

SEMI E49.1-0304

GUIDE FOR TOOL FINAL ASSEMBLY, PACKAGING, AND DELIVERY

This Standard was technically approved by the Liquid Chemicals Global Technical Committee. This edition was approved for publication by the global Audits and Reviews Subcommittee on December 4, 2003. Available at www.semi.org in March 2004; originally published in 1995.

NOTICE: This Document is no longer supported by the global technical committee. It has been replaced by SEMI E137.

1 Purpose

1.1 The objective of this Document is to establish standard guidelines for cleanroom activities specific to the final assembly, packaging, and delivery of semiconductor manufacturing equipment.

2 Scope

2.1 This Standard has been developed as a guide for final tool assembly and packaging. This Standard covers both high and ultrahigh purity applications. Process specifications related to wafer particles and/or quality are not in the scope of this Document. Parameters such as particles per wafer pass (PWP) should be in the user's specific equipment process performance specification.

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 Referenced Standards and Documents

NOTE 1: Refer to the latest version of the following documents for general cleanroom protocol.

3.1 *Federal Standard*¹

FED-STD-209 — Federal Standard Cleanroom and Work Station Requirements, Controlled Environment

3.2 *IEST Documents*²

IES-RP-CC-001 — Recommended Practices for HEPA Filters

IES-RP-CC-002 — Recommended Practices for Laminar Flow Clean Air Devices

IES-RP-CC-003 — Recommended Practices for Garments Required in Clean Rooms and Controlled Environmental Areas

IES-RP-CC-006 — Recommended Practices for Testing Cleanrooms

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

4 Terminology

4.1 See § 4 of SEMI E49.

5 Pre-Packaging Procedures

5.1 All components of the equipment should be thoroughly cleaned before assembly and assembled in at least a Class 1000/100 cleanroom (HP/UHP).

5.2 *Tools* — Maintain a set of clean tools in the clean assembly area. If this is not possible, tools should be cleaned according to the following section (cleaning) each time they reenter the clean assembly area.

¹ Federal Standard available from EverySpec; <http://everyspec.com>

² Institute of Environmental Sciences and Technology, 1827 Walden Office Square, Suite 400, Schaumburg, IL 60173, USA; Telephone: +1.847.981.0100, Fax: +1.847.981.4130; <http://iest.org>

5.3 *Cleaning* — Assembly tools and all system components should be vacuumed, blown off with filtered air, and cleaned with a solution of 10% IPA in deionized (DI) water immediately prior to being brought in to the clean assembly area. Use swabs and wipes rated for Class 100 service.

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

5.4 *Exclusions* — Machining, sawing, welding, brazing, grinding, and sanding operations must be completed before components are brought into the clean assembly area.

5.5 The equipment should be subject to a thorough cleanliness inspection. The supplier should provide a copy of the inspection results (e.g., marked checklist) with the equipment.

5.6 All equipment with water (including ultrapure water) or other liquids should be fully emptied and completely dried using dry, oil-free air or nitrogen.

5.7 The equipment should be clearly marked showing correct lifting points for removal from shipping container.

5.8 All utility lines should be capped during shipment.

5.9 All vacuum systems should be shipped under vacuum.

6 Packaging Procedures

6.1 The equipment and separate subassemblies or support equipment should be totally enclosed and sealed in at least two layers of clean, oil-free clear 6 mil polyethylene so each layer forms a seal against moisture and particles.

6.2 A humidity indicator should be included inside of the initial wrapping layer.

6.3 *Triple Wrap Strategy* — The individual wraps are intended to be removed in stages and should adhere to the following guidelines:

6.3.1 *Inner Wrap* — This wrap should stay with the tooling all the way into the final cleanroom or a staging area of the same order wipe down. The wrap should be cleaned prior to movement into the cleanroom.

6.3.2 *Middle Wrap* — This wrap should stay with tooling until it reaches a Class 10,000 intermediate staging area. The wrap should be cleaned before leaving the receiving area and again before it is removed in the staging area.

6.3.3 *Outer Wrap* — This wrap is used to protect the tooling while in transit to the loading dock. While the equipment is on the loading dock, outer shipping material should be removed and the wrap cleaned and removed.

6.4 *Clean Assembly Area* — Following final assembly and test, all exposed parts should be thoroughly wiped down with deionized water, using cleanroom wipes. Approved materials for cleaning are described in § 6.6. Tooling should then be totally enclosed in a clean, oil-free inner wrap using transfer tape as required. If two sets of pallets are used, the inner pallet should meet the requirements of § 6.3.1 and should be enclosed with the tool. Jacking points should be identified to facilitate rigging.

6.5 *Dedicated Packaging Area* — After the first wrap has been applied, the equipment should be moved to a dedicated clean (Class 10,000 or better) packaging area. Here the outer two wraps of clear polyethylene are installed and taped.

6.5.1 After the equipment is triple wrapped, it should be placed on a pallet so that the triple wrapping is not damaged or violated. The pallet should be movable (with equipment attached to it) with a conventional pallet jack or fork lift. The equipment should also be capable of placement on and removal from the pallet with a conventional pallet jack or fork lift without compromising or tearing any of the triple wrapping.

6.5.2 After the equipment is on the pallet, the manufacturer may use any conventional packaging materials (e.g., bubble wrap, styrofoam, or wood) to ensure that the equipment is not damaged in transit. However, these conventional materials cannot compromise or tear the triple wrapping.

6.6 Recommended Materials

6.6.1 For cleaning and triple wrap packaging:

- DI water, resistivity 18.0 MΩ·cm, minimum
- UHP isopropyl alcohol (IPA)