SEMI E100-0302
SPECIFICATION FOR A RETICLE SMIF POD (RSP) USED TO TRANSPORT AND STORE 6 INCH OR 230 mm RETICLES

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1 Purpose

1.1 This Standard specifies the Reticle SMIF Pod (RSP) used to transport and store 6 inch or 230 mm reticles in a reticle (photomask) or integrated circuit (IC) manufacturing facility.

2 Scope

2.1 This Standard is intended to set an appropriate level of specification that places minimal limits on innovation while ensuring modularity and interchangeability at all mechanical interfaces. Most of the requirements given in this Specification are in the form of maximum or minimum dimensions with very few required surfaces. Only the physical interfaces for the RSP are specified; no materials requirements or micro-contamination limits are given in this Specification.

2.2 The pellicle exclusion volumes of this Specification accommodate pellicles which extend the full length of the reticles. The pellicle exclusion volume widths are limited to 151 mm for 230 mm reticles, and 129 mm for 6 inch reticles.

2.3 The RSP has the following components, sub-components, and other features. A "●" symbol indicates components or features which are *required* and a "◊" symbol indicates components or features which are *optional*.

- Top
  - ◊ robotic handling flange (optional)
- Interior
  - supports for one 6 inch or 230 mm reticle
  - reticle capture mechanism
  - end-effector exclusion volume
  - 2 safety rail exclusion volumes
  - pellicle exclusion volume
  - transverse pellicle exclusion volume
- Sides
  - ◊ 2 side handling flanges on the sides parallel to the bi-lateral reference plane (optional)
  - 1 carrier ID exclusion volume on the rear side
  - ◊ 2 side handling exclusion volumes
- Bottom
  - door compatible with SMIF as defined in SEMI E19.4
  - pod latch-pin holes
  - features which mate with kinematic coupling pins
  - carrier sensing pads as defined in SEMI E1.9
  - 4 info pads

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◊ 4 bottom conveyor rails

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

3.1 *SEMI Standards*

SEMI E1.9 — Provisional Mechanical Specification for Cassettes Used to Transport and Store 300 mm Wafers

SEMI E19.4 — 200 mm Standard Mechanical Interface (SMIF)

SEMI E30.1 — Inspection and Review Specific Equipment Model (ISEM)

SEMI E44 — Guide for Procurement and Acceptance of Minienvironments

SEMI E47.1 — Provisional Mechanical Specification for Boxes and Pods Used to Transport and Store 300 mm Wafers

SEMI E57 — Provisional Mechanical Specification for Kinematic Couplings Used to Align and Support 300 mm Wafer Carriers

SEMI P5 — Specification for Pellicles

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

4 Terminology

4.1 *bilateral reference plane* — a vertical plane that bisects the reticle and is perpendicular to both the horizontal and facial reference planes. The bilateral reference plane is coplanar with the bilateral datum plane defined in SEMI E57.

4.2 *facial reference plane* — a vertical plane which bisects the reticle and is parallel to the front side of the pod (where reticles are removed or inserted). The facial reference plane passes through the center of the 200 mm SMIF as defined in SEMI E19.4. The facial reference plane is coplanar with the facial datum plane defined in SEMI E57.

4.3 *horizontal reference plane* — a horizontal plane coplanar with the top surface of the port door as defined in SEMI E19.4. The horizontal reference plane is coplanar with the horizontal datum plane defined in SEMI E57.

4.4 *minienvironment* — a localized environment created by an enclosure to isolate the product from contamination and people (as defined in SEMI E44).

4.5 *nominal reticle center line* — the line that is defined by the intersection of the two vertical reference planes (facial and bilateral) and passes through the nominal center of the seated reticle (which must be horizontal when the carrier is placed on the SMIF as defined in SEMI E19.4).

4.6 *pellicle* — as defined in SEMI P5.

4.7 *reticle* — as defined in SEMI E30.1.

4.8 *Reticle SMIF Pod (RSP)* — a minienvironment compatible carrier capable of holding one 6 inch or one 230 mm reticle in a horizontal orientation during transport and storage and is compatible with a Standard Mechanical Interface (SMIF) per SEMI E19.4.

4.9 *robotic handling flanges* — horizontal projections on the top of the box for lifting and rotating the box (as defined in SEMI E47.1).

4.10 *side handling flanges* — horizontal projections on the sides of the pod (sides parallel to the bilateral reference plane) for manual or automated lifting, transportation or positioning of the pod.

5 Ordering Information

5.1 *Intended Use* — This Standard is intended to specify reticle carriers over a reasonable lifetime of use, not just those in new condition. For this reason, the purchaser needs to specify a time period and the number and type of uses to which the carriers will be put. It is under these conditions that the carriers must remain in compliance with the requirements listed in § 6.

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5.2 *Reticle Size and Thickness* — The purchaser needs to specify the reticle size and thickness to be accommodated in the RSP.

5.3 *Optional Features* — The purchaser needs to specify whether optional components (identified in § 2) are required.

5.4 *Temperature Ranges* — The purchaser needs to specify two sets of temperatures to which the RSPs might be exposed. An operating temperature range is the set of environmental temperatures in which the RSPs will remain in compliance with the requirements listed in § 6. A temporary temperature range is the set of environmental temperatures to which the pods can be exposed such that when the RSPs return to the operating temperature range, the RSPs will be in compliance with the requirements listed in § 6. Limits on exposure times to elevated temperatures should be specified.

5.5 *Electrostatic Dissipation* — The end user may require a continuous path to ground from the reticle to the carrier registration and handling features. The purchaser needs to specify whether electrostatic dissipation is required.

5.6 *Contamination Requirements* — The purchaser needs to specify their contamination requirements.

6 Requirements

6.1 *Symmetry* — Most of the dimensions of the RSP are determined with respect to the three orthogonal reference planes defined in this Document: the facial reference plane, the horizontal reference plane and the bilateral reference plane. All dimensions are symmetric about the bilateral reference plane except the latch features. All dimensions are symmetric about the facial reference plane except the registration features, carrier sensing pads, info pads, and latch features.

6.2 *Door* — The pod door, and its frame on the bottom of the pod, must be compatible with a port which conforms to SEMI E19.4.

6.3 *Reticle Centering and Capture* — When the carrier is closed, the reticle must be secured in all degrees of freedom within the carrier to prevent movement during transport and must be centered with respect to the SMIF defined in SEMI E19.4. A bisecting plane through the reticle, parallel to the bilateral reference plane must be within x114 of the bilateral reference plane of the load port when the reticle is seated in the carrier. A bisecting plane through the reticle, parallel to the facial reference plane must be within y133 of the facial reference plane of the load port when the reticle is seated in the carrier. When the carrier is open, it must provide a horizontal reticle capture range of x135 and y135. This capture range must be provided at z162 above the horizontal reference plane.

6.4 *Exclusion Volumes* — The interior of the RSP must never intrude into the pellicle exclusion volumes, and must not intrude into the end-effector exclusion volumes or safety rail exclusion volumes when the carrier is open. Where the exclusion volumes overlap, the end-effector exclusion volume is reduced by the pellicle exclusion volume when handling pelliclized or chrome-down reticles.

6.4.1 *End-Effector Exclusion Volumes* — Volumes in an opened pod which must be free for the end-effector to enter and handle the reticle as defined by x116, x132, y136, x144, x146, y144, z159, and z160 for a 230 mm RSP, and by x118, x143, x145, y143, z159, and z160 for a 6 inch RSP. No obstructions should exist in the end-effector exclusion volume which extends in the direction normal to the facial reference plane.

6.4.2 *Pellicle Exclusion Volumes* — Volumes in the pod below the reticle which must remain free from intrusion to accommodate the pellicle mounted on the reticle. No obstructions should exist in the pellicle exclusion volume which extends in the direction normal to the facial reference plane as defined by x115, z159 and z161 for a 230 mm RSP, and by x119, z159 and z161 for a 6 inch RSP. No obstructions should exist in the transverse pellicle exclusion volume which extends in the direction normal to the bilateral reference plane as defined by y129, z159 and z163 for a 230 mm RSP, and by y130, z159 and z163 for a 6 inch RSP.

NOTE 1: The transverse pellicle exclusion volume is only intended to specify where the reticle supports in the pod cannot exist. Reticles with the pellicles transverse are typically handled with end-effectors which grip from above the reticle.

6.4.3 *Safety Rail Exclusion Volumes* — Volumes in an opened pod which must remain free from intrusion to accommodate safety rails which may be used on end-effectors to protect the edge of the reticle during handling. No obstructions should exist in the safety rail exclusion volumes which extend in the direction normal to the facial reference plane as defined by x137 and z167 for a 230 mm, and by x138 and z167 for a 6 inch RSP.

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6.5 *External Dimensions* — Figures 1, 2 and 3 show, respectively, the external top view, a detail and the front view of the RSP. Table 2 defines all of the external dimensions of the RSP (equivalent for both the 6 inch and the 230 mm versions).

6.6 *Internal Dimensions* — Figures 4 through 8 show internal dimensions for the 6 inch and 230 mm versions of the RSP. Table 2 defines all internal dimensions which are common to the 6 inch and 230 mm RSP. Table 3 defines the internal dimensions which apply only to the 230 mm RSP. Table 4 defines the internal dimensions which apply only to the 6 inch RSP. The maximum height of the features which support the reticle are given by z164 for a 230 mm RSP and z165 for a 6 inch RSP.

NOTE 2: The maximum height of the reticle supports, plus the clearance between the reticle supports and reticle (chosen by the tool supplier) determine the height the reticle must be lifted before being extracted from, or inserted into the RSP.

6.7 *Robotic Handling Flange* — On the top of the pod is an optional handling flange for automated manipulation of the RSP. Figures 1, 3, and 5 show dimensions for the robotic handling flange. Table 2 defines the dimensions for the robotic handling flange.

6.8 *Side Handling Flanges* — On the sides of the pod parallel to the bilateral reference plane are optional handling flanges for automated manipulation of the RSP. Figures 1, 2, and 3 show dimensions for the side handling flanges. Table 2 defines the dimensions for the side handling flanges. No obstructions may exist in the side handling exclusion volumes which extend in the direction normal to the facial reference plane as defined by x136 and z166 when the side handling flanges are present.

6.9 *Kinematic Coupling* — The RSP door must have the capability of registering on the kinematic pins defined in SEMI E57. The features that mate with the pins must provide a lead-in capability that corrects an RSP misalignment no greater than r19 in any horizontal direction. However, it is recommended that robots placing RSPs on kinematic couplings use as little of this lead-in capability as possible to avoid wear.

6.10 *Carrier Sensing Pads* — The RSP door must have carrier sensing pads as defined in SEMI E1.9.

6.11 *Info Pads* — When the RSP is placed on a port, the info pads A, B, C, and D communicate information about the RSP configuration. Figures 6 and 8 show the dimensions of the info pads. Table 2 defines the info pad dimensions. A pad in the up position must be z26 above the horizontal reference plane. A pad in the down position must be z2 above the horizontal reference plane. Info pad assignments are shown in Table 1. Info pads that are "not defined" can be at either the up or down position unless specified by the end user. RSP configurations "to be assigned" may be assigned by the end user.

Table 1 Info Pad Assignments

RSP Configuration	*Info Pad*			
	A	*B*	*C*	*D*
230 mm reticle	not defined	not defined	up	down
6 inch reticle	not defined	not defined	down	down
to be assigned	not defined	not defined	up	up
to be assigned	not defined	not defined	down	up

6.12 *Inner and Outer Radii* — All required concave features may have a radius of up to *r*65 to allow cleaning and to prevent contaminant build-up. All required convex features may also have a radius of up to *r*66 to prevent small contact patches with large stresses that might cause wear and particles. Note that these limits on the radius of all required features are specified as a maximum (not a minimum) to ensure that the required features are not rounded off too much. The lower bound on the radius is up to the carrier supplier. Note also that this radius applies to every required feature unless another radius is called out specifically. Here a required feature is an area on the surface of the carrier specified by a dimension (or intersections of dimensions) that has a tolerance and not just a maximum or minimum (such as the edges of the robotic handling flange).

6.13 *Carrier ID Exclusion Volume* — Volume external to the pod which must remain free from intrusion to accommodate a carrier ID label or tag mounted on the pod. No obstructions should exist in the carrier ID exclusion

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volume as defined by x147, y137, y138, z180, and z181. Figures 1 and 3 show dimensions for the carrier ID exclusion volume. Table 2 defines the dimensions for the carrier ID exclusion volume. If a label is used, its surface must be at y139.

6.14 *Conveyor Rails* — Optional surfaces on the bottom for transporting the RSP on roller conveyors. The conveyor rail surfaces are bounded by x140, x141, x142, y140, y141 and y142 as shown in Figure 9. The height of the conveyor rail surface is defined by z171. Table 2 defines the dimensions for the conveyor rails.

7 Related Documents

7.1 *SEMI Standards*

SEMI E15 — Specification for Tool Load Port

SEMI P1 — Specification for Hard Surface Photomask Substrates

SEMI P33 — Provisional Specification for Develop-mental 230 mm Square Hard Surface Photomask Substrates

SEMI S8 — Safety Guidelines for Ergonomics Engineering of Semiconductor Manufacturing Equipment

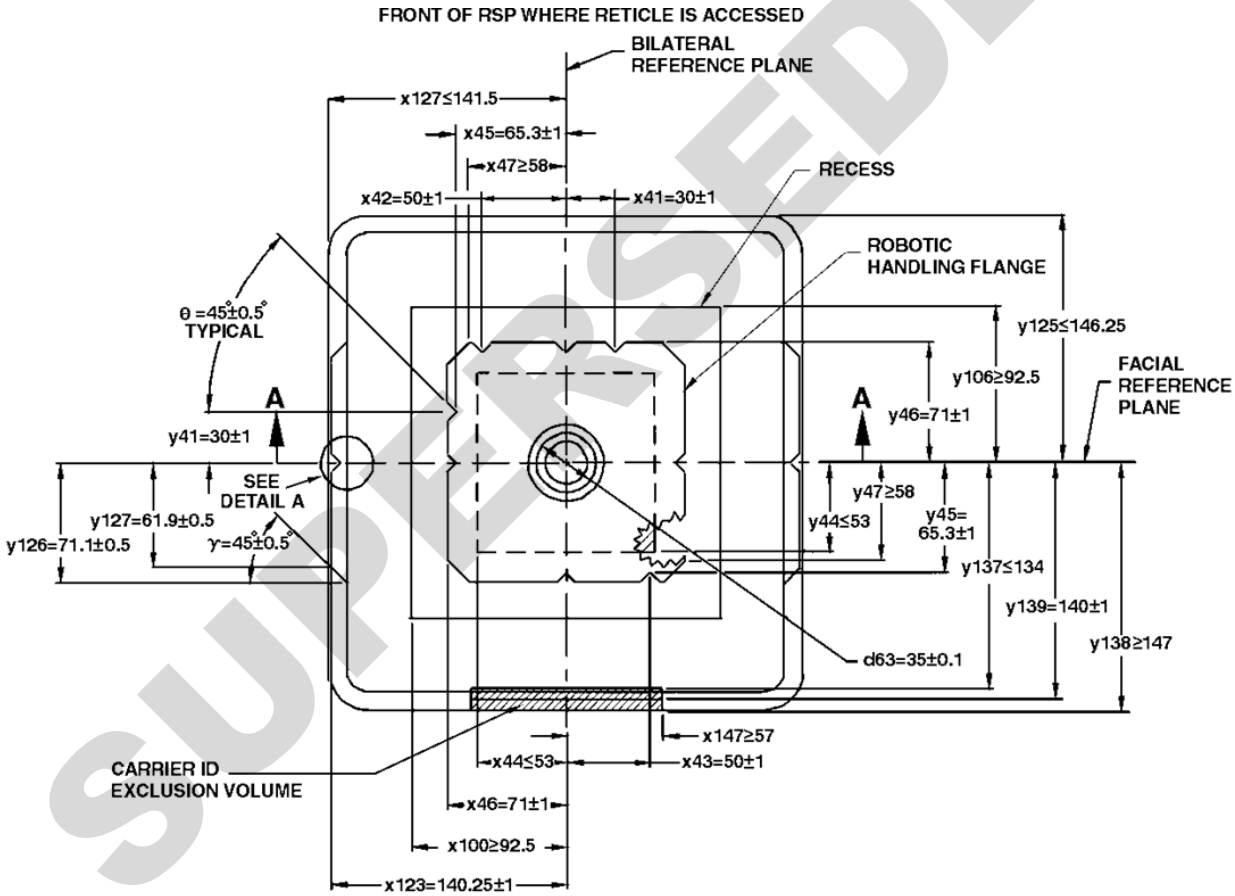

Figure 1
External Top View of 230 mm and 6 inch RSP

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