



Designation: A 635/A 635M – 02

# Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Commercial Steel, Drawing Steel, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, Hot-Rolled, General Requirements for<sup>1</sup>

This standard is issued under the fixed designation A 635/A 635M; 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, heavy-thickness, carbon commercial steel, drawing steel, structural steel, high-strength low-alloy, and high-strength low-alloy with improved formability sheet and strip. Structural steel may be ordered when the coils are intended for conversion to plate steels. It is included for that purpose only.

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 Annex A1 lists permissible variations in dimensions and mass (see Note 1) 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 1—The term *weight* is used when inch-pound units are the standard. However, under SI, the preferred term is *mass*.

1.4 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with this specification.

1.5 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.

## 2. Referenced Documents

### 2.1 ASTM Standards:

A 6/A 6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling<sup>2</sup>

A 568/A 568M Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for<sup>3</sup>

A 700 Practices for Packaging, Marking, and Loading Methods for Steel Products for Domestic Shipment<sup>4</sup>

A 751 Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products<sup>3</sup>

### 2.2 Federal Standards:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>5</sup>

Fed. Std. No. 183 Continuous Identification Marking of Iron and Steel Products<sup>5</sup>

### 2.3 Military Standards:

MIL-STD-129 Marking for Shipment and Storage<sup>5</sup>

MIL-STD-163 Steel Mill Products, Preparation for Shipment and Storage<sup>5</sup>

## 3. Terminology

### 3.1 Definitions of Terms Specific to This Standard:

3.1.1 *heavy thickness sheet and strip coils*—This material is commonly available as hot-rolled sheet and strip in coil form only furnished in the following size classifications:

Product	Size Limits, Coils Only	
	Width, in.	Thickness, in.

<sup>1</sup> 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 10, 2002. Published April 2002. Originally published as A 635 – 70. Last previous edition A 635 – 01.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 01.04.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 01.03.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 01.05.

<sup>5</sup> 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.

Strip	over 8 to 12, incl	0.230 to 1.000, incl
Sheet	over 12 to 48, incl over 48	0.230 to 1.000, incl 0.180 to 1.000, incl

Size Limits, Coils Only

Product	Width, mm		Thickness, mm	
	Over	Through	From	Through
Strip	200	300	6.0	25
Sheet	300	1200	6.0	25
	1200	...	4.5	25

3.1.1.1 *Discussion*—Steel products are available in various thickness, width, and length combinations depending upon equipment and processing capabilities of various manufacturers and processors. Historic limitations of a product based upon dimensions (thickness, width, and length) do not take into account current production and processing capabilities. To qualify any product to a particular product specification requires all appropriate and necessary tests be performed and that the results meet the limits prescribed in that product specification. If the necessary tests required by a product specification cannot be conducted, the product cannot be qualified to that specification. This general requirements specification contains permitted variances for the commonly available sizes. Permitted variances for other sizes are subject to agreement between the customer and the manufacturer or processor, whichever is applicable.

#### 4. Ordering Information

4.1 Orders for material under this specification shall include the following information, as required, to adequately describe the desired material:

4.1.1 ASTM designation number and year of issue, grade and quality.

4.1.2 Name of material (hot-rolled sheet coils or hot-rolled strip coils).

##### Index of Tables for Dimensions, Tolerances, and Allowances

Dimensions	Table No.	
	Inch-Pound Units	SI Units
Camber		
Sheet	8	A1.5
Strip	14	A1.10
Crown		
Strip	12	A1.8
Thickness		
Sheet	4, 5	A1.1, A 1.2
Strip	9, 10	A1.6, A 1.7
Width		
Sheet	6, 7	A1.3, A 1.4
Strip	13	A1.9

4.1.3 Copper-bearing steel (when required).

4.1.4 Condition (material to this specification is furnished in the hot-rolled condition) (pickled, or blast-cleaned, must be specified if required. Material so ordered will be oiled unless ordered not oiled.) (See 9.3 and 9.4.)

4.1.5 Edges (must be specified for hot-rolled sheet coils and strip coils) (see 9.5.)

4.1.6 Dimensions (decimal thickness and width of material).

4.1.6.1 As agreed upon between the purchaser and the producer, material ordered to this specification will be supplied to meet the appropriate standard or restricted thickness tolerance table shown in this specification.

NOTE 2—Not all producers are capable of meeting all of the limitations of the thickness tolerance tables in this specification. The purchaser should contact the producer regarding possible limitations prior to placing an order.

4.1.7 If intended for conversion to plate, the purchaser should indicate on the order the intended ASTM plate designation number as well as the grade and type of the pertinent plate specification.

4.1.8 Coil size and weight requirements (must include inside and outside diameters and maximum weight).

4.1.9 Quantity (weight or mass).

4.1.10 Application (show part identification and description) or pertinent plate specifications.

4.1.11 Special requirements (if required).

4.1.12 Cast or heat analysis (if required).

4.1.13 Test reports (if required).

NOTE 3—A typical ordering description is as follows: ASTM A 635 – XX; Grade 1023, hot-rolled sheet coils pickled and oiled, mill edge, 0.250 by 36 in. by coil; ID 24 in. OD 48 in., maximum coil weight 15 000 lb maximum, 100 000 lb for roll-forming shapes.

#### 5. Materials and Manufacture

5.1 *Melting Practice*—Hot-rolled heavy thickness sheet and strip coils are normally produced from rimmed, capped, 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 manufacturer to determine the percentages of the elements specified in Table 1. The analysis shall be from a test sample preferably taken during the pouring of the heat or cast and shall conform to the requirements in Table 1, or chemical compositions can be specified from carbon 0.08 maximum to 0.25 maximum, inclusive, percent, and manganese 1.65 maximum, inclusive, percent, that conform to the ranges and limits in Appendix X1 of Specification A 568/A 568M.

6.1.1 Unspecified elements may be present. Limits on elements shall be as stated in Table 2.

6.1.1.1 Each of the elements listed in Table 2 shall be included in the report of the heat analysis. When the amount of copper, nickel, chromium, or molybdenum is less than 0.02 %, the analysis may be reported as “< 0.02 %.” When the amount of vanadium or columbium is less than 0.008 %, the analysis may be reported as “< 0.008 %.”

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 3 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.

**TABLE 1 Chemical Requirements (Heat Analysis)**

Commercial Steel					
Grade Designation	Composition Limits				
	C	Mn	P, max	S, max	Cu, min <sup>A</sup>
1006	0.08 max	0.45 max	0.030	0.035	0.20
1008	0.10 max	0.50 max	0.030	0.035	0.20
1009	0.15 max	0.60 max	0.030	0.035	0.20
1010	0.08–0.13	0.30–0.60	0.030	0.035	0.20
1012	0.10–0.15	0.30–0.60	0.030	0.035	0.20
1015	0.12–0.18	0.30–0.60	0.030	0.035	0.20
1016	0.12–0.18	0.60–0.90	0.030	0.035	0.20
1017	0.14–0.20	0.30–0.60	0.030	0.035	0.20
1018	0.14–0.20	0.60–0.90	0.030	0.035	0.20
1019	0.14–0.20	0.70–1.00	0.030	0.035	0.20
1020	0.17–0.23	0.30–0.60	0.030	0.035	0.20
1021	0.17–0.23	0.60–0.90	0.030	0.035	0.20
1022	0.17–0.23	0.70–1.00	0.030	0.035	0.20
1023	0.19–0.25	0.30–0.60	0.030	0.035	0.20
1524	0.18–0.25	1.30–1.65	0.030	0.035	0.20

Drawing Steel

Element	Composition, max, % <sup>A</sup>
Carbon	0.10
Manganese	0.50
Phosphorus	0.020
Sulfur	0.030

Structural Quality

The compositional limits for structural quality steel are described in the pertinent ASTM plate specification.

<sup>A</sup> When specified.

**TABLE 2 Limits on Unspecified Elements (see 6.1.1)**

Copper, max % <sup>A</sup>	Heat analysis	0.20
	Product analysis	0.23
Nickel, max % <sup>A</sup>	Heat analysis	0.20
	Product analysis	0.23
Chromium, max % <sup>A</sup>	Heat analysis	0.15
	Product analysis	0.19
Molybdenum, max % <sup>A</sup>	Heat analysis	0.06
	Product analysis	0.07
Vanadium, max %	Heat analysis	0.008
	Product analysis	0.018
Columbium, max %	Heat analysis	0.008
	Product analysis	0.018

<sup>A</sup> The sum of copper, nickel, chromium, and molybdenum shall not exceed 0.50 % on heat analysis. When one or more of these elements are specified, the sum does not apply; in which case, only the individual limits on the remaining unspecified elements will apply.

**TABLE 3 Tolerances for Product Analysis**

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

Methods, Practices, and Terminology A 751, unless otherwise agreed upon between the manufacturer and the purchaser.

### 7. Mechanical Properties

7.1 Mechanical requirements are applicable only if coils are ordered as structural quality for conversion to plates under the provisions of Specification A 6/A 6M, in 4.1.6.

7.2 Not all specifications, grades, or dimensions are applicable nor available from all manufacturers. The producer should be consulted.

7.3 In addition to the information required in 4.1.7, tensile, yield, and elongation values of the intended plate must also be indicated on the order and are applicable to this specification.

7.4 Results of the coil end tests in accordance with Specification A 6/A 6M, in 4.1.6, shall be reported by the manufacturer and are the basis of compliance with the requirements of this specification as defined in 7.3.

7.5 Ultimate qualification to the intended plate specification through additional testing is the responsibility of the coil processor as defined in Specification A 6/A 6M, in 5.4.2.

7.6 For material produced under this section, the chemical requirements of the intended plate specification (see 7.1) apply. Other chemical requirements contained in this specification do not apply under this section.

**8. Dimensions and Tolerances**

8.1 The permissible tolerances for dimensions shall not exceed the applicable limits specified in Tables 4-8 for hot-rolled and hot-rolled, pickled-sheet coils and Tables 9-13 for hot-rolled and hot-rolled, pickled-strip coils. [Annex A1, Tables A1.1-A1.10]

**9. Workmanship, Finish, and Appearance**

9.1 The steel shall have a workmanlike appearance and shall not have defects of a nature or degree that will be detrimental to the stamping or fabrication of finished parts.

9.2 Coils may contain some abnormal imperfections that render a portion of the coil unusable since the inspection of coils does not afford opportunity to remove portions containing imperfections.

*9.3 Surface Finish:*

9.3.1 Unless otherwise specified, the material shall be furnished without removing the hot-rolled oxide or scale.

9.3.2 When required, the material may be specified to be pickled or blast-cleaned.

*9.4 Oiling:*

9.4.1 Unless otherwise specified, hot-rolled, as-rolled material shall be furnished not oiled, and hot-rolled, pickled, or blast-cleaned material shall be furnished oiled.

9.4.2 When required, as-rolled material may be specified to be furnished oiled, and pickled or blast-cleaned material may be specified to be furnished not oiled.

*9.5 Edges:*

9.5.1 As-rolled material has mill edges. Pickled or blast-cleaned material has cut edges; if mill-edge material is required, it must be specified.

9.5.2 When required, as-rolled material may be specified to have cut edges.

**10. Inspection**

10.1 When the purchaser’s order stipulates that inspection and chemical tests (except product analyses) for acceptance of the steel be made prior to shipment from the mill, the manufacturer shall afford the purchaser’s inspector all reasonable facilities to determine that the steel is being furnished in accordance with this specification. Steel sheet and strip products subject to the purchaser’s inspection and sampling are customarily inspected and sampled in conjunction with the manufacturer’s inspection and sampling operations.

**11. Rejection and Reheating**

11.1 Material that is reported to be defective subsequent to the acceptance at the purchaser’s works shall be set aside, adequately protected, and correctly identified. The manufacturer shall be notified as soon as possible so that an investigation may be initiated.

11.2 Samples that are representative of the rejected material shall be made available to the manufacturer. In the event that the manufacturer is dissatisfied with the rejection, he may request a reheating.

**12. Test Reports and Certification**

12.1 When test reports are required by the purchase order or the material specification, the supplier shall report the results of all tests required by the material specification and the order.

12.2 When certification is required by the purchase order, the supplier shall furnish a certification that the material has been manufactured and tested in accordance with the requirements of this material specification.

**TABLE 4 Standard Thickness Tolerances for Heavy-Thickness Hot-Rolled Sheet (Carbon and High-Strength Low-Alloy Steel)—<sup>3</sup>/<sub>8</sub>-in. (Cut Edge) and <sup>3</sup>/<sub>4</sub>-in. (Mill Edge) Minimum Edge Distance (Coils Only)**

NOTE 1—Thickness is measured at any point across the width not less than <sup>3</sup>/<sub>8</sub> in. from a cut edge and not less than <sup>3</sup>/<sub>4</sub> in. from a mill edge. This table does not apply to the uncropped ends of mill edge coils.

NOTE 2—The specified thickness range captions also apply when sheet is specified to a nominal thickness, and the tolerances are divided equally, over and under.

NOTE 3—Micrometers used for measurement of thickness shall be constructed with anvils and spindles having minimum diameters of 0.188 in. [4.80 mm]. The tip of the spindle shall be flat, and the tip of the anvil shall be flat or rounded with a minimum radius of curvature of 0.10 in. [2.55 mm]. Micrometers with pointed tips are not suitable for thickness measurements.

Specified Width, in.	Thickness Tolerances Over, in., No Tolerance Under					
	Specified Minimum Thickness, in.					
	0.180 to 0.229, incl	0.230 to 0.313, incl	Over 0.313 to 0.375, incl	Over 0.375 to 0.500, incl	Over 0.500 to 0.625, incl	Over 0.625 to 1.000, incl
Over 12 to 20, incl	<sup>A</sup>	0.020	0.024	0.028	0.030	0.032
Over 20 to 40, incl	<sup>A</sup>	0.022	0.024	0.028	0.030	0.032
Over 40 to 48, incl	<sup>A</sup>	0.024	0.026	0.028	0.030	0.032
Over 48 to 60, incl	0.020	0.024	0.028	0.030	0.032	0.034
Over 60 to 72, incl	0.022	0.026	0.030	0.032	0.036	0.038
Over 72	0.024	0.030	0.032	0.036	0.038	0.040

<sup>A</sup> Product not available in this size range.



**TABLE 5 Restricted Thickness Tolerances for Heavy-Thickness Hot-Rolled Sheet (Carbon and High-Strength Low-Alloy Steel)— $\frac{5}{8}$ -in. (Cut Edge) and 1-in. (Mill Edge) Minimum Edge Distance (Coils Only)**

NOTE 1—Thickness is measured at any point across the width not less than  $\frac{5}{8}$  in. from a cut edge and not less than 1 in. from a mill edge. This table does not apply to the uncropped ends of mill edge coils.

NOTE 2—The specified thickness range captions also apply when sheet is specified to a nominal thickness, and the tolerances are divided equally, over and under.

NOTE 3—Micrometers used for measurement of thickness shall be constructed with anvils and spindles having minimum diameters of 0.188 in. [4.80 mm]. The tip of the spindle shall be flat, and the tip of the anvil shall be flat or rounded with a minimum radius of curvature of 0.10 in. [2.55 mm]. Micrometers with pointed tips are not suitable for thickness measurements.

NOTE 4—This table was constructed by multiplying the values in the standard table by 0.75 and rounding to 3 decimal places using standard ASTM practice.

Specified Width, in.	Thickness Tolerances Over, in., No Tolerance Under					
	Specified Minimum Thickness, in.					
	0.180 to 0.229, incl	0.230 to 0.313, incl	Over 0.313 to 0.375, incl	Over 0.375 to 0.500, incl	Over 0.500 to 0.625, incl	Over 0.625 to 1.000, incl
Over 12 to 20, incl	<sup>A</sup>	0.015	0.018	0.021	0.022	0.024
Over 20 to 40, incl	<sup>A</sup>	0.016	0.018	0.021	0.022	0.024
Over 40 to 48, incl	<sup>A</sup>	0.018	0.020	0.021	0.022	0.024
Over 48 to 60, incl	0.015	0.018	0.021	0.022	0.024	0.026
Over 60 to 72, incl	0.016	0.020	0.022	0.024	0.027	0.028
Over 72	0.018	0.022	0.024	0.027	0.028	0.030

<sup>A</sup> Product is not available in this size range.

**TABLE 6 Width Tolerances for Heavy-Thickness Mill Edge Sheet (Coils Only)**

NOTE 1—This table does not apply to the uncropped end of mill-edge coils.

Specified Width, in.	Tolerance Over Specified Width, in. (No Tolerance Under)
Over 12 to 14, incl	$\frac{7}{16}$
Over 14 to 17, incl	$\frac{1}{2}$
Over 17 to 19, incl	$\frac{9}{16}$
Over 19 to 21, incl	$\frac{5}{8}$
Over 21 to 24, incl	$\frac{11}{16}$
Over 24 to 26, incl	$\frac{13}{16}$
Over 26 to 28, incl	$\frac{15}{16}$
Over 28 to 35, incl	$1\frac{1}{8}$
Over 35 to 50, incl	$1\frac{1}{4}$
Over 50 to 60, incl	$1\frac{1}{2}$
Over 60 to 65, incl	$1\frac{3}{8}$
Over 65 to 70, incl	$1\frac{3}{4}$
Over 70 to 80, incl	$1\frac{7}{8}$
Over 80	2

**TABLE 7 Width Tolerances for Heavy-Thickness Cut-Edge Sheet (Coils Only)**

NOTE 1—Heavy-thickness edge cutting results in a bevelled edge. The width shall be measured on the wide surface of the cut-edge coil. Depending upon the angle of the bevelled edge cut, the width of the narrow surface of the cut-edge coil may be less than the minimum ordered width. The manufacturer must be consulted regarding the capability to control bevel angle.

Specified Width, in.	Tolerance Over Specified Width, in. (No Tolerance Under)
Over 12 to 30, incl	$\frac{1}{8}$
Over 30 to 48, incl	$\frac{3}{16}$
Over 48 to 60, incl	$\frac{1}{4}$
Over 60 to 80, incl	$\frac{5}{16}$
Over 80	$\frac{3}{8}$

**TABLE 8 Camber Tolerances for Heavy-Thickness Sheet (Coils Only)**

NOTE 1—Camber is the deviation of a side edge from a straight line. Such a deviation is measured by placing a straightedge on the concave side and measuring the greatest distance between the sheet edge and the straightedge.

Camber should not exceed 1 in. in any 20 ft of length.

NOTE 4—The industry definition as invoked here is as follows: EDI is the computer to computer exchange of business information in an agreed upon standard format such as ANSI ASC X12.

### 13. Product Marking

13.1 As a minimum requirement, the material shall be identified by having the manufacturer's name, ASTM designation, grade, weight, purchaser's order number, and material identification legibly marked on a tag attached to each coil or shipping unit.

13.2 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

12.3 A signature is not required on test reports or certifications. 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.

12.4 When test reports are required, copies of the original material manufacturer's test report shall be included with any subsequent test report.

12.5 A Material Test Report, Certificate of Inspection, or similar document printed from or used in electronic form from an electronic data interchange (EDI) transmission shall be regarded as having the same validity as a counterpart printed in the certifier's facility. The content of the EDI transmitted document must meet the requirements of the invoked ASTM standard(s) and conform to any existing EDI agreement between the purchaser and the supplier. Notwithstanding the absence of a signature, the organization submitting the EDI transmission is responsible for the content of the report.

**TABLE 9 Standard Thickness Tolerances for Heavy-Thickness Hot-Rolled Strip Ordered to Minimum Thickness (Carbon and High-Strength Low-Alloy Steel)— $\frac{3}{8}$  in. Minimum Edge Distance (Coils Only)**

NOTE 1—Thickness measurements are taken  $\frac{3}{8}$  in. from edge of strip. These tolerances do not include crown, and, therefore, the tolerances given in Table 11 are in addition to this table.

NOTE 2—The specified thickness range captions also apply when sheet is specified to a nominal thickness, and the tolerances are divided equally, over and under.

NOTE 3—Micrometers used for measurement of thickness shall be constructed with anvils and spindles having minimum diameters of 0.188 in. [4.80 mm]. The tip of the spindle shall be flat, and the tip of the anvil shall be flat or rounded with a minimum radius of curvature of 0.10 in. [2.55 mm]. Micrometers with pointed tips are not suitable for thickness measurements.

Specified Width, in.	Thickness Tolerances, in., No Tolerance Under Specified Minimum Thickness, in.				
	0.230 to 0.313, incl	Over 0.313 to 0.375, incl	Over 0.375 to 0.500, incl	Over 0.500 to 0.625, incl	Over 0.625 to 1.000, incl
Over 8 to 12, incl	0.516	0.018	0.020	0.022	0.024

**TABLE 10 Restricted Thickness Tolerances for Heavy-Thickness Hot-Rolled Strip Ordered to Minimum Thickness (Carbon and High-Strength Low-Alloy Steel)— $\frac{5}{8}$  in. Minimum Edge Distance (Coils Only)**

NOTE 1—Thickness measurements are taken  $\frac{5}{8}$  in. from edge of strip. These tolerances do not include crown, and, therefore, the tolerances given in Table 11 are in addition to this table.

NOTE 2—The specified thickness range captions also apply when sheet is specified to a nominal thickness, and the tolerances are divided equally, over and under.

NOTE 3—Micrometers used for measurement of thickness shall be constructed with anvils and spindles having minimum diameters of 0.188 in. [4.80 mm]. The tip of the spindle shall be flat, and the tip of the anvil shall be flat or rounded with a minimum radius of curvature of 0.10 in. [2.55 mm]. Micrometers with pointed tips are not suitable for thickness measurements.

NOTE 4—This table was constructed by multiplying the values in the standard table by 0.75 and rounding to 3 decimal places using standard ASTM practice.

Specified Width, in.	Thickness Tolerances, in., No Tolerance Under Specified Minimum Thickness, in.				
	0.230 to 0.313, incl	Over 0.313 to 0.375, incl	Over 0.375 to 0.500, incl	Over 0.500 to 0.625, incl	Over 0.625 to 1.000, incl
Over 8 to 12, incl	0.012	0.014	0.015	0.016	0.018

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.

13.3 For government procurement by the Defense Supply Agency, strip material shall be continuously marked for identification in accordance with Fed. Std. No. 183.

**TABLE 11 Crown Tolerances for Heavy-Thickness Strip (Coils Only)**

NOTE 1—Strip may be thicker at the center than at a point  $\frac{3}{8}$  in. from the edge by the amount given in this table.

Specified Widths, in.	Crown Tolerances for Specified Thickness and Width Given, in.
	0.2300 to 0.750, incl
Over 8 to 12, incl	0.002

**TABLE 12 Width Tolerances for Heavy-Thickness Strip (Coils Only)**

Specified Width, in.	Tolerances for Specified Width for Thickness Given, Over and Under, in.	
	Mill Edge and Square Edge All Thicknesses	Slit or Cut Edge
Over 8 to 12	$\frac{3}{16}$	A

<sup>A</sup> The manufacturer must be consulted.

**TABLE 13 Camber Tolerances for Heavy-Thickness Strip (Coils Only)**

NOTE 1—Camber is the deviation of a side edge from a straight line. Such a deviation is obtained by placing an 8-ft straightedge on the concave side and measuring the greatest distance between the strip edge and the straightedge.

For strip over 8 in. to 12 in., incl	$\frac{1}{4}$ in. in any 8 ft
--------------------------------------	-------------------------------

13.4 Bar coding is acceptable as a supplementary identification method. Bar coding should be consistent with the Automotive Industry Action Group (AIAG) standard prepared by the primary metals subcommittee of the AIAG bar code project team.

## 14. Packaging and Package Marking

14.1 Unless otherwise specified, the sheet and strip shall be packaged and loaded in accordance with Practices A 700.

14.2 When specified in the contract or order, and for direct procurement by or direct shipment to the government, when Level A is specified, preservations, packaging, and packing shall be in accordance with the Level A requirements of MIL-STD-163.

14.3 When coils are ordered, it is customary to specify a minimum or range of inside diameter, maximum outside diameter, and a maximum coil weight, if required. The ability of manufacturers to meet the maximum coil weights depends upon individual mill equipment. When required, minimum coil weights are subject to negotiation.