Designation: A322 – 13 (Reapproved 2018)

Standard Specification for Steel Bars, Alloy, Standard Grades[1]

This standard is issued under the fixed designation A322; 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 covers hot-wrought alloy steel bars. Bar applications include forging, heat treating, cold drawing, machining and many structural components (Note 1).

NOTE 1—A guide for the selection of steel bars is contained in Practice A400.

1.2 The bars shall be furnished in the grades specified in Table 1. Sections and sizes of bar steel available are covered in Specification A29/A29M. Hot-wrought alloy steel bars are produced in cut lengths and coils; the manufacturer should be consulted regarding sections and sizes available in coils, produced to a chemical composition.

1.3 Some applications may require superior surface quality, or special chemical restrictions, metallurgical characteristics, heat treatment, or surface finishes which the purchaser may obtain by designating one or more of the available Supplementary Requirements.

1.4 *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:*[2]

A29/A29M Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought

A304 Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements

A400 Practice for Steel Bars, Selection Guide, Composition, and Mechanical Properties

E112 Test Methods for Determining Average Grain Size

E381 Method of Macroetch Testing Steel Bars, Billets, Blooms, and Forgings

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

3. Ordering Information

3.1 Orders under this specification should include the following as required to describe adequately the desired material:

3.1.1 Quantity (weight or number of bars),

3.1.2 Name of material (hot-wrought alloy steel bars),

3.1.3 Dimensions,

3.1.4 ASTM designation,

3.1.5 Deoxidation practice (see 5.3),

3.1.6 Grade designation or chemical composition limits (see 6.1 and Table 1),

3.1.7 Grain size if required,

3.1.8 Test reports, if required (Section 8),

3.1.9 Additions to the specification and Supplementary Requirements, if required, and

3.1.10 Application.

4. General Requirements

4.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A29/A29M, unless otherwise provided herein.

5. Materials and Manufacture

5.1 The steel shall be made by one or more of the following primary processes: basic-oxygen or electric-furnace. The primary melting may incorporate separate degassing or refining and may be followed by secondary melting using electro-slag remelting or vacuum arc remelting. Where secondary melting is employed, the heat shall be defined as all of the cast product remelted from a single primary heat.

5.2 The steel shall be furnished as strand cast or ingot cast, unless otherwise specified.

5.2.1 *Discard*—A sufficient discard shall be made to secure freedom from injurious piping and undue segregation.

5.3 *Deoxidation*—Killed steel is required.

[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 A01.15 on Bars.

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[2] 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.

TABLE 1 Grade Designations and Chemical Compositions of Hot-Wrought Alloy Steel Bars[A, B]

UNS Designation[C]	Grade[D] Designations	Chemical Composition, Ranges and Limits, %							
		Carbon	Manganese	Phosphorus, max	Sulfur,[E] max	Silicon[F]	Nickel	Chromium	Molybdenum
G13300	1330	0.28–0.33	1.60–1.90	0.035	0.040	0.15–0.35	...	...	...
G13350	1335	0.33–0.38	1.60–1.90	0.035	0.040	0.15–0.35	...	...	...
G13400	1340	0.38–0.43	1.60–1.90	0.035	0.040	0.15–0.35	...	...	...
G13450	1345	0.43–0.48	1.60–1.90	0.035	0.040	0.15–0.35	...	...	...
G40120	4012	0.09–0.14	0.75–1.00	0.035	0.040	0.15–0.35	...	...	0.15–0.25
G40230	4023	0.20–0.25	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.20–0.30
G40240	4024	0.20–0.25	0.70–0.90	0.035	0.035–0.050	0.15–0.35	...	...	0.20–0.30
G40270	4027	0.25–0.30	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.20–0.30
G40280	4028	0.25–0.30	0.70–0.90	0.035	0.035–0.050	0.15–0.35	...	...	0.20–0.30
G40320	4032	0.30–0.35	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.20–0.30
G40370	4037	0.35–0.40	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.20–0.30
G40420	4042	0.40–0.45	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.20–0.30
G40470	4047	0.45–0.50	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.20–0.30
G40420	4042	0.40–0.45	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.20–0.30
G41180	4118	0.18–0.23	0.70–0.90	0.035	0.040	0.15–0.35	...	0.40–0.60	0.08–0.15
G41200	4120	0.18–0.23	0.90–1.20	0.035	0.040	0.15–0.35	...	0.40–0.60	0.13–0.20
G41210	4121	0.18–0.23	0.75–1.00	0.035	0.040	0.15–0.35	...	0.45–0.65	0.20–0.30
G41300	4130	0.28–0.33	0.40–0.60	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41350	4135	0.33–0.38	0.70–0.90	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41370	4137	0.35–0.40	0.70–0.90	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41400	4140	0.38–0.43	0.75–1.00	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41420	4142	0.40–0.45	0.75–1.00	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41450	4145	0.43–0.48	0.75–1.00	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41470	4147	0.45–0.50	0.75–1.00	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41500	4150	0.48–0.53	0.75–1.00	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15–0.25
G41610	4161	0.56–0.64	0.75–1.00	0.035	0.040	0.15–0.35	...	0.70–0.90	0.25–0.35
G43200	4320	0.17–0.22	0.45–0.65	0.035	0.040	0.15–0.35	1.65–2.00	0.40–0.60	0.20–0.30
G43400	4340	0.38–0.43	0.60–0.80	0.035	0.040	0.15–0.35	1.65–2.00	0.70–0.90	0.20–0.30
G43406	E4340	0.38–0.43	0.65–0.85	0.025	0.025	0.15–0.35	1.65–2.00	0.70–0.90	0.20–0.30
G44190	4419	0.18–0.23	0.45–0.65	0.035	0.040	0.15–0.35	...	...	0.45–0.60
G44220	4422	0.20–0.25	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.35–0.45
G44270	4427	0.24–0.29	0.70–0.90	0.035	0.040	0.15–0.35	...	...	0.35–0.45
G46150	4615	0.13–0.18	0.45–0.65	0.035	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
G46170	4617	0.16–0.21	0.40–0.65	0.030	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
G46200	4620	0.17–0.22	0.45–0.65	0.035	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
G46210	4621	0.18–0.23	0.70–0.90	0.035	0.040	0.15–0.35	1.65–2.00	...	0.20–0.30
G46260	4626	0.24–0.29	0.45–0.65	0.035	0.040	0.15–0.35	0.70–1.00	...	0.15–0.25
G47150	4715	0.13–0.18	0.70–0.90	0.035	0.040	0.15–0.35	0.70–1.00	0.45–0.65	0.45–0.60
G47180	4718	0.16–0.21	0.70–0.90	0.035	0.040	0.15–0.35	0.90–1.20	0.35–0.55	0.30–0.40
G47200	4720	0.17–0.22	0.50–0.70	0.035	0.040	0.15–0.35	0.90–1.20	0.35–0.55	0.15–0.25
G48150	4815	0.13–0.18	0.40–0.60	0.035	0.040	0.15–0.35	3.25–3.75	...	0.20–0.30
G48170	4817	0.13–0.20	0.40–0.60	0.035	0.040	0.15–0.35	3.25–3.75	...	0.20–0.30
G48200	4820	0.18–0.23	0.50–0.70	0.035	0.040	0.15–0.35	3.25–3.75	...	0.20–0.30
G50150	5015	0.12–0.17	0.30–0.50	0.035	0.040	0.15–0.35	...	0.30–0.50	...
G50460	5046	0.43–0.48	0.75–1.00	0.035	0.040	0.15–0.35	...	0.20–0.35	...
G51150	5115	0.13–0.18	0.70–0.90	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G51170	5117	0.15–0.20	0.70–0.90	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G51200	5120	0.17–0.22	0.70–0.90	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G51300	5130	0.28–0.33	0.70–0.90	0.035	0.040	0.15–0.35	...	0.80–1.10	...
G51320	5132	0.30–0.35	0.60–0.80	0.035	0.040	0.15–0.35	...	0.75–1.00	...
G51350	5135	0.33–0.38	0.60–0.80	0.035	0.040	0.15–0.35	...	0.80–1.05	...
G51400	5140	0.38–0.43	0.70–0.90	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G51450	5145	0.43–0.48	0.70–0.90	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G51470	5147	0.46–0.51	0.70–0.95	0.035	0.040	0.15–0.35	...	0.85–1.15	...
G51500	5150	0.48–0.53	0.70–0.90	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G51550	5155	0.51–0.59	0.70–0.90	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G51600	5160	0.56–0.64	0.75–1.00	0.035	0.040	0.15–0.35	...	0.70–0.90	...
G50986	E50100	0.98–1.10	0.25–0.45	0.025	0.025	0.15–0.35	...	0.40–0.60	...
G51986	E51100	0.98–1.10	0.25–0.45	0.025	0.025	0.15–0.35	...	0.90–1.15	...
G52986	E52100	0.98–1.10	0.25–0.45	0.025	0.025	0.15–0.35	...	1.30–1.60	...
G52985	52100	0.93–1.05	0.25–0.45	0.025	0.015	0.15–0.35	...	1.35–1.60	...
									Vanadium
G61180	6118	0.16–0.21	0.50–0.70	0.035	0.040	0.15–0.35	...	0.50–0.70	0.10–0.15
G61500	6150	0.48–0.53	0.70–0.90	0.035	0.040	0.15–0.35	...	0.80–1.10	0.15 min
									Molybdenum
G81150	8115	0.13–0.18	0.70–0.90	0.035	0.040	0.15–0.35	0.20–0.40	0.30–0.50	0.08–0.15
G86150	8615	0.13–0.18	0.70–0.90	0.035	0.04	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86170	8617	0.15–0.20	0.70–0.90	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86200	8620	0.18–0.23	0.70–0.90	0.035	0.04	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86220	8622	0.20–0.25	0.70–0.90	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86250	8625	0.23–0.28	0.70–0.90	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86270	8627	0.25–0.30	0.70–0.90	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86300	8630	0.28–0.33	0.70–0.90	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25