



Designation: A 263 – 94a (Reapproved 1999)

Standard Specification for Corrosion-Resisting Chromium Steel-Clad Plate, Sheet, and Strip¹

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1. Scope

1.1 This specification² covers plate, sheet, and strip of a carbon steel or low-alloy steel base to which is integrally and continuously bonded on one or both sides a layer of corrosion-resisting chromium steel. The material is generally intended for pressure vessel use.

1.2 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 Vessels³

A 240/A 240M Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels⁴

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products⁴

A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip⁴

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products⁴

2.2 ASME Code:

Boiler and Pressure Vessel Code, Section IX, Welding Qualifications⁵

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 This material is considered as single-clad or double-clad corrosion-resisting chromium-steel plate, sheet, or strip depending on whether one or both sides are covered.

3.1.2 The terms plate, sheet, and strip as used in this specification apply to the following:

3.1.3 *plate*—Material $\frac{3}{16}$ in. (2.73 mm) and over in thickness and over 10 in. (254 mm) in width.

3.1.4 *sheet*—Material under $\frac{3}{16}$ in. in thickness and 24 in. (609.6 mm) and over in width, material under $\frac{3}{16}$ in. in thickness and all widths and finishes of Nos. 3 to 8 inclusive, and

3.1.5 *strip*—Cold-rolled material under 24 in. in width and $\frac{3}{16}$ in. and under in thickness.

4. Ordering Information

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

4.1.1 Quantity (mass or number of pieces).

4.1.2 Name of material (corrosion-resisting chromium steel-clad plate, sheet or strip).

4.1.3 Cladding alloy.

4.1.4 Base metal.

4.1.5 Dimensions including the thickness of the cladding alloy.

4.1.6 Product analysis, if required (see Section 8).

4.1.7 Mechanical properties (see Sections 7, 14, and 15).

4.1.8 Finish (see Section 11).

4.1.9 Restrictions, if required, on repair by welding (see Section 12).

4.1.10 Additions to the specification or special requirements.

5. Materials and Manufacture

5.1 Process:

5.1.1 The steel shall be made by the open-hearth, electric-furnace (with separate degassing and refining optional), or basic-oxygen processes, or by secondary processes whereby steel made from these primary processes is remelted using electroslag remelting or vacuum-arc remelting processes.

5.1.2 The alloy-cladding metal may be metallurgically bonded to the base metal by any method that will produce a clad steel that will conform to the requirements of this specification.

5.2 *Heat Treatment*—Unless otherwise specified or agreed upon between the purchaser and the manufacturer, all plates shall be furnished in the normalized or tempered condition, or both.

¹ This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel and Related Alloys, and is the direct responsibility of Subcommittee A01.17 for Flat Stainless Steel Products.

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² For ASME Boiler and Pressure Vessel Code applications see related Specification SA-263 in Section II of that Code.

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

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

⁵ Available from American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

6. Chemical Composition

6.1 The composite plate, sheet, or strip shall conform to any desired combination of alloy-cladding metal and base metal as described in 6.2 and 6.3 and as agreed upon between the purchaser and the manufacturer.

6.2 *Alloy Cladding Metal*—The alloy-cladding metal specified shall conform to the requirements as to chemical composition prescribed for the respective chromium steel in Specification A 240/A 240M.

6.3 *Base Metal*—The base metal may be carbon steel or low-alloy steel conforming to the ASTM specifications for steels for pressure vessels. The base metal shall conform to the chemical requirements of the specification to which it is ordered.

7. Mechanical Properties

7.1 Plate:

7.1.1 Tensile Requirements:

7.1.1.1 The tensile properties shall be determined by a tension test of the composite plate for clad plates that meet all of the following conditions. However, if the cladding is for corrosion allowance only, the cladding may be removed before tensile testing. The tensile properties thus determined shall be not less than the minimum and not more than 5000 psi (35 MPa) over the maximum prescribed in the specification for the base steel used. All other tensile test requirements of the specification for the base steel shall be met.

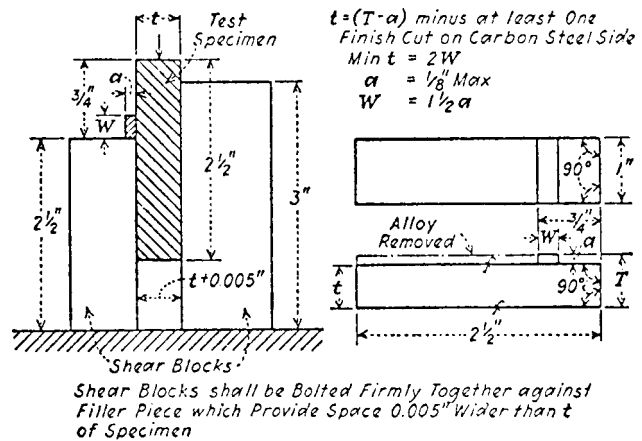
- (a) (a) The composite gage is less than or equal to 1½ in.
- (b) (b) The specified minimum tensile strength of the base steel is less than or equal to 70 000 psi (485 MPa).
- (c) (c) The specified minimum yield strength of the base steel is less than or equal to 40 000 psi (275 MPa).

7.1.1.2 The tensile properties shall be determined by a tension test of the base steel only for clad plates that meet one of the following conditions. The properties thus determined shall meet all of the tensile test requirements for the base steel.

- (a) (a) The composite gage is greater than 1½ in.
- (b) (b) The specified minimum tensile strength of the base steel is greater than 70 000 psi (485 MPa).
- (c) (c) The specified minimum yield strength of the base steel is greater than 40 000 psi (275 MPa).

7.1.2 *Ductility*—Two bend tests of the composite plate shall be made, one with the alloy cladding in tension and the other with the alloy cladding in compression, to determine the ductility of the materials. On double-clad plates, the bend tests shall be made so that one specimen represents the alloy cladding in tension on one side while the other specimen represents the alloy cladding in tension on the opposite side. The bend test having the alloy cladding in tension shall be made in accordance with the requirements prescribed in the specifications for the cladding metal. The bend test having the base metal in tension shall be made in accordance with the requirements prescribed in the specifications for the base metal.

7.1.3 *Shear Strength*—When required by the purchaser, the minimum shear strength of the alloy cladding and base metals shall be 20 000 psi (140 MPa). The shear test, when specified, shall be made in the manner indicated in Fig. 1.



Metric Equivalents

in.	mm	in.	mm
0.005	0.127	1	25.4
1/8	3.18	2 1/2	64.5
3/4	19.1	3	76.2

FIG. 1 Test Specimen and Method of Making Shear Test of Clad Plate

7.1.4 *Bond Strength*—As an alternative to the shear strength test provided in 7.1.2 and when required by the purchaser, three bend tests shall be made with the alloy cladding in compression to determine the quality of the bond. These bend tests shall be made in accordance with the specifications for the cladding metal. At least two of the three tests shall show not more than 50 % separation on both edges of the bent portion. Greater separation shall be cause for rejection.

7.2 Sheet and Strip:

7.2.1 The bend test specimens of sheet and strip shall stand being bent cold, without cracking on the outside of the bent portion, through an angle of 180°.

7.2.2 The bend test specimens shall be bent over a single piece of flat stock of the same thickness as the material tested, allowing the test material to form its natural curvature. The axis of the bend shall be transverse to the direction of rolling.

NOTE 1—The bend may be made over a diameter equal to the thickness of the test material.

7.2.3 The bond between the alloy cladding and the base metal shall be ascertained by observation of the behavior of the composite sheet or strip when sheared with the alloy side down.

7.3 Methods and practices relating to mechanical testing required by this specification shall be in accordance with Test Methods and Definitions A 370.

8. Product Analysis

8.1 Product analyses may be required on the finished product only when the composite plate thickness is sufficient to permit obtaining drillings or millings without danger of contamination from the adjacent layer.

8.2 If product analysis is specified by the purchaser, it shall be made from drillings or millings taken from the final piece or a broken test specimen. In order to avoid contamination by the

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base plate metal, cladding samples shall be taken from the test coupon by removal and discard of all the base metal plate material, plus 40 % of the cladding thickness from the bonded side, not to exceed 1/16 in. (1.588 mm). The material shall be chemically cleaned and millings shall be taken to represent the full cross-section of the remainder.

8.3 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A 751.

8.4 Results of the product analysis shall conform to the requirements of Section 7 of Specification A 480/A 480M.

9. Dimensions, Mass, and Permissible Variations

9.1 Composite plates, sheets, and strips shall conform to the dimensional and mass requirements prescribed in Table 1, Table 2, Table 3, Table 4, and Table 5.

10. Thickness of Cladding Metal

10.1 The minimum thickness and tolerances on the thickness of the alloy-cladding metal shall be agreed upon between the purchaser and the manufacturer.

11. Workmanship, Finish, and Appearance

11.1 The material shall be free of injurious defects, shall have a workmanlike appearance, and shall conform to the designated finish.

11.2 Plate alloy surfaces shall be sand-blasted, pickled, or blast-cleaned and pickled.

11.3 The finish for the alloy surfaces of sheets and strips shall be as specified in the applicable sections of Specification A 240/A 240M.

12. Repair of Cladding by Welding

12.1 The material manufacturer may repair defects in cladding by welding provided the following requirements are met:

12.1.1 Prior approval shall be obtained from the purchaser if the repaired area exceeds 3 % of the cladding surface.

12.1.2 The welding procedure and the welders or welding operators shall be qualified in accordance with Section IX of the ASME Code.

12.1.3 The defective area shall be removed and the area prepared for repair shall be examined by a magnetic particle method or a liquid penetrant method to ensure all defective area has been removed. Method of test and acceptance standard shall be as agreed upon between the purchaser and the manufacturer.

12.1.4 The repair weld shall be deposited in accordance with a welding procedure and welding materials suitable for the cladding material. The surface condition of the repaired area shall be restored to a condition similar to the rest of the cladding.

TABLE 1 Permissible Variations in Dimensions and Weight of Standard Sheet (No. 1 and No. 2 Finishes)

Specified Thickness, in. (mm)	Permissible Variations in Thickness, ±, in. (mm)	
0.005 (0.127)	0.001 (0.025)	0.0015 (0.038)
0.006 to 0.007 (0.152 to 0.178)	0.002 (0.051)	0.003 (0.076)
0.008 to 0.016 (0.203 to 0.406)	0.004 (0.102)	0.005 (0.127)
0.0161 to 0.026 (0.409 to 0.660)	0.006 (0.152)	0.007 (0.178)
0.027 to 0.040 (0.686 to 1.016)	0.008 (0.203)	0.008 (0.203)
0.041 to 0.058 (1.041 to 1.473)	0.009 (0.229)	0.010 (0.254)
0.059 to 0.072 (1.499 to 1.829)	0.012 (0.305)	0.014 (0.356)
0.073 to 0.083 (1.854 to 2.108)		
0.084 to 0.098 (2.133 to 2.489)		
0.099 to 0.114 (2.515 to 2.896)		
0.115 to 0.130 (2.921 to 3.302)		
0.131 to 0.145 (3.327 to 3.683)		
0.146 to 0.176 (3.708 to 4.470)		
Specified Width, in. (mm) ^A	Permissible Variations in Width, in. (mm)	
	+	-
Up to 42 (1066.8)	1/16 (1.59)	0
42 and Over (1066.8 and Over)	1/8 (3.18)	0
Specified Length, in. (mm) ^A	Permissible Variations in Length, in. (mm)	
	+	-
Up to 120 (3048)	1/16 (1.59)	0
120 and Over (3048 and Over)	1/8 (3.18)	0
Weight	Estimated Permissible Variations, Actual Weight Over the Estimated Weight, % ^B	
Permissible variations in weight apply only to polished finishes. The actual weight of any one item of an ordered thickness and size in any finish is limited in overweight by the following tolerances:		
Any item of 5 sheets or less, or any item estimated to weigh 200 lb (90.72 kg) or less	10	
Any item of more than 5 sheets, and estimated to weigh more than 200 lb (90.72 kg)	7.5	

^A Sheet 0.131 in. (3.33 mm) and over in thickness, regardless of size, may have permissible variations of ±1/4 in. (6.35 mm) in width and in length, respectively.
^B There is no under variation in weight for No. 1 and No. 2 finishes, these finishes being limited in under variations only by the permissible variations in thickness. Polished sheets may actually weigh as much as 5 % less than the estimated weight. Estimated weight of the composite plates may be calculated using the following weights of the component materials:

	Weight per Square Foot for Material 1 in. in Thickness, lb
Steel	40.8
Chromium steel cladding	41.2

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TABLE 2 Permissible Variations in Thickness of Cold-Rolled Strip

NOTE—Permissible variations in thickness are based on measurements taken 3/8 in. (9.53 mm) in from the edge on cold-rolled strip 1 in. (25.4 mm or over in width and at any place on the strip on material less than 1 in. (25.4 mm) in width.

Specified Thickness, in. (mm)	Permissible Variations in Thickness, ±, for Widths Given, in. (mm)									
	3/16 to 1/2 (4.76 to 12.7 mm)	1/2 to 1 (12.7 to 25.4 mm)	1 to 1 1/2 (25.4 to 38.1 mm)	1 1/2 to 3 (38.1 to 76.2 mm)	3 to 6 (76.2 to 152.4 mm)	Over 6 to 9 (152.4 to 228.6 mm)	Over 9 to 12 (228.6 to 304.8 mm)	Over 12 to 16 (304.8 to 406.4 mm)	Over 16 to 20 (406.4 to 508.0 mm)	Over 20 to 23 15/16 (508.0 to 608.1 mm)
0.249 to 0.161 (6.632 to 4.09), incl	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.004 (0.1016)	{ 0.004 (0.1016)	{ 0.004 (0.1016)	{ 0.005 (0.1270)	{ 0.006 (0.1524)	{ 0.006 (0.1524)
0.160 to 0.100 (4.08 to 2.54), incl	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.003 (0.0762)	{ 0.004 (0.1016)	{ 0.004 (0.1016)	{ 0.004 (0.1016)	{ 0.005 (0.1270)	{ 0.005 (0.1270)
0.099 to 0.069 (2.53 to 1.75), incl	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.004 (0.1016)	{ 0.004 (0.1016)	{ 0.004 (0.1016)
0.068 to 0.050 (1.74 to 1.27), incl	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.004 (0.1016)	{ 0.004 (0.1016)
0.048 to 0.040 (1.26 to 1.02), incl	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.0025 (0.0635)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.004 (0.1016)	{ 0.004 (0.1016)
0.039 to 0.035 (1.01 to 0.88), incl	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.002 (0.0508)	{ 0.0025 (0.0635)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.003 (0.0762)	{ 0.003 (0.0762)
0.034 to 0.032 (0.87 to 0.81), incl	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.0025 (0.064)	{ 0.0025 (0.064)	{ 0.0025 (0.064)	{ 0.003 (0.076)	{ 0.003 (0.076)
0.031 to 0.029 (0.80 to 0.74), incl	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.0025 (0.064)	{ 0.0025 (0.064)	{ 0.0025 (0.064)	{ 0.003 (0.076)	{ 0.003 (0.076)
0.028 to 0.026 (0.73 to 0.66), incl	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.002 (0.051)	{ 0.002 (0.051)	{ 0.0025 (0.064)	{ 0.003 (0.076)
0.025 to 0.023 (0.65 to 0.58), incl	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.002 (0.051)	{ 0.002 (0.051)	{ 0.0025 (0.064)	{ 0.0025 (0.064)
0.022 to 0.020 (0.57 to 0.51), incl	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.002 (0.051)	{ 0.002 (0.051)	{ 0.0025 (0.064)	{ 0.0025 (0.064)
0.019 to 0.017 (0.50 to 0.43), incl	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.002 (0.051)	{ 0.002 (0.051)
0.016 to 0.015 (0.42 to 0.38), incl	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.002 (0.051)
0.014 to 0.013 (0.37 to 0.33), incl	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.002 (0.051)	{ 0.002 (0.051)
0.012 (0.30)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)
0.011 (0.28)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.0015 (0.038)	{ 0.0015 (0.038)
0.010 (0.25)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.001 (0.025)	{ 0.0015 (0.038)	{ 0.0015 (0.038)
0.009 to 0.006 (0.23 to 0.15), incl	{ 0.00075 (0.019)	{ 0.00075 (0.019)	{ 0.00075 (0.019)	{ 0.00075 (0.019)	{ 0.00075 (0.019)	{ ...	{ ...	{ ...	{ ...	{ ...
Under 0.006 (Under 0.15)	{ 0.0005 (0.013)	{ 0.0005 (0.013)	{ 0.0005 (0.013)	{ 0.0005 (0.013)	{ 0.0005 (0.013)	{ ...	{ ...	{ ...	{ ...	{ ...

12.1.5 The repaired area shall be examined by a liquid penetrant method in accordance with 12.1.3.

12.1.6 The location and extent of the weld repairs together with the repair procedure and examination results shall be transmitted as a part of the certification.

12.2 All repairs in Alloy type 410 or repairs penetrating into

the base steel shall be stress relieved to eliminate residual stresses.

13. General Requirements for Delivery

13.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of