Designation: A564/A564M – 19

Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes[1]

This standard is issued under the fixed designation A564/A564M; 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 U.S. Department of Defense.

1. Scope*

1.1 This specification[2] covers bars and shapes of age-hardening stainless steels. Hot-finished or cold-finished rounds, squares, hexagons, bar shapes, angles, tees, and channels are included; these shapes may be produced by hot rolling, extruding, or forging. Billets or bars for reforging may be purchased to this specification.

1.2 These steels are generally used for parts requiring corrosion resistance and high strength at room temperature, or at temperatures up to 600 °F [315 °C]; 700 °F [370 °C] for Type 632; 840 °F [450 °C] for Type UNS S46910. They are suitable for machining in the solution-annealed condition after which they may be age-hardened to the mechanical properties specified in Section 7 without danger of cracking or distortion. Type XM-25 is machinable in the as-received fully heat treated condition. Type UNS S46910 is suitable for machining in the solution-annealed, cold-worked, and aged-hardened condition.

1.3 Types 631 and 632 contain a large amount of ferrite in the microstructure and can have low ductility in forgings and larger diameter bars. Applications should be limited to small diameter bar.

1.4 The values stated in either inch-pound units or SI (metric) units are to be regarded separately as standards; within the text and tables, the SI units are shown in [brackets]. The values stated in each system are not exact equivalents; therefore, each system must be used independent of the other. Combining values from the two systems may result in nonconformance with the specification.

1.5 Unless the order specifies an "M" designation, the material shall be furnished to inch-pound units.

NOTE 1—For forgings, see Specification A705/A705M.

NOTE 2—For billets and bars for forging see Specification A314.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

A314 Specification for Stainless Steel Billets and Bars for Forging

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A484/A484M Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings

A705/A705M Specification for Age-Hardening Stainless Steel Forgings

A751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products

E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)

2.2 *Other Documents:*

SAE J1086 Recommended Practice for Numbering Metals and Alloys (UNS)[4]

3. Ordering Information

3.1 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:

3.1.1 Quantity (weight or number of pieces),

3.1.2 Type or UNS designation (Table 1),

3.1.3 Specific melt type when required,

3.1.4 Heat treated condition (5.1),

[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-Rolled and Wrought Stainless Steel.

Current edition approved May 1, 2019. Published June 2019. Originally approved in 1966. Last previous edition approved in 2013 as A564/A564M – 13$^{\varepsilon 1}$. DOI: 10.1520/A0564_A0564M-19.

[2] For ASME Boiler and Pressure Vessel Code applications, see related Specification SA-564/SA-564M in Section II of that Code.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001, http://www.sae.org.

*A Summary of Changes section appears at the end of this standard

TABLE 1 Chemical Requirements[A]

UNS Designation[B]	Type	Composition, % C	Mn	P	S	Si	Cr	Ni	Al	Mo	Ti	Cu	Other Elements
S17400	630	0.07	1.00	0.040	0.030	1.00	15.00–17.50	3.00–5.00	...	...	...	3.00–5.00	[C]
S17700	631	0.09	1.00	0.040	0.030	1.00	16.00–18.00	6.50–7.75	0.75–1.50	...	...	...	...
S15700	632	0.09	1.00	0.040	0.030	1.00	14.00–16.00	6.50–7.75	0.75–1.50	2.00–3.00	...	...	...
S35500	634	0.10–0.15	0.50–1.25	0.040	0.030	0.50	15.00–16.00	4.00–5.00	...	2.50–3.25	...	...	[D]
S17600	635	0.08	1.00	0.040	0.030	1.00	16.00–17.50	6.00–7.50	0.40	...	0.40–1.20	...	...
S15500	XM-12	0.07	1.00	0.040	0.030	1.00	14.00–15.50	3.50–5.50	...	...	...	2.50–4.50	[C]
S13800	XM-13	0.05	0.20	0.010	0.008	0.10	12.25–13.25	7.50–8.50	0.90–1.35	2.00–2.50	...	...	[E]
S45500	XM-16	0.03	0.50	0.015	0.015	0.50	11.00–12.50	7.50–9.50	...	0.50	0.90–1.40	1.50–2.50	[F]
S45503	...	0.010	0.50	0.010	0.010	0.20	11.00–12.50	7.50–9.50	...	0.50	1.00–1.35	1.50–2.50	[F]
S45000	XM-25	0.05	1.00	0.030	0.030	1.00	14.00–16.00	5.00–7.00	...	0.50–1.00	...	1.25–1.75	[G]
S46500	...	0.02	0.25	0.015	0.010	0.25	11.00–12.50	10.75–11.25	...	0.75–1.25	1.50–1.80	...	[E]
S46910	...	0.030	1.00	0.030	0.015	0.70	11.0–13.0	8.0–10.0	0.15–0.50	3.0–5.0	0.50–1.20	1.5–3.5	...
S10120	...	0.02	0.25	0.015	0.010	0.25	11.00–12.50	9.00–10.50	0.80–1.10	1.75–2.25	0.20–0.50	...	[E]
S11100	...	0.02	0.25	0.015	0.010	0.25	11.00–12.50	10.25–11.25	1.35–1.75	1.75–2.25	0.20–0.50	...	[E]

[A] Limits are in percent maximum unless shown as a range or stated otherwise.
[B] New designation established in accordance with Practice E527 and SAE J1086.
[C] Niobium[H] 0.15–0.45.
[D] Nitrogen 0.07–0.13.
[E] Nitrogen 0.01.
[F] Niobium 0.10–0.50.
[G] Niobium 8 times carbon minimum.
[H] Niobium (Nb) and Columbium (Cb) refer to the same element.

3.1.5 Transverse properties when required (7.6),

3.1.6 Finish (Specification A484/A484M),

3.1.7 Surface preparation of shapes (5.2.1),

3.1.8 Size, or applicable dimension including diameter, thickness, width, length, and so forth,

3.1.9 Preparation for delivery (Specification A484/A484M),

3.1.10 Special requirements (refer to 7.4 and 8.3),

3.1.11 Marking requirements (Specification A484/A484M), and

3.1.12 ASTM designation and date of issue if other than that currently published.

3.2 If possible, the intended use of the item should be given on the purchase order especially when the item is ordered for a specific end use or uses.

NOTE 3—A typical ordering description is as follows: 5000 lb [2270 kg] Type 630, Solution-Annealed Cold Finished Centerless Ground, 1½ in. [38.0 mm] round bar, 10 to 12 ft [3.0 to 3.6 m] in length, ASTM A564 dated _____. End use: valve shafts.

4. General Requirements

4.1 In addition to the requirements of this specification, all requirements of the current edition of Specifications A484/A484M shall apply. Failure to comply with the general requirements of Specification A484/A484M constitutes nonconformance with this specification.

5. Materials and Manufacture

5.1 *Heat Treatment and Condition:*

5.1.1 Material of types other than XM-16, XM-25, and Type 630 shall be furnished in the solution-annealed condition, or in the equalized and oven-tempered condition, as noted in Table 2, unless otherwise specified by the purchaser.

5.1.1.1 Types 630, XM-16, and XM-25 may be furnished in the solution-annealed or age-hardened condition.

5.1.2 Type UNS S46910 shall be furnished in solution-annealed condition in accordance with Table 2, or solution-annealed and cold-worked condition in accordance with Table 3, or aged-hardened condition in accordance withTable 4.

5.1.3 Reforging stock shall be supplied in a condition of heat treatment to be selected by the forging manufacturer.

5.2 Shapes may be subjected to either Class A or Class C preparation as specified on the purchase order.

5.2.1 Class A consists of preparation by grinding for the removal of imperfections of a hazardous nature such as fins, tears, and jagged edges provided the underweight tolerance is not exceeded and the maximum depth of grinding at any one point does not exceed 10 % of the thickness of the section.

5.2.2 Class C consists of preparation by grinding for the removal of all visible surface imperfections provided the underweight tolerance is not exceeded and the maximum depth of grinding at any one point does not exceed 10 % of the thickness of the section.

6. Chemical Composition

6.1 Each alloy covered by this specification shall conform to the chemical requirements specified in Table 1.

6.2 Methods and practices relating to chemical analysis required by this specification shall be in accordance with Test Methods, Practices, and Terminology A751.

7. Mechanical Properties Requirements

7.1 The material, as represented by mechanical test specimens, shall conform to the mechanical property requirements specified in Table 2 or Table 3 and shall be capable of developing the properties in Table 4 when heat treated as specified in 5.1.

TABLE 2 Solution Treatment

UNS Designation	Type	Condition	Solution Treatment	Mechanical Test Requirements in Solution Treated Condition[A]							
				Tensile Strength, min		Yield Strength, min[B]		Elongation in 2 in. [50 mm] or 4D, min. %	Reduction of Area, min %	Hardness[C]	
				ksi	[MPa]	ksi	[MPa]			Rockwell C, max	Brinell, max
S17400	630	A	1900 ± 25 °F [1040 ± 15 °C] (cool as required to below 90 °F (32 °C))	...	...	...	...	...	...	38	363
S17700	631	A	1900 ± 25 °F [1040 ± 15 °C] (water quench)	...	...	...	...	...	...	HRB98	229
S15700	632	A	1900 ± 25 °F [1040 ± 15 °C] (water quench)	...	...	...	...	...	...	HRB100	269[D]
S35500	634[E]	A	1900 ± 25 °F [1040 ± 15 °C] quench, hold not less than 3 h at minus 100 °F or lower	...	...	...	...	...	...	...	363[E]
S17600	635	A	1900 ± 25 °F [1040 ± 15 °C] (air cool)	120	[825]	75	[515]	10	45	32	302
S15500	XM-12	A	1900 ± 25 °F [1040 ± 15 °C] (cool as required to below 90 °F (32 °C))	...	...	...	...	...	...	38	363
S13800	XM-13	A	1700 ± 25 °F [925 ± 15 °C] Cool as required to below 60 °F [16 °C]	...	...	...	...	...	...	38	363
S45500	XM-16	A	1525 ± 25 °F [830 ± 15 °C] (cool rapidly)	...	...	...	...	...	...	36	331
S45000	XM-25	A	1900 ± 25 °F [1040 ± 15 °C] (cool rapidly)	125[F]	[860]	95	[655]	10	40	32	321
S45503	...	A	1525 ± 25 °F [830 ± 15 °C] (cool rapidly)	...	...	...	...	...	...	36	331
S46500	...	A	1800 ± 25 °F [980 ± 15 °C] (oil or water quench), hold for min. 8 h at minus 100 °F (73 °C), air warm	...	...	...	...	...	...	36	331
S46910	...	A	1830 – 2050 °F [1000 – 1120 °C] (cool rapidly)	87	[600]	58	[400]	10	...	33	315
S10120	...	A	1545 ± 25 °F [840 ± 14 °C] (cool rapidly below 90 °F [32 °C])	...	...	...	...	...	...	36	331
S11100	...	A	1545 ± 25 °F [840 ± 14 °C] (oil or water quench), hold for minimum of 8 h at -100 °F [-73 °C],[G] air warm	...	...	...	...	...	...	36	331

[A] See 7.1.
[B] See 7.3.
[C] Either Rockwell C hardness or Brinell is permissible. On sizes ½ in. (12.70 mm) and smaller, Rockwell C is preferred.
[D] 321 BH for rounds cold drawn after solution treating.
[E] Equalization and over-tempering treatment 1425 ± 50 °F [775 ± 30 °C] for not less than 3 h, cool to room temperature, heat to 1075 ± 25 °F [580 ± 15 °C] for not less than 3 h.
[F] Maximum 165 ksi [1140 MPa] tensile strength only for sizes up to ½ in. (13 mm).
[G] Required hold time at minus 100 °F [-73 °C] is not mandatory if product is under 2 in. [51 mm] thickness.

TABLE 3 Solution-Annealed and Cold-Worked Condition

UNS Designation	Type	Condition	Mechanical Test Requirements in Solution-Annealed and Cold-Worked Condition							
			Tensile Strength, min		Yield Strength, min		Elongation in 2 in. [50 mm] or 4D, min %	Reduction of Area, min %	Hardness	
			ksi	[MPa]	ksi	[MPa]			Rockwell C, max	Brinell, max
S46910	...	CW ½ hard	131	[900]	109	[750]	8	...	40	380
	...	CW full hard	189	[1300]	175	[1200]	3	...	55	580

TABLE 4 Mechanical Test Requirements After Age Hardening Heat Treatment[A]

Type	Condition	Suggested Hardening or Aging Treatment, or Both[B,C,D]			Applicable Thickness, in. and Test Direction[E]	Tensile Strength, min		Yield Strength, min[F]		Elongation in 2 in. [50 mm] or 4D, min. %	Reduction of area, min, %	Hardness[G]		Impact Charpy-V, min	
		Temperature, °F [°C]	Time, h	Quench[H]		ksi	[MPa]	ksi	[MPa]			Rockwell C, min	Brinell, min	ft·lbf	J
630	H900	900 [480]	1.0	air cool	Up to 3 in. incl [75 mm] (L) Over 3 in. [75 mm] to 8 in. incl [200 mm] (T)	190	[1310]	170	[1170]	10	40 35	40	388	...	...
	H925	925 [495]	4.0	air cool	Up to 3 min. incl [75 mm] (L) Over 3 in. [75 mm] to 8 in. incl [200 mm] (T)	170	[1170]	155	[1070]	10	44 38	38	375	5	6.8
	H1025	1025 [550]	4.0	air cool	Up to 8 in. incl [200 mm] (L)	155	[1070]	145	[1000]	12	45	35	331	15	20
	H1075	1075 [580]				145	[1000]	125	[860]	13	45	32	311	20	27
	H1100	1100 [595]				140	[965]	115	[795]	14	45	31	302	25	34
	H1150	1150 [620]				135	[930]	105	[725]	16	50	28	277	30	41
	H1150M	1400 [760] for 2 h, air cool plus 1150 [620] for 4 h, air cool				115	[795]	75	[520]	18	55	24	255	55	75
	H1150D	1150 [620] for 4 h, air cool plus 1150 [620] for 4 h, air cool				125	[860]	105	[725]	16	50	24 33 max	255 311 max	30	41
631	RH950	1750 °F [955 °C] for not less than 10 min, but not more than 1 h, cool rapidly to room temperature. Cool within 24 h to minus 100 ± 10 °F [75 °C], hold not less than 8 h. Warm in air to room temperature. Heat to 950 °F [510 °C], hold 1 h, air cool.			Up to 4 in. incl. [100 mm] (L)	185	[1280]	150	[1030]	6	10	41	388	...	...
	TH1050	Alternative treatment: 1400 °F [760 °C] hold 90 min, cool to 55 ± 5 °F [15 ± 3 °C] within 1 h. Hold not less than 30 min, heat to 1050 °F [565 °C] hold for 90 min, air cool.			Up to 6 in. incl [150 mm] (L)	170	[1170]	140	[965]	6	25	38	352	...	...
632	RH950	Same as Type 631			Up to 4 in. incl [100 mm] (L)	200	[1380]	175	[1210]	7	25	...	415	...	...
	TH1050				Up to 6 in. incl [150 mm] (L)	180	[1240]	160	[1100]	8	25	...	375	...	...
634[I]	H1000	1750 [955] for not less than 10 min, but not more than 1 h. Water quench. Cool to not higher than minus 100 °F [75 °C]. Hold for not less than 3 h. Temper at 1000 °F [540 °C], holding for not less than 3 h.				170	[1170]	155	[1070]	12	25	37	341	...	...
635	H950	950 (510)	0.5	air cool		190	[1310]	170	[1170]	8	25	39	363	...	...
	H1000	1000 [540]				180	[1240]	160	[1100]	8	30	37	352	...	...
	H1050	1050 [565]				170	[1170]	150	[1035]	10	40	35	331	...	...
XM-12	H900	900 [480]	1.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	190	[1310]	170	[1170]	10 6	35 15	40	388	...	...
	H925	925 [495]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	170	[1170]	155	[1070]	10 7	38 20	38	375	5 ...	6.8 ...
	H1025	1025 [550]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	155	[1070]	145	[1000]	12 8	45 27	35	331	15 10	20 14
	H1075	1075 [580]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	145	[1000]	125	[860]	13 9	45 28	32	311	20 15	27 20

TABLE 4 *Continued*

Type	Condition	Suggested Hardening or Aging Treatment, or Both[B,C,D]			Applicable Thickness, in. and Test Direction[E]	Tensile Strength, min		Yield Strength, min[F]		Elongation in 2 in. [50 mm] or 4D, min. %	Reduction of area, min, %	Hardness[G]		Impact Charpy-V, min	
		Temperature, °F [°C]	Time, h	Quench[H]		ksi	[MPa]	ksi	[MPa]			Rockwell C, min	Brinell, min	ft·lbf	J
	H1100	1100 [595]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	140	[965]	115	[795]	14 10	45 29	31	302	25 15	34 20
	H1150	1150 [620]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	135	[930]	105	[725]	16 11	50 30	28	277	30 20	41 27
	H1150M	1400 [760] for 2 h, air cool plus 1150 [620] for 4 h, air cool			Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	115	[795]	75	[515]	18 14	55 35	24	255	55 35	75 47
XM-13	H950	950 [510]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	220	[1515]	205	[1415]	10	45 35	45	430	...	...
	H1000	1000 [540]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	205	[1415]	190	[1310]	10 10	50 40	43	400	...	...
	H1025	1025 [550]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	185	[1280]	175	[1210]	11	50 45	41	380	...	...
	H1050	1050 [565]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	175	[1210]	165	[1140]	12	50 45	40	372	...	...
	H1100	1100 [595]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	150	[1035]	135	[930]	14	50 50	34	313	...	...
	H1150	1150 [620]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	135	[930]	90	[620]	14	50 50	30	283	...	...
	H1150M	1400 [760] for 2 h, air cool plus 1150 [620] for 4 h, air cool			Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	125	[860]	85	[585]	16	55 55	26	259	...	...
XM-16	H900	900 [480]	4.0	air cool	Up to 6 in. incl [150 mm] (L)	235	[1620]	220	[1515]	8	30	47	444	...	...
	H950	950 [510]				220	[1515]	205	[1415]	10	40	44	415	...	...
	H1000	1000 [540]				205	[1415]	185	[1275]	10	40	40	363	...	...
S45503	H900	900 [480]	4.0	air cool	Up to 6 in. incl [150 mm] (L) Up to 6 in. incl [150 mm] (T)	235	[1620]	220	[1520]	8 4	30 15	47	444	...	...
	H950	950 [510]	4.0	air cool	Up to 6 in. incl [150 mm] (L) Up to 6 in. incl [150 mm] (T)	220	[1515]	205	[1410]	10 5	40 20	44	415	...	...
	H1000	1000 [540]	4.0	air cool	Up to 6 in. incl [150 mm] (L) Up to 6 in. incl [150 mm] (T)	205	[1410]	185	[1275]	10 6	40 25	40	363	...	...

TABLE 4 *Continued*

Type	Condition	Suggested Hardening or Aging Treatment, or Both[B,C,D]			Applicable Thickness, in. and Test Direction[E]	Tensile Strength, min		Yield Strength, min[F]		Elongation in 2 in. [50 mm] or 4D, min. %	Reduction of area, min, %	Hardness[G]		Impact Charpy-V, min	
		Temperature, °F [°C]	Time, h	Quench[H]		ksi	[MPa]	ksi	[MPa]			Rockwell C, min	Brinell, min	ft·lbf	J
XM-25	H900	900 [480]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	180	[1240]	170	[1170]	10 6	40 20	39	363	. . .	. . .
	H950	950 [510]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	170	[1170]	160	[1100]	10 7	40 22	37	341	. . .	. . .
	H1000	1000 [540]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	160	[1100]	150	[1035]	12 8	45 27	36	331	. . .	. . .
	H1025	1025 [550]	4.0	air cool	Up to 8 in. incl [200 mm]	150	[1035]	140	[965]	12	45	34	321	. . .	. . .
	H1050	1050 [565]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	145	[1000]	135	[930]	12 9	45 30	34	321	. . .	. . .
	H1100	1100 [595]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	130	[895]	105	[725]	16 11	50 30	30	285	. . .	. . .
	H1150	1150 [620]	4.0	air cool	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	125	[860]	75	[515]	18 12	55 35	26	262	. . .	. . .
S46500	H950	950 [510]	4.0	air or oil	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	240	[1655]	220	[1515]	10 8	45 35	47	444	. . .	. . .
	H1000	1000 [540]	4.0	air or oil	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	220	[1515]	200	[1380]	10 10	50 40	45	430	. . .	. . .
	H1025	1025 [560]	4.0	air or oil	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	210	[1450]	195	[1345]	12 11	50 45	44	415	. . .	. . .
	H1050	1050 [565]	4.0	air or oil	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	200	[1380]	185	[1280]	13 12	50 45	43	400	. . .	. . .
UNS S46910	CW ½ hard + aging	890 [475]	1.0	Air cool	. . .	245	[1690]	218	[1500]	6	. . .	48	456	. . .	. . .
	CW full hard + aging	890 [475]	1.0	Air cool	. . .	320	[2205]	290	[2005]	2	. . .	55	561	. . .	. . .
S10120	H950	950 [510]	4.0	air or oil	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	203	[1400]	189	[1300]	10 9	50 45	43	401	. . .	. . .
S11100	H900	900 [480]	J	air or oil or water	Up to 12 in. incl [300 mm] (L)	247	[1700]	231	[1590]	11	43	47	448	. . .	. . .
	H950	950 [510]	8.0	air or oil or water	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	240	[1655]	220	[1517]	10 8	45 35	47	448	. . .	. . .

TABLE 4 *Continued*

Type	Condition	Suggested Hardening or Aging Treatment, or Both[B,C,D]			Applicable Thickness, in. and Test Direction[E]	Tensile Strength, min		Yield Strength, min[F]		Elongation in 2 in. [50 mm] or 4D, min. %	Reduction of area, min, %	Hardness[G]		Impact Charpy-V, min	
		Temperature, °F [°C]	Time, h	Quench[H]		ksi	[MPa]	ksi	[MPa]			Rockwell C, min	Brinell, min	ft·lbf	J
	H1000	1000 [540]	8.0	air or oil or water	Up to 12 in. incl [300 mm] (L) Up to 12 in. incl [300 mm] (T)	220	[1517]	200	[1378]	10 10	50 40	45	426	. . .	. . .

[A] See 7.1.
[B] Time refers to minimum time material is at temperature and may be extended to obtain required ductility properties.
[C] Unless otherwise noted, temperatures shown are suggested temperatures and may be varied to obtain required tensile properties.
[D] Intermediate temperatures must meet the ductility requirements of the next highest suggested hardening or aging temperature, or both. Example: Type 630 at 1050 °F [565 °C] must have 13 % elongation and 45 % reduction, same as for age hardening at 1075 °F [580 °C].
[E] (L) - Longitudinal axis of specimen parallel to direction of grain flow during rolling or forging. (T) - Transverse axis of specimen perpendicular to direction of grain flow during rolling or forging.
[F] See 7.3.
[G] Either Rockwell C hardness or Brinell is permissible. On sizes ½ in. (12.70 mm) and smaller, Rockwell C is preferred.
[H] When air cooling is specified, gases other than air may be used.
[I] Refer to Table 2 for details on equalize and over temper heat treatment.
[J] For the H900 condition of S11100, the duration set up between 4 and 8 hours.

7.2 Samples cut from bars for forging stock shall conform to the mechanical properties of Table 2 and Table 4 when heat treated as specified in Table 2 and Table 4.

7.3 The yield strength shall be determined by the offset method as described in the current edition of Test Methods and Definitions A370. The limiting permanent offset shall be 0.2 % of the gauge length of the specimen.

7.4 The impact requirement shall apply only when specified in the purchase order. When specified, the material, as represented by impact test specimens, shall be capable of developing the impact property requirements specified in Table 4 when heat treated in accordance with 5.1.

7.5 Longitudinal impact requirements are not applicable to bars less than ⅝ in. (16.9 mm) diameter or size or flats less than ⅝ in. (16.9 mm) thick.

7.6 Tensile and impact requirements in the transverse (through thickness) direction are not applicable to bars less than 3 in. [75 mm] diameter in size or flats less than 3 in. [75 mm] thick.

7.7 Material tensile tested and, when specified, impact tested in the transverse (through thickness) direction and meeting the requirements shown in Table 4 need not be tested in the longitudinal direction.

8. Number of Tests

8.1 At least one room temperature tension test and one or more hardness tests shall be made on each lot.

8.2 One or more hardness tests and at least one tension test shall be made from each lot on test samples heat treated as required in . Unless otherwise specified in the purchase order, the condition of hardening heat treatment shall be at the option of the producer. The tests shall meet the requirements of Table 4.

8.3 When specified in the purchase order, the impact test shall consist of testing three Charpy V-notch Type A specimens in accordance with Methods and Definitions A370. The specimens shall be heat treated in accordance with 5.1. Unless otherwise specified in the purchase order, the condition of hardening heat treatment shall be at the option of the producer and testing shall be done at 70 to 80 °F [20 to 25 °C]. The tests shall meet the requirements of Table 4. When tested at temperatures other than 70 to 80 °F, [20 to 25 °C] the impact test requirements will be as agreed upon by purchaser and producer.

9. Keywords

9.1 age-hardening stainless steel; precipitation hardening stainless steel; stainless steel bars; stainless steel shapes

SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A564/A564M – 13$^{\varepsilon 1}$) that may impact the use of this standard. (Approved May 1, 2019.)

(1) Changed "Columbium plus tantalum" to "Niobium" in Table 1.

(2) Added footnote to Table 1 stating that Niobium and Columbium are the same element.

Contact ASTM

Call Us

Monday through Friday 8:30am-6:00pm Eastern US Standard Time

Sales & Support

1-877-909-2786 (USA & Canada)

International

001-610-832-9585 (Customer Service)

001-610-832-9578 (Technical Support)

ASTM Headquarters

100 Barr Harbor Drive
P.O. Box C700
West Conshohocken, PA
19428-2959, USA
Tel: +1.610.832.9500
Fax: +1.610.832.9555
service@astm.org
Directions

Washington Office

1850 M Street, NW
Suite 1030
Washington, DC 20036
Jeffrey Grove
Tel: +1.202.223.8505

Latin America Office

EnginZone
Monterosa 233
of. 402 Chacarilla del Estanque
Surco, Lima 33
PERU
Maria Isabel Barrios
Tel: +51 (1) 205-5502

ASTM INTERNATIONAL

Contact ASTM

Call Us

Monday through Friday 8:30am-6:00pm Eastern US Standard Time

Sales & Support

1-877-909-2786 (USA & Canada)

International

001-610-832-9585 (Customer Service)

001-610-832-9578 (Technical Support)

Canada Office

171 Nepean Street, Suite 400
Ottawa, ON K2P 0B4
Diane Thompson
Tel: +1.613.751.3409

Brussels Office

Rue de la Loi 67
B-1040 Brussels,
Belgium
Sara Gobbi
Tel +32.(0)2.8405127

China Office

Suite EF-09, Twin Towers East,
B-12 Jianguomenwai Ave.
Chaoyang District, Beijing, P.R. China
100022
Liu Fei
Tel: +86.10.5109.6033
Fax: +86.10.5109.6039

Contact ASTM

Call Us

Monday through Friday 8:30am-6:00pm Eastern US Standard Time

Sales & Support

1-877-909-2786 (USA & Canada)

International

001-610-832-9585 (Customer Service)

001-610-832-9578 (Technical Support)

Media Contact

Nathan Osburn, Director, Corporate Communications
Tel: +610.832.9603