SEMI E19.4-0417
SPECIFICATION FOR 200 mm STANDARD MECHANICAL INTERFACE (SMIF)

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1 Purpose

1.1 A standard interface is required for containers intended to control the transport environment of cassettes containing substrates. The interface must address the proper container orientation for material transfer and maintain continuity between the container and equipment environment in order to control particulate matter.

2 Scope

2.1 This Specification describes one approach to interfacing a clean cassette transport box to a clean environmental housing on a piece of semiconductor processing equipment or to other clean environments. The system concept involves mating a door on a cassette container to a door on an equipment enclosure and transferring the cassette into, and out of, the equipment without exposing the cassette and substrates to outside contamination.

2.2 The incorporation of this Standard may require equipment designers to include the features of the interface into the tool design. Spacing between open cassette ports must be considered when incorporating this interface. Designers are directed to the specifications and recommendations made in SEMI E15 in this regard.

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 Limitations

3.1 This Standard is specific to 200 mm wafers. This Specification focuses on applications in which the interface port is positioned horizontally. The standard is focused exclusively on the box-to-canopy interface. Other considerations of box and equipment design are purposely excluded.

NOTE 1: Hewlett Packard has patent coverage for this concept and is offering nonexclusive licenses on an equal basis to any company. Companies intending to manufacture products to this standard should be aware of Hewlett Packard's position.

4 Referenced Standards and Documents

4.1 *SEMI Standards and Safety Guidelines*

SEMI E15 — Specification for Tool Load Port

SEMI E19 — Specification for Standard Mechanical Interface (SMIF)

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

5 Terminology

5.1 See Figure 1 for a pictorial depiction of most terms.

5.2 *Definitions*

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

5.2.2 *cassette* — an open structure that holds one or more substrates (wafers, masks, etc.).

5.2.3 *guide rail* — a component of a port plate that provides coarse location for placing the pod on the port assembly.

5.2.4 *hold-down latch* — a mechanism for locking the pod to the port plate.

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5.2.5 *latch pins* — pins that engage the pod door latch and accomplish the pod door lock/unlock functions. Latch pins are carried by the port door.

5.2.6 *pod* — a box having a Standard Mechanical Interface per SEMI E19.

5.2.7 *pod door* — a removable bottom for the pod that contains a means for properly positioning the cassette.

5.2.8 *pod latch* — a mechanical latch that holds the pod door to the pod until activated by the latch mechanism pins. Upon activation, the pod door is released from the pod.

5.2.9 *pod latch holes* — holes near the center of the pod door bottom which accept the latch pins.

5.2.10 *port assembly* — an assembly of the port plate and port door that includes the guide rails, registration pins, latch pins, and pod hold-down latches.

5.2.11 *port door* — a door for the port plate opening that provides a mating surface for the bottom of the pod door when the pod is in place on the port plate. The port door contains the registration pins and the pod door latch pins.

5.2.12 *port plate* — a horizontal mating surface for the base of the pod that provides a seal surface for the bottom surface of the pod perimeter. The port plate contains the guide rails and the pod hold-down latches.

5.2.13 *registration holes* — holes in the bottom of the pod door that fit over registration pins in the top of the port door when the pod is placed on the port door.

5.2.14 *registration pins* — pins that provide fixed position and orientation between the port door and pod door and assist in the final positioning of the pod on the port assembly. The registration pins fit into the registration holes in the bottom of the pod door.

6 Requirements

NOTE 2: The requirements and dimensions for the design of mechanical interface standard ports and pods are given in this section. See Table 1 for 200 mm (8 in.) Port Dimensions.

6.1 *Cassette Sizes* — All specifications are related to 200 mm wafers held in an appropriate cassette. It is understood that smaller diameter wafers and other substrates may be contained in pods which are compatible with this Standard.

6.2 *Port Design Requirements* — The general design of the port is shown in Figures 2 and 3. Design requirements for the interface components are provided in §§ 6.2.1 through 6.2.5.

6.2.1 *Port Door* — Dimensions A1 through A3 specify the port door top view. The gap between port door and port plate is not specified, but should be kept to a minimum distance to restrict particle movement.

6.2.2 *Pod Guide* — The inside distance of the corner guides of the port is specified by B1 and B2. The length of the corner is specified by B12. The corner guides may be connected by guide rails if desired.

6.2.3 *Latch Pins* — Two latch pins are located around the port door center. For location of the pins, see C1, C2, and C3.

6.2.4 *Registration Pins* — The three registration pins on the port door are located asymmetrically, and spaced by dimensions D1 through D4. The size of the pins is specified by D5 through D7.

6.2.5 *Pod* — The bottom surfaces of the pod body and pod door shall conform to the specified port dimensions. The upper part of the pod body and top surface of the pod door must fit and hold in place the cassette for 200 mm (8 in.) wafers. Although the pod dimensions are not explicitly specified by this Standard, the following requirements apply:

6.2.5.1 The bottom surfaces of the pod door at its perimeter shall match the dimensions of the port door top (A1 through A3). The tolerances shall be chosen so that the pod door does not extend over the port door in any instance, even when the port door is built to its minimal acceptable dimensions and potential variance between registration pins and holes is considered. This is to ensure an interference-free passage of the pod door through the port opening.

6.2.5.2 The base of the pod body shall fit freely but with close tolerance between the guide rails (B1, B2, and B9), which not only hold the pod in place while the port is open, but also provide proper alignment for closure of the pod at the end of the open/shut cycle.

6.2.5.3 The bottom surface of the pod requires three registration holes to engage with the registration pins on the port. The registration pins shall be positioned in the door bottom so that the registration pins prevent seating of the pod with

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the port in the event that the pod is improperly rotated by 180 degrees from the correct orientation. The correct orientation is illustrated in Figure 2.

6.2.5.4 The perimeter of the bottom surface of the pod body shall be continuous and shall be positioned against the port surface. This positioning assures the activation of an optional sensor, placed in an unspecified location along the port perimeter, for the sensing of proper pod placement.

6.2.5.5 The center of the cassette crossbar shall coincide with the center of the pod door, with the cassette oriented as shown in Figure 2. The top surface of the pod door requires the registration bars that hold the cassette in place. The horizontal cassette movement is limited by the tolerances G2. The vertical position of the cassette while located on the pod door is specified by the distance G1 between the top of the port surface and the bottom surface of the cassette.

6.2.5.6 A pod hold-down latch is required. The available latch area is specified by dimension B11 in Figure 2. Latch detail dimensions are specified in Figure 3.

6.2.5.7 The pod latch holes have a dimension of I1 perpendicular to the plane connecting both holes.

6.2.5.8 Positions for latches are identified in Figure 2 by positions 1, 2, 3, and 4. The following options for hold-down latch positions are defined by this Specification:

Option A	Positions 1 and 2
Option B	Positions 3 and 4
Option C	Positions 1, 2, 3, and 4

7 References

7.1 The following articles describe the standard mechanical interface concept:

7.1.1 "The Challenge to Control Contamination: A Novel Technique for the IC Process." The Journal of Environmental Sciences, May/June 1984, p. 23.

7.1.2 "SMIF, A Technology for Wafer Cassette Transfer in VLSI Manufacturing." Solid State Technology, July 1984, p. 111.

7.2 The complete specification for this interface includes all general requirements of SEMI E19.

Table 1 Port Dimensions for 200 mm (8 in.) Wafer Cassette

Feature	*Dimension Label*	*Metric*	*English*
Port Door	A1	135.84 mm ± 0.13 mm	(5.348 in. ± 0.005 in.)
	A2	131.06 mm ± 0.13 mm	(5.160 in. ± 0.005 in.)
	A3	13.08 mm ± 0.25 mm	(0.515 in. radius ± 0.010 in.)
	A4	0.38 mm ± 0.13 mm	(0.015 in. ± 0.005 in.)
Guide Rails	B1	146.48 mm ± 0.13 mm	(5.767 in. ± 0.005 in.)
	B2	141.71 mm ± 0.13 mm	(5.579 in. ± 0.005 in.)
	B3		
	B4		
	B5	29.97 mm maximum	(1.18 in. maximum)
	B6		
	B7	16 mm minimum	(0.630 in. minimum)
	B8	45° maximum	(45° maximum)
	B9	22.22 mm radius maximum	(0.875 in. radius maximum)
	B10		
	B11	50.8 mm maximum	(2.00 in. maximum)

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