SEMI E22-0697 (Reapproved 1102)
CLUSTER TOOL MODULE INTERFACE: TRANSPORT MODULE END EFFECTOR EXCLUSION VOLUME STANDARD

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1 Purpose

1.1 The purpose of the standard is to provide sufficient detail to allow the transport module end effector to move wafers to and from process and cassette modules in a cluster tool without mechanical interference.

2 Scope

2.1 The standard describes the volume within any process or cassette module which shall be accessible to the transport module end effector in a cluster tool. The standard is limited to modules which accommodate wafer sizes from 100 mm up to and including 200 mm in diameter.

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 Impact

3.1 The adoption of the standard requires equipment designers to allow specific unobstructed volumes within process and cassette modules for wafer transport and places restrictions on the design of the transport module end effector. Some restrictions are dependent on the wafer size.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI E1 — Specification for 3 inch, 100 mm, 125 mm, and 150 mm Plastic and Metal Wafer Carriers

SEMI E21 — Cluster Tool Module Interface: Mechanical Interface and Wafer Transport Standard

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

5 Terminology

5.1 *Definitions*

5.1.1 *exclusion zone* — a restricted area within a process or cassette module reserved for access by the transport module end effector during wafer handling.

5.1.2 *fork* — a two-prong transport module end effector designed to hold the wafer around its periphery.

5.1.3 *paddle* — a blade transport module end effector designed to support the wafer.

5.1.4 *pedestal* — a support pillar axially symmetric to the wafer transport position in a process or cassette module.

5.1.5 *slot* — a two-sided support, for example as defined for a standard wafer carrier in SEMI E1 when the carrier is oriented with its axis in a vertical attitude.

5.1.6 *transport module end effector* — that part of the transport module that supports the wafer and can extend beyond the interface plane (defined in SEMI E21).

5.1.7 *wafer support platform* — a slot, pedestal, or set of pins used to hold a wafer in a horizontal attitude.

5.1.8 *wafer transport axis* — the centerline of transport module end effector motion. This centerline is symmetric with the wafer transport zone as described in SEMI E21.

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5.1.9 *wafer transport position* — a location within a process or cassette module where the wafer is accepted or presented by the transport module end effector. This is also the location of the wafer centroid.

6 Requirements

6.1 *Wafer Transport* — The wafer is to be transported in a horizontal attitude (see Related Information, § R1-1).

6.2 *Wafer Transport Plane Exclusion Zone* — The exclusion zone is illustrated in Figure 1, and the variables are defined in Table 1 and specified in Table 2 (see Related Information, § R1-2). The clear areas between B and C and along the wafer transport axis are specified to allow the transport module end effector to be retracted after the wafer has been placed on the support platform in the process or cassette module. The right-hatched (////) area denotes the exclusion zone which could be occupied by a paddle. The left-hatched (\\\\) area denotes the additional exclusion zone which could be occupied by a fork. The cross-hatched (XXXX) area denotes the reduction in the dimensions of the paddle exclusion zone to accommodate a pedestal and or pin(s) in a process or cassette module (referred to as a pedestal or pin exclusion zone).

6.3 *Maximum Pedestal Diameter* — The diameter is not to exceed dimension H given in Table 2.

6.4 *Pin Location* — Wafer support pins to be located relative to the wafer transport plane exclusion zone. The pins are to be located at radii dependent upon wafer diameter as specified in Table 2.

6.5 *Vertical Plane Exclusion Zone* — The extent of the exclusion zone in the vertical plane is indicated by the hatched area and the dashed outline in Figure 2. The maximum extent of the exclusion zone allows the transport module end effector to clear the minimum wafer transport zone at the interface plane (see Related Information, § R1-3). The vertical plane exclusion zone is decreased in height in the vicinity of the wafer transport position to allow the presence of shields, electrodes, etc. in the process or cassette module.

6.6 *Transport Module End Effector Exclusion Volume* — The exclusion volume within a process or cassette module reserved for access by the transport module end effector is defined by the intersection of the two orthogonal exclusion zones described in ¶¶ 6.2 and 6.5. This exclusion volume allows the transport module end effector to accept or present a wafer at the wafer transport position within a process or cassette module (see Related Information, § R1-4).

7 List of Figures

7.1 *Figure 1* — Wafer Transport Plane Exclusion Zone (Plan View)

7.2 *Figure 2* — Vertical Plane Exclusion Zone (Elevation View)

Table 1 Wafer Transport Plane Exclusion Zone Variables

A	Maximum width of the wafer transport plane exclusion zone
B	Minimum outside clearance for support pins
C	Maximum inside clearance for support pins and/or slot
D	Minimum radial clearance for support pins
E	Outermost radius of wafer transport plane exclusion zone
F	Minimum clearance for entry into SEMI Standard Wafer Carrier
G	Maximum clearance for support pins
H	Maximum clearance for support pedestal

Table 2 Wafer Transport Plane Exclusion Zone Dimensions

Variables	*Wafer Size*			
	100 mm (4 in.)	*125 mm (5 in.)*	*150 mm (6 in.)*	*200 mm (8 in.)*
A	120 mm (4.72 in.)	145 mm (5.71 in.)	170 mm (6.69 in.)	220 mm (8.66 in.)
B	86 mm (3.39 in.)	107 mm (4.21 in.)	129 mm (5.08 in.)	172 mm (6.77 in.)

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