

SEMI E15-0698^{E2} (Reapproved 1016) SPECIFICATION FOR TOOL LOAD PORT

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NOTICE: This Document was reapproved with minor editorial changes.

1 Purpose

1.1 This Standard is intended to unify the interface between process/inspection tools and automated wafer carrier transport systems while maintaining compatibility with human transport.

2 Scope

2.1 This Specification deals with the mechanical interface (load port) for wafer carrier transfer between wafer carrier material transport systems, including humans, and wafer fabrication/inspection equipment (tools). The concept defines the placement and orientation of a wafer carrier on a tool to allow reasonable interfacing with mechanized material movement systems without compromising human access to perform the material exchange function.

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3 Impact

3.1 Compliance with this Specification requires the placement of load ports on tools to specific heights, orientations, and load depths. Restrictions are also placed on clearances to obstructions which may be adjacent to such ports.

4 Referenced Standards and Documents

4.1 SEMI Standards and Safety Guidelines

SEMI E1 — Specification for Open Plastic and Metal Wafer Carriers

SEMI E19 — Standard Mechanical Interface (SMIF)

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

5 Terminology

5.1 Definitions

5.1.1 *box* — a protective portable carrier for a cassette and/or substrate(s).

5.1.2 *cassette* — an open structure that holds one or more substrates.

5.1.3 *cassette centroid* — a datum representing the theoretical center of a stack of wafers in a cassette formed by the pocket centerline and the ‘center’ pocket as defined by the location associated with dividing dimension B3 by two (see SEMI E1, Figure 1).

5.1.4 *cassette envelope* — a rectangular volume with vertical sides which completely contains a cassette, even if the cassette is tilted (see Figure 1).

5.1.5 *enclosed load port* — a load port with overhead clearance obstructed by the tool.

5.1.6 *global orientation* — the general orientation of a wafer carrier in a tool; may be vertical or horizontal.

5.1.7 *load depth* — the horizontal distance from the load face plane to cassette centroid or carrier centroid (see Figures 2 and 3 [D]).

5.1.8 *load face plane* — the furthest physical vertical boundary plane from cassette centroid or carrier centroid on the side (or sides) of the tool where loading of the tool is intended (see Figures 2 and 3).

5.1.9 *load height* — the distance from the bottom of the cassette or carrier to the floor at the load face plane (see Figure 3 [H]).

5.1.10 *load port* — the interface location on a tool where wafer carriers are delivered. It is possible that wafers are not removed from, or inserted into, the carrier at this location.

5.1.11 *open load port* — a load port with overhead clearance unobstructed by the tool.

5.1.12 *pod* — a box having a Standard Mechanical Interface (SMIF) per SEMI E19.

5.1.13 *spacing* — the minimum spacing between centroids (see Figure 2, S).

5.1.14 *tool* — any piece of semiconductor fabrication or inspection equipment designed to process wafers delivered in wafer carriers.

5.1.15 *tilt* — a small angle of offset from the normal horizontal or vertical orientation of a cassette or wafer carrier designed to preferentially align or keep wafers in their intended place within the carrier/cassette (see Figure 1, T).

5.1.16 *wafer carrier* — any cassette, box, pod, or boat that contains wafers.

5.1.17 *wafer carrier centroid* — a datum representing the theoretical location of the center of a stack of wafers in the carrier.

5.1.18 *wafer carrier envelope* — a rectangular volume with vertical sides which completely contains a carrier, even if the carrier is tilted (see Figure 1).

5.2 Description of Terms Specific to this Standard

5.2.1 *carrier* — wafer carrier.

6 Ordering Information

6.1 The following items require communication between the tool supplier and user and shall be included in any request for quotation, quotation, or purchase order:

6.1.1 If the tool has multiple load ports, provide the spacing, S, between carrier centroids (see ¶ 7.8).

6.1.2 Specify what carrier (e.g., SEMI Standard cassette, pod) is to be accommodated by the load port.

6.1.3 Specify whether the load port is open or enclosed.

6.1.4 Specify whether the wafer orientation is horizontal (per ¶ 7.3.1) or vertical (per ¶ 7.3.2).

7 Requirements

7.1 The dimensions for the placement of a wafer carrier on the load port of a tool are given in Table 1.

7.2 This Standard is based upon the concept that any wafer carrier can be used. Dimensions are usually specified as clearances to wafer carrier envelopes (see envelope concept in Figure 1).

7.3 The global orientation of the cassette or wafer carrier is constrained to be parallel or perpendicular to the load face plane. Allowable cassette orientations are:

7.3.1 For wafers horizontal, the opening of the cassette must be opposite the load face plane, and the front surface of the wafer must face up (see Figure 4);

7.3.2 For wafers vertical, the opening of the cassette must face up, and the front surface of the wafer must face the load face plane (see Figure 5).

7.3.3 This requirement also applies to cassettes in pods.

7.4 The maximum tilt is 10 degrees.

7.5 The load height is specified as follows (see Figure 3):

7.5.1 Dimension H is 900 mm (~35.4 in.), fully adjustable over ± 10 mm (~0.4 in.).

7.6 The maximum height above H of an obstruction between the load face plane and the carrier envelope (such as for an alignment device or identification tag reader) is 50 mm (~2 in.) (see Dimension H1 in Figure 3).

7.7 Clearances (C1, C2, and C3) are defined with respect to the largest carrier envelope required. For cassettes, envelopes are defined using cassette dimensions from SEMI E1. For pods or other wafer carriers, envelopes are defined using the carrier standard (if any) or the carrier manufacturer's specifications (see Figure 1 for concept and Figures 2 and 3 for use).

7.8 Dimension S specifies the recommended minimum spacing between cassette/wafer carrier centroids. In any case, if S violates clearance C1 in any application, then C1 prevails (see Figure 2).

7.9 Tools with enclosed load ports shall have a minimum vertical clearance, C3, above the cassette or carrier at the load port. Open load ports shall have a vertical clearance above the load port which is unrestricted by the tool.

Table 1 Dimension Requirements, mm (in.)

<i>Dimension</i>	<i>Application</i>	<i>Value, mm (in.)</i>	<i>Notes</i>
C1	minimum	75 (3)	
C2	minimum	30 (1.2)	
C3	minimum	225 (9)	#1
D	maximum	250 (9.8)	
H	range	900 (35.4) ± 10 (0.4)	#2
H1	maximum	50 (2.0)	
S	≤150 mm carriers 200 mm carriers	350 (13.8) 400 (15.7)	See ¶ 7.8.
T	maximum	10 degrees	

#1 Applies to tools with enclosed port; otherwise, clearance above the port must be unrestricted by the tool (see § 5.8).

#2 Fully adjustable over ±10 mm (~0.4 in.) range.

Table 2 Dimension Definitions

<i>Dimension</i>	<i>Description</i>
C1	Minimum side clearance between one carrier envelope and another, or to vertical obstruction.
C2	Minimum rear clearance from carrier envelope to vertical obstruction.
C3	Minimum clearance above carrier envelope to horizontal obstruction on the tool.
D	Maximum load depth to carrier centroid.
H	Allowable load height to bottom of carrier envelope.
H1	Maximum height of horizontal obstruction above load height between load face plane and carrier envelope.
S	Recommended minimum spacing between carrier centroids.
T	Maximum cassette or wafer carrier tilt.