

SEMI E156-0710

MECHANICAL SPECIFICATION FOR 450 mm AMHS STOCKER TO TRANSPORT INTERFACE

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1 Purpose

1.1 This specification defines the dimensional requirements for the load ports of 450 FOUP stockers. It is intended to provide the required features and dimensions that define the physical interfaces between different types of transport equipment and stockers and to facilitate the use of different automated transport systems in order to meet the different material handling requirements found throughout the factory. This is done by defining four options of interfaces that both the stocker and transport system must comply with. Options defined are as follows:

- Option A: Active transport (e.g., active OHS) loads a FOUP horizontally to an internal stocker load port.
Option A is shown in Figure 1.
- Option B: Active Transport (e.g., OHT) picks or places a FOUP vertically to/from an external stocker load port.
The conceptual illustration of Option B is shown in Figure 2.
NOTE: The dimensional requirements of Option B are covered in SEMI E154.
- Option C: Passive Transport (e.g., passive OHS or conveyor) carries a FOUP to/from stocker port location.
The FOUP door is parallel to the stocker. Option C is shown in Figure 3.
- Option D: Passive Transport (e.g., conveyor) carries a FOUP to/from an internal stocker port location.
The FOUP door is parallel to the stocker. Option D is shown in Figure 4.

2 Scope

2.1 This standard covers physical interfaces of 450 FOUP stocker to transport equipment. Similar requirements covering physical interfaces of 450 mm semiconductor manufacturing equipment to transport equipment are in SEMI E154.

NOTICE: 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 or other limitations prior to use.

3 Limitations

3.1 This standard does not specify that every type of 450 FOUP stocker has to interface with every type of 450 mm transport system. It only specifies four different options of physical interface. This standard only specifies single FOUP hand off.

3.2 Each option of this specification defines the minimum interface requirements between a stocker load port and a transport system using that option. The stocker user and AMHS suppliers should jointly own the responsibility of defining transport system specific interface dimensions that are not defined in this standard.

3.3 This standard specifies the minimum requirements and adequate conditions for having an interface to a 450 FOUP stocker. Those areas which may limit the competitiveness of stocker and or interfacing equipment are intentionally not listed in this standard.

4 Referenced Standards and Documents

4.1 SEMI Standards

SEMI E154 — Mechanical Interface Specification for 450 mm Load Port

SEMI E158 — Mechanical Specification for Fab Wafer Carrier Used to Transport and Store 450 mm Wafers (450 Foup) and Kinematic Coupling

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

5 Terminology

NOTE 1: For many of the used terms, see SEMI E154.

5.1 Abbreviations and Acronyms

5.1.1 AMHS — Automated Material Handling Systems

5.1.2 BP — Bilateral Plane

5.1.3 FP — Facial Plane

5.1.4 HP — Horizontal Plane

5.1.5 OHS — Overhead Shuttle

5.1.6 OHT — Overhead Hoist Transport

5.2 Definitions

5.2.1 *450 FOUP* — used generally as a “term” only to identify the front-opening carrier used in fabs for 450 mm wafers. [SEMI E154]

5.2.2 *450 stocker load boundary (LB)* — a plane parallel to the facial plane establishing the boundary between the stocker load port and the fab aisle.

5.2.3 *active transport system* — a transport system that transfers a carrier to and from a load port using robotics located on the transport.

5.2.4 *bilateral plane (BP)* — a vertical plane, defining $x=0$ of a system with three orthogonal planes (HP, BP, FP), coincident with the nominal location of the rear primary KC pin, and midway between the nominal locations of the front primary KC pins. [SEMI E154]

5.2.5 *external stocker load port* — a load port that is external to the stocker equipment boundary (such as a shelf or ledge on the stocker).

5.2.6 *facial plane (FP)* — a vertical plane, defining $y=0$ of a system with three orthogonal planes (HP, BP, FP), coincident with the center of circle defined by the centerline of the three kinematic coupling pins. [SEMI E154]

5.2.7 *FOUP* — as used herein, a 450 FOUP.

NOTE 2: These are the carriers specified in SEMI E158.

5.2.8 *horizontal plane (HP)* — a horizontal plane, defining $z=0$ of a system with three orthogonal planes (HP, BP, FP), coincident with the nominal location of the uppermost points (tips) of the three kinematic coupling pins. [SEMI E154]

5.2.9 *internal stocker load port* — a load port that is recessed from the stocker equipment boundary (a cavity or cutout in the stocker).

5.2.10 *load face plane* — the furthest physical vertical boundary plane from the cassette centroid or carrier centroid on the side (or sides) of the equipment where loading of the equipment is intended.

5.2.11 *overhead shuttle (OHS)* — an AMHS vehicle that does not use a vertical hoist mechanism to transfer the carrier from one piece of equipment to another. An OHS is typically supported on top of transport rail while overhead hoist transport (OHT) vehicles hang from underneath the transport rail.

5.2.12 *overhead hoist transport (OHT)* — a rail guided vehicle and hoist used to transport material above the factory floor over the heads of factory personnel.

5.2.13 *passive transport system* — a transport system that requires the equipment to transfer the carrier to and from the equipment load port to the transport.

5.2.14 *stocker* — an AMHS storage device.

5.2.15 *stocker crane* — stocker transfer agent that moves carriers between stocker storage location and internal load port location.

5.2.16 *stocker port robot* — robot for transport of the carrier to/from vehicle or conveyor and from/to internal load port location in a stocker.

5.2.17 *transport system* — the component of AMHS that moves material from one part of the factory to another.

6 Requirements

6.1 The FOUP shall be loaded and unloaded with the door parallel to and away from the load face plane as illustrated in Figures 1–4.

6.2 The wafers in the FOUP 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 FOUP and the load port, as specified in SEMI E154.

6.3 AMHS equipment load ports on 450 FOUP stockers must conform to one of the following configuration options (¶¶ 6.3.1, 6.3.2, 6.3.3 or 6.3.4). The dimensional requirements for the configurations are in Table 1. Figures 1–4 illustrate the options and are not intended to contain requirements, be dimensionally accurate or be to scale.

6.3.1 In Option A, an active transport (active OHS) loads/unloads a FOUP to/from an internal stocker load port utilizing the KC mating grooves on the FOUP. The stocker load port must therefore maintain the center exclusion volume below the HP as shown in Figure 1. This exclusion volume in the stocker load port facilitates FOUP delivery from the transport using the secondary set of kinematic pins. Although the stocker may use any of the other FOUP handling features, the two primary kinematic coupling pins closest to the door are reserved for the stocker port. An exclusion height above the FOUP, defined by dimension C, allows for clearance during FOUP transfer. The central exclusion volume below the HP is defined by dimensions H1, A1, A2, D, D1 and D3. The central exclusion volume below the HP has a height H1, width ($A1 + A1$) extending from the load face plane to a distance ($D - D1$), width ($A2 + A2$) from that point to a distance D3 away from the FP with total depth of ($D + D3$).

6.3.2 In Option B, an OHT loads/unloads a FOUP to/from an external stocker load port. The stocker must be equipped with an active transfer device to move the FOUP to/from internal stocker storage locations. The stocker load port is open from above to facilitate vertical delivery from an OHT. The stocker load port features, exclusion volumes, and dimensions are defined in SEMI E154, Options A, B, or C.

6.3.3 In Option C, the FOUP is oriented with the FOUP door parallel to the load face plane on a passive transport (e.g., passive OHS or conveyor) for pickup by the stocker port robot. In option C, the transport system shall use the FOUP handling features that are compatible with the exclusion volumes for the transport. This includes the use of the primary kinematic coupling pins (all 3 pins accessible). The stocker port robot shall use the secondary kinematic coupling pins (all 3 pins accessible) to transfer the FOUP. The transport system must maintain the center exclusion volume shown in Figure 3 to allow for the stocker port robot to use the secondary kinematic pins to transfer the FOUP, but no open volume internal to the stocker is required as in Figure 1, Option A. The center exclusion volume of the transport system below the HP is defined by dimensions H1, A2 and D4.

6.3.4 In Option D, the FOUP is oriented with the FOUP door parallel to the load face plane for transfer to/from an internal stocker port position by a passive transport system (e.g., Conveyor). In Option D, the transport system shall use the SEMI Standard handling features that are compatible with the exclusion volumes for the transport. This includes the conveyor rail on the FOUP bottom, and the primary kinematic coupling pins (all 3 pins). At the internal stocker port position, the stocker crane shall use the SEMI Standard handling features that are compatible with the exclusion volumes for the stocker. This includes the secondary kinematic coupling pins (all 3 pins accessible). For transport system installation in the stocker an exclusion volume is required in the stocker and is defined by dimension A3, C, H2, D and D5. For pickup of the FOUP by the stocker crane an exclusion volume is required in the transport system and is defined by dimensions A2, H1 and D4.

Table 1 Dimensional Requirements for 450 mm AMHS Load Ports^{#1}

Dim	Definition	Option A	Option B ^{#2}	Option C	Option D
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