

A 176

Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip

This specification covers stainless and heat-resisting chromium-nickel steel plate, sheet, and strip available in a wide variety of surface finishes.

A. Chemical Composition :-

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

Table 1

UNS	S40300	S42000	S42200	S43100	S44200	S44600
Type	403	420	422	431	442	446
Carbon, min	0.15	0.15 min	0.2-0.25	0.2	0.2	0.2
Manganese, min	1	1	0.5-1	1	1	1.5
Phosphorus, min	0.04	0.04	0.025	0.04	0.04	0.04
Sulfur, min	0.03	0.03	0.025	0.03	0.04	0.03
Silicon, min	0.50	1	0.5	1	1	1
Chromium	11.5-13	12.0-14.0	11-12.5	15-17	18-23	23-27
Nickel, min	0.60	0.75	0.5-1	1.25-2.5	0.6	0.75
Nitrogen, min	...	...	...	...	...	0.25
Molybdenum, min	...	0.5	0.9-1.25	...	...	...
Vanadium	...	...	0.2-0.3	...	...	...
Tungsten	...	...	0.9-1.25	...	...	...

B. Mechanical Properties :-

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

Table 2

UNS	S40300	S42000	S42200	S43100	S44200	S44600
Type	403	420	422	431	442	446
Tensile Strength, min, ksi(MPa)	70 (485)	100 ^E (690)	...	...	75 (515)	75 (515)
Yield Strength, min ^A , ksi(MPa)	30 (205)	...	...	...	40 (275)	40 (275)
Elongation in 2 in. or 50 mm, min, %	25 ^D	15	...	...	20	20
Hardness, max ^B	Brinell	217	217	248	285	217
	Rockwell B	96	96	24 ^F	29 ^F	96
Cold bend deg. ^C	180	...	Not Required	Not Required	180	135

^A Yield strength shall be determined by the offset method at 0.2 % in accordance with Test Methods and Definitions A 370. Unless otherwise specified, an alternative method of determining yield strength may be based on a total extension under load of 0.5 %.

^B Either Brinell or Rockwell B hardness is permissible.

^C Bend test not required for steels thicker than 1 in. (25.4 mm) unless specified by the purchaser.

^D Material 0.05 in (1.27 mm) & under in thickness shall have a minimum elongation of 20.0%.

^E Maximum.

^F Rockwell C scale.

C. Process :-

1. The steel shall be made by one of the following processes: electric-arc, electric-induction, or other suitable processes.
2. If a specific type of melting is required by the purchaser, it shall be so specified on the purchase order.
3. The steel shall be made by one of the following processes: electric-arc, electric-induction, or other suitable processes.
4. If a specific type of melting is required by the purchaser, it shall be so specified on the purchase order.

D. Heat Treatment :-

1. Heat treatment thermal cycles shall be separate from other thermal processing cycles; for example, in-process thermal cycles are not permitted as a substitute for the separate annealing cycle.
2. The material shall be solution annealed to meet the mechanical property requirements of the applicable material specification unless otherwise stated in the material specification.
3. The material shall be heat treated at temperature 1900°F [1040°C] or higher and then Quenched in water or rapidly cooled by other means at a rate sufficient to prevent reprecipitation of carbides, as demonstrable by the capability of passing the test for resistance to intergranular corrosion.

E. Test Methods

1. Tension Tests.
2. Brinell Tests.
3. Rockwell Hardness.
4. Hardness Equivalents.
5. Intergranular Corrosion (when specified).
6. Permeability Test (when required).
7. Charpy Impact Testing (when required).
8. Intermetallic Phases (when specified).

F. Special Tests :-

1. Resistance to Intergranular Corrosion :- The intergranular corrosion test, Practice E of Practices A262, is not required unless it is specified on the purchase order.
All austenitic chromium-nickel types capable of passing this test.
2. Detrimental Intermetallic Phases in Duplex Stainless Steels :- The tests for detrimental intermetallic phases in wrought duplex stainless steels, Methods A, B, or C of Test Methods A923, are not required unless it is specified on the purchase order.

G. Finish :-

1. Finish for Sheet :-

The types of finish available on sheet products are:

- a. No. 1 Finish—Hot-rolled, annealed, and descaled.
- b. No. 2D Finish—Cold-rolled, dull finish.
- c. No. 2B Finish—Cold-rolled, bright finish.
- d. Bright Annealed Finish—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.
- e. No. 3 Finish—Intermediate polished finish, one or both sides.
- f. No. 4 Finish—General purpose polished finish, one or both sides.
- g. No. 6 Finish—Dull satin finish, Tampico brushed, one or both sides.
- h. No. 7 Finish—High luster finish.
- i. No. 8 Finish—Mirror finish.
- j. TR Finish—Cold-worked to obtain specified properties.
- k. Architectural finish, No. 5, or other proprietary names are special finishes.

2. Finish for Strip :-

The various types of finish procurable on cold-rolled strip products are:

- a. No. 1 Finish—Cold-rolled to specified thickness, annealed, and descaled.
- b. No. 2 Finish—Same as No. 1 Finish, followed by a final light cold-roll pass, generally on highly polished rolls.

- c. Bright Annealed Finish—A bright cold-rolled finish retained by final annealing in a controlled atmosphere furnace.
 - d. TR Finish—Cold-worked to obtain specified properties.
 - e. Polished Finish—Stainless steel strip is also available in polished finishes such as No. 3 and No. 4.
3. Finish for Plates :-
- The types of finish available on plates are:
- a. Hot-Rolled or Cold-Rolled, and Annealed or Heat Treated :- Scale not removed, an intermediate finish.
 - b. Hot-Rolled or Cold-Rolled, and Annealed or Heat Treated, and Blast Cleaned or Pickled :- essentially a No. 1 Finish.
 - c. Hot-Rolled or Cold-Rolled, and Annealed or Heat Treated, and Surface Cleaned and Polished :- Polish finish is generally No. 4 Finish.
 - d. Hot-Rolled or Cold-Rolled, and Annealed or Heat Treated, and Descaled, and Temper Passed :- Smoother finish for specialized applications.
 - e. Hot-Rolled or Cold-Rolled, and Annealed or Heat Treated, and Descaled; and Cold-Rolled, and Annealed or Heat Treated, and Descaled, and Optionally Temper Passed :- Smooth finish with greater freedom from surface imperfections.

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