



Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels¹

This standard is issued under the fixed designation A 240/A 240M; 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.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This specification² covers chromium, chromium-nickel, and chromium-manganese-nickel stainless and heat-resisting steel plate, sheet, and strip for pressure vessels.

1.2 Some steels covered by this specification, especially the chromium steels, because of their particular alloy content and specialized properties, may require special care in their fabrication and welding. Specific procedures are of fundamental importance, and it is presupposed that all parameters will be in accordance with approved methods capable of producing the desired properties in the finished fabrication.

1.3 The values stated in either inch-pound units or SI units are to be regarded separately as standard. 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.

1.4 This specification and the applicable material specifica-

tions are expressed in both inch-pound and SI units. However, unless the order specifies the applicable “M” specification designation (SI units), the material shall be furnished in inch-pound units.

2. Referenced Documents

2.1 ASTM Standards:

A 370 Test Methods and Definitions for Mechanical Testing of Steel Products³

A 480/A 480M Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip³

A 923 Test Methods for Detecting Detrimental Intermetallic Phase in Wrought Duplex Austenitic/Ferritic Stainless Steels³

E 112 Test Methods for Determining Average Grain Size⁴

E 527 Practice for Numbering Metals and Alloys (UNS)⁵

2.2 SAE Standard:

J 1086 Practice for Numbering Metals and Alloys (UNS)⁶

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 A01.17 on Flat Stainless Steel Products.

Current edition approved Mar. 10, 2001. Published April 2001. Originally published as A 240 – 40 T. Last previous edition A 240/A 240M – 00a.

² For ASME Boiler and Pressure Vessel Code applications see related Specification SA-240 in Section II of that Code.

³ Annual Book of ASTM Standards, Vol 01.03.

⁴ Annual Book of ASTM Standards, Vol 03.01.

⁵ Annual Book of ASTM Standards, Vol 01.01.

⁶ Available from Society of Automotive Engineers, 400 Commonwealth Dr., Warrendale, PA 15096.

3. General Requirements

3.1 The following requirements for orders for material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 480/A 480M.

- 3.1.1 Definitions,
- 3.1.2 General requirements for delivery,
- 3.1.3 Ordering information,
- 3.1.4 Process,
- 3.1.5 Special tests,
- 3.1.6 Heat treatment,
- 3.1.7 Dimensions and permissible variations,
- 3.1.8 Workmanship, finish and appearance,
- 3.1.9 Number of tests/test methods,
- 3.1.10 Specimen preparation,
- 3.1.11 Retreatment,
- 3.1.12 Inspection,
- 3.1.13 Rejection and reheating,
- 3.1.14 Material test report,
- 3.1.15 Certification, and
- 3.1.16 Packaging, marking, and loading.

4. Chemical Composition

4.1 The steel shall conform to the requirements as to chemical composition specified in Table 1, and shall conform to applicable requirements specified in Specification A 480/A 480M.

5. Mechanical Properties

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

5.2 When specified by the purchaser, Charpy impact tests shall be performed in accordance with Supplementary Requirement S1.

6. Materials for High-Temperature Service

6.1 The austenitic *H* Types shall conform to an average grain size of ASTM No. 7 or coarser as measured by Test Methods E 112.

6.2 Supplementary Requirement S2 shall be invoked when non-*H* grade austenitic stainless steels are ordered for ASME Code applications for service above 1000°F [540°C].

TABLE 1 Chemical Composition Requirements, %^A

UNS Designation ^B	Type ^C	Carbon ^D	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Other Elements ^{E,F}
Austenitic (Chromium-Nickel) (Chromium-Manganese-Nickel)												
N08020	...	0.07	2.00	0.045	0.035	1.00	19.0-21.0	32.0-38.0	2.00-3.00	...	3.0-4.0	Cb 8×C min, 1.00 max
N08367	...	0.030	2.00	0.040	0.030	1.00	20.0-22.0	23.5-25.5	6.0-7.0	0.18-0.25	0.75	Fe ^H 39.5 min
N08800	800 ^G	0.10	1.50	0.045	0.015	1.00	19.0-23.0	30.0-35.0	...	...	0.75	Al 0.15-0.60 Ti 0.15-0.60
N08810	800H ^G	0.05-0.10	1.50	0.045	0.015	1.00	19.0-23.0	30.0-35.0	...	...	0.75	Fe ^H 39.5 min Al 0.15-0.60 Ti 0.15-0.60
N08811	...	0.06-0.10	1.50	0.040	0.015	1.00	19.0-23.0	30.0-35.0	...	...	0.75	Fe ^H 39.5 min Ti ^I 0.15-0.60 Al ^I 0.15-0.60
N08904	904L ^G	0.020	2.00	0.045	0.035	1.00	19.0-23.0	23.0-28.0	4.0-5.0	0.10	1.0-2.0	...
N08926	...	0.020	2.00	0.030	0.010	0.50	19.0-21.0	24.0-26.0	6.0-7.0	0.15-0.25	0.5-1.5	...
S20100	201	0.15	5.5-7.5	0.060	0.030	1.00	16.0-18.0	3.5-5.5	...	0.25	...	...
S20103	...	0.03	5.5-7.5	0.045	0.030	0.75	16.0-18.0	3.5-5.5	...	0.25	...	...
S20153	...	0.03	6.4-7.5	0.045	0.015	0.75	16.0-17.5	4.0-5.0	...	0.10-0.25	1.00	...
S20161	...	0.15	4.0-6.0	0.040	0.040	3.0-4.0	15.0-18.0	4.0-6.0	...	0.08-0.20	...	...
S20200	202	0.15	7.5-10.0	0.060	0.030	1.00	17.0-19.0	4.0-6.0	...	0.25	...	...
S20400	...	0.030	7.0-9.0	0.040	0.030	1.00	15.0-17.0	1.50-3.00	...	0.15-0.30	...	...
S20910	XM-19 ^I	0.06	4.0-6.0	0.040	0.030	0.75	20.5-23.5	11.5-13.5	1.50-3.00	0.20-0.40	...	Cb 0.10-0.30 V 0.10-0.30
S21400	XM-31 ^J	0.12	14.0-16.0	0.045	0.030	0.30-1.00	17.0-18.5	1.00	...	0.35 min	...	...
S21600	XM-17 ^J	0.08	7.5-9.0	0.045	0.030	0.75	17.5-22.0	5.0-7.0	2.00-3.00	0.25-0.50	...	...
S21603	XM-18 ^J	0.03	7.5-9.0	0.045	0.030	0.75	17.5-22.0	5.0-7.0	2.00-3.00	0.25-0.50	...	...
S21800	...	0.10	7.0-9.0	0.060	0.030	3.5-4.5	16.0-18.0	8.0-9.0	...	0.08-0.18	...	...
S24000	XM-29 ^J	0.08	11.5-14.5	0.060	0.030	0.75	17.0-19.0	2.3-3.7	...	0.20-0.40	...	...
S30100	301	0.15	2.00	0.045	0.030	1.00	16.0-18.0	6.0-8.0	...	0.10	...	...
S30103	301L ^G	0.03	2.00	0.045	0.030	1.00	16.0-18.0	6.0-8.0	...	0.20	...	...
S30153	301LN ^G	0.03	2.00	0.045	0.030	1.00	16.0-18.0	6.0-8.0	...	0.07-0.20	...	...
S30200	302	0.15	2.00	0.045	0.030	0.75	17.0-19.0	8.0-10.0	...	0.10	...	...
S30400	304	0.08	2.00	0.045	0.030	0.75	18.0-20.0	8.0-10.5	...	0.10	...	...
S30403	304L	0.030	2.00	0.045	0.030	0.75	18.0-20.0	8.0-12.0	...	0.10	...	...
S30409	304H	0.04-0.10	2.00	0.045	0.030	0.75	18.0-20.0	8.0-10.5	...	...	...	...
S30415	...	0.04-0.06	0.80	0.045	0.030	1.00-2.00	18.0-19.0	9.0-10.0	...	0.12-0.18	...	Ce 0.03-0.08
S30451	304N	0.08	2.00	0.045	0.030	0.75	18.0-20.0	8.0-10.5	...	0.10-0.16	...	...
S30452	XM-21 ^J	0.08	2.00	0.045	0.030	0.75	18.0-20.0	8.0-10.5	...	0.16-0.30	...	...
S30453	304LN	0.030	2.00	0.045	0.030	0.75	18.0-20.0	8.0-12.0	...	0.10-0.16	...	...
S30500	305	0.12	2.00	0.045	0.030	0.75	17.0-19.0	10.5-13.0	...	...	...	...
S30600	...	0.018	2.00	0.020	0.020	3.7-4.3	17.0-18.5	14.0-15.5	0.20	...	0.50	...
S30601	...	0.015	0.50-0.80	0.030	0.013	5.0-5.6	17.0-18.0	17.0-18.0	0.20	0.05	0.35	...
S30615	...	0.05-0.24	2.00	0.030	0.030	3.2-4.0	17.0-19.5	13.5-16.0	...	...	...	Al 0.80-1.50
S30815	...	0.16-0.10	0.80	0.040	0.030	1.40-2.00	20.0-22.0	10.0-12.0	...	0.14-0.20	...	Ce 0.03-0.08
S30908	309S	0.08	2.00	0.045	0.030	0.75	22.0-24.0	12.0-15.0	...	...	...	...
S30909	309H ^G	0.04-0.10	2.00	0.045	0.030	0.75	22.0-24.0	12.0-15.0	...	...	...	Cb 10×C min, 1.10 max
S30940	309Cb ^G	0.08	2.00	0.045	0.030	0.75	22.0-24.0	12.0-16.0	...	...	...	Cb 10×C min, 1.10 max
S30941	309HCb ^G	0.04-0.10	2.00	0.045	0.030	0.75	22.0-24.0	12.0-16.0	...	...	...	Cb 10×C min, 1.10 max
S31008	310S	0.08	2.00	0.045	0.030	1.50	24.0-26.0	19.0-22.0	...	...	...	...
S31009	310H ^G	0.04-0.10	2.00	0.045	0.030	0.75	24.0-26.0	19.0-22.0	...	...	...	...
S31040	310Cb ^G	0.08	2.00	0.045	0.030	1.50	24.0-26.0	19.0-22.0	...	...	...	Cb 10×C min, 1.10 max

TABLE 1 Continued

UNS Designation ^B	Type ^C	Carbon ^D	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Other Elements ^{E,F}
S31041	310HCb ^G	0.04–0.10	2.00	0.045	0.030	0.75	24.0–26.0	19.0–22.0	...	...	...	Cb 10×C min, 1.10 max
S31050	310 MoLN ^G	0.020	2.00	0.030	0.010	0.50	24.0–26.0	20.5–23.5	1.60–2.60	0.09–0.15	...	...
S31254	...	0.020	1.00	0.030	0.010	0.80	19.5–20.5	17.5–18.5	6.0–6.5	0.18–0.22	0.50–1.00	...
S31266	...	0.030	2.0–4.0	0.035	0.020	1.00	23.0–25.0	21.0–24.0	5.2–6.2	0.35–0.60	1.00–2.50	W 1.50–2.50
S31600	316	0.08	2.00	0.045	0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	0.10	...	...
S31603	316L	0.030	2.00	0.045	0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	0.10	...	...
S31609	316H	0.04–0.10	2.00	0.045	0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	...	...	...
S31635	316Ti ^G	0.08	2.00	0.045	0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	0.10	...	Ti 5 × (C + N) min, 0.70 max
S31640	316Cb ^G	0.08	2.00	0.045	0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	0.10	...	Cb 10 × C min, 1.10 max
S31651	316N	0.08	2.00	0.045	0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	0.10–0.16	...	...
S31653	316LN	0.030	2.00	0.045	0.030	0.75	16.0–18.0	10.0–14.0	2.00–3.00	0.10–0.16	...	...
S31700	317	0.08	2.00	0.045	0.030	0.75	18.0–20.0	11.0–15.0	3.0–4.0	0.10	...	...
S31703	317L	0.030	2.00	0.045	0.030	0.75	18.0–20.0	11.0–15.0	3.0–4.0	0.10	...	...
S31725	317LM ^G	0.030	2.00	0.045	0.030	0.75	18.0–20.0	13.5–17.5	4.0–5.0	0.20	...	...
S31726	317LMN ^G	0.030	2.00	0.045	0.030	0.75	17.0–20.0	13.5–17.5	4.0–5.0	0.10–0.20	...	...
S31753	317LN ^G	0.030	2.00	0.045	0.030	0.75	18.0–20.0	11.0–15.0	3.0–4.0	0.10–0.22	...	...
S32050	...	0.030	1.50	0.035	0.020	1.00	22.0–24.0	20.0–23.0	6.0–6.8	0.21–0.32	0.40	...
S32100	321	0.08	2.00	0.045	0.030	0.75	17.0–19.0	9.0–12.0	...	0.10	...	Ti 5 × (C + N) min, 0.70 max
S32109	321H	0.04–0.10	2.00	0.045	0.030	0.75	17.0–19.0	9.0–12.0	...	...	...	Ti 4 × (C + N) min, 0.70 max
S32615	...	0.07	2.00	0.045	0.030	4.8–6.0	16.5–19.5	19.0–22.0	0.30–1.50	...	1.50–2.50	...
S32654	...	0.020	2.0–4.0	0.030	0.005	0.50	24.0–25.0	21.0–23.0	7.0–8.0	0.45–0.55	0.30–0.60	...
S33228	...	0.04–0.08	1.00	0.020	0.015	0.30	26.0–28.0	31.0–33.0	...	...	...	Ce 0.05–0.10
S33400	334 ^G	0.08	1.00	0.030	0.015	1.00	18.0–20.0	19.0–21.0	...	...	...	Cb 0.6–1.0
S34565	...	0.030	5.0–7.0	0.030	0.010	1.00	23.0–25.0	16.0–18.0	4.0–5.0	0.40–0.60	...	Al 0.025
S34700	347	0.08	2.00	0.045	0.030	0.75	17.0–19.0	9.0–13.0	...	...	...	Al 0.15–0.60
S34709	347H	0.04–0.10	2.00	0.045	0.030	0.75	17.0–19.0	9.0–13.0	...	...	...	Ti 0.15–0.60
S34800	348	0.08	2.00	0.045	0.030	0.75	17.0–19.0	9.0–13.0	...	...	...	Cb 10 × C min, 1.00 max
S34809	348H	0.04–0.10	2.00	0.045	0.030	0.75	17.0–19.0	9.0–13.0	...	...	...	Cb 8 × C min, 1.00 max
S35045	...	0.06–0.10	1.50	0.045	0.015	1.00	25.0–29.0	32.0–37.0	...	...	...	1.00 max (Cb + Ta) 10×C min, 1.00 max
S35135	...	0.08	1.00	0.045	0.015	0.60–1.00	20.0–25.0	30.0–38.0	4.0–4.8	...	0.75	Al 0.15–0.60
S35315	...	0.04–0.08	2.00	0.040	0.030	1.20–2.00	24.0–26.0	34.0–36.0	...	0.12–0.18	0.75	Ti 0.40–1.00
S38100	XM-15 ^J	0.08	2.00	0.030	0.030	1.50–2.50	17.0–19.0	17.5–18.5	...	...	...	Ce 0.03–0.10
S38815	...	0.030	2.00	0.040	0.020	5.5–6.5	13.0–15.0	13.0–17.0	0.75–1.50	...	...	...
Duplex (Austenitic-Ferritic)												
S31200	...	0.030	2.00	0.045	0.030	1.00	24.0–26.0	5.5–6.5	1.20–2.00	0.14–0.20	...	...
S31260	...	0.03	1.00	0.030	0.030	0.75	24.0–26.0	5.5–7.5	2.5–3.5	0.10–0.30	0.20–0.80	W 0.10–0.50
S31803	...	0.030	2.00	0.030	0.030	1.00	21.0–23.0	4.5–6.5	2.5–3.5	0.08–0.20	...	...
S32001	...	0.030	4.0–6.0	0.040	0.030	1.00	19.5–21.5	1.00–3.00	0.60	0.05–0.17	1.00	...

TABLE 1 Continued

UNS Designation ^B	Type ^C	Carbon ^D	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Other Elements ^{E,F}
S32205	2205 ^G	0.030	2.00	0.030	0.020	1.00	22.0–23.0	4.5–6.5	3.0–3.5	0.14–0.20	...	...
S32304	2304 ^G	0.030	2.50	0.040	0.030	1.00	21.5–24.5	3.0–5.5	0.05–0.60	0.05–0.20	0.05–0.60	...
S32520	...	0.030	1.50	0.035	0.020	0.80	24.0–26.0	5.5–8.0	3.0–4.0	0.20–0.35	0.50–2.00	...
S32550	255 ^G	0.04	1.50	0.040	0.030	1.00	24.0–27.0	4.5–6.5	2.9–3.9	0.10–0.25	1.50–2.50	...
S32750	2507 ^G	0.030	1.20	0.035	0.020	0.80	24.0–26.0	6.0–8.0	3.0–5.0	0.24–0.32	0.50	...
S32760 ^K	...	0.030	1.00	0.030	0.010	1.00	24.0–26.0	6.0–8.0	3.0–4.0	0.20–0.30	0.50–1.00	W 0.50–1.00
S32900	329	0.08	1.00	0.040	0.030	0.75	23.0–28.0	2.0–5.00	1.00–2.00	...	...	...
S32950	...	0.030	2.00	0.035	0.010	0.60	26.0–29.0	3.5–5.2	1.00–2.50	0.15–0.35	...	...
Ferritic or Martensitic (Chromium)												
S32803	...	0.015	0.50	0.020	0.0035	0.55	28.0–29.0	3.0–4.0	1.80–2.50	0.020 (C+N) 0.030	...	Cb 12×(C+N) min, 0.15–0.50 Al 0.10–0.30
S40500	405	0.08	1.00	0.040	0.030	1.00	11.5–14.5	0.60	...	...	...	...
S40900 ^L	409 ^L	0.030	1.00	0.040	0.020	1.00	10.5–11.7	0.50	...	0.030	...	Ti 6×(C+N) min, 0.50 max; Cb 0.17
S40910	...	0.030	1.00	0.040	0.020	1.00	10.5–11.7	0.50	...	0.030	...	Ti 8×(C+N) min, Ti 0.15–0.50; Cb 0.10
S40920	...	0.030	1.00	0.040	0.020	1.00	10.5–11.7	0.50	...	0.030	...	(Ti+Cb) [0.08+8×(C+N)] min, 0.75 max; Ti 0.05 min; Cb 0.18–0.40
S40930	...	0.030	1.00	0.040	0.020	1.00	10.5–11.7	0.50	...	0.030	...	Ti 6×(C+N) min, 0.75 max
S40945	...	0.030	1.00	0.040	0.030	1.00	10.5–11.7	0.50	...	0.030	...	...
S40975	...	0.030	1.00	0.040	0.030	1.00	10.5–11.7	0.50–1.00	...	0.030	...	...
S40977	...	0.030	1.50	0.040	0.015	1.00	10.5–12.5	0.30–1.00	...	0.030	...	...
S41000	410	0.08–0.15	1.00	0.040	0.030	1.00	11.5–13.5	0.75	...	...	...	...
S41003	...	0.030	1.50	0.040	0.030	1.00	10.5–12.5	1.50	...	0.030	...	...
S41008	410S	0.08	1.00	0.040	0.030	1.00	11.5–13.5	0.60	...	...	...	...
S41045	...	0.030	1.00	0.040	0.030	1.00	12.0–13.0	0.50	...	0.030	...	...
S41050	...	0.04	1.00	0.045	0.030	1.00	10.5–12.5	0.60–1.10	...	0.10	...	...
S41500 ^M	...	0.05	0.50–1.00	0.030	0.030	0.60	11.5–14.0	3.5–5.5	0.50–1.00	...	...	...
S42035	...	0.08	1.00	0.045	0.030	1.00	13.5–15.5	1.0–2.5	0.2–1.2	...	...	Ti 0.30–0.50
S42900	429 ^G	0.12	1.00	0.040	0.030	1.00	14.0–16.0	...	...	...	...	...
S43000	430	0.12	1.00	0.040	0.030	1.00	16.0–18.0	0.75	...	...	...	...
S43035	439	0.030	1.00	0.040	0.030	1.00	17.0–19.0	0.50	...	0.030	...	Ti [0.20+4(C+N)] min, 1.10 max; Al 0.15
S43400	434	0.12	1.00	0.040	0.030	1.00	16.0–18.0	...	0.75–1.25	...	...	...
S43600	436	0.12	1.00	0.040	0.030	1.00	16.0–18.0	...	0.75–1.25	...	...	Cb 5×C min, 0.80 max
S43932	...	0.030	1.00	0.040	0.030	1.00	17.0–19.0	0.50	...	0.030	...	(Ti+Cb) [0.20+4(C+N)] min, 0.75 max; Al 0.15
S43940	...	0.030	1.00	0.040	0.015	1.00	17.5–18.5	...	...	...	...	Ti 0.10–0.60 Cb [0.30+3×C] min
S44400	444	0.025	1.00	0.040	0.030	1.00	17.5–19.5	1.00	1.75–2.50	0.035	...	(Ti+Cb)[0.20+4(C+N)] min, 0.80 max

TABLE 1 Continued

UNS Designation ^B	Type ^C	Carbon ^D	Manganese	Phosphorus	Sulfur	Silicon	Chromium	Nickel	Molybdenum	Nitrogen	Copper	Other Elements ^{E,F}
S44500	...	0.020	1.00	0.040	0.012	1.00	19.0–21.0	0.60	...	0.03	0.30–0.60	Cb 10×(C+N) min, 0.80 max Ti 0.20–1.00; Ti 7(C+N) min
S44626	XM-33 ^G	0.06	0.75	0.040	0.020	0.75	25.0–27.0	0.50	0.75–1.50	0.04	0.20	Cb 0.05–0.20 (Ni + Cu) 0.50
S44627	XM-27 ^G	0.010 ^H	0.40	0.020	0.020	0.40	25.0–27.5	0.50	0.75–1.50	0.015 ^N	0.20	(Ti+Cb) [0.20+4(C+N)] min, 0.80 max
S44635	...	0.025	1.00	0.040	0.030	0.75	24.5–26.0	3.5–4.5	3.5–4.5	0.035	...	(Ti+Cb) 0.20 – (Ti+Cb) 0.20 – 1.00, Ti + Cb
S44660	...	0.030	1.00	0.040	0.030	1.00	25.0–28.0	1.0–3.5	3.0–4.0	0.040	...	6×(C+N) min (C+N) 0.025 (Ti+Cb)
S44700	...	0.010	0.30	0.025	0.020	0.20	28.0–30.0	0.15	3.5–4.2	0.020	0.15	0.20–1.00, (Ti+Cb) 6× (C+N) min
S44735	...	0.030	1.00	0.040	0.030	1.00	28.0–30.0	1.00	3.6–4.2	0.045	...	(C+N) 0.025 Ti 0.07–0.30 Cb 0.10–0.60
S44800	...	0.010	0.30	0.025	0.020	0.20	28.0–30.0	2.00–2.50	3.5–4.2	0.020	0.15	(Ti+Cb) [0.20+4(C+N)] min, 0.80 max
S46800	...	0.030	1.00	0.040	0.030	1.00	18.0–20.0	0.50	...	0.030	...	

^A Maximum, unless range or minimum is indicated.

^B Designation established in accordance with Practice E 527 and SAE J 1086.

^C Unless otherwise indicated, a grade designation originally assigned by the American Iron and Steel Institute (AISI).

^D Carbon analysis shall be reported to nearest 0.01 % except for the low-carbon types, which shall be reported to nearest 0.001 %.

^E The terms Columbium (Cb) and Niobium (Nb) both relate to the same element.

^F When two minimums or two maximums are listed for a single type, as in the case of both a value from a formula and an absolute value, the higher minimum or lower maximum shall apply.

^G Common name, not a trademark, widely used, not associated with any one producer.

^H Iron shall be determined arithmetically by difference of 100 minus the sum of the other specified elements.

^I (Al + Ti) 0.85–1.20.

^J Naming system developed and applied by ASTM.

^K Cr + 3.3 Mo + 16 N = 40 min.

^L S40900 (Type 409) has been replaced by S40910, S40920, and S40930. Unless otherwise specified in the ordering information, an order specifying S40900 or Type 409 shall be satisfied by any one of S40910, S40920, or S40930 at the option of the seller. Material meeting the requirements of S40910, S40920, or S40930, may at the option of the manufacturer be certified as S40900.

^M Plate version of CA-6NMI.

^N Product (check or verification) analysis tolerance over the maximum limit for C and N in XM-27 shall be 0.002 %.

TABLE 2 Mechanical Test Requirements

UNS Designation	Type ^A	Tensile Strength, min		Yield Strength, ^B min		Elongation in 2 in. or 50 mm, min, %	Hardness, max ^C		Cold Bend ^D
		ksi	MPa	ksi	MPa		Brinell	Rockwell B	
N08020	...	80	550	35	240	30.0 ^F	217	95	not required
N08367	...	100	690	45	310	30.0	...	100	not required
Sheet and Strip		95	655	45	310	30.0	241	...	not required
N08800	800 ^F	75	520	30 ^G	205 ^G	30.0 ^H	...	...	not required
N08810	800H ^F	65	450	25 ^G	170 ^G	30.0	...	...	not required
N08811	...	65	450	25	170	30.0	...	...	not required
N08904	904L ^F	71	490	31	220	35.0	...	90	not required
N08926	...	94	650	43	295	35.0	...	...	not required
S20100	201-1 ^I	75	515	38	260	40.0	...	95	...
S20100	201-2 ^I	95	655	45	310	40.0	217	100	...
S20103	201L ^F	95	655	38	260	40.0	217	95	not required
S20153	201LN ^F	95	655	45	310	45.0	241	100	not required
S20161	...	125	860	50	345	40.0	255	25 ^J	not required
S20200	202	90	620	38	260	40.0	241	...	...
S20400	...	95	655	48	330	35.0	241	100	not required
S30100	301	75	515	30	205	40.0	217	95	not required
S30103	301L ^F	80	550	32	220	45.0	241	100	not required
S30153	301LN ^F	80	550	35	240	45.0	241	100	not required
S30200	302	75	515	30	205	40.0	201	92	not required
S30400	304	75	515	30	205	40.0	201	92	not required
S30403	304L	70	485	25	170	40.0	201	92	not required
S30409	304H	75	515	30	205	40.0	201	92	not required
S30415	...	87	600	42	290	40.0	217	95	not required
S30451	304N	80	550	35	240	30.0	201	92	not required
S30453	304LN	75	515	30	205	40.0	201	92	not required
S30500	305	70	485	25	170	40.0	183	88	not required
S30600	...	78	540	35	240	40.0	...	...	...
S30601	...	78	540	37	255	30.0	...	...	not required
S30615	...	90	620	40	275	35.0	217	95	not required
S30815	...	87	600	45	310	40.0	217	95	...
S30908	309S	75	515	30	205	40.0	217	95	not required
S30909	309H ^F	75	515	30	205	40.0	217	95	not required
S30940	309Cb ^F	75	515	30	205	40.0	217	95	not required
S30941	309HCb ^F	75	515	30	205	40.0	217	95	not required
S31008	310S	75	515	30	205	40.0	217	95	not required
S31009	310H ^F	75	515	30	205	40.0	217	95	not required
S31040	310Cb ^F	75	515	30	205	40.0	217	95	not required
S31041	310HCb ^F	75	515	30	205	40.0	217	95	not required
S31254	...	75	515	30	205	40.0	217	95	not required
Sheet and Strip		100	690	45	310	35.0	223	96	not required
Plate		95	655	45	310	35.0	223	96	not required
S31266	...	109	750	61	420	35.0	...	...	not required
S31600	316	75	515	30	205	40.0	217	95	not required
S31603	316L	70	485	25	170	40.0	217	95	not required
S31653	316LN	75	515	30	205	40.0	217	95	not required
S31609	316H	75	515	30	205	40.0	217	95	not required
S31635	316Ti ^F	75	515	30	205	40.0	217	95	not required
S31640	316Cb ^F	75	515	30	205	30.0	217	95	not required
S31651	316N	80	550	35	240	35.0	217	95	not required
S31700	317	75	515	30	205	35.0	217	95	not required

TABLE 2 Continued

UNS Designation	Type ^A	Tensile Strength, min		Yield Strength, ^B min		Elongation in 2 in. or 50 mm, min, %		Hardness, max ^C		Cold Bend ^D
		ksi	MPa	ksi	MPa	2 in. or 50 mm, min, %	Brinell	Rockwell B		
S31725	317LM ^F	75	515	30	205	40.0	217	95	not required	
S31726	317LMN ^F	80	550	35	240	40.0	223	96	not required	
S31703	317L	75	515	30	205	40.0	217	95	not required	
S31753	317LN	80	550	35	240	40.0	217	95	not required	
S32050	...	98	675	48	330	40.0	250	...	not required	
S32100	321	75	515	30	205	40.0	217	95	not required	
S32109	321H	75	515	30	205	40.0	217	95	not required	
S32615 ^K	...	80	550	32	220	25	...	...	not required
S32654	...	109	750	62	430	40.0	250	...	not required	
S33228	...	73	500	27	185	30.0	217	95	not required	
S33400	334 ^F	70	485	25	170	30	...	92	not required	
S34565	...	115	795	60	415	35.0	241	100	not required	
S34700	347	75	515	30	205	40.0	201	92	not required	
S34709	347H	75	515	30	205	40.0	201	92	not required	
S34800	348	75	515	30	205	40.0	201	92	not required	
S34809	348H	75	515	30	205	40.0	201	92	not required	
S35045	...	70	485	25	170	35.0	...	...	not required
S35135	...	80	550	30	205	30.0	...	...	not required
Sheet and Strip	...	75	515	30	205	30.0	...	...	not required
Plate	...	94	650	39	270	40.0	217	95	not required	
S35315	...	75	515	30	205	40.0	217	95	not required	
S38100	XM-15 ^L	75	515	30	205	40.0	217	95	not required	
S38815	...	78	540	37	255	30.0	...	...	not required
S30452	XM-21 ^L	90	620	50	345	30.0	241	100	not required	
Sheet and Strip	...	85	585	40	275	30.0	241	100	not required	
Plate	...	84	580	39	270	25	217	95	not required	
S31050	310 MoLN ^F	78	540	37	255	25	217	95	not required	
...	t ≤ 0.25 in.	100	690	60	415	40.0	241	100	not required	
...	t > 0.25 in.	90	620	50	345	40.0	241	100	not required	
S21600	XM-17 ^J	100	690	60	415	40.0	241	100	not required	
Sheet and Strip	...	90	620	50	345	40.0	241	100	not required	
Plate	...	100	690	60	415	40.0	241	100	not required	
S21603	XM-18 ^L	90	620	50	345	40.0	241	100	not required	
Sheet and Strip	...	100	690	60	415	40.0	241	100	not required	
Plate	...	105	725	60	415	30.0	241	100	not required	
S20910	XM-19 ^L	100	690	55	380	35.0	241	100	not required	
Sheet and Strip	...	100	690	60	415	40.0	241	100	not required	
Plate	...	100	690	60	415	40.0	241	100	not required	
S24000	XM-29 ^L	125	860	70	485	40.0	...	...	not required
Sheet and Strip	...	105	725	55	380	40.0	...	...	not required
Plate	...	95	655	50	345	35.0	241	100	not required	
S21400	XM-31 ^L	110	760	80	550	15.0	302	32 ^J	not required	
Sheet	...	100	690	65	450	25.0	293	31 ^J	not required	
Strip	...	100	690	70	485	20.0	290	...	...
S21800	...	90	620	65	450	25.0	293	...	...
...	...	90	620	65	450	25.0	...	...	...
S31200	...	90	620	65	450	25.0	...	...	...
S31260	...	87	600	58	400	25.0	290	25 ^G	not required	
S31803	...	112	770	80	550	25.0	310	31 ^J	not required	
S32001	...	110	760	80	550	15.0	302	32 ^J	not required	
S32205	2205 ^F	100	690	65	450	25.0	293	...	...
S32304	2304 ^F	100	690	65	450	25.0	293	...	...
S32520	...	100	690	65	450	25.0	293	...	...
S32550	255 ^F	100	690	65	450	25.0	293	...	...

TABLE 2 Continued

UNS Designation	Type ^A	Tensile Strength, min		Yield Strength, ^B min		Elongation in 2 in. or 50 mm, min, %	Hardness, max ^C		Cold Bend ^D	
		ksi	MPa	ksi	MPa		Brinell	Rockwell B		
S32750	2507 ^F	116	795	80	550	15.0	310	32 ^J	not required	
S32760	...	108	750	80	550	25.0	270	...	not required	
S32900	329	90	620	70	485	15.0	269	28 ^J	not required	
S32950 ^M	...	100	690	70	485	15.0	293	32 ^J	not required	
Ferritic or Martensitic (Chromium)										
S32803	...	87	600	72	500	16.0	241	100	not required	
S40500	405	60	415	25	170	20.0	179	88	180	
S40900 ^N	409 ^N									
S40910	...	55	380	25	170	20	179	88	180	
S40920	...	55	380	25	170	20	179	88	180	
S40930	...	55	380	25	170	20	179	88	180	
S40945	...	55	380	30	205	22.0	...	80	180	
S40975	...	60	415	40	275	20.0	197	92	180	
S40977	...	65	450	41	280	18	180	88	not required	
S41000	410	65	450	30	205	20.0	217	96	180	
S41003	...	66	455	40	275	18	223	20 ^J	not required	
S41008	410S	60	415	30	205	22.0 ^C	183	89	180	
S41045	...	55	380	30	205	22.0	...	80	180	
S41050	...	60	415	30	205	22.0	183	89	180	
S41500	...	115	795	90	620	15.0	302	32 ^J	not required	
S42035	...	80	550	55	380	16	180	88	not required	
S42900	429 ^F	65	450	30	205	22.0 ^C	183	89	180	
S43000	430	65	450	30	205	22.0 ^P	183	89	180	
S43035	439	60	415	30	205	22.0	183	89	180	
S43400	434	65	450	35	240	22.0	...	89	180	
S43600	436	65	450	35	240	22.0	...	89	180	
S43932	...	60	415	30	205	22.0	183	89	180	
S43940	...	62	430	36	250	18	180	88	not required	

TABLE 2 Continued

UNS Designation	Type ^A	Tensile Strength, min		Yield Strength, ^B min		Elongation in 2 in. or 50 mm, min, %		Hardness, max ^C		Cold Bend ^{D,E}
		ksi	MPa	ksi	MPa	min, %	Brinell	Rockwell B		
S44400	...	60	415	40	275	20.0	217	96	180	
S44500	...	62	427	30	205	22	...	83	180	
S44626	XM-33 ^L	68	470	45	310	20.0	217	96	180	
S44627	XM-27 ^L	65	450	40	275	22.0	187	90	180	
S44635	...	90	620	75	515	20.0	269	28 ^F	180	
S44660	...	85	585	65	450	18.0	241	100	180	
S44700	...	80	550	60	415	20.0	223	20 ^F	180	
S44735	...	80	550	60	415	18.0	255	25 ^F	180	
S44800	...	80	550	60	415	20.0	223	20 ^F	180	
S46800	...	60	415	30	205	22	...	90	180	

^A Unless otherwise indicated, a grade designation originally assigned by the American Iron and Steel Institute (AISI).

^B Yield strength shall be determined by the offset method at 0.2 % in accordance with Test Methods and Definitions A 370. Unless otherwise specified (see Specification A 480/A 480M, paragraph 4.1.11, Ordering Information), an alternative method of determining yield strength may be based on total extension under load of 0.5 %.

^C Either Brinell or Rockwell B Hardness is permissible.

^D Bend tests are not required for chromium steels (ferritic or martensitic) thicker than 1 in. [25 mm] or for any austenitic or duplex (austenitic-ferritic) stainless steels regardless of thickness.

^E Elongation for thickness, less than 0.015 in. (0.38 mm) shall be 20 % minimum, in 1 in. (25.4 mm).

^F Common name, not a trademark, widely used, not associated with any one producer.

^G Yield strength requirements shall not apply to material under 0.020 in. [0.50 mm] in thickness.

^H Not applicable for thicknesses under 0.010 in. [0.25 mm].

^I Type 201 is generally produced with a chemical composition balanced for rich side (Type 201-1) or lean side (Type 201-2) austenite stability depending on the properties required for specific applications.

^J Rockwell C scale.

^K For S32615, the grain size as determined in accordance with the Test Methods E 112, Comparison Method, Plate II, shall be No. 3 or finer.

^L Naming system developed and applied by ASTM.

^M Prior to Specification A 240 – 89b, the tensile value for S32950 was 90 ksi.

^N S40900 (Type 409) has been replaced by S40910, S40920, and S40930. Unless otherwise specified in the ordering information, an order specifying S40900 or Type 409 shall be satisfied by any one of S40910, S40920, or S40930 at the option of the seller. Material meeting the requirements of S40910, S40920, or S40930, may at the option of the manufacturer be certified as S40900.

^O Material 0.050 in (1.27 mm) and under in thickness shall have a minimum elongation of 20 %.

SUPPLEMENTARY REQUIREMENTS

A supplementary requirement shall apply only when specified in the purchase order.

S1. Charpy Impact Testing of Plate

S1.1 Charpy impact tests shall be conducted in accordance with Test Methods and Definitions A 370.

S1.2 *Number of Tests* —One impact test (3 specimens) shall be made from one plate per heat treatment lot in the final heat treated condition.

S1.3 *Orientation of Test Specimens* —Unless specified as transverse specimens (long axis of the specimen transverse to the final rolling direction, root of the notch perpendicular to the rolling face) on the purchase order, the orientation of the specimens shall be longitudinal (long axis of the specimen parallel to the final rolling direction, root of the notch perpendicular to the rolling face). The manufacturer is permitted to test transverse specimens provided that such tests meet the acceptance criteria applicable to longitudinal specimens. Unless otherwise specified on the purchase order, the specimens shall be taken so as to include the mid-thickness of the product.

S1.4 *Test Temperature* —The purchaser shall specify the test temperature. The manufacturer is permitted to test specimens at a temperature lower than that specified by the purchaser, provided that such tests shall meet the acceptance criteria applicable to specimens tested at the specified temperature (see Note).

NOTE —Test Methods A 923, Method B, applicable to some duplex (austenitic-ferritic) stainless steels as listed in Test Methods A 923, uses a Charpy impact test for the purpose of determining the absence of detrimental intermetallic phases. Method B specifies a test temperature and acceptance criterion, expressed as impact energy, for each type of

steel covered. It may be economical for the Charpy impact tests performed on duplex stainless steels covered in both Specification A 240 and Test Methods A 923 to be performed at the lower of the temperatures specified by this supplementary requirement and Test Methods A 923 Method B, with measurement of both lateral expansion and impact energy.

S1.5 *Acceptance Limit* —Unless otherwise specified on the purchase order, each of the three specimens tested shall show a lateral expansion opposite the notch of not less than 0.015 in. [0.38 mm].

S1.6 *Records* —The recorded results shall include the specimen orientation, specimen size, test temperature, absorbed energy values (if required), and lateral expansion opposite the notch.

S2. Materials for High-Temperature Service

S2.1 Unless an H grade has been ordered, this supplementary requirement shall be specified for ASME Code applications for service above 1000°F [540°C].

S2.2 The user is permitted to use an austenitic stainless steel as the corresponding H grade when the material meets all requirements of the H grade including chemistry, annealing temperature, and grain size (see Section 6).

S2.3 The user is permitted to use an L grade austenitic stainless steel for service above 1000°F [540°C], subject to the applicable allowable stress table of the ASME Code, when the material meets all requirements of this specification and the grain size is ASTM No. 7 or coarser as determined in accordance with Test Method E 112. The grain size shall be reported on a Certified Test Report.

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