



Designation: A322 – 07

Standard Specification for Steel Bars, Alloy, Standard Grades¹

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 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.

2. Referenced Documents

2.1 ASTM Standards:²

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

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)

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.

Current edition approved May 1, 2007. Published May 2007. Originally approved in 1947. Last previous edition approved in 2006 as A322 – 06. DOI: 10.1520/A0322-07.

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.

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: open-hearth, 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.

5.3.1 The purchaser may designate that the steel be made to coarse or fine austenitic grain size. (See Supplementary Requirement S9 or S10.)

5.4 *Slow Cooling*—Immediately after hot forming, the bars shall be allowed to cool to a temperature below the critical range under suitable conditions to prevent imperfections caused by too rapid cooling.

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

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	...	...	...
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
G40370	4037	0.35–0.40	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
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		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		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
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
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
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		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
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
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	...
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	...
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	...
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									
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
G86370	8637	0.35–0.40	0.75–1.00	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86400	8640	0.38–0.43	0.75–1.00	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86420	8642	0.40–0.45	0.75–1.00	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86450	8645	0.43–0.48	0.75–1.00	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G86550	8655	0.51–0.59	0.75–1.00	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.15–0.25
G87200	8720	0.18–0.23	0.70–0.90	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.20–0.30
G87400	8740	0.38–0.43	0.75–1.00	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.20–0.30
G88220	8822	0.20–0.25	0.75–1.00	0.035	0.040	0.15–0.35	0.40–0.70	0.40–0.60	0.30–0.40
G92590	9259	0.56–0.64	0.75–1.00	0.035	0.040	0.70–1.10	...	0.45–0.65	...
G92600	9260	0.56–0.64	0.75–1.00	0.035	0.040	1.80–2.20	...	...	...
Standard Boron Steels ^G									
G50441	50B44	0.43–0.48	0.75–1.00	0.035	0.040	0.15–0.35	...	0.20–0.60	...
G50461	50B46	0.44–0.49	0.75–1.00	0.035	0.040	0.15–0.35	...	0.20–0.35	...
G50501	50B50	0.48–0.53	0.75–1.00	0.035	0.040	0.15–0.35	...	0.40–0.60	...
G50601	50B60	0.56–0.64	0.75–1.00	0.035	0.040	0.15–0.35	...	0.40–0.60	...
G51601	51B60	0.56–0.64	0.75–1.00	0.035	0.040	0.15–0.35	...	0.70–0.90	...