a single piece lot where the test specimens may be taken from both ends of one length.

[c] Each lot shall be from the same heat of steel for Grades L80 9Cr, L80 13Cr, C90, T95, C110, and Q125; See 9.2.3.

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Table E.35—Frequency of Hardness Testing (Continued)

Grade	Material		Number of Tests per Lot	Maximum Number of Pieces in a Lot	Type of Test	Location
1	*2*		*3*	*4*	*5*	*6*
C110, C125	As-quenched product		1	Each production run or heat treatment practice	Through-wall, 4 quadrants	Design area of greatest thickness
	Non-upset pipe		2	One from each end	Through-wall, 1 quadrant	Each end of each piece
	Coupling blanks, coupling stock, coupling material, pup joints and accessory material	Tube length heat treatment	2 [a]	Each length	Through-wall, 4 quadrants	One from each end
		Individual heat treatment	1	Each piece	Surface—HRC or HBW	Each piece
			1	Label 1: < 9 $^{5}/_{8}$: 50 [c] Label 1: ≥ 9 $^{5}/_{8}$ 30 [c]	Through-wall, 4 quadrants	From a piece with the highest surface hardness number in the lot
Q125	Casing		3 [a]	Lot (see 9.2) [b, c]	Through-wall, 1 quadrant	Pipe body
	Coupling blanks, coupling stock, coupling material, pup joints and accessory material	Tube length heat treatment	1	Each length	Through-wall, 1 quadrant	Approximately 50 % from each end
		Individual heat treatment	1	Each piece	Surface—HRC or HBW	Each piece
			1	Label 1: < 9 $^{5}/_{8}$: 50 [c] Label 1: ≥ 9 $^{5}/_{8}$: 30 [c]	Through-wall, 1 quadrant	Randomly selected piece

[a] When more than one test is required, the test specimens shall be from different lengths, except for a single piece lot where the test specimens may be taken from both ends of one length.

[b] The lengths tested shall be selected randomly and represent the start and end of the heat treatment cycle.

[c] Each lot shall be from the same heat of steel for Grades L80 9Cr, L80 13Cr, C90, T95, and Q125.

[d] One upset approximately 50 % from each end if both ends are upset.

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Table E.37—Summary of NDE Methods for Seamless Pipe, Coupling Stock, Body of Welded Pipe, and Accessory Material (In Accordance with 9.15.9 and 9.15.11)

Product	Grade	Visual inspection (see 10.14)	Wall Thickness Verification	Ultrasonic Inspection	Flux Leakage Inspection	Eddy Current Inspection	Magnetic Particle Inspection [a]
1	*2*	*3*	*4*	*5*	*6*	*7*	*8*
Pipe and accessory material	H40, J55, K55	R	N	N	N	N	N
	N80, L80, R95	R	R	A	A	A	A
	P110	R	R	A	A	A	NA
	Q125	R	R	C	B	B	B
Pipe	C90, T95, C110, C125	R	R	C (A) [b]	B (A) [b]	B (A) [b]	B (NA) [b]
Accessory Material	C90, T95, C110, C125	R	R	C (A) [b]	B (A) [b]	B (A) [b]	B (A) [b]
Coupling stock	H40, J55, K55	R	NA	N	N	N	N
	N80, L80, R95, P110, C90, T95, C110, C125, Q125	R	R	A	A	A	A

N = Not required
R = Required
A = One method or any combination of methods shall be used
B = At least one method shall be used in addition to ultrasonic inspection to inspect on the outside surface
C = Ultrasonic inspection shall be used to inspect the outside and inside surface
NA = Not applicable

[a] MPI is permitted for end-area inspection. MPI is permitted for pipe-body outside-surface inspection in combination with other methods of pipe body inspection. MPI is permitted for coupling stock outside surface inspection and coupling stock oblique inspection. Coupling stock receiving full-length MPI does not require full-length wall thickness verification, however, mechanical wall thickness measurement of each end is required; MPI is permitted for the pipe OD and ID when inspected on the ends of the pipe un-inspected area.

[b] Values in parenthesis () are specigic to oblique angled defects.

Table E.38—Acceptance (Inspection) Levels

Material	Grade		External imperfections			Internal imperfections		
			Longitudinal	Transverse	Oblique	Longitudinal	Transverse	Oblique
1	*2*		*3*	*4*	*5*	*6*	*7*	*8*
Pipe body [a]	N80 Type 1		L3	—	—	L3	—	—
	N80Q, L80, R95		L4	—	—	L4	—	—
	[P110 to A.9 (SR 16)]		L4	L4	—	L4	L4	—
	P110		L2	L2	—	L2	L2	—
	[P110 to A.9 (SR 16) and A.3 (SR 2)]		L2	L2	—	L2	L2	—
	Q125	UT	L2	L2	—	L2	L2	—
		Second method	L2	L2	—	—	—	—
	C90, T95, C110, C125	UT	L2	L2	L2 [b]	L2	L2	L2 [b]
		Second method	L2	L2	—	—	—	—
Coupling stock	All grades except C90, T95, ~~and~~ C110, and C125		L2	L2	—	N	N	—
	C90 and T95		L2	L2	L2	N	N	N
	C110, C125		L2	L2	L2	L3	L3	L3
Weld seam	P110, Q125		L2	N	—	L2	N	—
	All other grades		L3	N	—	L3	N	—
	All other grades to A.3 (SR 2)		L2	N	—	L2	N	—

N = not required; L*x* = acceptance (inspection) level.

[a] Accessory material shall be treated as pipe body.

[b] Flux leakage inspection or eddy current inspection may be used as alternative NDE methods for oblique inspection for pipe body; flux leakage inspection, eddy current inspection, or magnetic particle inspection may be used as alternative NDE methods for oblique inspection for accessory material.

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Table E.41—Grade Color Codes

Grade	Grade Type	Number and Color of Bands for Product [a] with Length ≥ 6.0 ft	Color(s) for Couplings	
			Entire Coupling	Band(s) [b, c]
1	2	3	4	5
H40	—	None or black band at the manufacturer's option	None	Same as for pipe
J55 Tubing	—	One bright green	Bright green	None
J55 Casing	—	One bright green	Bright green	One white
K55	—	Two bright green	Bright green	None
N80	1	One red	Red	None
N80	Q	One red, one bright green	Red	Green
R95	—	One brown	Brown	None
L80	1	One red, one brown	Red	One brown
L80	3Cr	One red, one white	Red[d]	One white
L80	9Cr	One red, one brown, two yellow	None	Two yellow
L80	13Cr	One red, one brown, one yellow	None	One yellow
C90	—	One purple	Purple	None
T95	—	One silver	Silver	None
C110	—	One white, two brown	White	Two brown
P110	—	One white	White	None
C125	---	One orange, one brown	Orange	Brown
Q125	—	One orange	Orange	None

[a] In the case of coupling material, unless otherwise specified in the purchase agreement, the manufacturer's internal requirements shall govern.

[b] Special clearance couplings shall also have a black band.

[c] Seal-ring couplings shall also have a blue band.

[d] The painting of the entire coupling surface may be waived, see 10.4.

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Table E.43—Marking Requirements and Sequence

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80 , R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
1	Manufacturer's name or mark	«....»	D or P	D or P	P	P	P
2	API Spec 5CT	5CT [c]	D or P	D or P	P	P	P
	Manufacturer's option: licensed/registered industry mark	«....»	D or P	D or P	P	P	P
	Date of manufacture as in 10.1.8 or 10.1.9	«....»	D or P	D or P	P	P	P
3	Unthreaded pipe or special end-finish, if applicable (place symbol after specification marking):						
	— Unthreaded pipe either upset or non-upset	PE	D or P		P		
	— Pipe with special end-finish threaded by the pipe mill or processor	SF	D or P		P		
	— Couplings threaded with special end-finish	SF		D or P		P	
	— Coupling stock	CS					P
4	Size designation (fill in Label 1 designation from Column 1 of Table E.1 or E.2)	«....»	P		P		
	Specified diameter for coupling stock and other products with no mass designation						P
5	Mass designation (fill in Label 2 designation from Table E.1 or E.2)	«....»	D or P		P		
	Specified wall thickness for coupling stock and other products with no mass designation						P
6	Grade of product:						
	— H40	H					
	— J55	J					
	— K55	K					

Table E.43—Marking Requirements and Sequence (Continued)

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80 , R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
6	— N80 Type 1 — N80Q — R95 — L80 Type 1 — L80 3Cr — L80 9Cr — L80 13Cr — C90 — T95 — C110 — P110 --- C125 — Q125	N1 NQ R L L3CR L9 L13 C90T C110 P Q C125					
7	Sulfide cracking test [f] — C90 — T95 — C110, C125 All test method designations	A, AH [g], B, or D A, AH [g], B, or D A, D			P	P	P
8	Reduced alternative impact test temperature, if applicable. Fill in specified test temperature for full-size specimens, including ± symbol and °F	«....»C	P	P	P	P	
9	Heat treatment, if applicable: — J55 or K55 normalised — J55 or K55 normalised and tempered	Z N&T	P P	P P			P P

10	Process of manufacture:						
	— Seamless	S					
	— Electric-welded	E					
	All designations		D or P		P		

Table E.43—Marking Requirements and Sequence (Continued)

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80, R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
11	Supplementary requirements, if applicable:						
	— A.2 (SR 1)	S1	P		P		
	— A.3 (SR 2)	S2	P		P		
	— A.4 (SR 9) (fill in type)	S9Q«....»				P	
	— A.8 (SR 13)	S13		D or P		P	
	— A.9 (SR 16) (fill in minimum full-size energy absorption requirement, in joules, and test temperature including ± symbol and °F)	S16«....»C	P		P		
	— A.13 (SR 41)	S41.1	P		P		
		S41.2	P		P		
	— A.14 (SR 42)	S42	P				
	— A.15 (SR 43)	S43			P	D[d] or P	
	— A.16 (SR 44)	S44			P	D[d] or P	
	— A.17 (SR 45)	S45			P	D[d] or P	
	— A.18 (SR 46)	S46	D or P	D or P	P		
	— A.19 (SR 47)	S47	P	D	P	D[d] or P	
	— A.20 (SR 48)	S48	P		P	D[d] or P	
	— A.21 (SR 49)	S49					
12	Hydrostatic test pressure [e] (fill in the actual test pressure, in MPa)						
	All designations	P«....»	P		P		
13	Type of thread, if applicable	«....» [h]	P	P	P	P	

Table E.43—Marking Requirements and Sequence (Continued)

Marking Sequence		Mark or Symbol [b]	Stencil and/or Stamp Marking Requirements [a]				
			Grades H40, J55, K55, N80 , R95, and P110		Grades L80, C90, T95, C110, C125, and Q125		All Grades
			Pipe	Couplings and Accessories	Pipe	Couplings and Accessories	Coupling Stock and Accessory Materials
1	2	3	4	5	6	7	8
14	Full-length drift test, if applicable:						
	— Standard (casing or tubing)	D					
	— Alternative (casing or tubing) where « » is the size of the alternative drift	DA«....»					
	— For casing specified for tubing service and drift-tested in accordance with 7.10	DT42					
	All designations		P		P		
15	Serialization of Grades C90, T95, C110, and Q125				D [d] or P	D [d] or P	P
16	Tin plating of couplings, if applicable	T		P		P	
17	Couplings H40, J55, and K55 only visually inspected	V		P			
18	Additional markings (see 10.1.10)		D or P	D or P	D or P	P	P

NOTE See 10.4 for mandatory color code requirements.

[a] D indicates for optional (die) stamping; P indicates a requirement for (paint) stenciling.

[b] A blank space, «....», indicates information to be filled in.

[c] The manufacturer may include “API” before “5CT”.

[d] Stamp marking shall conform to the requirements of 10.2.

[e] Pipe can be identified as manufactured to SI units by the marked hydro-test pressure which will be less than 100 (MPa), while the pressure marked for pipe manufactured to USC units will be over 1000 (psi); This information is used to clearly identify the units used for CVN markings, which shall be in the same unit system as the pressure markings.

[f] ”A” when tested using Method A (smooth tensile), “B” when tested using Method B, (bent beam), “D” when tested using Method D (DCB). If more than one Test Method is required, then state the combination of the Test Method designations as above, in alphabetical order. For example, if purchaser requires Method D and A, then state and mark "AD".

[g] For Grades C90 and T95, “AH” when tested at 90 % YS_{min}.

[h] See Table E.42 for thread type markings.

Table E.44—Retention of Records

Requirement	Sub-section Reference
Chemical Properties	
Heat analysis	9.3.1
Product analysis	9.3.2
Mechanical Properties	
Heat control tensile tests	9.4.2
Tensile tests on products	6.2, 9.4.7
Impact tests on products	6.4, 6.5, 6.6, 9.7
Hardness tests	6.7, 6.8, 6.9, 9.6
Hardenability tests	6.10, 9.9
Grain size (Grades C90, T95 ~~and~~ C110, and C125)	6.11, 9.8
Coupling tests	8.3
Hydrostatic Tests	
Tester recorder charts	9.12.1
Testing	9.12.1
Supplemental inspection when hydrostatic test pressure is limited, if applicable	A.13.1 (SR 41.1), A.13.2 (SR 41.2)
Manufacturer Certification	
Results of all required tests	12.3
Sulfide stress-cracking test (Grades C90, T95 ~~and~~ C110, and C125)	6.14, 9.10
Calibration	Various

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Annex G
(informative)

Procedures Used to Convert from USC Units to SI Units

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G.8 Charpy Impact Energy Requirements

G.8.4 Minimum Absorbed Energy Requirements for Pipe

The SI values for the maximum specified wall thickness for various grades of pipe for minimum absorbed energy values from full-size test specimens were calculated using Equations (G.24) to (G.27).

The rounding procedures of ISO 80000-1 or ASTM E29 shall be followed. For example, when calculating the requirements for 27 J, 27.49999999 should be used for Cpt,m or Cpl,m (since it rounds to 27). Similarly, when calculating the requirements for 28 J, 28.50000000 should be used for Cpt,m or Cpl,m (since it rounds to 28). The wall thickness that results from the calculation shall be rounded down to two decimal places.

a) Grades N80Q, L80, C90, R95, T95, and P110:

Transverse Charpy absorbed energy requirements for pipe (Table C.14):

$t = [(C_{pt,m} / Y_{smin}) - 0.01259] / 0.00118$ (G.24)

Longitudinal Charpy absorbed energy requirements for pipe (Table C.15):

$t = [(C_{pl,m} / Y_{smin}) - 0.02518] / 0.00236$ (G.25)

b) Grades C110, C125, and Q125:

Transverse Charpy absorbed energy requirements for pipe (Table C.14):

$t = [(C_{pt,m} / Y_{smax}) - 0.01259] / 0.00118$ (G.26)

Longitudinal Charpy absorbed energy requirements for pipe (Table C.15):

$t = [(C_{pl,m} / Y_{smax}) - 0.02518] / 0.00236$ (G.27)

where

$C_{pt,m}$ is the minimum transverse Charpy impact energy for pipe, expressed in joules;

$C_{pl,m}$ is the minimum longitudinal Charpy impact energy for pipe, expressed in joules;

Y_{smax} is the specified maximum yield strength of the pipe, expressed in megapascals;

Y_{smin} is