SPECIFICATION FOR SEAMLESS AND ELECTRIC-WELDED LOW-ALLOY STEEL TUBES

SA-423/SA-423M

(23)

(Identical with ASTM Specification A423/A423M-19.)

Specification for Seamless and Electric-Welded Low-Alloy Steel Tubes

1. Scope

1.1 This specification covers minimum-wall-thickness, low-alloy steel tubes for pressure containing parts such as economizers or other applications where corrosion resistance is important.

1.2 The tubing sizes and thicknesses usually furnished to this specification are ½ to 5 in. [12.7 to 127 mm] in outside diameter and 0.035 to 0.500 in. [0.9 to 12.7 mm] inclusive, in minimum wall thickness. Tubing having other dimensions may be furnished, provided such tubes comply with all other requirements of this specification.

1.3 Mechanical property requirements do not apply to tubing smaller than ¼ in. [3.2 mm] in inside diameter or 0.015 in. [0.4 mm] in thickness.

1.4 This specification covers three grades, two types, and two manufacture finishes:

1.4.1 Grades 1, 2, and 3 are identified in Table 1 (Chemical Requirements), and Table 3 (Tensile Requirements),

1.4.2 Type (seamless or electric-resistance welded),

1.4.3 Manufacture (hot finished or cold finished).

1.5 Optional supplementary requirements S1 and S2 are provided and, when desired, shall be so stated in the order.

1.6 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the SI units are shown in brackets. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*

A450/A450M Specification for General Requirements for Carbon and Low Alloy Steel Tubes

E213 Practice for Ultrasonic Testing of Metal Pipe and Tubing

E273 Practice for Ultrasonic Testing of the Weld Zone of Welded Pipe and Tubing

3. Ordering Information

3.1 Orders for material under this specification shall include the following, as required, to describe the desired material adequately:

3.1.1 Quantity (feet, metres, or number of lengths),

3.1.2 Type of material (seamless or electric-resistance-welded tubes),

3.1.3 Grade 1, 2, or 3 (Table 1 and Table 3),

3.1.4 Manufacture (hot finished or cold finished),

3.1.5 Size (outside diameter and minimum wall thickness),

3.1.6 Length (specific or random),

3.1.7 Required test options (hydrostatic or electric test, 11.7),

3.1.8 Test report required (see Certification Section of Specification A450/A450M),

3.1.9 Specification designation (including year of issue), and

3.1.10 Special requirements and any supplementary requirements selected.

4. Manufacture

4.1 Tubes made by the seamless process may be hot finished or cold finished.

5. Heat Treatment

5.1 All tubes shall be normalized or given such heat treatment as may be necessary to conform to the requirements of this specification.

TABLE 1 Chemical Requirements

	Composition, %		
	Grade 1	Grade 2	Grade 3
Carbon, max	0.15	0.15	0.06
Manganese	0.55 max	0.50–1.00	0.70–1.40
Phosphorus	0.06–0.16	0.04 max	0.020 max
Sulfur, max	0.060	0.05	0.020
Silicon	0.10 min	...	0.55 max
Copper	0.20–0.60	0.30–1.00	0.25–0.45
Chromium	0.24–1.31	...	...
Nickel	0.20–0.70	0.40–1.10	0.50 max
Molybdenum	...	0.10 min	0.20 max
Antimony	...	...	0.05–0.15

TABLE 3 Tensile Requirements

	Grades 1 and 2	Grade 3
Tensile strength, min, ksi [MPa]	60 [415]	55 [380]
Yield strength, min, ksi [MPa]	37 [255]	33 [230]
Elongation in 2 in. or 50 mm, min, %	25	35
For longitudinal strip tests a deduction for each 1/32 in. [0.8 mm] decrease in wall thickness below 5/16 in. [8 mm] from the basic minimum elongation of the following percentage points shall be made	1.25[A]	1.25[A]

[A] Calculated elongation requirements shall be rounded to the nearest whole number.

6. Chemical Composition

6.1 The steel shall conform to the requirements as to chemical composition prescribed in Table 1.

7. Product Analysis

7.1 An analysis of either one billet, one length of flat-rolled stock or one tube shall be made from each heat. The chemical composition thus determined shall conform to the requirements specified.

7.2 If the original test for product analysis fails, retests of two additional billets, lengths of flat-rolled stock, or tubes shall be made. Both retests, for the elements in question shall meet the requirements of the specification; otherwise all remaining material in the heat or lot (Note 1) shall be rejected or, at the option of the producer, each billet, length of flat-rolled stock or tube may be individually tested for acceptance. Billets, lengths of flat-rolled stock or tubes which do not meet the requirements of the specification shall be rejected.

NOTE 1—For flattening, flaring, and flange requirements, the term *lot* applies to all tubes prior to cutting of the same nominal size and wall thickness that are produced from the same heat of steel. When final heat treatment is in a batch-type furnace, a lot shall include only those tubes of the same size and from the same heat which are heat treated in the same furnace charge. When the final heat treatment is in a continuous furnace the number of tubes of the same size and from the same heat in a lot shall be determined from the size of the tubes as prescribed in Table 2.

NOTE 2—For tensile and hardness test requirements, the term *lot* applies to all tubes prior to cutting, of the same nominal diameter and wall thickness that are produced from the same heat of steel. When final heat treatment is in a batch-type furnace, a lot shall include only those tubes of the same size and the same heat which are heat treated in the same furnace charge. When the final heat treatment is in a continuous furnace, a lot shall include all tubes of the same size and heat, heat treated in the same furnace at the same temperature, time at heat, and furnace speed.

TABLE 2 Number of Tubes in a Lot Heat Treated by the Continuous Process

Size of Tube	Size of Lot
2 in. [50.8 mm] and over in outside diameter and 0.200 in. [5.1 mm] and over in wall thickness	not more than 50 tubes
Less than 2 in. [50.8 mm] but over 1 in. [25.4 mm] in outside diameter or over 1 in. [25.4 mm] in outside diameter and under 0.200 in. [5.1 mm] in wall thickness	not more than 75 tubes
1 in. [25.4 mm] or less in outside diameter	not more than 125 tubes

8. Tensile Requirements

8.1 The material shall conform to the requirements as to tensile properties prescribed in Table 3.

9. Hardness Requirements

9.1 The tubes shall have a hardness number not exceeding 170 HBW or 87 HRBW.

10. Forming Operations

10.1 Tubes when inserted in the boiler shall stand expanding and beading without showing cracks or flaws.

11. Mechanical Tests Required

11.1 *Tension Test*—One tension test shall be made on a specimen for lots of not more than 50 tubes. Tension tests shall be made on specimens from two tubes for lots of more than 50 tubes (Note 2).

11.2 *Flattening Test*—One flattening test shall be made on specimens from each end of one finished tube, not the one used for the flaring or flanging test, from each lot (Note 1).

11.3 *Flaring Test (Seamless Tubes)*—One flaring test shall be made on specimens from each end of one finished tube, not the one used for the flattening test, from each lot (Note 1).

11.4 *Flange Test (Welded Tubes)*—One flange test shall be made on specimens from each end of one finished tube, not the one used for the flattening test, from each lot (Note 1).

11.5 *Hardness Test*—Brinell or Rockwell hardness tests shall be made on specimens from two tubes from each lot (Note 2).

11.6 *Reverse Flattening Test*—For welded tubes, one reverse flattening test shall be made on a specimen from each 1500 ft [460 m] of finished tubing.

11.7 *Hydrostatic or Nondestructive Electric Test*—Each tube shall be subjected to the hydrostatic test, or, instead of this test, a nondestructive electric test may be used when specified by the purchaser.

12. General Requirements

12.1 Material furnished under this specification should conform to the applicable requirements of the current edition of Specification A450/A450M, unless otherwise provided herein.

13. Product Marking

13.1 In addition to the marking prescribed in Specification A450/A450M, the marking shall include whether hot finished or cold finished, and whether seamless or welded.

14. Keywords

14.1 seamless steel tube; steel tube; alloy; welded steel tube

SUPPLEMENTARY REQUIREMENTS

S1. Surface Condition

S1.1 If pickling or shot blasting, or both, are required, this shall be specifically stated in the order and shall be done at the purchaser's expense. Pickling or shot blasting shall apply only when specified by the purchaser in the inquiry, contract, or order. Details of this supplementary requirement shall be agreed upon by the manufacturer and the purchaser.

S2. Additional Testing of Welded Tubing per ASME Request

S2.1 Each tube shall be subjected to an ultrasonic inspection employing Practices E273 or E213 with the rejection criteria referenced in Specification A450/A450M.

S2.2 If Practice E273 is employed, a 100 % volumetric inspection of the entire length of each tube shall also be performed using one of the non-destructive electric tests permitted by Specification A450/A450M.

S2.3 The test methods described in the supplement may not be capable of inspecting the end portions of tubes. This condition is referred to as end effect. This portion, as determined by the manufacturer, shall be removed and discarded.

S2.4 In addition to the marking prescribed in Specification A450/A450M, "S2" shall be added after the grade designation.

S2.5 Additional Testing of Welded Tubing shall have been specified in the inquiry or invitation to bid, and purchase order or contract. The requirements shall not be considered unless specified in the order and the necessary tests shall be made at the mill.