SEMI E15.1-0200A
PROVISIONAL SPECIFICATION FOR 300 mm TOOL LOAD PORT

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1 Purpose

1.1 This specification defines dimensional requirements for the load ports of 300 mm wafer process and inspection equipment. It is intended to promote a uniform physical interface between equipment and the factory, to facilitate the use of automated wafer carrier transport systems, and/or to meet ergonomic requirements for manually loaded equipment.

2 Scope

2.1 This is a provisional standard covering 300 mm equipment only. Similar requirements covering equipment for 200 mm wafers and smaller are covered in SEMI E15. The provisional status is dictated by the immaturity of designs for 300 mm equipment and additional specifications may yet be defined.

2.2 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 Limitations

3.1 This standard is not met by direct loading/unloading of vacuum load locks. Requirements of such interfaces may differ from those in this document.

4 Referenced Standards

4.1 *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 E19.5 — Specification for 300 mm Bottom-Opening Standard Mechanical Interface (SMIF)

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)

SEMI E84 — Specification for Enhanced Carrier Handoff Parallel I/O Interface

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

5 Terminology

See SEMI E15.

6 Ordering Information

6.1 Per Section 6 of SEMI E15, except for Sections 6.1.3 and 6.1.4. Also, the user must specify which of the three options (defined in Section 7.5) is required for each load port, and whether a cover is needed over the exclusion volume for photo-coupled I/O interfaces (defined in Section 7.8).

7 Requirements

7.1 The dimensional requirements for the load port of a tool are given in Table 1 with reference to the figures in this document. Although the carrier transport systems shown in these figures appear similar to overhead monorails, they are intended to represent any type of transport system (AGV, PGV, conveyor, overhead track, etc.).

7.2 The dimensional requirements for the placement of a wafer carrier on the load port are given in Table 1 with reference to the figures of this document. The carriers shown in these figures are intended to represent any type of carrier (cassette or box).

7.3 The wafers are to be oriented horizontally face up with zero nominal tilt at the time they are placed on the load port. The tolerance in the horizontal plane is determined by the registration and alignment feature between the carrier and the load port, as specified in SEMI E57.

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7.3.1 The carrier shall be loaded and unloaded with its front parallel to and away from the load face plane (see Figure 1).

7.4 Dimension H is nominally 900 mm, fully adjustable at installation over the range of 890 to 910 mm. The precision with which the load port height must be maintained is dictated by the needs of the carrier delivery system.

7.5 As shown in Figure 3, the maximum allowable height of an obstruction on the load port over which the carrier must be lifted (before being set down on the kinematic couplings) is H1. Examples of such obstructions include alignment devices and identification tag readers as well as the kinematic couplings themselves. Below H1 above the horizontal datum plane, clearances C1 and C2 no longer apply.

7.5.1 Two exclusion volumes on the left and right side of the load port must also be kept clear so that fork-lifts or conveyors may be used. Each exclusion volume extends from the load face plane to D0 beyond the facial datum plane and extends H0 below the horizontal datum plane between W1 and W2 from the bilateral datum plane. Although the carrier shown in Figure 3 is an open cassette, these exclusion volumes are also required on load ports that are configured with a FIMS interface (conforming to SEMI E62) for front-opening boxes. However, these exclusion volumes are not required on load ports that are configured for bottom-opening (SMIF) pods, because SEMI E19.5 already defines that part of the load port.

7.5.2 A load port that advances the carrier from the undocked position (where the carrier is initially delivered to the load port) to the docked position (where the carrier is ready for wafer extraction or insertion) must reserve an exclusion volume that is intended for (but not limited to) containing automated units that read or write to an ID tag on the rear of a carrier in the *undocked* position (where the carrier is initially delivered to the load port). This exclusion volume extends W4 to either side of the bilateral datum plane and between D3 and D4 from the facial datum plane. When the load port is in the correct position to read or write to the ID tag, the exclusion volume must extend from the carrier down to H3 plus H4 below the horizontal datum plane. When the load port is in a different position, the volume from the carrier down to H3 below the horizontal datum plane may be occupied temporarily. The value of H3 is at the load port supplier's choice. As a result, reader/writer units (for this exclusion volume) must fit in a space no taller than H4, no wider than 2 times W4, and no deeper than D4 minus D3. If no reader/writer unit is installed, the exclusion volume may be covered by a panel. See Table 2 for dimensions of this exclusion volume.

7.5.3 Also, the load port must reserve another exclusion volume that is intended for (but not limited to) containing automated units that read or write to an ID tag on the rear of a carrier in the *docked* position (where the carrier is ready for wafer extraction or insertion). In this case, dimensions D3′, D4′, and W4′ are measured with respect to the datum planes defined by the kinematic couplings in the docked position (unlike all other use of datum planes in this standard). The distance between these two sets of datum planes (in the docked vs. undocked position) is not defined, and if the carrier is rotated during the advance motion, the two facial (or bilateral) datum planes will not be parallel. At the load port supplier's choice, the reader/writer unit in this exclusion volume may be mounted either on the advance mechanism of the load port (so it is very close to the carrier and it moves with the kinematic couplings) or below the advance mechanism (so it is farther from the carrier, is stationary, and may be covered temporarily by the advance mechanism). Again, this exclusion volume extends W4′ to either side of the bilateral datum plane and between D3′ and D4′ from the facial datum plane. When the load port is in the correct position to read or write to the ID tag, the exclusion volume must extend from the carrier down to H3 plus H4 below the horizontal datum plane. When the load port is in a different position, the volume from the carrier down to H3 below the horizontal datum plane may be occupied temporarily. The value of H3 is at the load port supplier's choice. As a result, reader/writer units (for this exclusion volume) must fit in a space no taller than H4, no wider than 2 times W4′, and no deeper than D4′ minus D3′. If no reader/writer unit is installed, the exclusion volume may be covered by a panel. See Table 2 for dimensions of this exclusion volume.

7.5.4 A load port that is configured for open cassettes (with bar-code ID tags on the bottom) or for FOUPs (with bar-code ID tags on the rear) must provide the appropriate exclusion volume a bar-code reader defined in Table 2.

7.6 As shown in Figure 2, tool load ports must conform to one of the following configuration options. If no option is specified, Option 1 is assumed.

7.6.1 In Option 1, the load port must nominally be at 900 mm, and it must be open from above to facilitate automatic carrier delivery from an overhead transport system. The open volume required for vertical delivery is defined by a projection of the tool load port area, including the area required for C1 and C2 clearances, projected upward to the top of the tool. Note that this condition need only be met when the tool is being loaded. For example, the load port may be formed by a surface that extends outward during loading to provide overhead access.

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7.6.2 In Option 2 (which allows faster automatic carrier delivery from an overhead transport system), the horizontal datum plane of the load port may be at any height above H that leaves the top of the carrier under H2, but it must be open from above.

7.6.3 In Option 3 (which allows bulkhead mounting of tools with fan/filter units at C3), the load port must nominally be at 900 mm, and it must have a clearance C3 above the maximum height of the carrier.

7.7 Clearances C1, C2, and C3 are defined with respect to the maximum dimensions of the carrier (defined in SEMI E47.1 for a box or in SEMI E1.9 for an open cassette), not to the rectangular wafer carrier envelope (defined in SEMI E15). To prevent interference between transport systems on the same or adjacent load ports, it is recommended that floor-based transport vehicles not exceed clearances C2 and C3 and overhead hoist vehicles not exceed clearance C2 when picking up or placing a carrier on the load port.

7.8 Dimension S specifies the recommended minimum spacing between cassette/wafer carrier centroids. In any case, if S violates C1, then C1 prevails. As shown in Figure 1, below each load port must be an exclusion volume (defined by dimensions D7, D8, H7, H8, and W8) for photo-coupled I/O interfaces to floor-based transport vehicles. This exclusion volume is centered on the bilateral datum plane, but its distance behind the load face plane may vary between zero and the upper limit on D7. If no photo-coupled I/O interfaces unit is installed, the exclusion volume may be covered by a panel. If a photo-coupled I/O device is installed, the center of its horizontal beam line must be within W9 of the bilateral datum plane and within H9 of a point H7 above the floor. On each tool, load ports are numbered in increasing order (beginning with 1) from left to right (as seen by a person facing the load face plane) beginning with load ports that are nominally at 900 mm (Option 1 or Option 3) and then continuing (from left to right) with any load ports that are higher (Option 2).

7.9 To add clearance for overhead carrier transport, no part of the tool in front of the plane defined by C2 may be higher than H2 from the floor. The volume below H2 may contain carriers stored in an internal buffer by the tool.

7.10 If the tool occupies the space behind the load port and above any interface to the carrier, then the front of that upper part of the tool (shown as the equipment boundary in Figure 1) must be at a distance D1 from the facial datum plane. This equipment boundary is parallel to the load face plane, and carriers may be moved or rotated below this surface after loading.

7.11 If the load port provides the option to use roller conveyors for carrier loading, the conveying surface of the rollers must be H5 above the horizontal datum plane (as shown in Figure 3) at the time of carrier loading or unloading. When not in use, the conveyors must be lowered below H0 under the horizontal datum plane.

7.12 *Dimension Definitions* — See SEMI E15 for applicable definitions.

8 Related Documents

8.1 *SEMI Standards*

SEMI E63 — Provisional Mechanical Specification for 300 mm Box Opener/Loader to Tool Standard (BOLTS-M) Interface

SEMI E64 — Provisional Specification for 300 mm Cart to SEMI E15.1 Docking Interface Port

SEMI E72 — Provisional Specification and Guide for 300 mm Equipment Footprint, Height, and Weight

SEMI M31 — Provisional Mechanical Specification for Front-Opening Shipping Box Used to Transport and Ship 300 mm Wafers

NOTE 2: As listed or revised, all documents cited shall be the latest publications of adopted standards.

Table 1 Dimensional Requirements for 300 mm Load Ports

Dimension	*Application*	*Value, mm (in.)*	*Notes*
C1	minimum	75 (3.0)	
C2	minimum	30 (1.2)	
C3	minimum	150 (5.91)	
D	range	250 +0/-10 (9.8 + 0 – 0.4)	
D0	minimum	110 (0.59)	
D1	range	200 + 10 – 4 (7.9 +0.4/-0.2)	
D7	maximum	450 (17.72)	
D8	minimum	30 (1.18)	

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Dimension	*Application*	*Value, mm (in.)*	*Notes*
H	nominal	900 (35.4)	(See NOTE 1.)
H0	minimum	15 (5.12)	
H1	maximum	25 (1.0)	
H2	maximum	2600 (102.4)	
H5	Range	33 ± 1 (1.30 ± 0.04)	height of roller conveyors
H7	nominal	250 (9.84)	center of optical beam line
H8	minimum	50 (1.97)	
H9	maximum	12 (0.47)	tolerance on photo-coupled I/O device beam line
S	minimum	420 (16.5)	open cassette (SEMI E1.9) only
		475 (18.7)	box (SEMI E47.1) without manual side handles
		505 (19.9)	box (SEMI E47.1) with manual side handles
W1	maximum	130 (5.12)	
W2	minimum	205 (8.07)	
W8	minimum	100 (3.94)	
W9	maximum	22 (0.87)	tolerance on photo-coupled I/O device beam line

NOTE 1: This value is ergonomically compatible with the proposed 13 wafer carriers and may not be ergonomically compatible with the proposed 25 wafer carriers. Such carriers may require assisted loading. H to be fully adjustable at installation over the range of 890 to 910 mm (35 to 35.8 inches).

Table 2 Required Exclusion Volume Dimensions for Carrier ID Reader/Writer Units

	Load Port Type			
Carrier Type (See NOTE 1.)	FOUP (SEMI E47.1) only	FOUP (SEMI E47.1) only	FOUP (SEMI E47.1) only	open cassette (SEMI E1.9) only
Carrier ID Type (See NOTE 1.)	electronic (read/write)	electronic (read/write)	bar-code (read only)	bar-code (read only)
Carrier Position (See NOTE 1.)	docked	undocked	undocked	not applicable
Dimension	mm (in.)	mm (in.)	mm (in.)	mm (in.)
D3 or D3′	D3' = 165 (6.50) max.	D3 = 190 (7.48) max.	D3 = 190 (7.48) max.	D3 = 136 (5.35) max.
D4 or D4′	D4' = 205 (8.07) min.	D4 = 235 (9.25) min.	D4 = 240 (9.45) min.	D4 = 230 (9.06) min.
H3	0 min. 75 (2.95) max.	15 (0.59) min. 36 (1.42) max.	0 min. 0 max.	0 min. 0 max.
H4	H4 = 30 (1.18) min.	H4 = 80 (3.15) min.	H4 = 80 (3.15) min.	H4 = 150 (5.91) min.
W4 or W4′	W4' = 35 (1.38) min.	W4 = 75 (2.95) min.	W4 = 75 (2.95) min.	W4 = 75 (2.95) min.

NOTE 1: Automated units to read or write to an ID tag, which are mounted in one of the exclusion volumes as defined by this standard, are not limited to be used on load ports in the Carrier Position, for the Carrier ID type or Carrier type indicated by this table.

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