Designation: A 506 – 00

Standard Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled[1]

This standard is issued under the fixed designation A 506; 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-rolled and cold-rolled alloy and structural alloy-steel sheet and strip. Alloy steel is furnished to chemical composition requirements and is intended primarily for general or miscellaneous use where bending and moderate forming is a requirement. Structural alloy steel is furnished to chemical composition requirements and to specific mechanical property requirements which may include tension tests, hardness tests, or other commonly accepted mechanical tests.

1.2 If material of a higher degree of uniformity of internal soundness and freedom from surface imperfections is required, reference should be made to Specification A 507.

1.3 Alloy and structural alloy-steel sheet and strip are not produced to internal cleanliness requirements. Normally surface imperfections are not objectionable, and a good finish is not a prime requirement.

1.4 The formability of structural alloy steel decreases with increasing yield strength or hardness. Therefore, product design in relation to the mechanical properties of the grade used must be considered.

1.5 The material covered by this specification may be furnished in several conditions: heat treatments, surface conditions, and edges, as specified herein, in coils or cut lengths.

1.6 The values stated in inch-pound units are to be regarded as the standard. SI units are provided for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

A 505 Specification for Steel, Sheet and Strip, Alloy, Hot-Rolled and Cold-Rolled, General Requirements for[2]

A 507 Specification for Drawing Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled[2]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *alloy steel*—alloy-steel sheet and strip furnished to chemical composition requirements and intended for general or miscellaneous applications where normal surface imperfections are not objectionable and a good finish is not the prime requirement.

3.1.2 *SAE*—Society of Automotive Engineers.

3.1.3 *standard steels*—steel chemical compositions defined as "standard" by SAE, shown in Table 1 and Table A1.1.

3.1.4 *steels other than standard*—steel chemical compositions other than those defined as "standard," and furnished to the composition limits shown in Table 2.

3.1.5 *structural alloy steel*—alloy-steel sheet and strip meeting the requirements of regular quality and also produced to specific mechanical property requirements.

4. General Requirements and Ordering Information

4.1 Material supplied to this specification shall conform to Specification A 505, which includes the general requirements and establishes the rules for the ordering information that should be complied with when purchasing material to this specification.

4.2 In addition to the ordering information required by Specification A 505, the following shall also be included:

4.2.1 Mechanical properties required for structural quality, when applicable,

4.2.2 Surface finish, if other than standard (see 8.1), and

4.2.3 Surface treatment, if other than standard (see 8.2).

5. Materials and Manufacture

5.1 *Rolling*—The material shall be furnished either hot-rolled or cold-rolled, as specified on the order.

5.2 *Heat Treatment*:

5.2.1 *Hot-Rolled*—Hot-rolled material shall be furnished in one of the following conditions, as specified on the order:

5.2.1.1 As-rolled,

5.2.1.2 Annealed,

5.2.1.3 Normalized, or

[1] This specification is under the jurisdiction of ASTM Committee A-1 on Steel, Stainless Steel, and Related Alloys, and is the direct responsibility of Subcommittee A01.19 on Steel Sheet and Strip.

Current edition approved May 10, 2000. Published July 2000. Originally published as A 506 – 64. Last previous edition A 506 – 93 (1998).

[2] *Annual Book of ASTM Standards*, Vol 01.03.

TABLE 1 Standard Steels Commonly Produced for Alloy-Steel Sheet and Strip

UNS Designation	SAE No.	Chemical Composition Ranges and Limits, % (Heat Analysis)[A]							
		C	Mn	P	S	Si[B]	Ni	Cr	Mo
G41180	4118	0.18–0.23	0.70–0.90	0.035	0.035	0.15–0.30	...	0.40–0.60	0.08–0.15
G41300	4130	0.28–0.33	0.40–0.60	0.035	0.035	0.15–0.30	...	0.80–1.10	0.15–0.25
G41400	4140	0.38–0.43	0.75–1.00	0.035	0.035	0.15–0.30	...	0.80–1.10	0.15–0.25
G43400	4340	0.38–0.43	0.60–0.80	0.035	0.035	0.15–0.30	1.65–2.00	0.70–0.90	0.20–0.30
G51400	5140	0.38–0.43	0.70–0.90	0.035	0.035	0.15–0.30	...	0.70–0.90	...
G51500	5150	0.48–0.53	0.70–0.90	0.035	0.035	0.15–0.30	...	0.70–0.90	...
G51600	5160	0.55–0.65	0.75–1.00	0.035	0.035	0.15–0.30	...	0.70–0.90	...
G86150	8615	0.13–0.18	0.70–0.90	0.035	0.035	0.15–0.30	0.40–0.70	0.40–0.60	0.15–0.25
G86200	8620	0.18–0.23	0.70–0.90	0.035	0.035	0.15–0.30	0.40–0.70	0.40–0.60	0.15–0.25

[A] The chemical ranges and limits shown are subject to product analysis tolerances. See Specification A 505.
[B] Other silicon ranges are available. Consult the producer.

TABLE 2 Heat (Cast) Analysis Ranges for Other than Standard Steel Alloy Sheet and Strip

Element	When Maximum of Specified Element Is, %	Range or Limit, %
Carbon	To 0.55 incl	0.05
	Over 0.55 to 0.70 incl	0.08
	Over 0.70 to 0.80 incl	0.10
	Over 0.80 to 0.95 incl	0.12
	Over 0.95 to 1.35 incl	0.13
Manganese	To 0.60 incl	0.20
	Over 0.60 to 0.90 incl	0.20
	Over 0.90 to 1.05 incl	0.25
	Over 1.05 to 1.90 incl	0.30
	Over 1.90 to 2.10 incl	0.40
Phosphorus	...	0.035 max
Sulfur	...	0.040 max
Silicon	To 0.15 incl	0.08
	Over 0.15 to 0.20 incl	0.10
	Over 0.20 to 0.40 incl	0.15
	Over 0.40 to 0.60 incl	0.20
	Over 0.60 to 1.00 incl	0.30
	Over 1.00 to 2.20 incl	0.40
Copper	To 0.60 incl	0.20
	Over 0.60 to 1.50 incl	0.30
	Over 1.50 to 2.00 incl	0.35
Nickel	To 0.50 incl	0.20
	Over 0.50 to 1.50 incl	0.30
	Over 1.50 to 2.00 incl	0.35
	Over 2.00 to 3.00 incl	0.40
	Over 3.00 to 5.30 incl	0.50
	Over 5.30 to 10.00 incl	1.00
Chromium	To 0.40 incl	0.15
	Over 0.40 to 0.90 incl	0.20
	Over 0.90 to 1.05 incl	0.25
	Over 1.05 to 1.60 incl	0.30
	Over 1.60 to 1.75 incl	0.35
	Over 1.75 to 2.10 incl	0.40
	Over 2.10 to 3.99 incl	0.50
Molybdenum	To 0.10 incl	0.05
	Over 0.10 to 0.20 incl	0.07
	Over 0.20 to 0.50 incl	0.10
	Over 0.50 to 0.80 incl	0.15
	Over 0.80 to 1.15 incl	0.20
Vanadium	To 0.25 incl	0.05
	Over 0.25 to 0.50 incl	0.10

5.2.1.4 Normalized-and-tempered.

5.2.2 *Cold-Rolled*—Cold-rolled material shall be fully annealed after cold-rolling. (Temper, skin, or roller leveling for the control of flatness, which does not significantly affect the properties, may be performed after annealing.)

6. Chemical Requirements

6.1 The heat analysis shall conform to the requirements for the grade specified on the order.

6.1.1 *Alloy Steel*—The grade shall be specified in accordance with either 6.1.1.1 or 6.1.1.2.

6.1.1.1 Standard steel alloy steel grades listed in Table 1 are those commonly produced for alloy steel sheet and strip. Other standard steel grades are listed in Annex A1.

6.1.1.2 Nonstandard steel grades may be specified using the ranges and limits shown in Table 2.

6.1.2 *Structural Alloy Steel*—The grade shall be specified as outlined in 6.1.1. However, since different mechanical properties may be expected for each of the many chemical compositions and conditions (heat treatment) that may be specified, consideration must be given to these factors in selecting the chemical composition to be specified.

7. Mechanical Requirements

7.1 *Alloy Steel*—Mechanical tests are not applicable to regular quality alloy steel sheet and strip.

7.2 *Structural Alloy Steel*:

7.2.1 *Tension Tests*:

7.2.1.1 *Requirements*—The tension test requirements shall conform to the requirements specified on the order. Yield strength, tensile strength, and elongation requirements may be specified. The tensile properties will vary depending on the chemical composition, condition, and heat treatment. Producers are frequently consulted as to grade, resultant mechanical properties, recommended heat treatment, and other information needed to establish the property parameters to meet end use requirements. Rockwell hardness requirements may be specified, providing the requirements are compatible with the tension test requirements.

7.2.1.2 *Number of Tests*—Two tension tests and two hardness tests, when specified, shall be made from coupons obtained from each heat (cast) and heat treatment lot.

7.2.2 *Bend Tests*: