

SEMI E85-1101

SPECIFICATION FOR PHYSICAL AMHS STOCKER TO INTERBAY TRANSPORT SYSTEM INTEROPERABILITY

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1 Purpose

1.1 This specification defines the dimensional requirements for the interbay load ports of 300 mm AMHS equipment. It is intended to promote a list of required features and dimensions that define the physical interfaces between different types of interbay equipment, 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 six options of interfaces that both the stocker and interbay transport system must comply with. Options defined are as follows:

- Option A: Active transport loads a carrier to an internal stocker position
- Option B: Active transport loads a carrier to an external stocker position
- Option C: Passive transport presents a carrier to an internal stocker position
- Option D: Passive transport presents a carrier to an external stocker position (kinematic coupling pin pick-up)
- Option E: Passive transport presents a carrier to an external stocker position (conveyor flange pick-up)
- Option F: Passive transport presents a carrier to an external stocker position for pickup with either (a) all 3 kinematic pins, (b) all 3 secondary kinematic pins or (c) top robotic flange. Carrier is oriented with front of carrier perpendicular to load face plane.

2 Scope

2.1 This is a standard covering physical interface of 300 mm AMHS interbay equipment only. Similar requirements covering 300 mm AMHS intrabay equipment are covered in SEMI E15.1.

2.2 This specification does not purport to address safety issues, if any, associated with its use. It is the responsibility of the users of this specification to establish appropriate safety and health practices and

determine the applicability of regulatory limitations prior to use.

3 Limitations

3.1 This standard does not specify that every type of 300 mm stocker has to interface with every type of 300 mm interbay transport system. It only specifies six different options of physical interface. Within any option however, all stockers must be able to physically interface with all interbay transports. This standard only specifies single carrier handoff and not dual simultaneous handoffs as implied by the dimensions in the rest of this document.

4 Referenced Standards

4.1 SEMI Standards

SEMI E1.9 — Mechanical Specification for Cassettes Used to Transport and Store 300 mm Wafers

SEMI E15 — Specification for Tool Load Port

SEMI E15.1 — Specification for 300 mm Tool Load Port

SEMI E47.1 — Provisional Mechanical Specification for Boxes and Pods Used to Transport and Store 300 mm Wafers

SEMI E57 — Mechanical Specification for Kinematic Couplings Used to Align and Support 300 mm Wafer Carriers

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

NOTE 2: For many of the used terms, see SEMI E15.1.

5.1 Abbreviations and Acronyms

5.1.1 AMHS — Automated Material Handling Systems

5.2 Definitions

5.2.1 active interbay transport system — an interbay transport system that transfers the carrier to and from

the stocker interbay load port itself using robotics that are located on the transport.

5.2.2 drive through interbay transport (DT) — an interbay transport system where the track runs internal to the stocker boundary for the entire width of the stocker (Option C application defined in Section 7.5.3).

5.2.3 external stocker load port — an interbay load port that is external to the stocker equipment boundary similar to a shelf or ledge on the stocker.

5.2.4 horizontal transfer interbay transport (HT) — an interbay transport system where a section of the track transfers or slides into an opening in the side of the stocker to present a passive interbay transport system to the stocker robot (Option C application defined in Section 7.5.3).

5.2.5 interbay load port — the interface location on a stocker where the interbay transport places wafer carriers to allow the stocker to store the carriers.

5.2.6 interbay transport system — is defined as the track and vehicle (if applicable) that transports the carrier to and from the interbay stockers.

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

5.2.8 overhead delivery — an interbay transport system that transfers the carrier to and from the stocker interbay load port itself from directly above the load port (raises and lowers the carrier to the load port).

5.2.9 passive interbay transport system — an interbay transport system that requires the stocker to transfer the carrier to and from the stocker interbay load port (stocker has robotics that transfers the carrier).

5.2.10 stocker — an AMHS storage device.

6 Ordering Information

6.1 Per Section 6 of SEMI E15, except for Sections 6.1.3 and 6.1.4.

6.2 The user and AMHS supplier will jointly own the responsibility of defining the height of the interbay load port defined by dimension H (the distance from the horizontal datum plan to the raised floor).

6.3 The user must specify which of the options (defined in Section 7.5) is required for each interbay load port. The user must also specify which carrier will be used: front-opening box or open cassette.

6.3.1 If the user specifies Option C, the user must also specify:

a) Which type of interbay transport system will be used. Dimensions A1 and S do not apply if it is a

drive through (DT) type. Dimensions A1 and S do apply if it is a horizontal transfer (HT) type (defined in Section 7.5.3).

b) Which height of exclusion volume in the stocker will be used defined as dimension T3 in Tables 1 and 2.

c) Which length of center exclusion volume in the interbay transport will be used defined as dimension D10 in Tables 1 and 2.

6.3.2 If the user specifies Option D, the user must specify which length of exclusion volume will be used in the interbay transport as defined by dimension D10 in Tables 1 and 2.

6.3.3 If the user specifies Option E, the user must specify which length of exclusion volume will be used in the interbay transport as defined by dimension D10 in Tables 1 and 2.

6.3.4 If the user specifies option F, the user must specify top (robotic flange pickup) or bottom access (secondary kinematic pins pickup).

7 Requirements

7.1 The dimensional requirements for the load port of a storage device and the interbay transport system are given in Table 1 for front-opening box and Table 2 for open cassette.

7.2 The carriers shown in these figures are intended to represent any type of carrier (open cassette or front-opening box). Figure 11 is only applicable for open cassette type carriers.

7.2.1 Except for option F, the carrier shall be loaded and unloaded with its front parallel to and away from the load face plane as illustrated in Figures 1–11.

7.3 The wafers in the front-opening box 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. The wafers in the front-opening open cassette are to be oriented horizontally face up with 2 degree nominal tilt at the time they are placed on the load port.

7.4 Dimension H of the load port is to be specified by the user and the AMHS supplier (Section 6.2). The height of the interbay transport system is to be fully configurable using the track hangers. The precision with which the interbay transport delivery system height must be maintained is dictated by the needs of the interbay load port.

7.5 AMHS interbay equipment load ports must conform to one of the following configuration options (see Section 6.3).

7.5.1 In Option A, an active transport loads a carrier to an internal stocker position. The stocker interbay load port must therefore maintain the center exclusion volume below the HDP defined in Section 7.6 and shown in Figures 1 and 10. This exclusion volume in the stocker load port facilitates carrier delivery from an active interbay transport system. The interbay transport may transfer the carrier to the passive stocker using the SEMI standard carrier handling features, which are compatible with the exclusion volumes in the stocker defined in this standard. Examples include the secondary set of kinematic pins and the top robotic flange. The use of the primary kinematic pins is reserved for the stocker load port. The two front kinematic pins and a guide are used to interface with a SEMI defined accurate outer carrier surface defined in SEMI E47.1 (front-opening box) or SEMI E1.9 (open cassette). Refer to Figure 1 and the Related Information for detail. The open volume internal to the stocker above the HDP is defined by dimensions A1, S, and a clearance C3 above the maximum height of the carrier.

7.5.2 In Option B, an active transport loads a carrier to an external stocker position. The stocker interbay load port must therefore maintain the two fork-lift or conveyor exclusion volumes as defined in SEMI E15.1 to allow for an active interbay transport system to transfer a carrier to the fork-lift or conveyor rails. The stocker interbay load port must also be open from above to facilitate delivery from an overhead transport system. The open volume required for vertical delivery is defined by a projection of the stocker load port area. The stocker interbay load port features, exclusion volumes, and dimensions are defined in SEMI E15.1 with the exception of dimension S and H. This option is illustrated in Figure 2.

7.5.3 In Option C, a passive transport presents a carrier to an internal stocker position. The passive interbay transport must therefore maintain the center exclusion volumes defined in Section 7.6 and shown in Figures 3, 4, and 10 in order to facilitate automatic carrier transfer by the active stocker. The stocker may transfer the carrier to the passive interbay transport system using the SEMI standard carrier handling features, which are compatible with the exclusion volumes in the interbay transport system defined in this standard. Examples include the secondary set of kinematic pins and the top robotic flange. The use of the primary kinematic pins is reserved for the interbay transport system. The two front kinematic pins and a guide are used to interface with a SEMI defined accurate outer carrier surface defined in SEMI E47.1 (front-opening box) or SEMI

E1.9 (open cassette). Refer to Figure 3 and the Related Information for detail. The open volume internal to the stocker to allow for the interbay transport to enter is defined by dimensions T3 and C5. This option is illustrated in Figures 3 and 4.

7.5.3.1 Option C allows for two different types of interbay transport (Section 6.3.1). The first type is a drive through (DT) interbay transport that will drive through the entire length of the stocker as illustrated in Figure 3. Dimensions A1 is therefore not applicable for this type of Option C interbay transport delivery. The other type of interbay transport is a horizontal transfer (HT) where a section of the track slides or advances into a predefined open volume in the side of the stocker as illustrated in Figure 4. Dimensions A1 and S are applicable for this type of Option C interbay transport delivery.

7.5.3.2 Option C prime (C') is different from Option C in that the pins used to transfer the carrier are different. In Option C', the transport vehicle uses the two front secondary, and single rear primary kinematic pins. This enables the stocker end-effector to use the two front primary pins and be of a wider configuration (see Figure 3a). All elevation dimensions for C' are the same as for Option C.

7.5.4 In Option D, a passive transport presents a carrier to an external stocker position. The passive interbay transport must maintain the center exclusion volume shown in Figures 5 and 10 to allow for the stocker to use the secondary kinematic pins or top robotic flange to transfer the carrier. No open volume internal to the stocker is required.

7.5.4.1 Option D prime (D') is different from Option D in that the pins used to transfer the carrier are different. In Option D', the transport vehicle uses the two front secondary, and single rear primary kinematic pins. This enables the stocker end-effector to use the two front primary pins and be of a wider configuration (see Figure 4a). All elevation dimensions for Option D' are the same as for Option D.

7.5.5 In Option E, a passive transport presents a carrier to an external stocker position. The passive interbay transport must maintain the side fork-lift/conveyor rail exclusion volumes shown in Figure 6 to allow the stocker to use the fork-lift/conveyor rails to transfer the carrier. No open volume internal to the stocker is required.

7.5.6 In option F and F' the carrier is oriented with the front of the carrier perpendicular to the load face plane by a passive transport for pickup by an active stocker. In option F the transport uses the kinematic coupling pins (all 3 may be used) and the stocker uses either the secondary kinematic coupling pins (all 3 accessible) or

the top robotic flange for pickup. In Option F' (F Prime) the transport uses the kinematic coupling pins, the secondary kinematic coupling pins or the conveyor runners, and the stocker uses the top robotic flange for pickup.

7.6 The center exclusion volume below the horizontal datum plane of the stocker for Option A (Section 7.5.1) or interbay transport system for Options C and D (Sections 7.5.3 and 7.5.4), is defined by dimensions H2, A2, and D (Figure 1 and 10). For Options C (Section 7.5.3) and D (Section 7.5.4), there are additional requirements that the center exclusion volume, defined by H2 and A2 extend from the facial datum plane a distance D10 (Sections 6.3.1 and 6.3.2), increase both in depth defined by dimension H4 and in width defined by dimension A3 from the plane defined by dimension D10 extending outwards for the rest of the interbay transport system. The conveyor flange exclusion volume below the horizontal datum plane of the interbay transport system (Section 7.5.4), is defined by dimensions H2, H4, A6, A8, and D10 (Figure 6). The center exclusion volume below the horizontal datum plane of the stocker for option F is defined by Figure 10, "Exclusion zone detail for option F". No exclusion volumes are required for option F' since stocker access is with the top robotic flange only. These exclusion volumes need to be open only during the carrier handoff between the stocker and the interbay transport system. For example, the stocker can temporarily occupy these exclusion volumes when transferring the carrier from the interbay load port to an internal shelf location.

7.7 Clearance C3 in Option A is 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).

7.8 Dimension S specifies the required range for spacing between carrier centroids.

7.9 For active interbay transports (Option A) and passive interbay transports (Options C, D, and E and F), the communication method will be defined by SEMI E84 (same as OHT), and the available SEMI E84 connector areas are defined by the following dimensions, and are illustrated in Figure 9.

- Dimensions of the SEMI E84 connector zone are as follows:
- Width (measured from BDP) = 225 mm
- Depth (measured from Stocker facial plane) = 200 mm
- Height (measured from HDP) = 300 mm

NOTE 3: The bottom of the SEMI E85 exclusion volumes defines the top of the SEMI E84 connector zones. For Option A, the top of the connector zone is defined by dimension H2. For Option B, the top of the connector zone is defined by dimension H0. For Options C, D, and E and F, the top of the connector zone is defined by dimension H4.

Table 1 Dimensional Requirements for 300 mm AMHS Interbay Load Ports (FOUP ONLY)

Dim	Definition	Option A	Option B	Option C	Option D	Option E	Option F
θ (deg)	tilt of the open cassette when placed to the load port	0	SEMI E15.1	0	0	0	N/A
A1	minimum width of the load port cavity or cut-out in the stocker measured from the facial datum plane to the nearest obstruction on the stocker	375 mm	N/A	600 mm for HT only (See NOTE 1.)	N/A	N/A	N/A
A2	width of the exclusion zone for center pickup using the secondary kinematic coupling pins (symmetric about the bilateral datum plane)	213 +2/-0 mm	N/A	213 +2/-0 mm	213 +2/-0 mm		213 + 2/-0
A3	Minimum width if the exclusion zone (starting at a distance D10 from the FDP) for center pickup using the secondary kinematic coupling pins (symmetric about the bilateral datum plane)	N/A	N/A	225 mm	225 mm	N/A	N/A
A6	maximum protrusion of the interbay transport measured from the facial datum plan of the transport (start of the exclusion volume for fork-lift or	N/A	SEMI E15.1	N/A	N/A	165 mm	N/A

Dim	Definition	Option A	Option B	Option C	Option D	Option E	Option F
	conveyor rail transfer)						
A8	minimum width of the exclusion volume for the fork-lift or conveyor rail transfer mechanism measured from the facial datum plane (end of the exclusion volume for fork-lift or conveyor rail transfer)	N/A	N/A	N/A	N/A	245 mm (80 wide)	N/A
C3	height of the nearest stocker obstacle above the carrier during transfer measured from the HDP of the transport—the maximum height of the carrier. This creates an exclusion zone for use of the top robotic flange.	150 mm	SEMI E15.1	N/A	N/A	N/A	N/A
C5	distance from the facial datum plane of the transport to the internal stocker boundary	N/A	SEMI E15.1	250 ± 50 mm	N/A	N/A	250 ± 50 mm
D	distance from the stocker boundary to the facial datum plane on the stocker load port (A,B)	240 mm	SEMI E15.1 250 +0/-10 mm	N/A	N/A	N/A	N/A
D1	maximum distance or protrusion of any load port feature measured from the facial datum plane on the load port (inside the stocker cut-out)	150 mm	SEMI E15.1 200 +10/-4 mm	N/A	N/A	N/A	TBD
D5	distance from the facial datum plane of the interbay transport system to the stocker boundary	N/A	SEMI E15.1	N/A	250 ± 50 mm	250 ± 50 mm	N/A
D6 (See NOTE 2.)	minimum distance or length of the center exclusion volume of the interbay transport system measured backwards from the facial datum plane of the interbay transport system to allow for stocker pick up using the secondary kinematic pins	N/A	SEMI E15.1	90 mm	90 mm	TBD	TBD
D10	distance measured from the facial datum plane (FDP) where the depth of the center exclusion zone lowers from H2 to H4 in the interbay transport system (C,D)	N/A	SEMI E15.1	150 mm or 230 mm (See NOTE 1.)	150 mm or 230 mm (See NOTE 1.)	150 mm or 230 mm (See NOTE 1.)	150 mm or 230 mm (See NOTE 1.)
H	Height of the horizontal datum plane of the interbay load port (stocker) or interbay transport system determined by user and supplier	TBD (See NOTE 1.)	TBD (See NOTE 1.)	TBD (See NOTE 1.)	TBD (See NOTE 1.)	TBD (See NOTE 1.)	TBD (See NOTE 1.)
H2	depth of exclusion zone below the horizontal datum plane (HDP) of the stocker load port (A,B) OR the interbay transport system (C,D)	130 mm	SEMI E15.1	100 mm	100 mm	100 mm	100 mm
H4	depth of the exclusion zone below the horizontal datum plane (HDP) of interbay transport system (C,D) starting at a distance D10 from the facial datum plane (FDP)	N/A	N/A	170 mm	170 mm	170 mm	170 mm
S	distance between the bilateral	450 mm	505 mm	N/A	N/A	N/A	N/A

<i>Dim</i>	<i>Definition</i>	<i>Option A</i>	<i>Option B</i>	<i>Option C</i>	<i>Option D</i>	<i>Option E</i>	<i>Option F</i>
	datum plane of two adjacent load ports						
T3	height of the open volume in that it allows the interbay transport system to enter the stocker the transport. This exclusion zone is occupied by the transport itself, the maximum height of the carrier, a clearance above carrier, and a clearance below the transport.	N/A	N/A	800 mm or 1150 mm (See NOTE 1.)	N/A	N/A	N/A

NOTE 1: User to specify which dimension (see Section 6).

NOTE 2: See Related Information 2 of this document.

SUPERSEDED

Active Transport Delivers a Carrier to an Internal Stocker Position

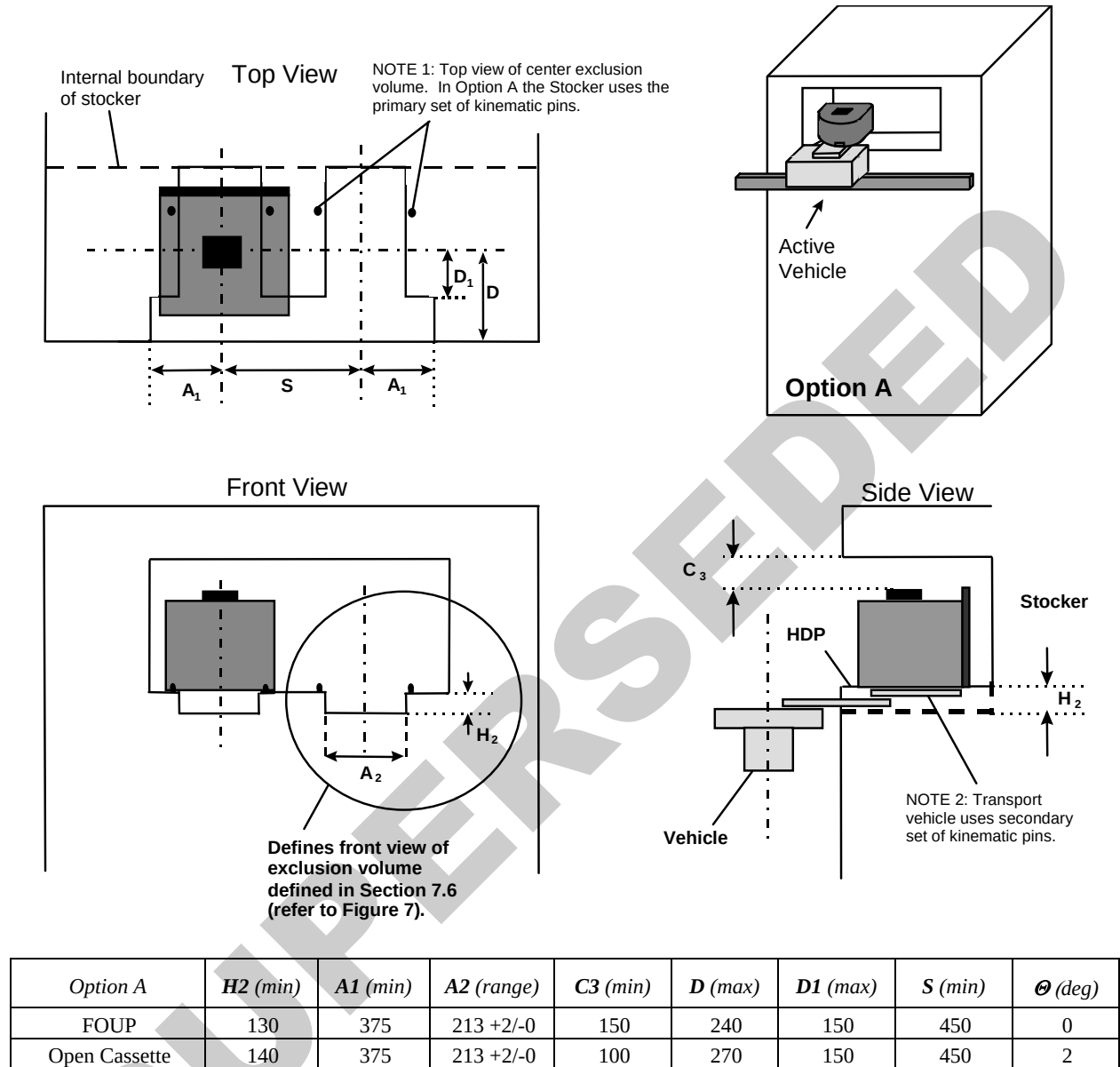
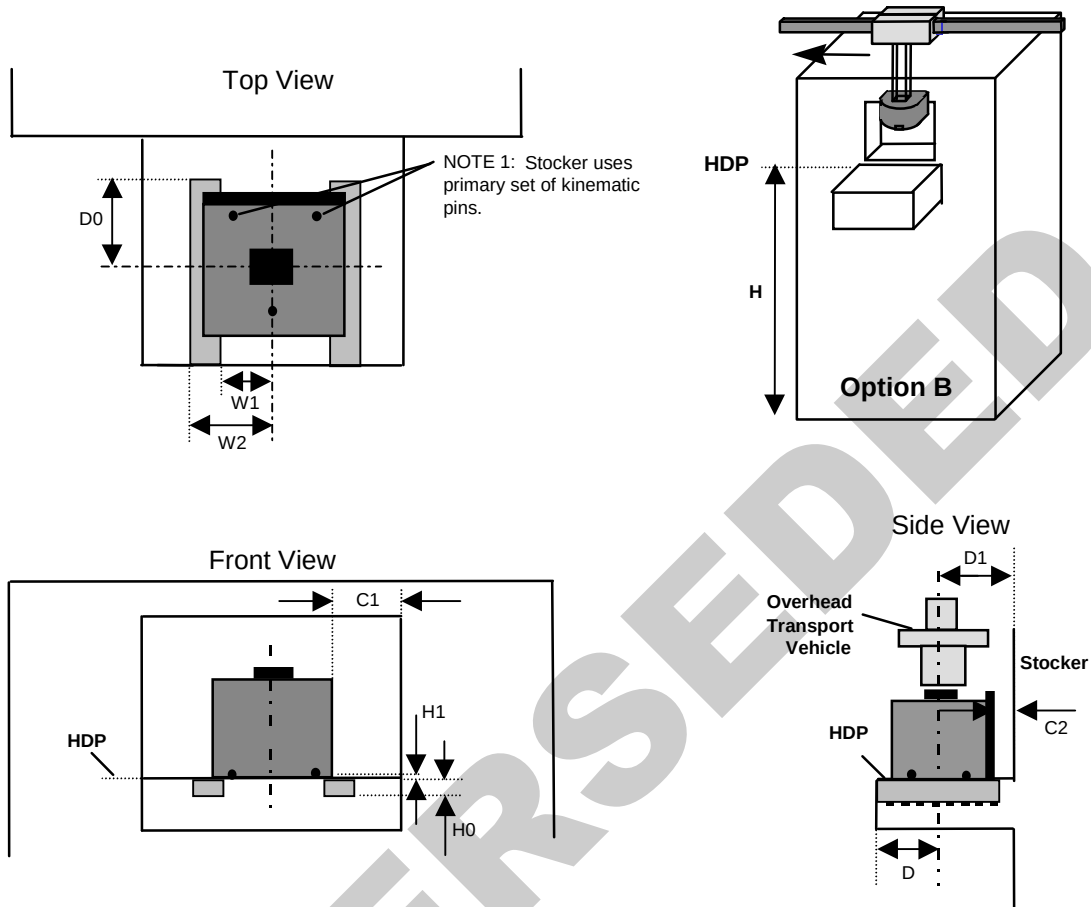


Figure 1
AMHS Interbay Load Port Option A

Active Transport Delivers a Carrier to an Internal Stocker Position

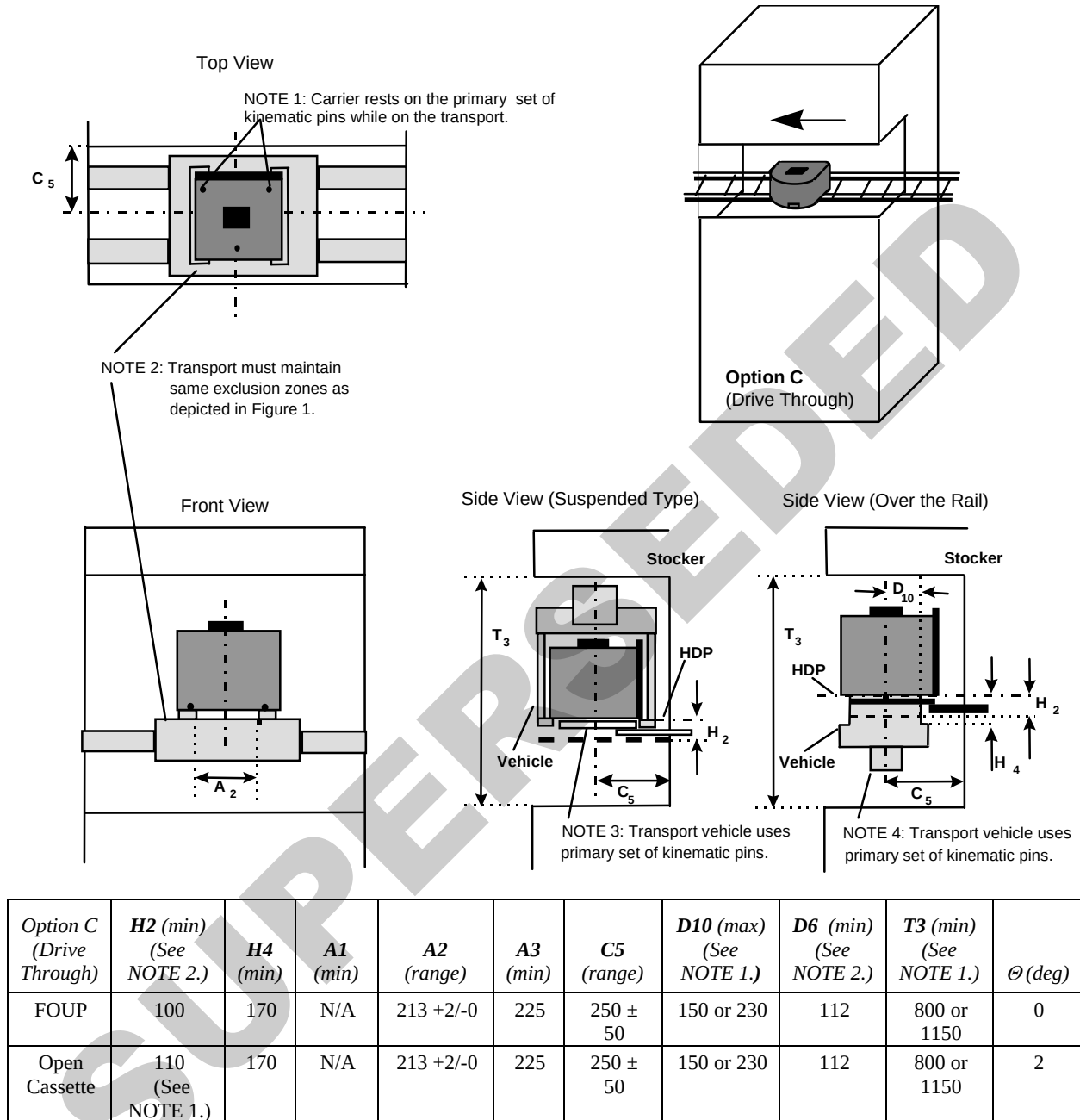


Option B	H (See NOTE 1.)	H0 (min)	H1 (max)	C1 (min)	C2 (min)	D0 (min)	D (range)	D1 (range)	W1 (max)	W2 (min)
FOUP	TBD	40	25	75	30	110	250 +0/-10	200 +10/-4	130	205
Open Cassette	TBD	50	25	75	30	110	250 +0/-10	200 +10/-4	130	205

NOTE 1: User to specify actual dimension (see Section 6.2).

Figure 2
AMHS Interbay Load Port Option B

Active Transport Delivers a Carrier to an Internal Stocker Position



NOTE 1: User to specify which dimension (see Section 6.3.1).

NOTE 2: See Related Information 2 of this document.

Figure 3
AMHS Interbay Load Port Option C (Drive Through)