SEMI E63-0200
PROVISIONAL MECHANICAL SPECIFICATION FOR 300 mm BOX OPENER/LOADER TO TOOL STANDARD (BOLTS-M) INTERFACE

This provisional specification was technically approved by the Global Physical Interfaces & Carriers Committee and is the direct responsibility of the North American Physical Interfaces & Carriers Committee. Current edition approved by the North American Regional Standards Committee on September 3, 1999. Initially available on SEMI OnLine December 1999; to be published February 2000. Originally published in 1997, previously published September 1999.

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1 Purpose

1.1 This standard specifies the tool side of the mechanical interface between the main part of a process or metrology tool and the component that opens boxes and presents the boxes to the tool wafer handler for unloading and loading 300 mm wafers. The box opener/loader unit would include one or more load ports (that would conform to SEMI E15.1) as well as storage capacity for empty boxes or waiting lots (if needed by the tool throughput). The box opener/loader unit might not only be configured to handle boxes (that would conform to SEMI E47.1, SEMI E62, or SEMI E19.5) but also to open cassettes (that would conform to SEMI E1.9). This standard defines one interface for all such carriers and for any carrier capacity (13 and 25 wafers).

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 mechanical interface is specified; no materials requirements or micro-contamination limits are given. The interface specified in this standard is designed for a tool with a sealed minienvironment, but it could also just be a well-defined automation interface. This interface is not intended to provide high repeatability or rapid removal (both of which can be provided by other couplings in the box opener/loader unit). This specification also does not apply when load ports are stacked one on top of the other. This specification does not apply when inserting open cassettes into load-lock chambers directly.

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.

2.3 This standard does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

3 Referenced Standards

3.1 *SEMI Standards*

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

SEMI E15 — Specification for Tool Load Port

SEMI E15.1 — Provisional Specification for 300 mm Tool Load Port

SEMI E19 — Standard Mechanical Interface (SMIF)

SEMI E19.5 — Specification for 300-mm Bottom-Opening 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

SEMI E62 — Provisional Specification for 300 mm Front-Opening Interface Mechanical Standard (FIMS)

3.2 *ISO Specification* [1]

ISO/DIS 68-1 — ISO General Purpose Screw Threads – Basic Profile – Part I: Metric Screw Threads

NOTE 1: As listed or revised, all documents cited shall be the latest publications of adopted standards.

4 Terminology

4.1 *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).

1 This ISO specification is available from ANSI: American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036

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4.2 *BOLTS plane* — a plane parallel to the facial datum plane near the front of the tool where the box opener/loader is attached.

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

4.4 *box opener/loader* — the equipment component that opens wafer carriers (if needed) and presents the carriers to the equipment's wafer handler for unloading and loading wafers.

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

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

4.7 *equipment front end module (EFEM)* — consists of the carrier handler that receives carriers from the factory material handling system on one or more load ports (as specified in *SEMI E15.1*), opens the carriers (if needed), and may include a substrate handler for unloading and loading wafers from the carrier to the process part of the equipment.

4.8 *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).

4.9 *horizontal datum plane* — a horizontal plane from which project 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).

4.10 *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).

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

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

4.13 *seal zone* — a surface on the tool at the BOLTS plane for sealing to the box opener/loader.

4.14 *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 for the box consists of features (not specified in this standard) on the box that mate with three or six pins underneath as defined in SEMI E57. Many of the dimensions of the BOLTS interface 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. The BOLTS plane is defined to be parallel to and at a distance *y*70 from the facial datum plane of the carrier (when the carrier is docked and in position for wafer extraction and insertion). If the carrier is rotated after being placed on the loadport, the facial datum plane of the carrier and the BOLTS plane may no longer be parallel to the load face plane of the equipment. If the carrier is not rotated, the distance (called the docking stroke) between the facial datum plane when the carrier is placed on the loadport (undocked) and the facial datum plane when the carrier is in position for wafer extraction and insertion (docked) must be *y*76 (but this is only a requirement for equipment delivered in the year 2000 or later). The tolerance on *y*70 is the installation tolerance. The cycle-to-cycle repeatability on *y*70 (without replacing the box opener/loader unit) must be within *y*75.

5.2 *Symmetry* — All of the dimensions for the interface are bilaterally symmetric about the bilateral datum plane. These dimensions are shown in Figure 1 and specified in Table 1.

5.3 *Hole Opening* — The BOLTS interface consists of a hole in the front of the tool at the BOLTS plane, a seal zone surrounding the hole, six threaded holes for bolting on the box opener/loader, reserved spaces for the box opener/loader inside the tool from the hole, and an exclusion volume for the box opener/loader outside of the hole. The dimensions of the hole are defined by *x*71, *z*71, and *z*76.

5.4 *Seal Zone* — On the BOLTS plane surrounding the hole opening must be a flat area for sealing between the tool and the box opener/loader. The inner dimensions of the seal zone are the same as the hole opening, and the outer dimensions of the seal zone are defined by *x*72, *z*72, and *z*77. The flatness of the seal zone must be within *y*71, and the perpendicularity of the seal zone to the facial and horizontal datum planes must be within σ.

5.5 *Bolt Holes* — At six points on the BOLTS plane there must be threaded holes for bolting on the box opener/loader. The opening of the threaded holes must be within the flatness of the seal zone (*y*71), and the holes must be at least *y*73 deep. The internal threads must conform to the ISO/DIS 68-1 specification which

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