

SEMI E137-0705 (Reapproved 0118)^E GUIDE FOR FINAL ASSEMBLY, PACKAGING, TRANSPORTATION, UNPACKING, AND RELOCATION OF SEMICONDUCTOR MANUFACTURING EQUIPMENT

This Standard was technically approved by the Facilities Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on May 16, 2017. Available at www.semiviews.org and www.semi.org in January 2018; originally published November 2004; previously published November 2011.

^E This Standard was editorially modified to make corrections that were approved outside of the normal reapproval process.

NOTICE: This Document was reapproved with minor editorial changes.

NOTICE: Paragraphs entitled ‘NOTE:’ are not an official part of this Standard or Safety Guideline and are not intended to modify or supersede the official Standard or Safety Guideline. These have been supplied by the global technical committee to enhance the usage of the Standard or Safety Guideline.

1 Purpose

1.1 The objective of this Document is to establish standard guidelines for activities specific to the final assembly and packaging at the supplier’s facility, transportation, and unpacking and relocation of semiconductor manufacturing equipment (SME) to the customer’s cleanroom manufacturing area.

NOTE 1: As with any SEMI Guide, the practices outlined herein are recommendations, not specifications. Users of this Document should recognize that alternate practices are not excluded as long as they produce results that are equivalent to those produced using the recommendations outlined here and meet the requirements of the end user.

2 Scope

2.1 This Standard has been developed as a guide for final assembly and packaging at the supplier’s facility through relocation of SME, separate subassemblies, and components from the customer’s loading dock/receiving area to their cleanroom manufacturing area for both high and ultrahigh purity applications.

NOTICE: SEMI Standards and Safety Guidelines do not purport to address all safety issues associated with their use. It is the responsibility of the users of the Documents to establish appropriate safety and health practices, and determine the applicability of regulatory or other limitations prior to use.

3 Limitations

3.1 Specific guidance associated with environment, health, and safety (EHS) concerns are not in the scope of this Document.

3.2 Process specifications related to wafer particles and/or qualities (e.g., ionic contamination) are not in the scope of this Document. Parameters, such as particles per wafer pass (PWP), should be in the customer’s specific equipment process performance specification.

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI C41 — Specifications and Guidelines for 2-Propanol

SEMI E49.2 — Guide for the Qualification of Polymer Assemblies Used in Ultrapure Water and Liquid Chemical Systems in Semiconductor Process Equipment

SEMI F63 — Guide for Ultrapure Water Used in Semiconductor Processing

4.2 APA Standard¹

NOTE 2: APA – The Engineered Wood Association was formerly known as the American Plywood Association.

APA PS 1 — Voluntary Product Standard, Structural Plywood

4.3 ISO Standards²

ISO 14644-1 — Cleanrooms and Associated Controlled Environments, Part 1: Classification of Air Cleanliness

4.4 MIL Standards³

MIL-D-3464 — Military Specification – Desiccants, Activated, Bagged, Packaging Use and Static Dehumidification

MIL-PRF-131 — Performance Specification – Barrier Materials, Watervaporproof, Greaseproof, Flexible, Heat-Sealable

4.5 Other Documents

WWPA — Western Lumber Grading Rules⁴

NOTICE: Unless otherwise indicated, all documents cited shall be the latest published versions.

5 Terminology

5.1 Abbreviations and Acronyms

5.1.1 DOD — Department of Defense

5.1.2 EPS — expanded polystyrene

5.1.3 IPA — isopropyl alcohol (2-propanol)

5.1.4 ISO — International Organization for Standardization

5.1.5 PO — purchase order

5.1.6 PWP — particles per wafer pass

5.1.7 SME — semiconductor manufacturing equipment

5.1.8 TOC — total organic carbon

5.1.9 UPW — ultrapure water

5.1.10 USA — United States of America

5.1.11 WLGR — Western Lumber Grading Rules

5.1.12 WWPA — Western Wood Products Association

6 Cleaning and Wrapping Materials

6.1 For cleaning and triple wrap packaging, the following materials are recommended.

6.1.1 Ultrapure Water (UPW) — Reference SEMI F63.

6.1.2 Isopropyl Alcohol (2-Propanol) (IPA) — Reference SEMI C41.

6.1.3 Ultralow particle generation, ultralow extractable ion level, polyester, ISO 14644-1 (subsequently called ISO) Class 5 cleanroom-compatible swabs and wipes with sealed edges.

¹ The Engineered Wood Association, 7011 S. 19th Street, Tacoma, WA 98466-5333, USA; Telephone: +1.253.565.6600; +1.253.565.7265; <http://www.apawood.org>

² International Organization for Standardization, ISO Central Secretariat, 1, ch. de la Voie-Creuse, CP 56, CH-1211 Geneva 20, Switzerland; Telephone: +41.22.749.01.11, Fax: +41.22.733.34.30, <http://www.iso.org>

³ United States Military Standards, Available through the Naval Publications and Forms Center, 5801 Tabor Avenue, Philadelphia, PA 19120-5099, USA; Telephone: +1.215.697.3321.

⁴ Western Wood Products Association, 522 SW Fifth Avenue, Suite 500, Portland, OR 97204-2122, USA; Telephone: +1.503.224.3930, Fax: +1.503.224.3934, <http://www.wwpa.org>

6.1.4 Ultralow particle generation, hydrocarbon-free, ultralow extractable ion level, ~150 μm (0.006 in.) thick, natural polyethylene film.

6.1.5 Ultralow particle generation adhesive tape.

7 Assembly and Pre-Packaging Procedures

7.1 Pre-Assembly

7.1.1 Machining, sawing, welding, brazing, grinding, sanding, and other manufacturing operations incompatible with cleanrooms should be completed before components are brought into the clean assembly area.

7.1.2 All SME components should be vacuumed, blown off with filtered air, and cleaned with a solution of 10% to 70% IPA diluted in UPW using wipes and swabs immediately prior to being brought into the clean assembly area.

7.1.3 Cutting oils, lubricants, and solder flux should be removed before components are brought into the clean assembly area.

7.2 Clean Assembly Area

7.2.1 All components of the SME should be assembled in at least an ISO Class 6 or better (ISO Class 5 preferred) cleanroom.

7.2.2 A set of clean assembly tools should be maintained in the clean assembly area.

7.2.2.1 If this is not possible, tools should be vacuumed, blown off with filtered air, and cleaned with a solution of 10% to 70% IPA diluted in UPW using wipes and swabs immediately prior to each time they reenter the clean assembly area.

7.2.2.2 The assembly tools in the clean assembly area should be cleaned periodically and as needed if they become contaminated during usage.

7.3 Pre-Packaging

7.3.1 All SME with water (including UPW) or other liquids should be fully emptied and completely dried using dry, hydrocarbon-free air or nitrogen.

7.3.1.1 All SME with UPW that comes in direct contact with the production units (e.g., wafers) should have lines, baths, tanks, etc. flushed with a bacteria retardant (e.g., H_2O_2 /UPW solution) before emptying them fully.

NOTE 3: The user is referred to the SEMI E49.2 qualification recommendations for ultrapure water and liquid chemical delivery polymer Assemblies in semiconductor process equipment. An 'Assembly' or 'Assemblies' is defined as a combination of two or more ultrapure water and liquid chemical delivery components. SEMI E49.2 provides guidelines for 1) ensuring these polymer Assemblies are leak free, 2) rinse requirements for resistivity and TOC levels, and 3) allowable adders for particles, ions, and metals. SEMI E49.2 is not intended to apply to non-polymer Assemblies or to Assemblies used in the delivery of liquids that do not contact the wafer's surface (e.g., drainage and cooling Assemblies).

7.3.2 All utility lines should be capped before and during shipment.

7.3.3 The SME with vacuum chambers should have these chambers and vacuum lines sealed and shipped under vacuum.

7.3.4 The SME should be clearly marked showing correct lifting points for removal from shipping container.

7.3.5 Following final assembly and test, all exposed surfaces should be thoroughly cleaned with a solution of 10% to 70% IPA diluted in UPW using wipes and swabs.

7.3.6 The SME should be inspected thoroughly for cleanliness.

7.3.6.1 The supplier should provide a copy of their inspection results (e.g., marked checklist) with the SME.

8 Triple Wrap Strategy

8.1 The following procedures support the strategy of totally enclosing and sealing the SME, separate subassemblies, or support components in three layers of protective wrap (see § 9) so that each layer forms a protective seal against moisture and particles.