



Designation: D609 – 17

Standard Practice for Preparation of Cold-Rolled Steel Panels for Testing Paint, Varnish, Conversion Coatings, and Related Coating Products¹

This standard is issued under the fixed designation D609; 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 practice covers various types of cold rolled steel panels and the procedures to be followed in their preparation for testing paint, varnish, lacquer, conversion coatings, and related products.

1.2 The procedures are as follows:

Procedure A—Conversion coatings (phosphates, chromates, etc.)

Procedure B—Vapor degreasing

Procedure C—Solvent brushing

Procedure D—Solvent wiping

Procedure E—Alkaline cleaning

1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.4 *This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.5 *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.*

2. Referenced Documents

2.1 ASTM Standards:²

¹ This practice is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.27 on Accelerated Testing.

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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.

A1008/A1008M Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

A109/A109M Specification for Steel, Strip, Carbon (0.25 Maximum Percent), Cold-Rolled

D235 Specification for Mineral Spirits (Petroleum Spirits) (Hydrocarbon Dry Cleaning Solvent)

3. Summary of Practice

3.1 Several procedures are described for the preparation and cleaning of the steel test panels shown in **Table 1**.

4. Significance and Use

4.1 The procedures described in this practice are designed to provide steel panels with a uniform and reproducible surface for testing of paint, varnish, lacquer, conversion coatings, and related products.

5. Test Panels

5.1 Prepare the test panels from rust and stain-free cold-rolled steel as described in **5.2**, **5.3**, **5.4**, and **Table 1**. The panels shall be made to a size and thickness as agreed upon between the purchaser and seller. Edges shall be smooth and corners rounded. The steel may have been coated at the mill with a suitable rust preventive compound for protection during shipment and storage. However, long-term steel storage with oil on the surface may cause an oil/steel reaction known as oil stain. Since such stains inhibit chemical bonding, the steel selected for panels shall be free of oil stain and other visible processing variation caused by pickling or annealing.

5.2 *Type 1* steel has a matte finish produced by steel mill rolls that have been grit blasted. This finish is typical of cold-rolled steel used for painted surfaces on automobiles, appliances, etc. Such surfaces can be partially characterized by measuring the average peak-to-valley distance and the number of peaks per unit area. However, conversion coating and paint performance on such surfaces may vary because of different oxidation, annealing procedures, and surface conditions.

TABLE 1 Steel Panels

NOTE 1— μ in. = microinches; nm = nanometer.

Type No.	Description	Thickness, in. (mm)	Hardness (Rockwell B)	Roughness (Arithmetic Mean), μ in. (nm)	ASTM Specification
1	Cold-rolled steel, as rolled (matte)	0.024 to 0.038 (0.6 to 1.0)	40–75	25–65 (760–1650)	A109/A109M, A1008/A1008M
2	Cold-rolled steel, flat-polished one side	0.024 to 0.038 (0.6 to 1.0)	40–75	flat polished to 15–50 (380–1270)	A109/A109M, A1008/A1008M
3	Cold-rolled steel, as rolled (smooth)	0.010 to 0.024 (0.25 to 0.6)	40–75	less than 20 (500)	A109/A109M, A1008/A1008M

5.3 *Type 2* steel panels are flat polished (or “ground”) after the steel has been received from the mill. Flat polishing is a method of mechanically grinding the surface with abrasive belts to remove surface contaminants and provide a more uniform and reproducible surface for testing. Flat-polished panels are not representative of the surface on which most coatings are applied, because polishing significantly improves the corrosion resistance performance of coatings by altering the metallurgical nature of the steel substrate. To ensure complete removal of surface contaminants, the original surface shall be completely removed as determined by visual inspection; in any case, a minimum of 7.5 μ m (0.3 mils) of surface shall be removed. Care must be used in the operation of the polishing apparatus and after cleaning the test panel, to ensure complete removal of grit and steel particles from the polished surface.

5.4 *Type 3* steel panels have a smooth finish produced by steel mill rolls which have been smooth ground. This smooth finish is useful for measuring many paint properties such as color, gloss, flexibility, or adhesion, where it is desirable to minimize the effects of variation in surface roughness.

6. Methods of Preparation

6.1 After preparation, the surface of the panel should be water-break free, which is determined by immersing a representative panel momentarily in distilled water. The water should form a continuous unbroken film over the entire surface, without beading up into droplets or other water-breaks.

6.2 *Procedure A: Conversion Coatings*—Conversion coatings such as phosphates or chromates are available from a number of sources as proprietary compounds or processes for application by either spray or immersion. Follow the manufacturer’s directions as to the application of the conversion coating. Preparation of test panels may consist of one or more steps of cleaning, rinsing, or conditioning prior to the application of the conversion coating. Additional rinsing with water will usually be required after the conversion coating is applied. To prevent rust, force dry immediately after rinsing.

6.3 *Procedure B: Vapor Degreasing*—Suspend the panels in a vapor-phase type degreaser containing stabilized 1,1,1-trichloroethane and allow them to remain above the boiling solvent. When the panels attain vapor temperature, condensation of vapor onto the panels no longer occurs. Prewiping with a clean, lintless cloth saturated with mineral spirits may be necessary, since vapor degreasing generally does not remove solid particulate matter such as dirt, etc. (see **Note 1**).

NOTE 1—Other organic solvents or combinations of solvents that will produce a water-break free surface may be used if agreed upon between

the purchaser and the supplier.

6.4 *Procedure C: Solvent Brushing*—Power-brush scrub the panel with mineral spirits (Specification **D235**). When all soluble and loosely adhering soil has been washed off, flush with clean mineral spirits. Dry at a temperature of 52 to 93°C (125 to 200°F) before use or storage (see **Note 1**).

6.5 *Procedure D: Solvent Wiping*—Using clean, lintless cloth wet with mineral spirits, vigorously rub the panel surface until all soluble and loosely adhering soil has been removed. Flush with clean solvent. Dry at a temperature of 52 to 93°C (125 to 200°F) before use or storage (see **Note 1**).

6.6 *Procedure E: Alkaline Cleaning*—Aqueous alkaline cleaners are available from a number of sources as proprietary compounds or processes. Clean the panels with an alkaline solution or cleaner applied by spray or immersion. Brush or wipe in accordance with the recommendations of the cleaner manufacturer. One or more steps of rinsing with water will be required after this procedure of cleaning. To prevent rust, force dry immediately after rinsing.

7. Protection After Preparation

7.1 To prevent rust, wrap panels that are not to be used immediately after preparation, in a paper impregnated with dicyclohexylammonium nitrite, or an equivalent volatile corrosion inhibitor (VCI), and place in a plastic bag or envelope.

7.1.1 Bare steel panels used after prolonged storage in VCI paper may have a residue of VCI that may affect some kinds of tests. The VCI residue can generally be removed by wiping the panel several times with a clean, lint-free cloth wetted with warm distilled water.³ It’s important to dry the panel thoroughly immediately after wiping to prevent flash rust. For critical tests, the operator can verify the presence and effect of VCI residue by testing a representative paint on both a panel wiped with water and on a panel straight out of the VCI wrap. Wiping with water is not recommended for phosphated panels, because of the difficulty of removing water from the phosphate coating.

7.2 To avoid contamination from fingerprints, do not touch the surface of the panels after preparation. It’s preferable that the panels be handled only with clean, lint-free gloves. Handle the panels only by the edges, even if wearing gloves.

³ Skerry, B., “Prewashing Commercially Supplied Cold-Rolled Steel Test Panels and Its Effect on Coating Adhesion,” *Journal of Coatings Technology*, Vol 62, No. 788, September 1990, pp. 55–58.



8. Keywords

8.1 panels; sheet metal; steel panels; substrate-coatings application

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