~~Designation:A 672–96~~

~~An American National Standard~~ Designation: A 672 – 96 (Reapproved 2001)

Standard Specification for Electric-Fusion-Welded Steel Pipe for High-Pressure Service at Moderate Temperatures[1]

This standard is issued under the fixed designation A 672; 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[2] covers steel pipe: electric-fusion-welded with filler metal added, fabricated from pressure-vessel quality plate of any of several analyses and strength levels and suitable for high-pressure service at moderate temperatures. Heat treatment may or may not be required to attain the desired properties or to comply with applicable code requirements. Supplementary requirements are provided for use when additional testing or examination is desired.

1.2 The specification nominally covers pipe 16 in. (405 mm) in outside diameter or larger with wall thicknesses up to 3 in. (75 mm), inclusive. Pipe having other dimensions may be furnished provided it complies with all other requirements of this specification.

1.3 Several grades and classes of pipe are provided.

1.3.1 *Grade* designates the type of plate used.

1.3.2 *Class* designates the type of heat treatment performed during manufacture of the pipe, whether the weld is radiographically examined, and whether the pipe has been pressure tested as listed in 1.3.3.

1.3.3 Class designations are as follows (Note 1):

Class	Heat Treatment on Pipe	Radiography, see Section	Pressure Test, see Section
10	none	none	none
11	none	9	none
12	none	9	8.3
13	none	none	8.3
20	stress relieved, see 5.3.1	none	none
21	stress relieved, see 5.3.1	9	none
22	stress relieved, see 5.3.1	9	8.3
23	stress relieved, see 5.3.1	none	8.3
30	normalized, see 5.3.2	none	none
31	normalized, see 5.3.2	9	none
32	normalized, see 5.3.2	9	8.3
33	normalized, see 5.3.2	none	8.3
40	normalized and tempered, see 5.3.3	none	none
41	normalized and tempered, see 5.3.3	9	none
42	normalized and tempered, see 5.3.3	9	8.3
43	normalized and tempered, see 5.3.3	none	8.3
50	quenched and tempered, see 5.3.4	none	none
51	quenched and tempered, see 5.3.4	9	none
52	quenched and tempered, see 5.3.4	9	8.3
53	quenched and tempered, see 5.3.4	none	8.3

NOTE 1—Selection of materials should be made with attention to temperature of service. For such guidance, Specification A 20/A 20M may be consulted.

1.4 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 *ASTM Standards:*

A 20/A 20M Specification for General Requirements for Steel Plates for Pressure Vessels[3]

[1] This specification is under the jurisdiction of ASTM Committee ~~A-1~~ A01 on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee A01.09 on Carbon Steel Tubular Products.

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[2] For ASME Boiler and Pressure Vessel Code applications see related Specification SA-672 in Section II of that Code.

[3] *Annual Book of ASTM Standards*, Vol 01.04.

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products[4]
A 435/A 435M Specification for Straight-Beam Ultrasonic Examination of Steel Plates[3]
A 530/A 530M Specification for General Requirements for Specialized Carbon and Alloy Steel Pipe[5]
A 577/A 577M Specification for Ultrasonic Angle-Beam Examination of Steel Plates[3]
A 578/A 578M Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications[3]
E 110 Test Method for Indentation Hardness of Metallic Materials by Portable Hardness Testers[6]
E 165 Test Method for Liquid Penetrant Examination[7]
E 350 Test Methods for Chemical Analysis of Carbon Steel, Low-Alloy Steel, Silicon Electrical Steel, Ingot Iron, and Wrought Iron[8]
E 709 Guide for Magnetic Particle Examination[7]

2.1.2 *Plate Steel Specifications* (Table 1):

A 202/A 202M Pressure Vessel Plates, Alloy Steel, Chromium-Manganese-Silicon[3]
A 204/A 204M Pressure Vessel Plates, Alloy Steel, Molybdenum[3]
A 285/A 285M Pressure Vessel Plates, Carbon Steel, Low- and Intermediate-Tensile Strength[3]
A 299/A 299M Pressure Vessel Plates, Carbon Steel, Manganese-Silicon[3]
A 302/A 302M Pressure Vessel Plates, Alloy Steel, Manganese-Molybdenum and Manganese-Molybdenum Nickel[3]
A 442/A 442M Pressure Vessel Plates, Carbon Steel, Improved Transition Properties[3]
A 515/A 515M Pressure Vessel Plates, Carbon Steel, for Intermediate- and Higher-Temperature Service[3]
A 516/A 516M Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service[3]

[4] *Annual Book of ASTM Standards*, Vol 01.03.
[5] *Annual Book of ASTM Standards*, Vol 01.01.
[6] *Annual Book of ASTM Standards*, Vol 03.01.
[7] *Annual Book of ASTM Standards*, Vol 03.03.
[8] *Annual Book of ASTM Standards*, Vol 03.05.

TABLE 1 Plate Specification

Pipe Grade	Type of Steel	ASTM Specification	
		No.	Grade
A 45	plain carbon	A 285	A
A 50	plain carbon	A 285	B
A 55	plain carbon	A 285	C
B 55	plain carbon, killed	A 515	55
B 60	plain carbon, killed	A 515	60
B 65	plain carbon, killed	A 515	65
B 70	plain carbon, killed	A 515	70
C 55	plain carbon, killed, fine grain	A 516	55
C 60	plain carbon, killed, fine grain	A 516	60
C 65	plain carbon, killed, fine grain	A 516	65
C 70	plain carbon, killed, fine grain	A 516	70
D 70	manganese-silicon—normalized	A 537	1
D 80	manganese-silicon—Q&T[A]	A 537	2
E 55	plain carbon	A 442	55
E 60	plain carbon	A 442	60
H 75	manganese-molybdenum—normalized	A 302	A
H 80	manganese-molybdenum—normalized	A 302	B, C or D
J 80	manganese-molybdenum—Q&T[A]	A 533	Cl-1[B]
J 90	manganese-molybdenum—Q&T[A]	A 533	Cl-2[B]
J 100	manganese-molybdenum—Q&T[A]	A 533	Cl-3[B]
K 75	chromium-manganese-silicon	A 202	A
K 85	chromium-manganese-silicon	A 202	B
L 65	molybdenum	A 204	A
L 70	molybdenum	A 204	B
L 75	molybdenum	A 204	C
N 75	manganese-silicon	A 299	. . .

[A] Q&T = quenched and tempered.
[B] Any grade may be furnished.

A 533/A 533M Pressure Vessel Plates, Alloy Steel, Quenched and Tempered, Manganese-Molybdenum and Manganese-Molybdenum-Nickel[3]
A 537/A 537M Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel[3]
2.2 *ASME Boiler and Pressure Vessel Code:*[9]
Section II, Material Specifications
~~Section III, Nuclear Vessels~~
~~Section VIII, Unfired Pressure Vessels~~
~~Section IX, Welding Qualifications~~
Section III, Nuclear Vessels
Section VIII, Unfired Pressure Vessels
Section IX, Welding Qualifications

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*
3.1.1 A *lot* shall consist of 200 ft (61 m) or fraction thereof of pipe from the same heat of steel.
3.1.2 The description of a lot may be further restricted by use of Supplementary Requirement S14.

4. Ordering Information

4.1 The inquiry and order for material under this specification should include the following information:
4.1.1 Quantity (feet, metres, or number of lengths),
4.1.2 Name of material (steel pipe, electric-fusionwelded),
4.1.3 Specification number,
4.1.4 Grade and class designations (see 1.3),
4.1.5 Size (inside or outside diameter, nominal or minimum wall thickness),
4.1.6 Length (specific or random),
4.1.7 End finish (11.4),
4.1.8 Purchase options, if any (see 5.2.3, 11.3, 14.1 and Sections 16, 20.1, 21, 22 of Specification A 530/A 530M), and
4.1.9 Supplementary requirements, if any, (refer to S1 through S14).

5. Materials and Manufacture

5.1 *Materials*—The steel plate material shall conform to the requirements of the applicable plate specification for pipe grade ordered as listed in Table 1.
5.2 *Welding*:
5.2.1 The joints shall be double-welded, full-penetration welds made in accordance with procedures and by welders or welding operators qualified in accordance with the ASME Boiler and Pressure Vessel Code, Section IX.
5.2.2 The welds shall be made either manually or automatically by an electric process involving the deposition of filler metal.
5.2.3 The welded joint shall have positive reinforcement at the center of each side of the weld, but not more than ⅛ in. (3.2 mm). This reinforcement may be removed at the manufacturer's option or by agreement between the manufacturer and purchaser. The contour of the reinforcement shall be smooth, and the deposited metal shall be fused smoothly and uniformly into the plate surface.
5.2.4 When radiographic examination in accordance with 9.1 is to be used, the weld reinforcement shall be governed by the more restrictive provisions of UW–51 of Section VIII of the ASME Boiler and Pressure Vessel Code instead of 5.2.3 of this specification.
5.3 *Heat Treatment*—All classes other than 10, 11, 12 and 13 shall be heat treated in furnace controlled to ± 25°F (14°C) and equipped with a recording pyrometer so that heating records are available. Heat treating after forming and welding shall be to one of the following:
5.3.1 Classes 20, 21, 22, and 23 pipe shall be uniformly heated within the post-weld heat-treatment temperature range indicated in Table 2 for a minimum of 1 h/in. of thickness or 1 h, whichever is greater.
5.3.2 Classes 30, 31, 32, and 33 pipe shall be uniformly heated to a temperature in the austenitizing range and not exceeding the maximum normalizing temperature indicated in Table 2 and subsequently cooled in air at room temperature.
5.3.3 Classes 40, 41, 42, and 43 pipe shall be normalized in accordance with 5.3.2. After normalizing, the pipe shall be reheated to the tempering temperature indicated in Table 2 as a minimum and held at temperature for a minimum of ½ h/in. of thickness or ½ h, whichever is greater, and air cooled.
5.3.4 Classes 50, 51, 52, and 53 pipe shall be uniformly heated to a temperature in the austenitizing range, and not exceeding the maximum quenching temperature indicated in Table 2 and subsequently quenched in water or oil. After quenching the pipe

[9] ~~Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.~~
[9] Available from ASME International, Three Park Avenue, New York, NY 10016–5990.

TABLE 2 Heat Treatment Parameters

Pipe Grade[A]	Specification and Grade[B]	Post-Weld Heat-Treat Temperature Range, °F (°C)	Normalizing Temperature, max, °F (°C)	Quenching Temperature, max, °F (°C)	Tempering Temperature, min, °F (°C)
A 45	A 285A	1100–1250 (590–680)	1700 (925)	. . .	. . .
A 50	A 285B	1100–1250 (590–680)	1700 (925)	. . .	. . .
A 55	A 285C	1100–1250 (590–680)	1700 (925)	. . .	. . .
B 55	A 515-55	1100–1250 (590–680)	1750 (950)	. . .	. . .
B 60	A 515-60	1100–1250 (590–680)	1750 (950)	. . .	. . .
B 65	A 515-65	1100–1250 (590–680)	1750 (950)	. . .	. . .
B 70	A 515-70	1100–1250 (590–680)	1750 (950)	. . .	. . .
C 55	A 516-55	1100–1250 (590–680)	1700 (925)	1650 (900)	1200 (650)
C 60	A 516-60	1100–1250 (590–680)	1700 (925)	1650 (900)	1200 (650)
C 65	A 516-65	1100–1250 (590–680)	1700 (925)	1650 (900)	1200 (650)
C 70	A 516-70	1100–1250 (590–680)	1700 (925)	1650 (900)	1200 (650)
D 70	A 537-1	1100–1250 (590–680)	1700 (925)	. . .	. . .
D 80	A 537-2	1100–1250 (590–680)	. . .	1650 (900)	1200 (650)
E 55	A 442-55	1100–1250 (590–680)	1700 (925)	1650 (900)	1200 (650)
E 60	A 442-60	1100–1250 (590–680)	1700 (925)	1650 (900)	1200 (650)
H 75	A 302-A	1100–1250 (590–680)	1800 (980)	. . .	1100 (590)
H 80	A 302-B, C or D	1100–1250 (590–680)	1800 (980)	. . .	1100 (590)
J 80	A 533-C11[B]	1100–1250 (590–680)	. . .	1800 (980)	1100 (590)
J 90	A 533-C12[B]	1100–1250 (590–680)	. . .	1800 (980)	1100 (590)
J 100	A 533-C13[B]	1100–1250 (590–680)	. . .	1800 (980)	1100 (590)
K 75	A 202A	1100–1200 (590–650)	. . .	. . .	. . .
K 85	A 202B	1100–1200 (590–650)	. . .	. . .	. . .
L 65	A 204A	1100–1200 (590–650)	. . .	. . .	. . .
L 70	A 204B	1100–1200 (590–650)	. . .	. . .	. . .
L 75	A 204C	1100–1200 (590–650)	. . .	. . .	. . .
N 75	A 299	1100–1200 (590–650)	1700 (925)	. . .	. . .

[A] Numbers indicate minimum tensile strength in ksi.
[B] Any grade may be used.

shall be reheated to the tempering temperature indicated in Table 2 as a minimum and held at temperature for a minimum of ½ h/in. of thickness or ½ h, whichever is greater, and air cooled.

6. *General Requirements* General Requirements

6.1 Material furnished to this specification shall conform to the applicable requirements of the current edition of Specification A 530/A 530M unless otherwise provided herein.

7. Chemical Composition

7.1 *Product Analysis of Plate*—The pipe manufacturer shall make an analysis of each mill heat of plate material. The product analysis so determined shall meet the requirements of the plate specification to which the material was ordered.

7.2 *Product Analysis of Weld*—The pipe manufacturer shall make an analysis of the finished deposited weld material from each 500 ft (152 m) or fraction thereof. Analysis shall conform to the welding procedure for deposited weld metal.

7.3 Analysis may be taken from the mechanical test specimens. The results of the analyses shall be reported to the purchaser.

7.4 If the analysis of one of the tests specified in 7.1 or 7.2 does not conform to the requirements specified, analyses shall be made on additional pipes of double the original number from the same lot, each of which shall conform to the requirements specified. Nonconforming pipe shall be rejected.

8. Mechanical Properties

8.1 *Tension Test*:

8.1.1 *Requirements*—Transverse tensile properties of the welded joint shall meet the minimum requirements for ultimate tensile strength of the specified plate material. In addition for Grades Dxx, Hxx, Jxx, and Nxx in Classes 3x, 4x, and 5x transverse tensile properties of the base plate, shall be determined on specimens cut from the heat-treated pipe. These properties shall meet the mechanical test requirements of the plate specification.

8.1.2 *Number of Tests*—One test specimen shall be made to represent each lot of finished pipe.

8.1.3 *Test Specimen Location and Orientation*—The test specimens shall be taken transverse to the weld at the end of the finished pipe and may be flattened cold before final machining to size.