



AMERICAN NATIONAL
STANDARD

ANSI/ASTM A 412 - 75

Standard Specification for STAINLESS AND HEAT-RESISTING CHROMIUM- NICKEL-MANGANESE STEEL PLATE, SHEET, AND STRIP¹

This Standard is issued under the fixed designation A 412; 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 reappraisal.

1. Scope

1.1 This specification² covers annealed, and annealed and cold-rolled, chromium-nickel-manganese austenitic stainless and heat-resisting steel plate, sheet, and strip.

1.1.1 Type 201 is satisfactory for applications where severe forming characteristics are not too important. Type 201 is nonmagnetic when annealed, but is magnetic after cold working.

1.1.2 Type 202 is satisfactory for applications where severe forming characteristics are important. Type 202 is nonmagnetic when annealed, but is slightly magnetic after cold working.

1.1.3 Types XM-10 and XM-11 are intended for applications where normal forming characteristics are important. They are nonmagnetic in the annealed condition and also after 10 percent cold working.

1.1.4 Type XM-14 is intended for applications requiring service at cryogenic temperatures: It is nonmagnetic in the annealed condition and slightly magnetic after cold working.

1.1.5 Type XM-19 is intended for applications requiring added corrosion resistance and high strength. It is readily formed and welded.

1.1.6 Type XM-29 is intended for applications requiring good formability and good weldability. It is nonmagnetic even when severely cold formed.

NOTE 1—The values stated in U.S. customary units are to be regarded as the standard.

2. General Requirements for Delivery

2.1 Material furnished under this specifica-

tion shall conform to the applicable requirements of the current edition of ASTM Specification A 480, General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.³

3. Ordering Information

3.1 Orders for material under this specification shall include the following information:

3.1.1 Quantity (weight or number of pieces),

3.1.2 Name of material (stainless steel),

3.1.3 Condition (see Section 6),

3.1.4 Dimensions,

3.1.5 Form (plate, sheet, or strip),

3.1.6 Edge, strip only (see Specification A 480),

3.1.7 Type (Table 1),

3.1.8 ASTM designation and date of issue, and

3.1.9 Additions to the specification or special requirements.

NOTE 2—A typical ordering description is as follows: 100 pieces, high-strength cold-rolled stainless steel strip, 0.050 by 16 by 120 in., Type 201, ½-Hard temper, tensile strength 150,000 psi min, ASTM A 412 dated ———

4. Process

4.1 The steel shall be made by one or more of the following processes: electric-arc, elec-

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² For ASME Boiler and Pressure Vessel Code applications see related Specification SA-412 in Section II of that code.

³ *Annual Book of ASTM Standards*, Part 3.

tric-induction, or other suitable commercial processes.

5. Chemical Requirements

5.1 The steel shall conform to the requirements as to chemical composition specified in Table 1.

6. Conditions

6.1 Sheet and strip may be specified in one of the following conditions:

Type	Condition
201	annealed quarter-hard half-hard three quarter-hard full-hard
202	annealed quarter-hard
XM-10	annealed cold rolled 10 percent
XM-11	annealed cold rolled 10 percent
XM-14	annealed
XM-19	annealed
XM-29	annealed

6.2 Plate may be specified in the hot-rolled annealed, hot-rolled annealed and descaled, or hot-rolled annealed and polished condition (see Section 9 of Specification A 480).

7. Mechanical Requirements

7.1 The material shall conform to the requirements as to mechanical properties specified in Table 2.

8. Bend Test Specimens

8.1 Bend test specimens shall withstand cold bending without cracking when subjected to either the free-bend method or the controlled-bend (V-block) method at the condition specified by Tables 3 or 4, respectively. The choice of method of test for materials in physical conditions other than annealed shall be at the option of the seller.

8.2 The axis of the bend test specimen shall be parallel to the direction of rolling.

8.3 The bend test specimen shall be bent around a diameter equal to the product of the bend factor times the nominal thickness of the test specimen.

8.3.1 Free-bend test specimens shall be bent cold, either by pressure or by blows. However, in case of dispute, tests shall be made by pressure.

8.3.2 Controlled-bend (V-block) test specimens shall be bent cold by means of V-blocks or a mating punch and die having an included

angle of 45 deg and with proper curvature of surface at the bend areas to impart the desired shape and diameter of bend to the specimen.

9. Tension Test Specimens

9.1 The tension test specimen for the quarter-hard, half-hard, three quarter-hard, and full-hard tempers shall be selected in the transverse direction wherever possible. The tension test specimens shall conform to Sections 7, 8, 9, and 10 of ASTM Methods and Definitions A 370, for Mechanical Testing of Steel Products.¹

NOTE 3—For plate material up to and including 3/4 in. (19.1 mm) thick, the sheet-type tension specimen described in Section 8 (Fig. 5) of Methods A 370 is also permitted.

10. Number of Tests

10.1 In the case of sheet and strip produced in coil form, at least one tension test and one bend test shall be taken from each end of each coil. When material is produced in sheet, strip, or plate form, at least one tension and one bend test shall be made on each 100 or less sheets, strips, or plates of the same gage and heat produced under the same processing conditions.

11. Test Methods

11.1 The yield strength shall be determined by the offset method as described in Methods A 370. The limiting permanent offset shall be 0.2 percent of the gage length of the specimen. An alternate method of determining yield strength may be used, based on the following total extensions under load:

Yield Strength, min, psi (MPa)	Total Extension Under Load in 2-in. or 50-mm Gage Length, incl
45 000 (310)	0.0071 (0.180 mm)
75 000 (515)	0.0098 (0.249 mm)
110 000 (760)	0.0125 (0.318 mm)
135 000 (930)	0.0144 (0.366 mm)
140 000 (965)	0.0148 (0.376 mm)

11.2 The requirements of this specification for yield strength will be considered as having been fulfilled if the extension under load for the specified yield strength does not exceed the specified values. The value obtained in this manner should not, however, be taken as the actual yield strength for 0.2 percent per-

¹ Annual Book of ASTM Standards, Parts 1, 2, 3, 4, 5, and 10.



manent set. In case of dispute, the offset method of determining yield strength shall be used.

11.2.1 Between the yield strength and fracture of the specimen, the crosshead speed of the testing machine shall be between $\frac{1}{8}$ and $\frac{1}{2}$ in./in. (0.125 mm and 0.500 mm/mm) of gage length/min.

12. Permissible Variations in Dimensions

12.1 Unless otherwise specified in the purchase order, material shall conform to the permissible tolerances shown in Specification A 480.

13. Workmanship

13.1 The material shall be of uniform quality consistent with good manufacturing and inspection practices. The steel shall have no defects of a nature or degree, for the grade and quality ordered, that will be detrimental to the stamping, forming, or fabrication of finished parts.

14. Inspection

14.1 Inspection of the material by the purchaser's representative at the producing plant shall be made as agreed upon by the pur-

chaser and the seller as part of the purchase order.

15. Certification

15.1 Upon request of the purchaser in the contract or order, the purchaser's certification that the material was manufactured and tested in accordance with this specification together with a report of the test results shall be furnished at the time of shipment.

16. Rejection

16.1 Unless otherwise specified, any rejection based on tests made in accordance with this specification shall be reported to the seller within 60 working days from receipt of the material by the purchaser.

17. Rehearing

17.1 Samples tested by the purchaser in accordance with this specification that represent rejected material shall be retained for 3 weeks from the date of the notification to the seller of the rejection. In case of dissatisfaction with the results of the tests, the seller may make claim for a rehearing within that time.

TABLE 1 Chemical Requirements

UNS Designation ^a	Type	Composition, percent							
		Carbon, max	Manganese	Phosphorus, max	Sulfur, max	Silicon, max	Chromium	Nickel	Other
S20100	201	0.15	5.50–7.50	0.060	0.030	1.00	16.00–18.00	3.50–5.50	N 0.25 max
S20200	202	0.15	7.50–10.00	0.060	0.030	1.00	17.00–19.00	4.00–6.00	N 0.25 max
S21900	XM-10	0.08	8.00–10.00	0.060	0.030	1.00	19.00–21.50	5.50–7.50	N 0.15–0.40
S21904	XM-11	0.04	8.00–10.00	0.060	0.030	1.00	19.00–21.50	5.50–7.50	N 0.15–0.40
S21460	XM-14	0.12	14.00–16.00	0.060	0.030	1.00	17.00–19.00	5.00–6.00	N 0.35–0.50
S20910	XM-19	0.06	4.00–6.00	0.040	0.030	1.00	20.50–23.50	11.50–13.50	N 0.20–0.40 Cb 0.10–0.30 V 0.10–0.30 Mo 1.50–3.00
S24000	XM-29	0.08	11.50–14.50	0.060	0.030	1.00	17.00–19.00	2.25–3.75	N 0.20–0.40

^a New designation established in accordance with ASTM E 527 and SAE J1086, Recommended Practice for Numbering Metals and Alloys (UNS).

TABLE 2 Tensile Requirements

Condition	Tensile Strength, min, psi (MPa)	Yield Strength, min, psi (MPa)	Elongation in 2 in. or 50 mm, min, percent		
			Up to 0.015 in. (0.38 mm) in Thickness	0.016 (0.40 mm) to 0.030 in. (0.76 mm) in Thickness	0.031 in. (0.79 mm) and over in Thickness
Type 201					
Annealed	95 000 (655)	45 000 (310)	40	40	40
¼ hard	125 000 (860)	75 000 (515)	20	20	20
½ hard	150 000 (1025)	110 000 (760)	9	10	10
¾ hard	175 000 (1205)	135 000 (930)	3	5	7
Full hard	185 000 (1275)	140 000 (965)	3	4	5
Type 202					
Annealed	90 000 (620)	45 000 (310)	40	40	40
¼ hard	125 000 (860)	75 000 (515)	12	12	12
Type XM-10 and XM-11					
Annealed ^a	100 000 (690)	60 000 (415)	40	40	40
10% cold rolled ^a	130 000 (895)	115 000 (795)	15	15	15
Annealed plate	90 000 (620)	50 000 (345)	...	...	45
Type XM-14					
Annealed	105 000 (725)	55 000 (380)	40	40	40
Type XM-19					
Annealed ^a	120 000 (825)	75 000 (515)	30	30	30
Annealed plate	100 000 (690)	55 000 (380)	...	...	35
Type XM-29					
Annealed ^a	100 000 (690)	60 000 (415)	40	40	40
Annealed plates	100 000 (690)	55 000 (380)	...	...	40

^a Sheet and strip.



TABLE 3 Free-Bend Requirements

Condition	0.030 in. (0.76 mm) and Less in Thickness ^a		0.031 (0.79 mm) to 0.050 in. (1.27 mm) in Thickness ^a		Over 0.050 in. (1.27 mm) in Thickness ^a	
	Angle of Bend		Angle of Bend		Angle of Bend	
	Deg	Factor ^b	Deg	Factor ^b	Deg	Factor ^b
Type 201						
Annealed	180	1	180	1	180	1
¼ hard	180	2	180	2	90	2
½ hard	180	4	180	8	90	2
¾ hard	180	8	90	2½	...	...
Full hard	180	12	90	3½	...	...
Type 202						
Annealed	180	1	180	1	180	1
¼ hard	180	2	180	2	90	2
Type XM-10 and XM-11						
Annealed	180	1	180	1	180	1
10 percent cold rolled	90	2	90	2	90	2
Types XM-14, XM-19, and XM-29						
Annealed	180	1	180	1	180	

^a Ordered thickness.^b See 8.3.

TABLE 4 Controlled-Bend (V-Block) Test Requirements

Condition	0.050 in. (1.27 mm) and Less in Thickness ^a		0.051 (1.30 mm) to 0.187 in. (4.76 mm) in Thickness ^a		Over 0.187 in. (4.76 mm) in Thickness ^a	
	Angle of Bend		Angle of Bend		Angle of Bend	
	Deg	Fac- tor ^b	Deg	Fac- tor ^b	Deg	Fac- tor ^b
Type 201						
¼ hard	135	2	135	3	...	...
½ hard	135	4	135	4	...	...
¾ hard	135	6
Full hard	135	6
Type 202						
¼ hard	135	4	135	4

^a Ordered thickness.^b See 8.3.

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