~~Designation:A505–00 (Reapproved 2005)~~ Designation: A505 – 12

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

This standard is issued under the fixed designation A505; 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 a group of common requirements that, unless otherwise specified in the material specification, apply to hot-rolled and cold-rolled alloy steel sheet and strip under each of the following specifications: A506, A507, and A873/A873M.

1.2 In case of any conflict in requirements, the requirements of the individual material specification shall prevail over those of this general specification.

1.3 The purchaser may specify additional requirements which do not negate any of the provisions of this general specification or of the individual material specification. Such additional requirements, the acceptance of which are subject to negotiation with the supplier, must be included in the order information (see 4.1.9).

1.4 For purposes of determining conformance with this specification and the various material specifications referenced in 1.1, values shall be rounded to the nearest unit in the right-hand place of figures used in expressing the limiting values in accordance with the rounding provisions of Test Methods and Definitions A370 and Test Methods, Practices, and Terminology A751.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

A370 Test Methods and Definitions for Mechanical Testing of Steel Products

A506 Specification for Alloy and Structural Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled

A507 Specification for Drawing Alloy Steel, Sheet and Strip, Hot-Rolled and Cold-Rolled

A700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment

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

A873/A873M Specification for Steel Sheet and Strip, Chromium-Molybdenum Alloy, for Pressure Vessels[3]

A919 Terminology Relating to Heat Treatment of Metals[3]

2.2 *Federal Standard:*[4]

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)

2.3 *Military Standard:*[4]

~~MIL-STD-163Steel Mill Products, Preparation for Shipment and Storage~~ MIL-STD-129 Marking for Shipment and Storage

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *sheet and strip*—hot-rolled and cold-rolled alloy steel sheet and strip is classified as shown in Table 1.

3.1.2 *exclusive*—when used in relation to ranges, as for ranges of thicknesses in the tables of permissible variations in dimensions, the term "exclusive" is intended to exclude only the greater value of the range. Thus a range from 60 to 72 in. (1524

[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 A01.19 on Steel Sheet and Strip.

~~Current edition approved March 1, 2005. Published March 2005. Originally approved in 1964. Last previous edition approved in 2000 as A505–00. DOI: 10.1520/A0505-00R05.~~

Current edition approved May 1, 2012. Published May 2012. Originally approved in 1964. Last previous edition approved in 2005 as A505 – 00 (2005). DOI: 10.1520/A0505-12.

[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] Withdrawn. The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

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

to 1829 mm) *exclusive* includes 60 in. but does not include 72 in.

3.1.3 *manufacturer (material manufacturer)*—an organization that performs or directly controls one or more operations, such as melting, rolling, coiling, and heat treatment, that affects the chemical composition or mechanical properties of the material.

4. Ordering Information

4.1 Orders shall include the following information, as necessary, to describe adequately the desired material:
4.1.1 Specification designation, including year of issue,
4.1.2 Chemical composition (grade),
4.1.3 Classification of the material (that is, hot-rolled sheet),
4.1.4 Dimensions (thickness, width, length) in decimal inches,
4.1.5 Quantity (weight or number of pieces),
4.1.6 Condition (that is, "hot-rolled," "cold-rolled"),
4.1.7 Heat treatment required, if any,
4.1.8 Type of edge,
4.1.9 Additional information as specified in the individual material specification,
4.1.10 Any special requirements not specified in the individual material specification, and
4.1.11 Whether certification of compliance or test reports are required.

5. Materials and Manufacture

5.1 *Melting Process*—Unless otherwise specified in the individual material specification, the steel may be made by any process that produces material that conforms to the specified requirements.

5.2 *Hot or Cold Rolling*—The sheet and strip shall be produced by hot rolling or cold rolling, as specified in the individual material specification and as specified on the order.

5.3 *Heat Treatment*—When heat treatment is required, it shall be performed in accordance with the requirements specified in the individual material specification. Heat treatment may be performed by either the manufacturer or the purchaser; however, if the purchaser intends to perform the heat treatment, it shall be so stated on the order.

5.3.1 Heat treatment terms shall be in accordance with Terminology A919.

~~6.Chemical Requirements~~

6. *Chemical Requirements* Chemical Requirements

6.1 *Cast or Heat Analysis* of each cast or heat shall be made by the manufacturer to determine the percentage of elements specified in the individual material specification. This analysis shall be made from a test specimen preferably taken during the teeming of the cast or heat. The chemical composition thus determined shall be reported to the purchaser or his representative upon request, and shall conform to the cast or heat analysis requirements of the applicable material specification.

6.2 *Product or Verification Analysis*— An analysis may be made by the purchaser from finished material representing each cast or heat. The composition thus determined shall conform to the requirements for product analysis specified in the individual material specification or on the order; however, if only cast or heat analysis requirements are specified in the material specification or on the order, the composition determined on product analysis shall conform to those requirements subject to the product analysis tolerances specified in Table 2.

6.3 *Referee Analysis*—In case referee analysis is required to resolve a dispute concerning the results of a chemical analysis, the procedures for performing the referee analysis shall be in accordance with Test Methods, Practices, and Terminology A751.

7. Metallurgical Structure

7.1 The requirements for metallurgical structure, if any, shall be as specified in the individual material specification.

8. Mechanical Property Requirements

8.1 *Requirements*—The requirements for mechanical properties, if any, shall be as specified in the individual material specification.

8.2 *Number of Tests*—The number of specimens shall be as specified in the individual material specification.

8.3 *Location and Orientation of Tension Test Specimens*—Unless otherwise specified in the individual material specification, tension test specimens shall be the full thickness of the material. The test coupons shall be taken from the material in its finished condition except as otherwise provided in 8.4; shall be taken approximately midway between the edge and centerline of the sheet or strip; and shall be taken such that the long axis of the test specimen will be transverse to the final direction of rolling.

8.4 *Heat Treatment of Test Coupons*:

8.4.1 When heat treatment is required by the material specification and is to be performed by the purchaser or his agent, and the material is to be supplied by the manufacturer in a condition other than that required by the material specification, the material shall be qualified on the basis of tests made on specimens taken from coupons, obtained from the material in its as-shipped condition, that have been heat treated in accordance with the requirements specified in the material specification or on the order. If the heat-treatment temperatures are not specified, the manufacturer shall heat treat the coupons under conditions he considers appropriate.

8.4.2 When specified on the order, the test coupons may be subjected to additional heat treatment to simulate thermal treatments that will be used during fabrication.

8.4.3 The purchaser shall be informed of the procedures followed in heat treating the test coupons.

8.5 *Test Methods*:

8.5.1 All tests shall be conducted in accordance with Test Methods and Definitions A370.

8.5.2 Yield strength shall be determined either by the 0.2 % offset method or by the 0.5 % extension-under-load method.

9. Quality

9.1 *General*—Sheet and strip furnished under this specification shall be clean, sound, and free of internal or external imperfections which would make the material unsuitable for the intended application. Care should be taken to avoid cracks, seams, slivers, grooves, laminations, pits, blisters, buckles, coil breaks, creases, holes, pickling stains and patches, ragged and torn edges, and "rolled-in" dirt and scale.

9.2 *Surface Finish*—The degree or amount of surface imperfections on material in cut lengths shall be such that only a reasonable amount of metal finishing is required. Slight surface imperfections that are completely removable without reducing the thickness below the minimum permissible limits shall not be considered to be defects. Coils may contain some abnormal defects such as holes, welds, etc., which render a portion of the coil unusable, since the inspection of coils does not afford the same opportunity to reject portions containing defects as is the case with cut lengths. However, an excessive number of abnormal imperfections is cause for rejection.

10. Edges

10.1 *Edges*—The types of edges procurable in hot-rolled and in cold-rolled alloy-steel sheet and strip are as follows:

10.2 *Hot-Rolled Sheet and Strip*:

10.2.1 *Mill Edge*—Normal edge produced in hot rolling that does not conform to any definite contour.

10.2.2 *Cut Edge*—Approximately square edge resulting from the cutting of sheet into one or more desired widths by means of rotary knives (slit edge) or blade shears (sheared edge).

10.2.3 *Square Edge*—Type of mill edge produced by hot edge-rolling; furnished on strip only.

10.3 *Cold-Rolled Sheet*:

10.3.1 *Cut Edge*—Same description as shown in 10.2.2 for hot-rolled sheet and strip.

10.4 *Cold-Rolled Strip*:

10.4.1 *No. 1 Edge*—Prepared edge of a specified round or square contour that is produced when a very accurate width is required.

10.4.2 *No. 2 Edge*—Natural mill edge carried through the cold rolling from the hot-rolled strip without additional processing of the edge.

10.4.3 *No. 3 Edge*—Approximately square edge produced by slitting.

10.4.4 *No. 4 Edge*—Rounded edge produced by edge rolling either the natural edge of hot-rolled strip or slit-edge strip. Used when an approximately round edge is desired and when the finish of the edge is not important.

10.4.5 *No. 5 Edge*—Square edge produced by edge rolling or filing for the purpose of eliminating burr.

10.4.6 *No. 6 Edge*—Square edge produced by edge rolling the natural edge of hot-rolled strip or slit-edge strip, when the width tolerances and finish required are not as exacting as for the No. 1 Edge.

11. Permissible Variations in Dimensions

11.1 The permissible variations in dimensions (see Table 3) for hot-rolled and cold-rolled alloy steel sheet and strip shall be in accordance with Tables 4-22.

12. Identification of Product

12.1 As a minimum, the material shall be identified with the manufacturer's name or brand, the specification designation, weight, purchaser's order number, and material identification which is traceable to the heat or cast.

12.2 The identification shall be legibly stenciled on top of each lift or shown on a tag attached to each coil or shipping unit.

12.3 When specified on the order, each sheet shall be identified as agreed upon.

13. Retests

13.1 The retest provisions of Test Methods and Definitions A370 shall apply.

13.2 If the results of any tests do not conform to the specified requirements, (unless otherwise specified in the individual material specification), retests may be made on double the original number of specimens from the same lot, each of which must conform to the requirements specified. If the results of the retests do not conform to the specified requirements, the lot shall be rejected.

14. Inspection and Testing

14.1 When the order specifies that the purchaser will inspect the material and witness testing, the inspector representing the purchaser shall have entry at all times while work on the contract of the purchaser is being performed, to all parts of the

manufacturer's works that concern the manufacture of the material ordered. The manufacturer shall afford the inspector all reasonable facilities to satisfy the inspector that the material is being furnished in accordance with the specification.

14.2 All tests (except product analysis) and inspection shall be made at the place of manufacture before shipment, unless otherwise specified on the order, and shall be so conducted as not to interfere unnecessarily with the operation of the works.

15. Rework and Retreatment

15.1 If inspection and test results fail to conform to the specified requirements, the material may be reworked or retreated, if the manufacturer can assure that the cause of failure is curable and that the quality of the material shall conform to the specified requirements. After retreatment, testing shall be done in accordance with the material specification requirements.

16. Rejection Subsequent to Shipment

16.1 Material that shows characteristics not in conformance with the material specification subsequent to its initial acceptance may be rejected. In such cases, the manufacturer should be notified in a timely manner.

17. Certification

17.1 When specified on the order, a certification of compliance shall be furnished that the material was manufactured, sampled, tested, and inspected in accordance with the requirements of the applicable specification.

17.2 When specified on the order, a report of the test results shall be furnished.

17.3 A signature is not required on the certification of compliance or the report of test results. However, the document shall clearly identify the organization submitting the document. Notwithstanding the absence of a signature, the organization submitting the document is responsible for the content of the document.

18. Packaging, Marking, and Loading for Shipment

18.1 Packaging, marking, and loading for shipment shall be in accordance with those procedures recommended in Practices A700.

18.2 *For Government Procurement*—~~Packaging, packing, and marking of material for military procurement shall be in accordance with the requirements of MIL-STD-163, Level A, Level C, or commercial, as specified in the contract or purchase order. Marking for shipment of material for civil agencies shall be in accordance with Fed. Std. No. 123.~~—When specified in the contract or order, and for direct procurement by or direct shipment to the government, marking for shipment in addition to requirements specified in the contract or order, shall be in accordance with MIL-STD-129 for military agencies and in accordance with Fed. Std. No. 123 for civil agencies.

SUMMARY OF CHANGES

Subcommittee A01 has identified the location of selected changes to this standard since the last issue, A505 - 12, that may impact the use of this standard. (Approved May 1, 2012.)

(*1*) Deleted references to MIL-STD-163 and MIL-STD-129 in Section 2.

(*2*) Added reference to MIL-STD-129 to Section 2.

(*3*) Added Scope (Section 1.5) and added metric conversions where applicable.

TABLE 1 Classification of Hot-Rolled and Cold-Rolled Sheet and Strip

Hot-Rolled Sheet and Strip

Thickness, in. (mm)[A]	Width, in. (mm)[A]			
	Up to 6 (150), incl	Over 6 to 23 15/16, (150 to 608), incl	24 to 48, (610 to 1220), incl	Over 48 (1220)
~~0.2299 to 0.2031, incl~~	~~...~~	~~strip~~	~~sheet~~	~~...~~
0.2299 to 0.2031 (5.84 to 5.16), incl	...	strip	sheet	...
~~0.2030 to 0.1800, incl~~	~~strip~~	~~strip~~	~~sheet~~	~~...~~
0.2030 to 0.1800 (5.15 to 4.57), incl	strip	strip	sheet	...
~~0.1799 and thinner~~	~~strip~~	~~strip~~	~~sheet~~	~~sheet~~
0.1799 (4.56) and thinner	strip	strip	sheet	sheet

Cold-Rolled Sheet and Strip

Thickness, in. (mm)[A]	Width, in.[A]		
	Up to 23 15/16 (608), incl	24 to 48, (610 to 1220), incl	Over 48 (1220)
~~0.2499 to 0.2300, incl~~	~~strip~~	~~...~~	~~...~~
0.2499 to 0.2300 (5.84 to 5.15), incl	strip	...	...
~~0.2299 to 0.1800, incl~~	~~strip~~	~~sheet~~	~~...~~
0.2299 to 0.1800 (5.84 to 4.57), incl	strip	sheet	...
~~0.1799and thinner~~	~~strip~~	~~sheet~~	~~sheet~~
0.1799 (4.56)and thinner	strip	sheet	sheet

[A] 1 in. = 25.4 mm.

TABLE 2 Product Analysis Tolerances Over or Under Specified Range or Limit

Element	Limit or Maximum of Specified Element, %	Tolerance Over Maximum Limit or Under Minimum Limit
Carbon	to 0.30, incl	0.01
	over 0.30–0.75, incl	0.02
	over 0.75	0.03
Manganese	to 0.90, incl	0.03
	over 0.90–2.10, incl	0.04
Phosphorus	over max only	0.005
Sulfur	over max only	0.005
Silicon	to 0.35, incl	0.02
	over 0.35–2.20, incl	0.05
Copper	to 1.00, incl	0.03
	over 1.00–2.00, incl	0.05
Nickel	to 1.00, incl	0.03
	over 1.00–2.00, incl	0.05
	over 2.00–5.30, incl	0.07
	over 5.30–10.00, incl	0.10
Chromium	to 0.90, incl	0.03
	over 0.90–2.10, incl	0.05
	over 2.10–3.99, incl	0.10
Molybdenum	to 0.20, incl	0.01
	over 0.20–0.40, incl	0.02
	over 0.40–1.15, incl	0.03
Vanadium	to 0.10, incl	0.01
	over 0.10–0.25, incl	0.02
	over 0.25–0.50, incl	0.03
	minimum value specified, check under minimum limit	0.01
Tungsten	to 1.00, incl	0.04
	over 1.00–4.00, incl	0.08
Aluminum	to 0.10, incl	0.03
	over 0.10–0.20, incl	0.04
	over 0.20–0.30, incl	0.05
	over 0.30–0.80, incl	0.07
	over 0.80–1.80, incl	0.10

TABLE 3 Dimensional Tolerance Tables

NOTE 1— The following table shows the dimensional tolerance table number applicable to the different product classification and rolling methods. Continuous mill tolerances apply unless otherwise specified.

	Hot-Rolled					Cold-Rolled							
	Sheet		Strip		Sheet			Strip					
	Hand Mill		Continuous Mill					Continuous Mill					
	Mill Edge	Cut Edge	Mill Edge	Cut Edge		Mill Edge	Cut Edge	Edges					
								1	2	3	4	5	6
								Mill	Slit				
Thickness	5	5	4	4	13	6	6	18	18	18	18	18	18
Width	7	8	7	8	15	7	8	21	19	20	21	21	21
Length	9	9	9	9	16	9	9	22	22	22	22	22	22
Flatness for cut lengths	10	10	10	10	17	10	10	. . .	. . .	. . .	. . .	. . .	. . .
Camber	11	11	11	11	11	11	11	11	11	11	11	11	11
Out-of-square	. . .	12	. . .	12	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
Crown	. . .	. . .	. . .	. . .	14	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .