QQ-S-766D
February 5, 1988
SUPERSEDING
QQ-S-766C
24 September 1959
(See 6.5)

FEDERAL SPECIFICATION

STEEL, STAINLESS AND HEAT RESISTING, ALLOYS, PLATE, SHEET AND STRIP

This specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal Agencies.

1. SCOPE

1.1 Scope. This specification covers corrosion and heat resisting chromium, and chromium-nickel steel plate, sheet and strip.

1.2 Classification. Corrosion and heat resisting steel plate, sheet and strip shall be of the classes and conditions shown in table I and of the finishes shown in ASTM A 480/A 480M, as specified (see 6.2).

TABLE I. Classes of stainless steels and related commercial specifications.

UNS designation	Class	Condition	Commercial specification
S20100	201	Annealed, 1/4, 1/2, 3/4, and full hard	ASTM A 666
S20200	202	Annealed	ASTM A 240
S21400	XM-31	Annealed	ASTM A 240
S21910	XM-19	Annealed	ASTM A 240
S24000	XM-29	Annealed	ASTM A 240
S30100	301	Annealed, 1/4, 1/2, 3/4, and full hard	ASTM A 666
S30200	302	Annealed, 1/4 and 1/2 hard	ASTM A 666
S30400	304	Annealed	ASTM A 240
S30403	304L	Annealed	ASTM A 240
S30500	305	Annealed	ASTM A 240
S30908	309S	Annealed	ASTM A 240
S31008	310S	Annealed	ASTM A 240
S31600	316	Annealed	ASTM A 240
S31603	316L	Annealed	ASTM A 240
S32100	321	Annealed	ASTM A 240

TABLE I. Classes of stainless steels and related commercial specifications. - Continued

UNS designation	Class	Condition	Commercial specification
S17400	324	Solution treated	ASTM A 693, type 630
S17700	323	Solution treated	ASTM A 693, type 631
S34700	347	Annealed	ASTM A 240
S34800	348	Annealed	ASTM A 240
S41000	410	Annealed	ASTM A 240
S43000	430	Annealed	ASTM A 240
S44600	446	Annealed	ASTM A 176

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

Federal Standard:

FED-STD-123 - Marking for Shipment (Civil Agencies).

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and Commercial Item Descriptions as outlined under General Information in the Index of Federal Specifications, Standards, and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Copies of listed federal and military standards, specifications, Commercial Item Descriptions (CIDs), handbooks and associated documents listed in the Department of Defense Index of Specifications and Standards (DoDISS), should be obtained from the DoD Single Stock Point, Commanding Officer, Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120. Copies of industry association documents should be obtained from the sponsor. Copies of all other listed documents should be obtained from the contracting activity or as directed by the contracting officer.

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

Military Standard:

MIL-STD-129 - Marking for Shipment and Storage.

(Copies of federal and military standards required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A 176 - Standard Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip.

A 240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels. (DoD adopted)

A 262 - Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels. (DoD adopted)

A 342 - Standard Test Methods for Permeability of Feebly Magnetic Materials.

A 480/A 480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip. (DoD adopted)

A 666 - Standard Specification for Austenitic Stainless Steel, Sheet, Strip, Plate, and Flat Bar for Structural Applications. (DoD adopted)

A 693 - Standard Specification for Precipitation-Hardening Stainless and Heat-Resisting Steel Plate, Sheet, and Strip. (DoD adopted)

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

3. REQUIREMENTS

3.1 General. Corrosion and heat resisting steel plate, sheet and strip shall be furnished in accordance with the commercial specifications listed in table I and the following requirements (see 6.2).

3.2 Material. Stainless steels may be melted by one of the commercially acceptable types of melting, including electric arc furnace and argon-oxygen refining. Secondary melting such as electroslag or vacuum arc remelting may be used to improve cleanliness and grain refinement. Stainless steel may be ingot cast or continuous cast into billets. When ingot casting, sufficient discard shall be made to secure freedom from piping and undue segregation.

3.3 Heat treatment. Material supplied in the annealed condition shall be heat treated as specified in ASTM A 240 and ASTM A 693.

3.4 Intergranular corrosion. When specified (see 6.2), classes 304, 316, 304L, 316L, 321, 347, and 348 in all thicknesses shall be free of intergranular corrosion resulting from precipitated carbides (see 4.5.2).

3.5 Magnetic permeability. When low magnetic permeability is specified (see 6.2), all austenitic material (class 200 and 300) shall show a magnetic permeability not higher than 1.02 at 200 oersteds (air equal to 1.00).

3.6 Dimensions, weight and tolerances. Tolerances for plates, strip, and sheet shall conform to ASTM A 480/A 480M for the weight and dimensions specified (see 6.2).

3.7 Marking. Product marking shall be as specified in ASTM A 240. When specified (see 6.2), marking shall be in accordance with FED-STD-123 for civil agencies and MIL-STD-129 for military agencies.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Lot definition. For purposes of sampling for inspection, a lot shall consist of all plate, sheet, or strip of the same thickness, class, condition or temper, rolled from the same heat, and heat treated at the same time or by the same continuous process.

4.3 Sampling.

4.3.1 Sampling for chemical analysis. Samples for chemical analysis shall be selected as specified in ASTM A 480/A 480M for heat analysis. Product analysis may be performed by the purchaser in which case the product analysis tolerances of ASTM A 480/A 480M shall govern.

4.3.2 Sampling for mechanical tests. Sampling for mechanical tests shall be in accordance with the applicable product specifications. Samples shall be taken in the transverse direction, except when the product does not have sufficient width, in which case, longitudinal samples may be taken. In either case, the mechanical property requirements of the product specification shall be met.

4.3.3 Sampling for intergranular corrosion. For plate, sheet or strip up to and including 1/2 inch in thickness, one sample shall be taken. Material over 1/2 inch in thickness shall have two samples taken. When the lot consists of one piece, only one test shall be required. For the purpose of the intergranular corrosion test, all material from the same heat and heat treated in the same furnace charge may be considered one lot, and one test may be made from the thickest plate in the lot and be applied to all plates in the lot regardless of thickness. If the heat cannot be identified, each plate shall be tested.

4.3.4 Sampling for magnetic permeability. When required, one sample shall be selected from each lot. The specimen shall be as specified in ASTM A 342.

4.3.5 Sampling for visual and dimensional inspection. For visual and dimensional inspection, each plate, sheet coil or strip coil shall be inspected.

4.4 Visual and dimensional examination. Each sample selected in accordance with 4.3.5 shall be visually examined for conformance to soundness, surface condition, and marking as specified in the applicable ASTM specifications. The sample shall be dimensionally examined for conformance to the ordering data within the tolerances specified in ASTM A 480/A 480M.

4.4.1 Reinspection. Lots rejected because of visual or dimensional defects may be resubmitted for examination after the lot has been reworked and reinspected to remove all nonconforming material.

4.5 Test methods.

4.5.1 Chemical analysis and mechanical property tests. Chemical analysis, mechanical property, and hardness tests shall be performed as specified in ASTM A 480/A 480M.

4.5.2 Intergranular corrosion test. The intergranular corrosion test shall be performed as specified in practice E of ASTM A 262, except screening by practice A will not be permitted.

4.5.3 Magnetic permeability. The magnetic permeability test shall be conducted as specified in method 6 of ASTM A 342. The material shall meet the requirements specified in 3.5.

5. PACKAGING

5.1 Preservation-packaging and packing. Preservation-packaging and packing shall be in accordance with ASTM A 480/A 480M.

6. NOTES

6.1 Intended use.

6.1.1 Class 201, 202, 301, 302, 304, and 304L. Class 201, 202, 301, 302, 304, and 304L materials are intended primarily for special structural applications, and where welding is limited to spot welding or similar methods where corrosion resistance of welds is not a prime concern. Fusion welds of 304 and 304L will maintain corrosion resistance more closely approximating that of the base metal.

6.1.2 Class 316L, 321, 347, and 348. Class 316L, 321, 347, and 348 materials are intended primarily for use in applications where welding is necessary, where subsequent annealing and quenching is impracticable, and where exposure to most severely corrosive media is involved. Classes 321, 347, and 348 are also intended for use in the manufacture of exhaust stacks, manifolds, ring collectors, and similar applications where a weldable corrosion and heat resisting steel is required. Due to the difficulty encountered in keeping carbides in solution in plates over 2-inches thick, the L or stabilized grades are recommended for use above 2 inches.

6.1.3 Class 305, XM-19, XM-29, and XM-31. Class 305, XM-19, XM-29, and XM-31 materials are intended for applications where a smaller increase in magnetic permeability than classes 302 and 304 is desired for cold worked material.

6.1.4 Class 309S and 310S. Class 309S and 310S materials are intended for the highest temperature applications requiring high temperature strength. Classes 309S and 310S have superior resistance to oxidation in the highest temperature applications.

6.1.5 Class 316, 316L, and XM-19. Class 316, 316L, and XM-19 material are intended for parts subjected to corrosion by seawater where greater resistance to pitting corrosion is desired.

6.1.6 Class 323 and 324. Class 323 and 324 materials are intended for use where high mechanical properties are required. These classes are subject to pitting and crevice corrosion in seawater. Therefore, they may not be desirable in some applications. These classes are not suitable where non-magnetic alloys are required. The solution-treated materials can be converted to the high strength condition with minimum distortion and scaling by a short time, low temperature, heat treatment.

6.1.7 Class 410. Class 410 material is intended for structural parts in applications where corrosive conditions are not of primary consideration. Welding of this material results in hardening and embrittlement unless subjected to proper heat treatment.

6.1.8 Class XM-31. Class XM-31 material is intended for applications requiring low magnetic permeability and only moderate corrosion resistance.

6.1.9 Class 430. Class 430 material is intended for use in applications where resistance to corrosion superior to that of class 410 is required, where the extreme ductility and formability of class 304 is not necessary, and where welding is limited to those applications that are not subject to shock or bending stresses.

6.1.10 Class 446. Class 446 material is intended for high temperature applications where resistance to oxidation is important. However, class 446 material tends to lose strength at temperatures over 900 degrees Fahrenheit, and consequently should not be used where high strength and impact resistance are required. For greater strength and impact resistance in high temperature locations, 309S and 310S should be used. Class 446 is recommended for resistance to sulfur bearing gases at high temperatures.

6.1.11 Class 201, 202, 301, and 302. Where other considerations do not preclude their use, classes 201 and 202 may be used in lieu of classes 301 and 302. These classes can be used for applications requiring materials of low magnetic permeability. Class 201 is a satisfactory substitute for classes 301 and 302 in some applications where machining and severe forming characteristics are not essential. Where these characteristics are essential, class 202 should be used because of its lower rate of work hardening. Classes 201 and 202 are not recommended for use in seawater.

6.2 Ordering data. Acquisition documents should specify the following:

(a) Title, number, and date of this specification.
(b) Class, condition or temper, finish, and for strip, type of edge preparation required (see 1.2 and 3.1).
(c) If inspection for intergranular corrosion is required (see 3.4).
(d) If low magnetic permeability is required (see 3.5).
(e) Weight, size, and quality required (see 3.6).
(f) When marking shall be as specified in FED-STD-123 or MIL-STD-129.

6.3 Definitions. For an explanation of finish and edge preparation, see ASTM A 480/A 480M.

6.4 Subject term (key word) listing.

Argon-oxygen refining
Austenitic material
Electric arc furnace refining
Electroslag remelting
Intergranular corrosion
Magnetic permeability

6.5 Changes from previous issue. Asterisks are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

MILITARY INTERESTS:

Custodians
Army - MR
Navy - SH

Review activities
Army - MI, EA, AR
Navy - MC
DLA - IS

User activity
Navy - OS

CIVIL AGENCY COORDINATING ACTIVITIES:

GSA-FSS

Preparing activity:
Navy - SH
(Project 9515-0660)