



Designation: A635/A635M – 22

Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for¹

This standard is issued under the fixed designation A635/A635M; 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 the general requirements for hot-rolled, heavy-thickness sheet and strip in coils.

1.2 It applies to Specifications [A414/A414M](#), [A424/A424M](#), [A1018/A1018M](#), and [A1031/A1031M](#).

1.3 This material is available only in coils described as follows:

Size Limits, Coils Only

| Product | Width, in. [mm] | Thickness, in. [mm] |
|---------|--|---|
| Strip | over 8 to 12, incl [over 200 through 300] | 0.230 to 1.000, incl [from 6.0 through 25] |
| Sheet | All Widths ⁴ All Widths | 0.230 to 1.000, incl [from 6.0 through 25] |

⁴ Hot-rolled heavy thickness sheet in coils less than 12 in. [300 mm] and less in width must have slit edges. Hot-rolled heavy thickness coils 12 in. [300 mm] and wider with mill edge is considered hot-rolled heavy thickness strip.

NOTE 1—The changes in width limits with the publication of A635/A635M – 06a result in a change in tensile testing direction for material from 0.180 in. [4.5 mm] to 0.230 in. exclusive [6.0 mm exclusive] over 48 in. [1200 mm] wide, as that material is now covered by Specification [A568/A568M](#) – 06a. The purchaser is advised to discuss this change with the supplier.

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

1.5 For the purposes of determining conformance with this and the appropriate product specifications referenced in [1.2](#), measured values, calculated values, and observed values shall

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 Sept. 1, 2022. Published October 2022. Originally approved in 1970. Last previous edition approved in 2015 as A635/A635M – 15. DOI: 10.1520/A0635_A0635M-22.

be rounded to the nearest unit in the right hand place of figures used in expressing the limiting values in accordance with the rounding method of Practice [E29](#).

1.5.1 Ordered values, identified in tables, specified such as over 30 through 48, or 30 exclusive to 48 inclusive, covers all ordered values specified as 30.1, 30.01, 30.001, etc., up to and including 48.000 etc., but does not cover ordered values specified as 30.000 etc. or less, nor does it cover ordered values specified as 48.1, 48.01, 48.001, etc., in accordance with the absolute method of Practice [E29](#).

1.6 [Annex A1](#) lists permissible variations in dimensions and mass (see [Note 2](#)) in SI [metric] units. The values listed are not exact conversions of the values listed in the inch-pound tables, but instead are rounded or rationalized values. Conformance to [Annex A1](#) is mandatory when the “M” specification is used.

NOTE 2—The term *weight* is used when inch-pound units are the standard. However, under SI, the preferred term is *mass*.

1.7 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

1.8 This specification and the applicable material specifications are expressed in both inch-pound units and SI units. However, unless the order specifies the applicable “M” specification designation (SI units), the material shall be furnished to inch-pound units.

1.9 *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.*

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

2. Referenced Documents

2.1 ASTM Standards:²

- [A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)
 - [A414/A414M Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy for Pressure Vessels](#)
 - [A424/A424M Specification for Steel, Sheet, for Porcelain Enameling](#)
 - [A568/A568M Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for](#)
 - [A700 Guide for Packaging, Marking, and Loading Methods for Steel Products for Shipment](#)
 - [A751 Test Methods and Practices for Chemical Analysis of Steel Products](#)
 - [A941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys](#)
 - [A1018/A1018M Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Carbon, Commercial, Drawing, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength](#)
 - [A1031/A1031M Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Alloy, Drawing Steel and Structural Steel, Hot-Rolled](#)
 - [A1073/A1073M Practice for Using Hand Micrometers to Measure the Thickness of Uncoated Steel Sheet and Nonmetallic and Metallic-Coated Steel Sheet](#)
 - [E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves](#)
 - [E29 Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications](#)
- ### 2.2 Federal Standards:³
- [Fed. Std. No. 123 Marking for Shipment \(Civil Agencies\)](#)
- ### 2.3 Military Standards:³
- [MIL-STD-129 Marking for Shipment and Storage](#)

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 Steel Types:

3.1.2 *carbon steel, n*—the designation for steel when no minimum content is specified or required for aluminum, chromium, cobalt, columbium, molybdenum, nickel, titanium, tungsten, vanadium, zirconium, or any element added to obtain a desired alloying effect; when the specified minimum for copper does not exceed 0.40 %; or when the maximum content specified for any of the following elements does not exceed the percentages noted: manganese 1.65, silicon 0.60, or copper 0.60.

3.1.2.1 *Discussion*—In all carbon steels small quantities of certain residual elements unavoidably retained from raw ma-

terials are sometimes found which are not specified or required, such as copper, nickel, molybdenum, chromium, and so forth. These elements are considered as incidental and are not normally determined or reported.

3.1.3 *high-strength, low-alloy steel, n*—a specific group of steels in which higher strength, and in some cases additional resistance to atmospheric corrosion or improved formability, are obtained by moderate amounts of one or more alloying elements.

3.2 Product Types:

3.3 *hot-rolled sheet and strip, n*—manufactured by hot rolling slabs in a continuous mill to the required thickness; however, the product classification of sheet and strip is based on a combination of thickness and width (see Specifications [A414/A414M](#), [A424/A424M](#), [A1018/A1018M](#), and [A1031/A1031M](#)).

3.4 *steel manufacturer, n*—the organization that directly controls, or is responsible for, the melting and refining of steel and the conversion of that steel into semifinished steel products known as slabs either through continuous casting, conventional or compact, or ingot casting and subsequent conversion of the ingots to slabs, and for one or more additional operations such as testing, marking, loading for shipment, and certification.

3.5 *hot roll manufacturer, n*—the organization that directly controls, or is responsible for, the conversion of steel slabs, by hot rolling into coils, and for one or more additional operations such as leveling, cutting to length, testing, inspection, blanking, slitting, pickling, cold rolling, heat treating, coating, packaging, marking, loading for shipment, and certification.

3.6 *coil processor, n*—the organization that directly controls, or is responsible for, operations involved in processing the coil such as leveling, cutting to length, testing, inspection, blanking, slitting, pickling, cold rolling, heat treating, coating, packaging, marking, loading for shipment, and certification.

3.6.1 *Discussion*—The processing operations need not be controlled by the organization that hot rolls the slab into a coil. If only one organization controls or is responsible (or both) for the hot rolling and processing operations, that organization is termed the hot roll manufacturer. If more than one organization controls or is responsible (or both) for hot rolling and processing operations, the organization that controls and is responsible for the hot rolling is termed the manufacturer and the organization or organizations controlling and responsible for the processing operations is/are termed the coil processor or coil processors.

3.7 Refer to Terminology [A941](#) for additional definitions of terms used in this standard.

4. Index of Tables, Dimensions, and Allowances

4.1 See the following table:

| Index of Tables for Dimensions, Tolerances, and Allowances | | |
|--|------------------|----------|
| Dimensions | Table No. | |
| | Inch-Pound Units | SI Units |
| Camber Sheet | 5 | A1.4 |

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 Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, <http://www.dodssp.daps.mil>.

| Index of Tables for Dimensions, Tolerances, and Allowances | | |
|--|-----------|------------|
| Dimensions | Table No. | |
| Strip | 9 | A1.8 |
| Crown | 7 | A1.6 |
| Strip | | |
| Thickness | | |
| Sheet | 2, S1.1 | A1.1, S1.3 |
| Strip | 6, S1.2 | A1.5, S1.4 |
| Width | | |
| Sheet | 3, 4 | A1.2, A1.3 |
| Strip | 8 | A1.7 |

5. Materials and Manufacture

5.1 *Melting Practice*—Hot-rolled heavy thickness sheet and strip coils are normally produced from rimmed, capped, killed, or semi-killed steel. If either coarse or fine-grain practice is specified, special soundness steel will be furnished.

5.2 Steel may be produced as ingot-cast or strand-cast. When different grades of strand-cast steel are sequentially cast, identification and separation of the transition material is required.

5.3 The steel shall be in the hot-rolled condition.

6. Chemical Composition

6.1 *Cast or Heat (Formerly Ladle) Analysis*—An analysis of each heat or cast shall be made by the steel manufacturer to determine the conformance with the appropriate requirement. The analysis shall be from a test sample preferably taken during the pouring of the heat or cast.

6.1.1 Where the material is used for fabrication by welding, care must be exercised in selection of chemical composition or mechanical properties to assure compatibility with the welding process and its effect on altering the properties.

6.2 Product, Check, or Verification Analysis:

6.2.1 Non-killed steels such as capped or rimmed steels are not technologically suited to product analysis due to the nonuniform character of their chemical composition, and therefore, the tolerances in [Table 1](#) do not apply. Product analysis is appropriate on these types of steel only when misapplication is apparent, or for copper when copper steel is specified.

6.2.2 For steels other than non-killed (capped or rimmed), product analysis may be made by the purchaser. The chemical analysis shall not vary from the limits specified by more than

TABLE 1 Tolerances for Product Analysis

| Element | Limit, or Maximum of Specified Element, % | Tolerance | |
|------------|---|---------------------|--------------------|
| | | Under Minimum Limit | Over Maximum Limit |
| Carbon | to 0.15, incl | 0.02 | 0.03 |
| | over 0.15 to 0.25, incl | 0.03 | 0.04 |
| Manganese | to 0.60, incl | 0.03 | 0.03 |
| | over 0.60 to 1.15, incl | 0.04 | 0.04 |
| | over 1.15 to 1.65, incl | 0.05 | 0.05 |
| Phosphorus | | ... | 0.01 |
| Sulfur | | ... | 0.01 |
| Silicon | to 0.30, incl | 0.02 | 0.03 |
| | over 0.30 to 0.60, incl | 0.05 | 0.05 |
| Copper | | 0.02 | ... |

the amounts in [Table 1](#). The several determinations of any element in a cast shall not vary both above and below the specified range.

6.2.3 Sampling for Product Analysis:

6.2.3.1 To indicate adequately the representative composition of a cast by product analysis, it is general practice to select samples to represent the steel, as fairly as possible, from a minimum number of pieces as follows: three pieces for lots up to 15 tons included, and six pieces for lots over 15 tons.

6.2.3.2 When the steel is subject to tension test requirements, samples for product analysis may be taken either by drilling entirely through the used tension test specimens themselves, or as covered in [6.2.3.3](#).

6.2.3.3 When the steel is not subject to tension test requirements, the samples for analysis must be taken by milling or drilling entirely through the sheet in a sufficient number of places so that the samples are representative of the entire sheet or strip. The sampling may be facilitated by folding the sheet both ways, so that several samples may be taken at one drilling. Steel subjected to certain heating operations by the purchaser may not give chemical analysis results that properly represent its original composition. Therefore, users must analyze chips taken from the steel in the condition in which it is received from the steel manufacturer.

6.3 *Specimen Preparation*—Drillings or chips must be taken without the application of water, oil, or other lubricant, and must be free of scale, grease, dirt, or other foreign substances. They must not be overheated during cutting to the extent of causing decarburization. Chips must be well mixed and those too coarse to pass a No. 10 sieve or too fine to remain on a No. 30 sieve are not suitable for proper analysis. Sieve size numbers are in accordance with Specification [E11](#).

6.4 *Test Methods*—In case a referee analysis is required and agreed upon to resolve a dispute concerning the results of a chemical analysis, the procedure for performing the referee analysis must be in accordance with the latest issue of Test Methods, Practices, and Terminology [A751](#), unless otherwise agreed upon between the manufacturer and the purchaser.

7. Mechanical Properties

7.1 The mechanical property requirements, number of specimens, and test locations and specimen orientation shall be in accordance with the applicable product specification.

7.2 Unless otherwise specified in the applicable product specification, test specimens must be prepared in accordance with Test Methods and Definitions [A370](#).

7.3 Mechanical tests shall be conducted in accordance with Test Methods and Definitions [A370](#).

7.4 To determine conformance with the product specification, a calculated value shall be rounded to the nearest 1 ksi tensile strength and yield point or yield strength, and to the nearest unit in the right hand place of figures used in expressing the limiting value for other values in accordance with the rounding off method given in Practice [E29](#).