Designation: A 758/A 758M – 00

Standard Specification for Wrought-Carbon Steel Butt-Welding Piping Fittings with Improved Notch Toughness[1]

This standard is issued under the fixed designation A 758/A 758M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers wrought-carbon steel butt-welding seamless or welded fittings specially processed to ensure better notch toughness than that to be expected in fittings manufactured to the requirements of Specification A 234/A 234M.

1.1.1 Included are elbows, caps, tees, reducers, and other type fittings covered by ASME B 16.9.

1.1.2 Heat treatment is required for all fittings.

1.1.3 Fittings with mandatory radiographic examination of welds are included.

1.1.4 Supplementary requirements are provided for use when additional testing or examination is desired.

1.1.5 Cast fittings, and fittings formed from all weld metal, are not included.

1.2 Several type of fittings are provided, as follows:

Type	Heat Treatment Required	Weld Seam Finish (5.3.2)	Radiography Required?
30	normalize	UW-35	no
31	normalize	UW-35	yes
32	normalize	UW-35 and ground flush	yes
40	normalize and temper	UW-35	no
41	normalize and temper	UW-35	yes
42	normalize and temper	UW-35 and ground flush	yes
50	quench and temper	UW-35	no
51	quench and temper	UW-35	yes
52	quench and temper	UW-35 and ground flush	yes

1.3 It shall be the responsibility of the purchaser to determine whether material meeting the requirements of this specification is satisfactory for the service application.

1.4 This specification is expressed in both inch-pound units and SI units. However, unless the order specifies the applicable "M" specification designation (SI units), the material shall be furnished to inch-pound units.

1.5 The values stated in either inch-pound units or SI units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with the specification.

2. Referenced Documents

2.1 In addition to those reference documents listed in Specification A 960, the following list of standards apply to this specification:

2.2 *ASTM Standards:*

A 234/A 234M Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures[2]

A 275/A 275M Test Method for Magnetic Particle Examination of Steel Forgings[3]

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products[4]

A 960 Specification for Common Requirements for Wrought Steel Piping Fittings[2]

E 165 Practice for Liquid Penetrant Inspection Method[5]

E 709 Practice for Magnetic Particle Examination[5]

2.3 *ASME Boiler and Pressure Vessel Code (ASME Code):*[6]

Section VIII, Division 1 Pressure Vessels

Section IX, Welding and Brazing Qualifications

2.4 *ASME Standard:*

B 16.9 Standards for Steel Butt-Welding Fittings[6]

2.5 *ASNT Standard:*

SNT-TC-1A-1984 Practice for Nondestructive Examination Personnel Qualification and Certification[7]

3. Ordering Information

3.1 See Specification A 960.

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[1] This specification is under the jurisdiction of ASTM Committee A01 on Steel, Stainless Steel, and Related Alloys, and is the direct responsibility of Subcommittee A01.22 on Steel Forgings and Wrought Fittings for Piping Applications and Bolting Materials for Piping and Special Purpose Applications.

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[2] *Annual Book of ASTM Standards*, Vol 01.01.

[3] *Annual Book of ASTM Standards*, Vol 01.05.

[4] *Annual Book of ASTM Standards*, Vol 01.03.

[5] *Annual Book of ASTM Standards*, Vol 03.03.

[6] Available from ASME International, Three Park Avenue, New York, NY 10016–5990.

[7] Available from American Society for Nondestructive Testing, 1711 Arlingate Plaza, P.O. Box 28518, Columbus, OH 43228-0518.

4. General Requirements

4.1 Product furnished to this specification shall conform to the requirements of Specification A 960, including any supplementary requirements that are indicated in the purchase order. Failure to comply with the requirements of Specification A 960 constitutes non-conformance with this specification. In case of a conflict between the requirements of this specification and Specification A 960, this specification shall prevail.

5. Materials and Manufacture

5.1 The steel shall be killed and shall be melted to a fine austenitic grain size practice.

5.2 The starting material shall be wrought and in the form of blooms, billets, slabs, forgings, bars, plates, sheets, seamless pipe or tube, or welded-with-filler-metal pipe or tube. Cast products shall not be used.

5.3 Any forming process, fusion-welding process, or combination of such processes, may be used.

5.3.1 All welding shall be fusion-welded in accordance with the requirements of Section IX of the ASME Code. Welding procedures, welders, and welding operators shall be qualified in accordance with Section IX.

5.3.2 All welded joints shall be finished in accordance with Paragraph UW-35 of Section VIII, Division 1, of the ASME Code.

5.3.3 Welded joints of Type 32, 42, and 52 shall be ground flush.

5.3.4 Welded joints of Types 31, 41, 51, 32, 42, and 52 shall be examined by radiography in accordance with the requirements of Paragraph UW-51 of Section VIII, Division 1, of the ASME Code, and shall conform to the requirements of Paragraph UW-51.

5.4 *Heat Treatment*—All fittings shall be heat treated subsequent to final welding and forming.

5.4.1 *Types 30, 31, and 32* fittings shall be normalized by uniformly heating to a temperature in the austenitizing range, but not to exceed 1700°F [925°C], and subsequently removed from the furnace and air-cooled individually to room temperature.

5.4.2 *Types 40, 41, and 42* fittings shall be normalized in accordance with 5.4.1. After normalizing, the fittings shall be tempered by heating to a temperature in the range from 1100°F to 1200°F [595°C to 675°C], soaking at that temperature for ½ h minimum per 1 in. [25 mm] of thickness, but not less than 15 min, and then air-cooled to room temperature.

5.4.3 *Types 50, 51, and 52* fittings shall be quenched-and-tempered by uniformly heating to a temperature in the austenitizing range, but not to exceed 1700°F [925°C], and then quenching in a liquid media from the austenitizing temperature to a temperature below 800°F [425°C]. After quenching, the fittings shall be reheated to a temperature in the range from 1100°F to 1250°F [595°C to 675°C], soaking at that temperature for ½ h minimum per 1 in. [25 mm] of thickness, but not less than 15 min, and then air-cooled to room temperature.

6. Chemical Composition

6.1 *Heat or Cast Analysis*— The results shall conform to the requirements for the applicable grade as specified in Table 1.

TABLE 1 Chemical Requirements

Element	Cast or Heat Analysis	Product Analysis
Carbon, max, %	0.27	0.30
Manganese, %	0.85–1.20	0.75–1.25
Phosphorus, max, %	0.035	0.040
Sulfur, max, %	0.035	0.040
Silicon, %	0.15–0.30	0.13–0.33
Vanadium, max, %	0.05	0.05
Residual elements[A,B]		
Chromium, max, %	0.25	0.25
Nickel, max, %	0.25	0.25
Molybdenum, max, %	0.08	0.08
Copper, max, %	0.35	0.35
Lead, max, %	0.05	0.05

[A]Individual limits of chromium, nickel, molybdenum, and copper may be exceeded by 0.05 % provided that their total does not exceed 0.90 % in both the heat and product analysis.

[B]These are not to be added to the melt and shall only occur as a result of unavoidable residuals from the melting stock.

6.2 *Product Analysis*—Product analysis may be made by the purchaser. The results shall conform to the requirements for the applicable grade as specified in Table 1.

6.3 The steel shall not contain any unspecified elements for the ordered grade to the extent that it conforms to the requirements of another grade for which that element is a specified element having a required minimum content.

7. Mechanical Requirements

7.1 *Tensile Requirements*:

7.1.1 The fittings, as represented by tensile test specimens taken subsequent to final heat treatment, shall conform to the requirements for the applicable grade as specified in Table 2.

7.1.2 *Number and Location of Specimens*:

7.1.2.1 *Lot*—For tension testing, a lot shall consist of the fittings from a heat, in each heat treatment charge, with nominal wall thicknesses within ¼ in. [6 mm] of the nominal thickness of the test specimen. In addition, for Types 32, 42, and 52, the lot definition shall include each heat or lot of weld metal. If heat treatment is performed in a continuous or batch-type furnace controlled within a range of plus-or-minus 25°F [14°C] and equipped with calibrated thermocouples and recording pyrometers, and records of heat treatment are maintained, all fittings heat treated in such a furnace are considered to be in one charge. For furnaces not so equipped and controlled, each batch constitutes a charge.

7.1.2.2 *Representative Test Piece*—For instances in which the tension test specimen cannot be obtained from a fitting due to size limitations, a representative test piece may be used. The test piece shall be from the same heat and shall be heat treated

TABLE 2 Tensile Requirements

	Grade 60	Grade 70
Tensile strength, ksi [MPa]	60 to 85 [415 to 585]	70 to 95 [485 to 635]
Yield strength,[A] min, ksi [MPa]	35 [240]	38 [260]
Elongation in 2 in. [50 mm], min, %		
Longitudinal	30	27
Transverse	22	20

[A]0.2 % offset or 0.5 % EUL.

in the same heat treatment batch or charge as the fittings it represents, and shall have had approximately the same amount of working as the fittings. In addition, for fittings manufactured from bars, plate, or forgings, the test piece shall have a cross-section equal to or larger than the greatest cross-section of the fittings it represents. Test pieces representing fittings manufactured from pipe shall have a nominal outside diameter and wall thickness equal to that of the pipe from which the fitting was formed. Test pieces for fittings fabricated by welding or formed from welded pipe shall be prepared with the same welding procedure and from the same heat or lot of weld metal as the fitting it represents.

7.1.2.3 *Types 30, 31, 40, 41, 50, and 51*— One base-metal tension test specimen shall be tested from each lot. For fittings fabricated by welding, one transverse-weld tension test specimen shall also be made from each lot. One traverse-weld tension test specimen shall also be required from each lot for fittings formed from welded pipe if the weld in the welded pipe was not tested in the same heat treatment condition as the fittings.

7.1.2.4 *Types 32, 42, and 52*—One base-metal and one transverse-weld tension test specimen shall be tested from each lot. Fittings fabricated by welding or formed from welded pipe shall be tested as in 7.1.2.3.

7.1.2.5 Tension test specimens shall be taken from an integral part of the fitting where practicable. All base-metal tension tests shall be conducted in the longitudinal direction. Weld metal specimens shall be taken transverse to the weld.

7.1.2.6 Tests shall be conducted in accordance with Test Methods and Definitions A 370. Yield strength shall be determined either by the 0.2 % offset method or the 0.5 % extension-under-load method.

7.2 *Transverse Guided Weld Bend Tests—Welded Fittings Only*:

7.2.1 *Number of Tests*:

7.2.1.1 *Lot*—A lot shall be as defined in 7.1.2.1.

7.2.1.2 One guided face-bend and one guided root-bend test shall be made to represent each lot for fittings with a nominal wall thickness of ⅜ in. [10 mm] and less. For fittings with a nominal wall thickness greater than ⅜ in. [10 mm], one guided side-bend test shall be made to represent each lot.

7.2.2 *Test Specimen Location and Orientation*—Full thickness specimens shall be taken transverse to the weld, subsequent to final heat treatment, in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.

7.2.3 *Requirement*—The guided-bend test specimen shall not have any cracks or other open defects exceeding ⅛ in. [3 mm], measured in any direction on the convex surface of the specimen after bending. Cracks occurring on the corners of the specimen during testing shall not be considered unless there is definite evidence that they result from slag inclusions or other internal defects.

8. Dimensions

8.1 Butt-welded fittings shall conform to the dimensions and tolerances specified in ASME B 16.9.

9. Surface Quality

9.1 See Specification A 960.

10. Radiographic Examination

10.1 *Types 31, 32, 41, 42, 51, and 52* fittings shall have the entire length of each weld joint examined radiographically in accordance with Paragraph UW-51 of Section VIII, Division 1, of the ASME Boiler and Pressure Vessel Code.

10.2 Radiographic examination may be performed prior to final heat treatment.

10.3 Personnel performing radiographic examination shall be qualified and certified in accordance with SNT-TC-1A, or with the approval of the purchaser, in accordance with another nationally-accepted standard which covers the qualification and certification of radiographic examination personnel.

11. Rework and Retreatment

11.1 See Specification A 960.

11.2 *Repair Welding—Parent Metal*:

11.2.1 Repair welding by the manufacturer is permissible for parts made to dimensional standards, in ASME or equivalent standards.

11.2.2 Prior approval of the purchaser shall be required to weld repair special parts made to the purchaser's requirements.

11.2.3 Welding shall produce low hydrogen in the weldment.

11.2.4 The product shall be heat treated in accordance with Section 5 after weld repair.

12. Inspection

12.1 The manufacturer shall afford the purchaser's inspectors all reasonable facilities necessary to satisfy him that the material is being produced and furnished in accordance with this specification. Inspection by the purchaser shall not interfere unnecessarily with the manufacturer's operations. All tests and inspections shall be made at the place of manufacture, unless otherwise agreed to.

13. Rejection and Rehearing

13.1 Material that fails to conform to the requirements of this specification may be rejected. Rejection should be reported to the producer or supplier promptly and in writing. In case of dissatisfaction with the results of the test, the producer or supplier may make claim for a rehearing.

13.2 Fittings that develop defects in shop working or application operations may be rejected. Upon rejection, the manufacturer shall be notified in writing.

14. Certification

14.1 See Specification A 960.

15. Product Marking

15.1 See Specification A 960.

15.2 The marking shall be legibly forged, stamped, stencilled, or otherwise suitably marked on each fitting. Use low-stress stamps for all metal stamping. The marking shall not cause cracks or reduce the wall thickness of the product below the minimum allowed.

15.3 *Bar Coding*—Bar coding is acceptable as a supplemental identification method. The purchaser may specify in the order a specific bar coding system to be used. The bar coding

system, if applied at the discretion of the supplier, should be consistent with one of the published industry standards for bar coding. If used on small fittings, the bar code may be applied to the box or a substantially applied tag.

16. Packaging, Package Marking, and Loading for Shipment

16.1 See Specification A 960.

17. Keywords

17.1 low; pipe fittings; piping applications; pressure containing parts; steel; temperature service applications

SUPPLEMENTARY REQUIREMENTS

One or more of the following supplementary requirements shall be applied only when specified by the purchaser in the inquiry, contract, or order. Details of these supplementary requirements shall be agreed upon in writing by the manufacturer and purchaser. Supplementary requirements shall in no way negate any requirement of the specification itself.

S1. Product Analysis

S1.1 A product analysis shall be made for each heat of base material, by the manufacturer of the fitting, to determine the element percentage points specified in Table 1.

S1.2 The determined chemical composition shall be reported to the purchaser, or his representative, and shall conform to the product analysis requirements of Table 1.

S1.3 A product analysis shall also be made of the deposited weld metal. The weld metal analysis shall conform to the requirements of the Welding Procedure Specification, Section IX of the ASME Boiler and Pressure Vessel Code.

S2. Charpy V-Notch Test

S2.1 Charpy V-notch test shall be made as specified on the order. The test temperature, acceptance criteria, number of tests, and location of tests (whether from base-metal, weld metal, or heat-affected zone of welds) shall be specified.

S3. Pressure Test

S3.1 The completed fitting shall be pressure tested with water at 1.5 times design pressure for 10 min and shall not leak or show evidence of reduced service.

S4. Magnetic Particle Examination—Base Metal

S4.1 All accessible surfaces of the fittings shall be examined in accordance with Practice E 709. Accessible is defined as all outside surfaces, all inside surfaces of fittings 24 in. [610 mm] in diameter and greater, and inside surfaces of fittings less than 24 in. [610 mm] in diameter, for a distance of one diameter from the ends.

S4.2 *Acceptance Criteria*—The following indications are unacceptable:

S4.2.1 Linear indications greater than (*1*) 1⁄16 in. [1.6 mm] long for materials less than 5⁄8 in. [16 mm] thick; (*2*) 1⁄8 in. [3.2 mm] long for materials from 5⁄8 in. [16 mm] thick to below 2 in. [50 mm] thick, and; (*3*) 3⁄16 in. [5 mm] long for materials 2 in. [50 mm] thick or greater.

S4.2.2 Rounded indications with dimensions greater than (*1*) 1⁄8 in. [3.2 mm] for thicknesses less than 5⁄8 in. [16 mm] and, (*2*) 3⁄16 in. [5 mm] for thicknesses 5⁄8 in. [16 mm] and greater.

S4.2.3 Four or more indications in any line separated by 1⁄16 in. [1.6 mm] or less edge to edge.

S4.2.4 Ten or more indications located in any 6 in.^{2} [4000 mm^2] of surface, with major dimension not to exceed 6 in. [150 mm] when the major dimension is oriented so that the area includes the maximum number of indications being evaluated.

S4.3 Personnel performing NDE examinations shall be qualified in accordance with SNT-TC-1A-1984.

S5. Liquid Penetrant Examination of Base Metal

S5.1 All accessible surfaces of the fittings shall be examined in accordance with Practice E 165. Accessible is defined in S4.1

S5.2 Acceptance criteria shall be in accordance with S4.2.

S5.3 Personnel performing NDE examinations shall be qualified in accordance with SNT-TC-1A-1984.

S6. Weld Repair Surface

S6.1 Area(s) to be repair-welded and weld repaired surface shall be magnetic particle inspected in accordance with Test Method A 275/A 275M in order to agree with the purchaser's acceptance criteria.

S6.2 Area(s) to be repair welded and weld repaired surface shall be liquid penetrant inspected in accordance with Practice E 165 in order to agree with the purchaser's acceptance criteria.

S7. Weld Repair Imperfections

S7.1 These are not permitted without the purchaser's prior approval.