Designation: A 803/A 803M – 08

Standard Specification for Welded Ferritic Stainless Steel Feedwater Heater Tubes[1]

This standard is issued under the fixed designation A 803/A 803M; 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 welded ferritic stainless steel feedwater heater tubes including those bent, if specified, into the form of U-tubes for application in tubular feedwater heaters.

1.2 The tubing sizes covered shall be ⅝ to 1 in. [15.9 to 25.4 mm] inclusive, in outside diameter, and average or minimum wall thicknesses of 0.028 in. [0.7 mm] and heavier.

1.3 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. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

2. Referenced Documents

2.1 *ASTM Standards:* [2]

A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip

A 763 Practices for Detecting Susceptibility to Intergranular Attack in Ferritic Stainless Steels

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

A 1016/A 1016M Specification for General Requirements for Ferritic Alloy Steel, Austenitic Alloy Steel, and Stainless Steel Tubes

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, refer to Terminology A 941.

4. Ordering Information

4.1 It is the responsibility of the purchaser to specify all requirements that are necessary for material under this specification. Such requirements may include, but are not limited to, the following:

4.1.1 Quantity (length or number of pieces),

4.1.2 Material description,

4.1.3 Dimensions (outside diameter, wall thickness (minimum or average wall), and length),

4.1.4 Grade (chemical composition) (Table 1), and

4.1.5 U-bend requirements, if order specifies bending, U-bend schedules or drawings shall accompany the order.

4.2 *Optional Requirements*—Purchaser shall specify whether annealing of the U-bends is required or whether tubes are to be hydrotested or air-tested (see 10.5).

4.3 *Supplementary Requirements*—Purchaser shall specify on this purchase order if material is to be eddy-current tested in accordance with Supplementary Requirement S1 or S2, and if special test reports are required, under Supplementary Requirement S3, and,

4.4 Any special requirements.

5. General Requirements

5.1 Material furnished to this specification shall conform to the applicable requirements of the latest published edition of Specification A 1016/A 1016M unless otherwise provided herein.

6. Materials and Manufacture

6.1 The tube shall be made from flat-rolled steel by an automatic welding process with no addition of filler metal.

6.2 Surface contaminants may have detrimental effects on high temperature properties or corrosion resistance of tubing. Contamination by copper, lead, mercury, zinc, chlorides, or sulfur may be detrimental to stainless steels. The manufacturer shall employ techniques which minimize surface contamination by these elements.

7. Cleaning Before Annealing

7.1 All lubricants or coatings used in the manufacture of straight-length tube or in the bending shall be removed from all surfaces prior to any annealing treatments. U-bends on which a lubricant had been applied to the inside surface during

[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 A01.10 on Stainless and Alloy Steel Tubular Products.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

***A Summary of Changes section appears at the end of this standard.**

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TABLE 1 Chemical Requirements

Grade	UNS S 40900 TP409	UNS S 43035 TP439	UNS S 44627 TP XM-27	UNS S 44626 TP XM-33	UNS S 44635 25-4-4	UNS S 44660 26-3-3	UNS S 44700 29-4	UNS S 44800 29-4-2	UNS S 44400 18-2	UNS S 44735 29-4C
Element	Composition, %									
C, max	0.08	0.07	0.01[A]	0.06	0.025	0.030	0.010	0.010	0.025	0.030
Mn, max	1.00	1.00	0.40	0.75	1.00	1.00	0.30	0.30	1.00	1.00
P, max	0.045	0.040	0.02	0.040	0.040	0.040	0.025	0.025	0.040	0.040
S, max	0.030	0.030	0.02	0.020	0.030	0.030	0.020	0.020	0.030	0.030
Si, max	1.00	1.00	0.40	0.75	0.75	1.00	0.20	0.20	1.00	1.00
Ni	0.50 max	0.50 max	0.5[B] max	0.50 max	3.5–4.5	1.0–3.5	0.15 max	2.0–2.5	1.00 max	1.00 max
Cr	10.5–11.7	17.0–19.0	25.0–27.5	25.0–27.0	24.5–26.0	25.0–28.0	28.0–30.0	28.0–30.0	17.5–19.5	28.0–30.0
Mo	. . .	. . .	0.75–1.50	0.75–1.50	3.5–4.5	3.0–4.0	3.5–4.2	3.5–4.2	1.75–2.50	3.6–4.2
Al	. . .	0.15 max	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Cu	. . .	. . .	0.20 max	0.20 max	. . .	. . .	0.15 max	0.15 max	. . .	. . .
N	. . .	0.04 max	0.015 max	0.040 max	0.035	0.040 max	0.020 max[C]	0.020 max[C]	0.035 max	0.045 max
Ti	6 × C min; 0.75 max	0.20 + 4 (C + N) min; 1.10 max	. . .	7 × (C + N) but no less than 0.20 min; 1.00 max	(Ti + Cb) = 0.2 + 4 (C + N) min; 0.80 max	Ti + Cb = 6 × (C + N) but no less than 0.20 min; 1.00 max			(Ti + Cb) = 0.20 + 4 (C + N) min; 0.80 max	Ti + Cb = 6 × (C + N) but no less than 0.20 min; 1.00 max
Cb	. . .	. . .	0.05–0.20	. . .	. . .	. . .	. . .	. . .	. . .	. . .

[A] For small diameter or thin walls, or both, tubing, where many drawing passes are required, a carbon maximum of 0.015 % is necessary. Small outside diameter tubes are defined as those less than 0.500 in. [12.7 mm] in outside diameter and light wall tubes as those less than 0.049 in. [1.2 mm] in average wall thickness (0.040 in. [1 mm] in minimum wall thickness).
[B] Nickel + copper.
[C] Carbon + nitrogen = 0.025 max.

bending shall have the cleanness of their inside surface confirmed by blowing close-fitting acetone-soaked felt plugs through 10 % of the tubes of each bend radius. Dry, oil-free air or inert gas shall be used to blow the plugs through the tubes. If the plugs blown through any tube show more than a light gray discoloration, all tubes that have had a lubricant applied to the inside surface during bending shall be recleaned. After recleaning 10 % of the tubes of each bend radius whose inside surface had been subjected to bending, lubricants shall be retested.

8. Heat Treatment

8.1 All finished straight tubing or straight tubing ready for U-bending shall be furnished in the solution-annealed condition. The annealing procedure shall consist of heating the material to a temperature of 1200°F [650°C] or higher and cooling (as appropriate for the grade) to meet the requirements of this specification.

8.2 If heat treatment of U-bends is specified, it shall satisfy the annealing procedure described in 8.1 and shall be done as follows:

8.2.1 The heat treatment shall be applied to the U-bend area plus approximately 6 in. [150 mm] of each leg beyond the tangent point of the U-bend.

8.2.2 If the heat treatment specified in 8.2 is accomplished by resistance-heating methods wherein electrodes are clamped to the tubes, the clamped areas shall be visually examined for arc burns. Burn indications shall be cause for rejection unless they can be removed by local polishing without encroaching upon minimum wall thickness.

8.2.3 Temperature control shall be accomplished through the use of optical or emission pyrometers, or both. No temperature-indicating crayons, lacquers, or pellets shall be used.

8.2.4 The inside of the tube shall be purged with a protective or an inert gas atmosphere during heating and cooling to below 700°F [370°C] to prevent scaling of the inside surface. The atmosphere should be noncarburizing.

9. Chemical Composition

9.1 *Product Analysis*:

9.1.1 The steel shall conform to the chemical composition in Table 1.

9.1.2 When specified on the purchase order, a product analysis shall be supplied from one tube or coil of steel per heat. The product analysis tolerance of Specification A 480/A 480M shall apply.

9.1.3 If the original test for product analysis fails, retests of two additional lengths of flat-rolled stock or tubes shall be made. Both retests, for the elements in question, shall meet the requirements of this specification; otherwise all remaining material in the heat or lot shall be rejected or, at the option of the producer, each length of flat-rolled stock or tube may be individually tested for acceptance. Lengths of flat-rolled stock or tubes that do not meet the requirements of this specification shall be rejected.

10. Mechanical Requirements

10.1 *Tensile Properties*:

10.1.1 The material shall conform to the tensile properties shown in Table 2.

10.1.2 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.

10.1.3 Table 3 gives the computed minimum elongation values for each 1⁄32 in. [0.8 mm] decrease in wall thickness.

10.2 *Hardness*:

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TABLE 2 Tensile Requirements

Grade	Tensile Strength, min, ksi [MPa]	Yield Strength, min, ksi [MPa]	Elongation[A] in 2 in. or 50 mm, min, %
TP 409	55 [380]	30 [205]	20
TP 439	60 [415]	30 [205]	20
TP XM-27	65 [450]	40 [275]	20
TP XM-33	68 [470]	45 [310]	20
25-4-4	90 [620]	75 [515]	20
26-3-3	85 [585]	65 [450]	20
29-4	80 [550]	60 [415]	20
29-4-2	80 [550]	60 [415]	20
18-2	60 [415]	35 [240]	20
29-4C	75 [515]	60 [415]	18

[A] For longitudinal strip tests, a deduction of 0.90 % for 29-4C and 1 % for all other grades shall be made from the basic minimum elongation for each 1/32 in. [0.8 mm] decrease in wall thickness below 5/16 in. [8 mm]. Table 3 gives the computed minimum values.

TABLE 3 Minimum Elongation Values[A]

Wall Thickness[B]		Elongation in 2 in. or 50 mm, min, %	
in.	mm	29-4C	All Other
5/16 (0.312)	8	18	20
9/32 (0.281)	7.2	17	19
1/4 (0.250)	6.4	16	18
7/32 (0.219)	5.6	15	17
3/16 (0.188)	4.8	14	16
5/32 (0.156)	4	13	15
1/8 (0.125)	3.2	13	14
3/32 (0.094)	2.4	12	13
1/16 (0.062)	1.6	11	12
0.062 to 0.035, excl	1.6 to 0.9	10	12
0.035 to 0.022, excl	0.9 to 0.6	10	11
0.022 to 0.015, excl	0.6 to 0.4	10	11

[A] Calculation elongation shall be rounded to the nearest whole number.
[B] Where the wall thickness lies between two values shown above, the minimum elongation value shall be determined by the following equation:

Grade	Equation
29-4C	E = 28.8t + 9.00
	[E = 1.13t + 9.00]
All other	E = 32t + 10.00
	[E = 1.25t + 10.00]

where:
E = elongation in 2 in. or 50mm, %, and
t = actual thickness of specimen, in. [mm].

10.2.1 The tubes shall have a hardness number not to exceed those prescribed in Table 4. This hardness requirement is not to apply to the bend area of U-bend tubes which are not heat treated after bending.

10.2.2 Brinell or Rockwell hardness tests shall be made on specimens from two tubes from each lot.

10.3 *Reverse Flattening Test*—One reverse flattening test shall be made on a specimen from each 1500 ft [460 m] of finished tubing.

10.4 *Flange Test*—Flange tests shall be made on specimens from each end of one finished tube, not the one used for the flattening test, from each lot.

10.5 *Pressure Test*—Each straight tube, or each U-tube after completion of the bending and post-bending heat treatment, shall be pressure-tested in accordance with one of the following paragraphs as specified by the purchaser:

TABLE 4 Hardness Requirements

Grade	Brinell Hardness, max	Rockwell Hardness, B Scale, max
TP 409	207	95
TP 439	207	95
P XM-27	241	100
TP XM-33	241	100
25-4-4	270	27[A]
26-3-3	265	25[A]
29-4	241	100
29-4-2	241	100
18-2	217	95
29-4C	241	100

[A] Rockwell Hardness, C scale.

10.5.1 *Hydrostatic Test*—Each tube shall be given an internal hydrostatic test in accordance with Specification A 1016/A 1016M.

10.5.2 *Air Underwater Test*—Each tube shall be air underwater tested in accordance with Specification A 1016/A 1016M.

10.6 *Lot Definitions*:

10.6.1 For flange requirements, the term "lot" applies to 125 tube groupings, prior to cutting to length, of the same nominal size and wall thickness, produced from the same heat of steel and annealed in a continuous furnace.

10.6.2 For tension and hardness requirements, the term "lot" applies to all tubes, prior to cutting to length, of the same nominal diameter and wall thickness, produced from the same heat of steel and annealed in a continuous furnace at the same temperature, time at temperature, and furnace speed.

11. Corrosion Resisting Properties

11.1 One full section sample 1 in. [25 mm] long from the center of a sample tube of the smallest radius bend that is heat treated shall be tested in the heat treated condition in accordance with the appropriate practice in Practices A 763 for the specified grade, or as agreed upon for TP409.

11.2 One full-section sample 1 in. [25 mm] long from each lot of straight tubes shall be tested in the finished condition in accordance with the appropriate practice in Practices A 763 for the specified grade, or as agreed upon for TP409.

11.3 The appearance of any fissures or cracks in the test specimen, when evaluated in accordance with the Evaluation Sections of Practices A 763 indicating the presence of intergranular attack, shall be cause for rejection of that lot.

11.4 For corrosion test requirements, the term "lot" applies to all tubes, prior to cutting to length, of the same nominal diameter and wall thickness, produced from the same heat of steel and annealed in a continuous furnace at the same temperature, time at temperature, and furnace speed.

12. Permissible Variations in Dimensions (Fig. 1)

12.1 Permissible variations from the specified outside diameter shall be in accordance with Specification A 1016/A 1016M. Those tolerances do not apply to the bent portion of the U-tubes. At the bent portion of a U-tube for $R = 2 \times D$ or greater, neither the major nor minor diameter of the tube shall

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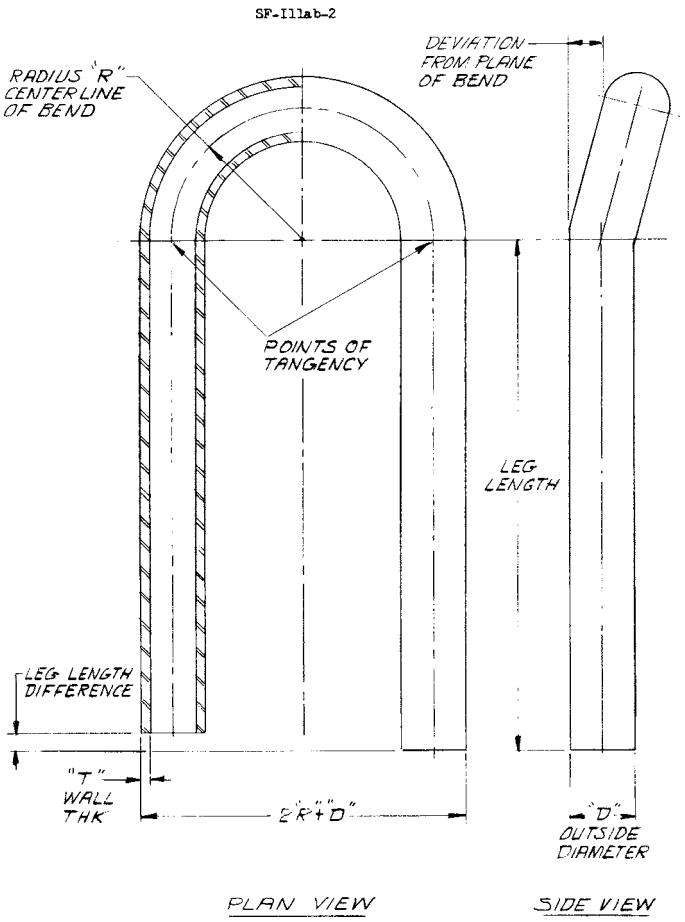

FIG. 1 Plane Bend for U-Tube

deviate from the nominal diameter prior to bending by more than 10 %. If less than 2 × *D* is specified, tolerances could be greater.

12.2 *Permissible Variations from the Specified Wall Thickness*:

12.2.1 Permissible variations from the specified minimum wall thickness shall not exceed +20 − 0 %.

12.2.2 Permissible variations from the specified average wall thickness are ±10 % of the nominal wall thickness.

12.2.3 The wall thickness of the tube in the U-bent section shall not be less than value determined by the equation:

$$t_f = \frac{4RT}{4R + D}$$

where:

t_f = wall thickness after bending, in. [mm],
T = specified minimum tube wall thickness, in. [mm],
R = centerline bend radius, in. [mm], and
D = nominal outside tube diameter, in. [mm].

12.3 *Permissible Variations from the Specified Length*:

12.3.1 *Straight Lengths*—The maximum permissible variations for lengths 24 ft [7.3 m] and shorter shall be +⅛ in. [+3 mm], −0; for lengths longer than 24 ft [7.3 m], an additional over tolerance of +⅛ in. [+3 mm] for each 10 ft [3 m], or fraction thereof, shall be permitted up to a maximum of +½ in. [+13 mm].

12.3.2 *U-Bends*—In the case of U-tubes, the length of the tube legs, as measured from the point of tangency of the bend and the tube leg to the end of the tube leg, shall not be less than specified, but may exceed the specified values by the amount given in Table 5. The difference in lengths of the tube legs shall not be greater than ⅛ in. [3 mm] unless otherwise specified.

12.4 The end of any tube may depart from square by not more than the amount given in Table 6.

12.5 The leg spacing measured between the points of tangency of the bend to the legs shall not vary from the value (2*R*-specified tube outside diameter) by more than 1⁄16 in. [1.5 mm] where *R* is the center-line bend radius.

12.6 The bent portion of the U-tube shall be substantially uniform in curvature, and not to exceed ± 1⁄16 in. [±1.5 mm] of the nominal center-line radius.

12.7 Permissible deviation from the plane of bend (see Fig. 1) shall not exceed 1⁄16 in. [1.5 mm] as measured from the points of tangency.

13. Workmanship, Finish, and Appearance

13.1 Tubing purchased to this specification is intended for use in heat exchangers and will be inserted through close-fitting holes in baffles or support plates, or both, spaced along the tube length. The tube ends will also be inserted into very close-fitting holes in a tubesheet and expanded and may be welded therein. The tubes shall be able to stand expanding and bending without showing cracks and flaws, and shall be finished reasonably straight and suitable for the intended purpose. Surface defects that violate minimum wall requirements shall be cause for rejection.

13.2 The residual chloride salt contamination of the inside and outside surface of the tubing at the time of packing for shipment from the mill shall not exceed a concentration of 1 mg/ft^2[10.7 mg/m^2] of tube surface. One tube in each 500 pieces shall be checked immediately prior to packing for shipment for chloride salt contamination by a procedure agreed to between the manufacturer and purchaser.

14. Surface Condition

14.1 The straight tubes, after final annealing, shall be pickled using a solution of nitric and hydrofluoric acids followed by flushing and rinsing in water. If bright-annealing is performed, this requirement does not apply.

14.1.1 All tubes shall be free of excessive mill scale, suitable for inspection. A slight amount of oxidation will not be considered as scale. Any special finish requirements shall be subject to agreement between the manufacturer and the purchaser.

14.2 A light oxide scale on the outside surface of U-bend area shall be permitted for tubes that have been electric-resistance heat treated after bending.

TABLE 5 Tube Leg Length Tolerance

Leg Length, ft [m]	Plus Tolerance, in. [mm]
Up to 20 [6], incl	⅛ [3.2]
Over 20 to 30 [6 to 9], incl	5⁄32 [4.0]
Over 30 to 40 [9 to 12], incl	3⁄16 [4.8]

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TABLE 6 Squareness of Ends Tolerance

Tube OD, in. [mm]	Tolerance, in. [mm]
Up to ⅝ [15.9], incl	0.010 [0.25]
Over ⅝ to 1 in. [15.9 to 25.4], incl	0.016 [0.41]

15. Nondestructive Test (Electric Test)

15.1 Each straight tube shall be tested after the finish heat treatment by passing it through a nondestructive tester capable of detecting defects on the entire cross section of the tube in accordance with Specification A 1016/A 1016M.

16. Inspection

16.1 The inspector representing the purchaser shall have entry, at all times, to those areas where inspection and testing is being performed on the purchaser's ordered material. The manufacturer shall afford the inspector all reasonable facilities to satisfy the inspector that the material is being furnished in accordance with this specification. All required tests and inspections shall be made at the place of manufacture prior to shipment, unless otherwise specified, and shall be conducted so as not to interfere unnecessarily with the operation of the works.

17. Rejection

17.1 Each length of tubing received from the manufacturer may be inspected by the purchaser, and, if it does not meet the requirements of the specification based on the inspection and test method outlined in the specification, the tubing may be rejected and the manufacturer shall be notified. Disposition of rejected tubing shall be a matter of agreement between the manufacturer and the purchaser.

17.2 Material that fails in any of the forming operations or in the process of installation and is found to be defective, shall be set aside, and the manufacturer shall be notified. Disposition of such material shall be a matter for agreement between the manufacturer and the purchaser.

18. Certification

18.1 A test report, signed by an authorized employee or representative of the manufacturer, shall be furnished to the purchaser to indicate the specification and grade, the results of the heat analysis, hardness, and tensile properties. Product analysis will be reported only when requested on the purchase order as provided in 9.1.1.

19. Product Marking

19.1 All tubes shall be marked with the heat number.

19.2 Containers and packages shall be marked or tagged to show the purchaser's order number, the manufacturer's order number, specification, grade, size and gage of tubing, number of pieces contained in the package, and item number (if appropriate).

20. Packaging

20.1 All tubing shall be packaged and blocked in such a manner as to prevent damage in ordinary handling and transportation. The boxes shall be constructed in such a manner that no nails, staples, screws, or similar fasteners are required to close and secure the box after the tubes have been placed in the box. The box shall be lined with plastic sheet or vapor barrier materials so as to prevent chloride contamination of the tube during handling, transportation, and storage.

20.2 The U-bent tubes shall be arranged in boxes so that the smaller radius bends may be removed without disturbing larger radius bends. Tubes for an item number shall be boxed together.

21. Keywords

21.1 feedwater heater tubes; ferritic stainless steel; seamless steel tube; stainless steel tube; steel tube; welded steel tube

SUPPLEMENTARY REQUIREMENTS

The following supplementary requirements may become a part of the specification when specified in the inquiry or invitation to bid and purchase order or contract. These requirements shall not be considered, unless specified in the order, in which event the necessary tests shall be made by the manufacturer prior to the bending or shipment of the tubing.

S1. Nondestructive Eddy-Current Test

S1.1 Each tube in the finished condition, except for bending if that is required, shall be tested by passing it through an electric nondestructive tester capable of detecting defects on the entire cross section of the tube. Suitable instrumentation shall be used to clearly distinguish the artificial defects. The outside and inside surfaces of the tubes shall be free of loose scale, metallic particles, or other material that would tend to restrict signals or create electrical noise. The tubing shall be inspected by feeding it longitudinally through an inspection coil or coils with a diameter suitable for the diameter of tubing to be inspected. The instrument calibration shall be accomplished with a reference standard prepared from the appropriate length of selected tubing of the same size, grade, and physical condition as the material to be inspected. The standard shall be fed through the coil at the same speed that the inspection of the tubing is performed.

S1.2 The factors listed in S1.3 shall be selected or adjusted, or both, in accordance with the instrument manufacturer's instructions, for the particular instrument involved as required to achieve optimum instrument distinction between the reference defects and plain portions of the tube.

S1.3 The following as well as other factors involved shall not be used in such a manner that they detract from the overall

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ability of the instrument to detect defects: test frequency, direct-current saturation level, filter networks, phase-analysis circuits, coil diameter, and instrument gain.

S1.4 The reference standard shall consist of a defect-free sample of the same size, alloy, and condition (temper) as that being tested, and shall contain longitudinal and circumferential notches on the outside diameter establishing the rejection level of the tubing to be tested. Inside diameter notches, both longitudinal and transverse, shall also be a part of the reference standard. These inside notches may be larger than the outside notches, and are intended for use only to assure instrument phase settings capable of yielding optimum inside surface sensitivity.

S1.4.1 All notches shall be produced by EDM methods. The outside diameter notches shall be of the dimensions shown in Table S1.1. See also Fig. S1.1.

S1.5 All tubing shall meet this specification. The instrument calibration shall be verified at the start of testing, after any shut down of the test equipment, after any test equipment adjustment, or at least every ½ h of continuous production testing, or both. Tubes generating a signal above the outside-diameter calibration standard sensitivity level shall be rejected.

S1.6 Tubes may be reconditioned and retested provided reconditioning does not adversely effect the minimum wall thickness or other properties of the tube specification requirements. Upon agreement between purchaser and manufacturer, the referee method, employing ultrasonic testing, may be employed for retesting tubes rejected by the eddy-current test. The calibration standard for this test shall be identical to that required for the eddy-current test.

TABLE S1.1 Notch Depth[A]

OD, in. [mm]	Wall, in. [mm]	Depth, max in. [mm]	Length, max, in. [mm]	Width, max
⅝ to 1 [15.9 to 25.4] incl	0.028 [0.71] and heavier	0.005 [0.12] or 10.8 % of specified average wall (when average wall is ordered), or 11.8 % of specified minimum wall (when minimum wall is ordered), whichever is greater	0.375 [9.52]	wall thickness, but not greater than 0.062 in. [1.6 mm]

[A] The tolerance of notch depth shall be ± 8 % or ± 0.0005 in. [0.01 mm], whichever is greater. Refer to Fig. S1.1 for notch location orientation and length of calibration standard.

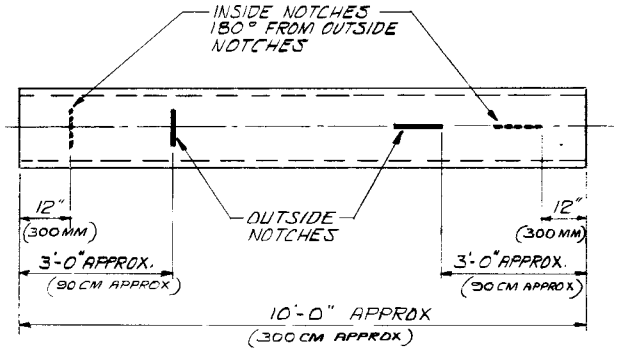

FIG. S1.1 Eddy-Current Test Standard

S2. Nondestructive Eddy-Current Testing (Select Commercial Grade)

S2.1 The manufacturer shall test the tubing using the procedure outlined in Supplementary Requirement S1, except for the notch standards, which shall be as indicated in Table S2.1.

S3. Report

S3.1 A report shall be furnished by the manufacturer to include a record of all tests performed to qualify material to this specification. This record shall include numbers of tests performed and qualitative or quantitative results as are applicable.

TABLE S2.1 Notch Depth for Select Commercial Grade[A]

OD, in. [mm]	Wall, in. [mm]	Depth, max in. [mm]	Length, max, in. [mm]	Width, max
⅝ to 1 [15.9 to 25.4], incl	0.035 [0.9 mm] and heavier	0.005 [0.12] or 10.8 % of specified average wall (when average wall is ordered), or 11.8 % of specified minimum wall (when minimum wall is ordered), whichever is greater	0.375 [9.5]	3 times notch depth
⅝ to 1 [15.9 to 25.4], incl	less than 0.035 [0.9 mm]		0.375 [9.5]	wall thickness

[A] The tolerance of notch depth shall be ± 8 % or ± 0.0005 in. [0.01 mm], whichever is greater. Refer to Fig. S1.1 for notch location orientation and length of calibration standard.

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SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this specification since the last issue, A 803/A 803M – 03, that may impact the use of this specification. (Approved March 1, 2008)

(*1*) Added notch tolerances to Table S2.1.

(*2*) The lot definitions were moved from old Notes 1 and 2 into the specific paragraphs related to the test description. Product analysis in the note definitions were removed, and subsequent notes were renumbered.

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