SEMI E62-0999
PROVISIONAL SPECIFICATION FOR 300 mm FRONT-OPENING INTERFACE MECHANICAL STANDARD (FIMS)

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1 Purpose

1.1 This Standard specifies the tool side of the interface between a process or metrology tool and a front-opening box used to transport and store 300 mm wafers (which may or may not be in removable cassettes) in an IC factory.

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. Only the physical interface is specified; no materials requirements or micro-contamination limits are given. The interface specified in this Standard can be for a sealed mini-environment, but it could also just be a well-defined automation interface.

2.2 This Standard is provisional because the front-opening interface is a new technology. Once interface testing is done, this Standard should be modified and upgraded from provisional status.

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 and Safety Guidelines*

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

SEMI E15 — Specification for Tool Load Port

SEMI E19 — Standard Mechanical Interface (SMIF)

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

3.2 *ISO Standard*[1]

ISO 4287 — Geometrical Product Specifications (GPS) — Surface Texture: Profile Method – Terms, Definitions and Surface Texture Parameters

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

4 Terminology

4.1 *Definitions*

4.1.1 *bilateral datum plane* — a vertical plane that bisects the wafers and that is perpendicular to both the horizontal and facial datum planes (as defined in SEMI E57).

4.1.2 *box* — a protective portable container for a cassette and/or substrate(s) (as defined in SEMI E44).

[1] 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

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4.1.3 *carrier capacity* — the number of substrates that a carrier holds (as defined in SEMI E1.9).

4.1.4 *cassette* — an open structure that holds one or more substrates (as defined in SEMI E44).

4.1.5 *door seal zone* — a surface on the exterior side of the port door for sealing to the box door.

4.1.6 *facial datum plane* — a vertical plane that bisects the wafers and that is parallel to the front side of the carrier (where wafers are removed or inserted). On tool load ports, it is also parallel to the load face plane specified in SEMI E15 on the side of the tool where the carrier is loaded and unloaded (as defined in SEMI E57).

4.1.7 *frame seal zone* — a surface on the exterior side of the frame of the port door for sealing to the frame of the box door.

4.1.8 *horizontal datum plane* — a horizontal plane from which projects the kinematic-coupling pins on which the carrier sits. On tool load ports, it is at the load height specified in SEMI E15 and might not be physically realized as a surface (as defined in SEMI E57).

4.1.9 *load face plane* — the furthest physical vertical boundary plane from the cassette centroid or carrier centroid on the side (or sides) of the tool where loading of the tool is intended (as defined in SEMI E15).

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

4.1.11 *pod* — a box having a Standard Mechanical Interface (SMIF) per SEMI E19 (as defined in SEMI E44).

4.1.12 *wafer carrier* — any cassette, box, pod, or boat that contains wafers (as defined in SEMI E15).

5 Requirements

5.1 *Datum Planes* — The physical alignment mechanism from the box to the tool load port consists of features (not specified in this Standard) on the box that mate with three or six pins underneath as defined in SEMI E57. Most of the dimensions of the interface from the box to the tool load port are determined with respect to the three orthogonal datum planes defined in that Standard: the horizontal datum plane, the facial datum plane, and the bilateral datum plane. However, the dimensions in this Standard do not apply when the box is placed on the load port, but rather when the box has been moved horizontally into place against the front-opening interface. Otherwise, the front-opening interface would interfere with the kinematic coupling during loading, and the minimum rear clearance in SEMI E15 would be violated.

5.2 *Symmetry* — All of the dimensions for the interface are bilaterally symmetric about the bilateral datum plane and about a plane *z*30 above the horizontal datum plane with the following exceptions (as viewed by a person standing in front of the tool and facing the interface):

- The registration pins are in the lower right and upper left quadrants of the port door.
- The areas reserved for purge ports are in the upper right and lower left quadrants of the port door.
- Both latch keys turn 90° counter-clockwise from vertical to unlatch the box door from the box.

5.3 *Door Alignment Mechanism* — The two registration pins that align the box door to the port door are shown in Figures 1 and 2 and specified in Table 1. The over-all surface finish of the registration pins must have a final roughness height less than or equal to *r*47. The registration pins are surrounded by reserved space for vacuum application (not required).

5.4 *Purge Ports* — Opposite the registration pins are reserved areas for optional purge ports (not yet specified) where inert gases may be pumped into and out of the box.

5.5 *Locking Mechanism* — The box door is locked and unlocked by a set of two 13.5 mm by 5 mm heads on shafts that have a 5 mm diameter. These latch keys must unlatch the box door from the box by rotating counter-clockwise to horizontal and must latch the box door to the box by rotating clockwise to vertical (as viewed by a person standing in front of the tool facing the interface). The latch keys must not rotate beyond these limits of the rotation angle ψ. To allow seal compression by latches, the torque delivered by the port to turn the latch keys must be at least *f*30. Thus, it is recommended that no box door be designed that needs more torque than this. Figure 3 shows front, side and top views of the latch keys. In addition to the dimensions shown in Figure 3 and Table 1, all required convex features on the latch keys must have a blend radius of *r*41 to prevent small contact patches with large stresses that might cause

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wear and particles. The over-all surface finish of the latch keys must have a final roughness height less than or equal to *r*47.

5.6 *Seal Zones* — On the exterior side of the port (at a distance *y*33 from carrier facial datum plane) must be two areas for sealing to the box. It is recommended that boxes be designed with flat areas opposite these seal zones. The door seal zone must be just inside the rim of the port door in the area between *x*32 and *x*33 from the facial datum plane and between *z*32 and *z*33 from the vertical center line of the port (which is *z*30 above the facial datum plane). Similarly, the frame seal zone must be on the frame of the port door in the area between *x*34 and *x*35 from the facial datum plane and between *z*34 and *z*35 from the vertical center line of the port. The inner seal zone should be no closer to, and not more than *y*34 farther from, the facial datum plane than the point on the outer seal zone nearest the facial datum plane.

5.7 *Inner and Outer Radii* — All required concave features may have a radius of up to *r*45 to allow cleaning and to prevent contaminant build-up. All required convex features may also have a radius of up to *r*46 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 interface supplier. Note also that this radius applies to every required feature unless another radius is called out specifically.

5.8 *Force Between Box and Port* — It is recommended that the box be pressed to the FIMS interface with a force no greater than *f*33. It is recommended that the force be as small as possible.

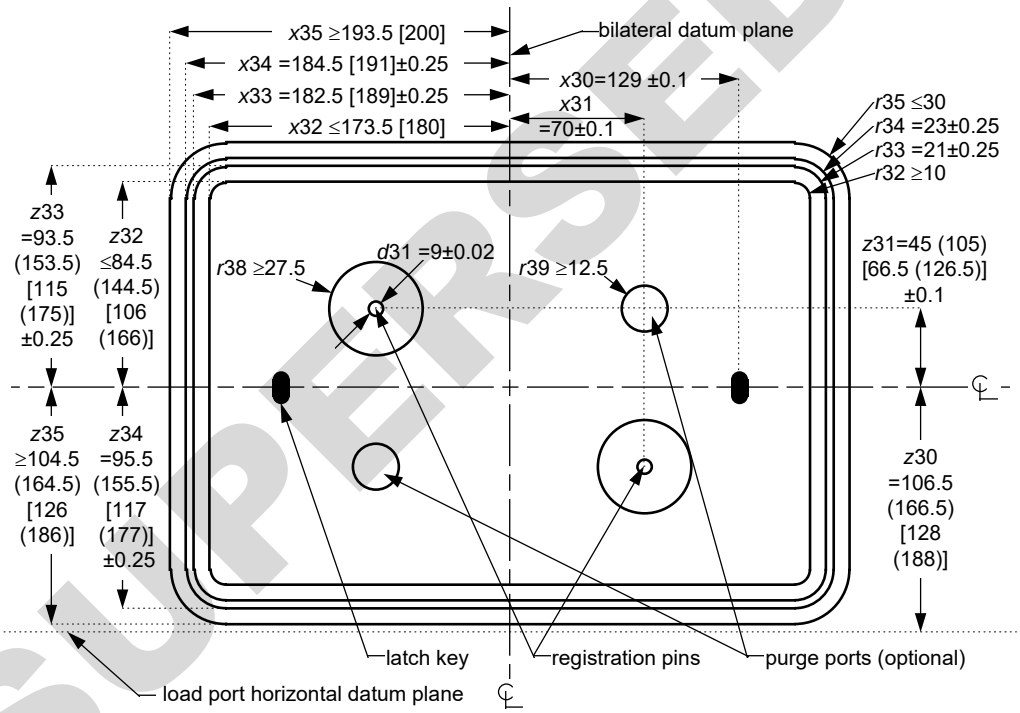

Figure 1
Dimensions for Front-Opening Interface

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