Designation: E1793 – 11

Standard Practice for Preparation of Aluminum Alloy for Bonding in Foam and Beam Type Transportable Shelters[1]

This standard is issued under the fixed designation E1793; 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 practice covers the preparation of clean, uniform surfaces of aluminum alloy suitable for formation of durable adhesive bonds in "foam and beam" panels used for the manufacture of tactical rigid wall shelters.

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

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:*[2]

E864 Practice for Surface Preparation of Aluminum Alloys to Be Adhesively Bonded in Honeycomb Shelter Panels

E1749 Terminology Relating to Rigid Wall Relocatable Shelters

E1794 Specification for Adhesive for Bonding Foam Cored Sandwich Panels (200°F Elevated Humidity Service), Type II Panels

E1800 Specification for Adhesive for Bonding Foam Cored Sandwich Panels (160°F Elevated Humidity Service), Type I Panels

3. Terminology

3.1 *Definitions*—See Terminology E1749 for definitions of other terms used in this practice.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *Type 1 panels*—panels used in the construction of foam and beam shelters designed for 71.1°C (160°F) elevated humidity service.

3.2.2 *Type 2 panels*—panels used in the construction of foam and beam shelters designed for 93.3°C (200°F) elevated humidity service.

3.2.3 *foam and beam panel*—a sandwich construction consisting of internal rigid foam core placed between structural beams (at specific distance(s) apart) and bonded to face sheets on both sides.

4. Significance and Use

4.1 Reproducible and durable adhesive bonds to aluminum alloys can be obtained reliably only through proper selection and careful control of the materials used and the steps in the bonding process. The preparation of the aluminum alloys to obtain clean, uniform surfaces with appropriate characteristics is a critical step. This practice describes how such surfaces can be obtained.

5. Apparatus

5.1 *General Processing*—Practice E864, paragraph 4.1, applies.

6. Materials

6.1 *Water*—Practice E864, paragraph 5.1, applies.

6.2 *Cleaning Solutions:*

6.2.1 *Type 1 Panels*—Parts shall be dip cleaned in a solution which is made up in accordance with the manufacturers' recommendations. The only requirement for acceptability being that the conditions of 7.2.1 be met.

6.2.2 *Type 2 Panels*—Treat aluminum using either Method 1 or Method 2 of Practice E864.

7. Test Methods

7.1 *General*—The test methods of Practice E864 apply, except as otherwise listed.

7.2 *Exceptions:*

7.2.1 *Surface Resistance*—Surface resistance measurements shall be made using a Model 152 Microhm meter and a Model

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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.

H-2000 test jig.[3] Current shall be 10.0 ± 0.2 A. The electrode force shall be 267 ± 11 kg (600 ± 25 lb). The entire apparatus shall be calibrated per the manufacturer's recommendations, and at least once every week inspect the electrode tips for deterioration and wear.

7.2.2 *Physical Strength Test*—The adequacy for preparing aluminum surfaces for bonding shall be determined by monitoring daily the results of the adhesive specimen testing performed in Specification E1794 or E1800.

7.2.3 *Visual*—After being cleaned and immediately prior to bonding, parts shall be visually inspected and shall be entirely free of contaminants, such as grease, oil, water, dirt, dust, loose particles, paint, ink markings, cleaning agent, etc.

8. Procedure

8.1 *Surface Preparation, Type 1 Panels*—Perform the steps in the procedure in accordance with 8.1.1 through 8.1.2.

8.1.1 *Cleaning*—All parts shall be subjected to a solution dip cleaning process such that their surface resistance after cleaning shall be no more than 100 μΩ.

8.1.2 *Spot Cleaning*—Localized contamination shall be removed from parts immediately prior to bonding.

8.1.2.1 Dust shavings, loose particles, etc. shall be removed using a vacuum cleaning device or wiping with a clean dry cloth, or both.

8.1.2.2 Other organic contaminates shall be removed by wiping with isopropyl alcohol applied on a clean cloth. Areas no larger than 0.84 m^2 (9 ft^2) shall be wiped at a time. Care shall be taken to avoid getting the solvent in cavities or between faying surfaces. A clean, dry cloth shall be used to remove the solvent and contaminant. The solvent shall not be allowed to dry on the parts.

8.2 *Surface Preparation, Type 2 Panels*—Perform the cleaning of aluminum panels in accordance with Practice E864, Section 7.

[3] Available from J. W. Dice Co., Englewood, NJ, or equivalent.

9. Quality Assurance

9.1 *Process Inspection*—Concentration of the cleaning solutions and their temperatures during use shall be in accordance with the manufacturer's recommendations or in accordance with the requirements of Practice E864. Daily titration and temperature readings shall be taken to determine compliance with the requirements.

9.2 *Handling*—Parts that have been processed shall be handled with white cotton gloves only. Gloves shall be clean and free of dirt, silicones, oils, grease, lint, etc.

9.3 *Storage*—Cleaned parts shall be stored and protected to preclude contamination with dust, dirt, oils, moisture, etc. Adhesive shall be applied for bonding within 72 h after parts are cleaned. Parts not bonded within 72 h shall be recleaned.

9.4 *Marking of Type 2 Panels*—Immediately after processing by this specification, parts shall be date stamped. The information shall be placed on a piece of masking tape 12.5 mm (½ in.) wide by approximately 75 mm (3 in.) long. The tape shall be applied to the clean part. The date and piece number shall be stamped on the tape. The inspection stamp shall be applied as a seal, half on the tape and half on the part surface. The masking tape shall not be placed on a surface which will subsequently be adhesively bonded. Any skin or assembly that does not have the date stamp and inspector's stamp applied in this manner shall be recleaned.

9.5 *Quality Assurance Test*—Five test strips of 6061-T6 aluminum 23 by 25 by 100 mm (0.090 by 1 by 4 in.) shall be subjected to the production cleaning process for the purpose of taking surface resistance readings. The strips shall be included with the normal production cleaning batch. Handling and storage after cleaning shall be the same as employed on the cleaned production parts.

10. Keywords

10.1 clean uniform surface; dip cleaned; durable adhesive bonds; foam and beam panels; tactical shelters; titration