Designation: A 424/A 424M – 09

Standard Specification for Steel, Sheet, for Porcelain Enameling[1]

This standard is issued under the fixed designation A 424/A 424M; 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 sheet steel in coils and cut lengths for porcelain enameling. The compositions and processing of these steels are such that articles for porcelain enameling may be fabricated from them and, under proper conditions, enameled. The steels are furnished as Type I, Type II, and Type III. Type I and Type II are supplied in two designations, Commercial Steel and Drawing Steel. Type III steel is interstitial-free and does not require a designation.

1.2 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.

1.3 Tolerances are found in General Requirements Specifications A 568/A 568M and A 635/A 635M. The appropriate General Requirements specification is applied based on the thickness and width of the product ordered.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

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

A 635/A 635M 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 for

A 941 Terminology Relating to Steel, Stainless Steel, Related Alloys, and Ferroalloys

3. Terminology

3.1 *Definitions*—For definitions of other terms used in this specification, refer to Terminology A 941.

3.2 *Definitions of Terms Specific to This Standard:*

3.3 *base coat*—also known as ground coat. This coating layer is applied directly to the steel and promotes adhesion of the coating system to the steel.

3.4 *cover coat*—This coating layer is usually applied over the base or ground coat to improve the appearance and provide the proper color.

3.5 *direct cover coat*—This refers to a single coating application that provides both adequate adhesion and appearance.

4. Classification

4.1 *Types*:

4.1.1 *Type I* steel has an extremely low carbon level achieved through sheet decarburization. This material is suitable for direct cover coat enameling practice, but this requirement must be indicated by the purchaser in accordance with 5.1.6. This material is also suitable for ground and cover coat enameling practice. It has good sag resistance and good formability.

4.1.2 *Type II* steel is suitable for applications where ground and cover coat enameling operations are employed. The composition of the Type II steel is obtained in melting operations.

4.1.3 *Type III* is an interstitial-free steel and is suitable for applications where ground and cover coat enameling operations are employed. The composition of the Type III steel is obtained in melting operations. It has good sag resistance and excellent formability.

4.2 *Product Designations*:

4.2.1 *Commercial Steel* is intended for parts where bending, moderate forming, or moderate drawing may be involved.

4.2.2 *Drawing Steel* is intended for fabricating identified parts where the draw is particularly severe or where the material shall be essentially free of changes in mechanical properties over a period of time. Drawing Steel should be specified where the formed material shall be essentially free of

[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.

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[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.

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

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such surface disturbances as stretcher strains or fluting without the need of prior roller leveling.

4.2.3 *Type III* interstitial-free steel is intended for fabricating identified parts where the most severe drawing or forming is involved and where the material must be free of changes in mechanical properties over a period of time and free of such surface disturbances as stretcher strains or fluting without the need of prior roller leveling.

4.3 *Porcelain Enamels*:

4.3.1 Ground coat enamels are glasses used primarily for their bonding characteristics. They may be applied after proper metal preparation (either pickle or pickle-free depending on enamel system). These glasses may be applied as either dry powders or wet slips. This type enamel is suitable for all three types of steel (Type I, II, or III).

4.3.2 Cover coat enamels are appearance glasses applied for specific color, corrosion, alkali resistance, and so forth. These enamels may be applied directly to Type I steels after suitable metal preparation. They may also be applied over fired ground coat enamels. They may be applied as either dry powder or wet slip.

4.3.3 Two coat-one fire enamels are special glass systems applied as dry powders. They usually are applied as pickle-free systems. They are suitable for all three types of steel (Type I, II, or III). Both the base coat (adherence promoting enamel) and the cover coat (color or other specific properties) are applied and fired at the same time.

5. Ordering Information

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

5.1.1 Quantity,

5.1.2 ASTM specification number and date of issue,

5.1.3 Name of material (Porcelain Enameling Sheet, Type I, Drawing Steel),

5.1.4 Condition (oiled unless otherwise specified),

5.1.5 Finish (matte (dull) finish will be supplied unless otherwise specified),

5.1.6 Enameling practice (for Type I, indicate if direct cover coat practice will be used), and

5.1.7 Dimensions (thickness, width, and length for cut lengths, or thickness and width of coils).

5.1.7.1 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 Specification A 568/A 568M.

NOTE 1—Not all producers are capable of meeting all of the limitations of the thickness tolerance tables in Specification A 568/A 568M. The purchaser should contact the producer regarding possible limitations prior to placing an order.

5.1.8 Coil size and weight requirements (must include inside and outside diameters and maximum weight),

5.1.9 Application (show part identification and description),

5.1.10 Special requirements (if required), and

5.1.11 Heat analysis (if required) (see 10.1).

NOTE 2—A typical ordering description is as follows: "40 000 lb, ASTM A 424-NN Porcelain Enameling Sheet, Type I, Drawing Steel, direct cover coat, 0.048 in. by 35 in. by 96 in., Part 2587, Range Top," or, "50 000 kg, ASTM A 424M-NN Porcelain Enameling Sheet, Type I, Drawing Steel, direct cover coat, 1.22 mm by 890 mm by 2440 mm, Part 2587, Range Top."

6. General Requirements for Delivery

6.1 Material furnished under this specification shall conform to the applicable requirements of the current edition of Specification A 568/A 568M.

6.2 Products covered by this specification are produced only to either decimal thickness where decimal thickness tolerances apply or to metric thickness where metric thickness tolerances apply.

7. Chemical Composition

7.1 The heat analysis of Type I, Type II, and Type III shall conform to the requirements prescribed in Table 1 except for carbon in Type I as noted.

8. Mechanical Properties

8.1 *Bend Test*—Commercial Steel sheet shall be capable of being bent at room temperature in any direction through 180° flat on itself without cracking on the outside of the bent portion.

8.2 *Formability*—Drawing Steel and Type III sheet shall produce an identified part within a properly established breakage allowance.

9. Workmanship, Finish, and Appearance

9.1 *Surface Finish*—Unless otherwise specified, the sheet shall have a matte (dull) finish suitable for porcelain enameling.

9.2 *Oiling*—Unless otherwise specified, the sheet shall be oiled.

10. Certification

10.1 When requested, the manufacturer shall furnish the results of the heat analysis made to determine compliance with this specification and shall include the purchase order number, ASTM designation number, and heat number correlating the results with the material represented.

11. Keywords

11.1 commercial steel; decarburization; drawing steel; enameling; interstitial free steel; porcelain

TABLE 1 Chemical Composition[A]

Element	Composition, max, percent		
	Type I	Type II	Type III
Carbon	0.008[B]	0.05	0.02
Manganese	0.40	0.50	0.35
Phosphorus	0.020	0.020	0.020
Sulfur	0.030	0.030	0.030
Other		[C]	[D]

[A] Where aluminum is used as the deoxidizing agent, the aluminum content total by product analysis is usually in excess of 0.010 %.

[B] Heat analysis of carbon is not appropriate for Type I. Sheet product analysis is appropriate for checking proper type of material.

[C] Microalloy additions are permitted to meet special customer requirements.

[D] Columbium or titanium additions, or both, are made to combine with carbon and nitrogen to produce an interstitial-free steel.

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SUMMARY OF CHANGES

Committee A01 has identified the location of selected changes to this standard since the last issue (A 424 – 06) that may impact the use of this standard. (Approved April 1, 2009.)

(*1*) Sections 1.2 and 1.3 added to make this a dual standard.
(*2*) Note 2—metric ordering example added.
(*3*) Section 6.2 modified to allow for metric thickness ordering
(*4*) Standard's designation changed to recognize dual standard.

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