



# Standard Specification for Low Volatile Organic Compound (VOC) Corrosion-Inhibiting Adhesive Primer for Aluminum Alloys to Be Adhesively Bonded<sup>1</sup>

This standard is issued under the fixed designation E 1826; 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 ( $\epsilon$ ) 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 is for pigmented, sprayable, low volatile organic compound (VOC) corrosion-inhibiting adhesive primers for use on aluminum alloys that are to be adhesively bonded in the fabrication of panels for tactical shelters. When applied to a properly prepared surface of aluminum alloy, the primer imparts corrosion resistance and forms a surface suitable for structural bonding and for coating with shelter paint finishes.

1.2 The values stated in SI units are to be regarded as the standard where only SI units are given or where SI units are given first followed by inch-pound units; where inch-pound units are given first followed by SI units, the inch-pound units are to be regarded as the standard.

1.3 *This standard does not purport to address all of 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.*

## 2. Referenced Documents

### 2.1 ASTM Standards:

- B 117 Practice for Operating Salt Spray (Fog) Apparatus<sup>2</sup>
- D 1002 Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal)<sup>3</sup>
- D 3167 Test Method for Floating Roller Peel Resistance of Adhesives<sup>3</sup>
- E 864 Practice for Surface Preparation of Aluminum Alloys to be Adhesively Bonded in Honeycomb Shelter Panels<sup>4</sup>
- E 865 Specification for Structural Film Adhesives for Hon-

eycomb Sandwich Panels<sup>4</sup>

E 874 Practice for Adhesive Bonding of Aluminum Facings to Nonmetallic Honeycomb Core for Shelter Panels<sup>4</sup>

### 2.2 Federal Specifications:

QQ-A-250/8d Aluminum Alloy 5052 H34 Plate and Sheet<sup>5</sup>

QQ-A-250/11d Aluminum Alloy 6061 T6 Plate and Sheet<sup>5</sup>

### 2.3 Government Document:

Rule 1124 Aerospace Assembly and Component Manufacturing Operations, South Coast Air Quality Management District<sup>6</sup>

## 3. Materials and Manufacturer

3.1 The primer shall be a pigmented liquid composed of a modified epoxy phenolic or other resin system compounded to be spray-applied to produce a continuous, uniform coating without dilution.

## 4. Physical Properties

4.1 The uncured primer shall be tested as specified in 5.1 and meet the requirement of Table 1.

4.2 *Properties of Cured Film*—When applied and cured in accordance with 5.1.8, the cured film shall meet the requirements of Tables 2 and 3 when tested as specified in 5.2 and 5.3.

4.3 *Storage Stability*—Primer stored in accordance with 5.1.3 shall meet the requirements for normal- and low-temperature floating roller peel in Table 3 when cured in accordance with 5.1.8 and tested as specified in 5.3.7 and 5.3.8.

4.4 *Shelf Life*—The shelf life of the primer at  $25 \pm 7^\circ\text{C}$  ( $77 \pm 12^\circ\text{F}$ ) shall be at least four days. After four days, when tested according to 5.1.4, the primer shall meet the requirements for normal- and low-temperature floating roller peel in Table 3 when cured in accordance with 5.1.8 and tested as specified in 5.3.7 and 5.3.8.

4.5 *Film Thickness*—The average, minimum, and maximum film thicknesses shall be between 0.0025 and 0.010 mm

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.53 on Materials and Processes for Durable Rigidwall Relocatable Structures.

Current edition approved Oct. 10, 2000. Published January 2001. Originally published as E 1826 – 96. Last previous edition E 1826 – 96.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 03.02.

<sup>3</sup> *Annual Book of ASTM Standards*, Vol 15.06.

<sup>4</sup> *Annual Book of ASTM Standards*, Vol 04.11.

<sup>5</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

<sup>6</sup> Available from South Coast Air Quality Management District, 9150 Flair Dr., El Monte, CA 91731.

**TABLE 1 Physical Properties of Uncured Liquid Polymer**

Test	Requirement
Solids content, %	Report only
Ash content, %	Report only
Color	Easily visible film
VOC content	250 g/L max

**TABLE 2 Physical Property of Cured Film on Primed Surfaces**

Test	Requirement
Smooth uniform coating	0.0025 to 0.010 mm (0.0001 to 0.0004 in.) ± 15 % coefficient of variation

**TABLE 3 Physical Properties of Bonded Specimens**

Test	Requirements (min)
Normal-temperature lap shear, 24°C (77°F), MPa (psi)	20.0 (2903)
Low-temperature lap shear, -55°C (-67°F), MPa (psi)	20.0 (2903)
High-temperature lap shear, 93°C (200°F), MPa (psi)	13.0 (1890)
Humidity exposure lap shear, 93°C (200°F), MPa (psi)	8.0 (1161)
Salt spray exposure lap shear, 35°C (95°F), MPa (psi)	16.0 (2322)
Normal-temperature floating roller peel strength, 24°C (75°F), N/m (lbf/in.)	4400 (25.1)
Low-temperature floating roller peel strength, -55°C (-67°F), N/m (lbf/in.)	2625 (15.0)

(0.0001 and 0.0004 in.) ± 15 % coefficient of variation. At least five thickness readings shall be made with no more than one in any 645 mm<sup>2</sup> (1 in.<sup>2</sup>) area.

4.6 *VOC Content*—The volatile organic compound (VOC) is any volatile compound containing the element of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonates, as stated in [Rule 1124](#). The VOC content shall meet the requirement in [Table 1](#) when determined in accordance with [5.1.9](#).

## 5. Test Methods

### 5.1 Uncured Primer:

5.1.1 *Solids Content*—Determine the solids content by heating a 2-g sample of thoroughly mixed primer in an ignition-loss crucible with cover at 121 ± 5°C (250 ± 9°F) for not less than 90 min. Cool the crucible to room temperature in a desiccator. Weighings before and after heating shall be accurate to ± 0.001 g. Calculate the mass of solids remaining as a percentage of the initial sample mass as follows:

$$\text{Percent solids content} = \frac{\text{mass of nonvolatile residue}}{\text{initial sample mass}} \times 100 \quad (1)$$

5.1.2 *Ash Content*—Place the crucibles containing the solids content samples in a furnace at 565 ± 28°C (1050 ± 82°F) for not less than 60 min. Cool the crucible to room temperature in a desiccator. Weighings before and after heating shall be accurate to ± 0.001 g. Calculate the ash content remaining as a percentage of the solids content as follows:

$$\text{Percent ash content} = \frac{\text{mass of ash residue}}{\text{mass of nonvolatile residue}} \times 100 \quad (2)$$

5.1.3 *Storage Stability*—Store a sample of the primer for three months from the date of manufacture at a temperature recommended by the manufacturer. The stored sample shall

meet the requirements for normal- and low-temperature floating roller peel in [Table 3](#) when cured in accordance with [5.1.8](#) and tested as specified in [5.3.7](#) and [5.3.8](#).

5.1.4 *Shelf Life*—Store a sample of the primer for four days at 25 ± 7°C (77 ± 13°F). The aged sample shall meet the requirements for normal- and low-temperature floating roller peel in [Table 3](#) when cured in accordance with [5.1.8](#) and tested as specified in [5.3.7](#) and [5.3.8](#).

5.1.5 *Film Thickness*—The cured primer film thickness shall be determined with an eddy-current instrument as specified in [5.2.2](#).

5.1.6 *Color*—During spray application, there shall be a discernible color change for the primer thickness specified in [4.5](#).

5.1.7 *Sprayability*—The primer shall be capable of being readily applied in accordance with the manufacturer's instructions to all test panels of either 6061 T6 or 5052 H34 aluminum alloy (Fed. Spec. [QQ-A-250/11d](#) or [QQ-A-250/8d](#), respectively) and cleaned in accordance with [Practice E 864](#) for each of the tests described in [5.1.8-5.3.8](#).

5.1.8 *Curing Properties*—Test the cured film for the ability to meet the requirements listed in [Tables 2](#) and [3](#). Spray the primer onto the test panels and air dry at least 20 min at 24 ± 5°C (77 ± 9°F); then heat in air for 65 ± 5 min at 121 ± 5°C (250 ± 9°F).

5.1.9 *VOC Content*—The grams of VOC per litre of primer, less water and exempt compounds per [Rule 1124](#), shall be determined by the adhesive primer manufacturer in accordance with [Rule 1124](#) and meet the requirement for VOC content in [Table 1](#).

### 5.2 Cured Film:

5.2.1 *Test Panels and Panel Preparation*—Test panels shall be either 6061 T6 or 5052 H34 bare aluminum alloy (Fed. Spec. [QQ-A-250/11d](#) or [QQ-A-250/8d](#), respectively) and cleaned in accordance with [Practice E 864](#).

5.2.2 *Smooth Uniform Coating*—Clean a 30 by 30 cm (12 by 12 in.) panel, spray to a primer thickness as specified in [4.5](#), and cure as specified in [5.1.8](#). Determine the primer thickness with a Fisher isoscope MP2-T3.3B (or equivalent) calibrated with standards between 0.0025 and 0.010 mm (0.0001 and 0.0004 in.). The primer thickness shall meet the requirements in [4.5](#) and [Table 2](#).

5.2.3 *Pencil Hardness*—Determine the pencil hardness of the cured film using the following procedure:

5.2.3.1 *Preparation of Pencils*—Prepare a set of drawing pencils ranging in hardness from 6B to 5H by stripping the wood away from the end approximately 10 mm (3/8 in.) without damaging the lead. Square the tip of the lead by holding the pencil in a vertical position and moving the lead back and forth over 400-grit or finer abrasive paper. Square the tip of the lead after each trial.

5.2.3.2 *Procedure*—Place a test panel with the cured primer applied in a horizontal position. Push pencils of increasing hardness at a 45° angle into the coated surface of the panel until one is found that will cut or scratch the coating. Use the number of this pencil to express the primer hardness.

5.2.4 *Environmental Resistance Test*—Clean three test panels for each test described in [5.2.5-5.2.7](#) approximately 76