

AEROSPACE RECOMMENDED PRACTICE

SAE ARP1372

REV. C

Issued 1975-09
Revised 2004-07
Stabilized 2011-09

Superseding ARP1372B

Minimum Requirements for Air Cargo Unit Load Device Ground Handling and Transport Systems

RATIONALE

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1. SCOPE:

The requirements of this SAE Aerospace Recommended Practice (ARP) are applicable to ground handling and transport systems equipment which is designated to accommodate main deck unitized cargo in the form of intermodal containers and other compatible unitized load devices. Intermodality in the context of this document concerns primarily air and land modes but does not exclude the marine mode. Equipment with compatibility features for other than main deck cargo is likewise not excluded.

It is not the intent of this document to specify equipment design but rather to ensure interface compatibility of the various elements which might make up a total ground handling and transport system developed within a number of different operational schemes. It is the intent of this document to specify minimum ULD handling and restraint features to ensure future interchange capability.

1.1 Purpose:

This document specifies minimum performance and compatibility requirements for air cargo unit load device (ULD) ground handling and transport systems equipment employed to service wide-body freighter aircraft operations.

2. APPLICABLE DOCUMENTS:

2.1 Applicable Documents:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of a conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications: Available from SAE, 400 Commonwealth Drive, Warrendale, PA 150096-0001.

AS832	Air and Air/Surface (Intermodal) General Purpose Containers
AS1130	Air and Air/Surface (Platform) Cargo Pallets
ARP1247	General Requirements for Aerospace Ground Support Equipment Motorized and Non-motorized
ARP1334	Ground Equipment Requirements for Compatibility with Aircraft Unit Load Devices
AS1491	Interline Air Cargo Pallets

2.2 Reference Documents:

2.2.1 ISO Publications: Available from International Organisation for Standardisation, Case Postale 56, CH-1211, Geneva 20, Switzerland.

ISO1496	Series I Freight Containers
ISO8323	Air mode containers
ISO4116	Air cargo Equipment – Ground Equipment Requirements for Compatibility with Aircraft Unit Load Devices
ISO4117	Air and Air/Land cargo Pallets – Specification and Testing
ISO4128	Aircraft – Air mode modular container
ISO 6966-1	Aircraft ground equipment - Basic requirements - Part 1: general requirements
ISO 6966-2	Aircraft ground equipment - Basic requirements - Part 2: safety requirements
ISO6967	Aircraft – Wide Body Aircraft Main Deck Container/Pallet Loader Functional Requirements
ISO7715	Air Cargo Equipment –Ground Handling and Transport Systems for Unit Load Devices – Minimum Requirements

2.2.2 IATA Publications: Available from International Air Transport Association (IATA), 800 Place Victoria, P.O.Box 113, Montreal, Quebec, Canada H4Z 1M1.

IATA UTM 50/0 Requirements for Interlining of ULD's

IATA UTM 50/1 Pallet for NAS3610 Class II Restraint Systems

IATA UTM 50/4 Certified Aircraft Container

IATA UTM 50/6 Air/Surface (Intermodal) Container

IATA UTM 50/9 16' and 20' Pallet for NAS3610 Class II Restraint Systems

IATA AHM 932 Functional Specification for Main Deck Container/Pallet Loader

3. EQUIPMENT:

It is envisioned that an air cargo ULD ground handling and transport system, in addition to ULDS, includes a loading system or loader and ground transport equipment.

The loading device or loader in the context used herein is that equipment, fixed or mobile, designed to remove ULDs from the ground transport equipment, relocate the ULDs to a position for the aircraft to receive them into the main- and upper cargo deck and load them into the aircraft. The loader also serves the unloading function by receiving ULDs from the aircraft main- and upper cargo deck and repositioning them onto the ground transport equipment. Facility docking equipment can be interpreted as performing the loader function.

Section 3 defines the minimum performance requirements for specific elements of the ground handling and transport system.

Section 4 specifies minimum performance requirements of the system dictated by the interface requirements between these elements of the system. The ground handling system should be thoroughly compatible and integrated with the aircraft and the facility environmental features. Example environmental features associated with the system are: aircraft door opening sizes and locations, cargo envelopes clearances, cargo movement paths, sill heights, aircraft stabilization characteristics, height limitations for working under the aircraft, noise control, turning radius, and driver visibility.

3.1 Outsize Cargo:

Cargo which exceeds the dimensions of 2.1.1 ULD's but which is within the maximum aircraft size and load-carrying capabilities should be considered. For that purpose, particular consideration shall be given to the following characteristics:

- a. Any part of the handling or loading equipment, protruding beyond the conveyor plane, which might interfere with an overhanging load within the maximum aircraft envelope, should be retractable or removable.
- b. Compatibility with any additional equipment which might be necessary to handle overweight or oversize pieces of cargo should be ensured.

3.2 Ground Transport Equipment:

The ground transport equipment provides the carriage and support structure for the unit load devices during land transportation. This equipment also shall incorporate the necessary restraint devices to secure the ULD to the chassis during ground movement. This equipment shall meet the following minimum requirements:

3.2.1 Types: Air cargo ULD chassis shall be of the following types:

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|----------|--|
| TYPE I | Nominal 40-ft (12,2 m) air cargo container chassis – suitable for movement of one 40-ft air cargo container or pallet or two 20-ft containers or pallets. |
| TYPE II | Nominal 20-ft (6,10 m) air cargo container chassis – suitable for movement of one 20-ft air cargo container or pallet. |
| TYPE III | ULD Chassis - suitable for movement of one 40-ft (12,2 m) or one 20-ft air cargo container or pallet, as well as mixed loads of 20-ft or 10-ft (3 m) air cargo containers or pallets and other ULDS. |

3.2.2 Classes: Air cargo ULD chassis shall be of the following classes:

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|---------|---|
| Class A | Transporters with conveyorized decks capable of transporting ULDs as well as interfacing with conveyorized loading systems. |
| Class B | Skeletal transporter chassis designed for use with lifting equipment for transfer of ULDs onto conveyorized on-airport equipment. |

3.2.3 Air Cargo ULD transportation chassis shall be designed to meet the minimum applicable local, state or federal regulations when designed for operation on public highways.

- 3.2.4 Dimensional Criteria: Air cargo container chassis shall be designed to have a laden and unladen deck (or roll plane) height of from 48 to 62 in (1,22 to 1,57 m). Chassis width to be such that when loaded with ULDs located at the extremes of lateral tolerances, the overall width is less than or equal to maximum allowable local, state or federal regulations when designed for operation on public highways (Figures 1 and 2).
- 3.2.5 Environment: This equipment shall be capable of operation under the environmental conditions specified in ARP1247. (ISO 6966 & IATA AHM 910 are equivalent.)
- 3.2.6 Operation: The equipment shall be operable by one man without tools of any kind. The operation of the equipment shall not require the operator to leave ground level.
- 3.2.7 Restraints: Type III chassis shall be capable of restraining the various main deck size ULDs of wide body aircraft for which the equipment is designed to transport in random mixes up to the bed length of the chassis.
- 3.2.8 Power Loading: Powered Class A equipment should include a self-contained powered loading system for loading and unloading ULDs which meets the following criteria:
- a. Driveaway disconnect umbilical connection for electrical power (see 3.2.8.1e and 3.2.8.2e).
 - b. Conveyor deck design shall permit manual movement of ULDs and hence should include adequate walk area consisting of a non-slip surface.
 - c. The mechanical efficiency of the conveyor system should be 97% or better. (ISO 6966 Annex A)
 - d. Manual override shall be accomplished by the operator without the use of tools and within the time period of 1 minute.
- 3.2.8.1 The following items are recommended for the purpose of interface commonality for operation on the North American continent:
- a. Drive motor voltage - 230 VAC, 3-phase, 50-60 Hz.
 - b. Conveyor speed - 60 fpm (0,3 m/s) at 60 Hz nominal.
 - c. A safety interlock shall be provided for umbilical connections. Interlock voltage should not exceed 24 VAC 50-60 Hz.
 - d. Auxiliary circuit - 24 volts dc.

3.2.8.1 (Continued):

- e. The connector (3.2.8a) employed for electrical circuits 3.2.8.1a, b, and d should be an 8-pin type. Three pins are used for 3-phase 230 V power, 1 pin for ground, 2 pins for 24 V DC control or auxiliary power and 2 pins (shorter than the rest) are used as a safety circuit. Electrical and interface information is provided in Figure 3A.

3.2.8.2 The following items are recommended for the purpose of interface commonality for operation on the European continent:

- a. Drive motor voltage - 380 VAC, 3-phase, 50 Hz.
- b. Conveyor speed - 60 fpm (0,3 m/s) at 50 Hz nominal.
- c. A safety interlock shall be provided for umbilical connections. Interlock voltage should not exceed 24 VAC 50 Hz.
- d. No auxiliary circuit is required.
- e. The connector (3.2.8a) employed for electrical circuits 3.2.8.2a and 3.2.8.2b should be of a 6-pin type. Three pins are used for 3-phase 380 V power, 1 pin for ground and 2 pins (shorter than the rest) are used as a safety circuit. Electrical and interface information is provided in Figure 3B.

3.2.8.3 The wiring and pin configuration must provide a totally safe control system free of potential for inadvertent actuation.

3.2.9 Manual Loading: Non-powered equipment shall require a minimum effort to operate as designated in 3.2.8c.

3.2.10 Design Goals: Air cargo ULD chassis, particularly those of Types I and II, Class B, should be designed for minimum weight, simple construction, ruggedness, and low cost.

3.3 Aircraft Loader Equipment:

The aircraft loader equipment should be designed to meet as many as possible of the alignment and interface requirements for the exchange of ULDs between aircraft and ground transport equipment, to minimize the complexity and hence cost of the more numerous equipment employed in this system. See 4.2 and 4.4.

3.3.1 Loader Types: Aircraft loader systems may be of the following types:

Type A Direct interchange of ULDs between aircraft and chassis. (This might be a fixed facility or movable equipment.)

Type B Loader - Transporter - In addition to aircraft interchange, the loader transports ULDs to a site other than that of the parked aircraft for on or off loading from ground transportation equipment.

3.3.2 Environment: Aircraft loader systems shall be capable of operation under the environmental conditions specified in ARP1247. (ISO 6966 and IATA AHM 910 are equivalent.)

3.4 Terminal Lifters:

The ground transport system family of equipment may include unit load device lifting equipment which would permit transfer of ULDs from skeletal Class B transporter-chassis onto Class A conveyORIZED transporters capable of interfacing with the loading systems. A mobile gantry to perform the lift function is described in IATA AHM 936. ISO/DIS 6965 is equivalent.

4. INTERFACE REQUIREMENTS:

4.1 ULD to Chassis:

4.1.1 Restraints, General: The restraint system shall meet or exceed the requirements of the Department of Transportation, Motor Carrier Safety Regulation Part 393, Subpart I, "Protection Against Shifting or Falling Cargo."

4.1.2 Restraints for Types I and II Chassis: Air cargo unit load devices of the 20 and 40-ft (6,1, and 12,2 m) lengths shall be restrained to chassis of Types I and II by one of the following means:

- a. Bottom corner fittings in accordance with AS832 (Type B containers only) or AS1130 (Type B pallets only).
- b. End slots in accordance with AS832 (Type A and B containers) or AS1130 (Type A, B and C pallets).

- 4.1.3 Restraints for Type III Chassis: Unit load devices of the 10, 20, and 40-ft (3, 6, 1, and 12, 2 m) lengths shall be restrained to Type III chassis by one of the following means:
- End slots in accordance with AS832 (Type A and B containers) and AS1130 (Type A, B and C pallets).
 - Bottom corner fittings in accordance with AS832 (Type B containers only) and AS1130 (Type B pallets only) are also acceptable.
- 4.1.4 Support: Air cargo unit load devices of the 10, 20, and 40-ft (3, 6, 1, and 12, 2 m) lengths shall either be (1) fully supported on the base as in the case of a conveyORIZED deck per ARP1334, or (2) rest on structural supports only as when bottom corner fittings are the support means. Clearance between the base and any other chassis non-supporting member must be ensured under all conditions. Bottom corner fitting support pad areas shall be consistent with the corner fitting area.
- 4.1.5 Guides: The chassis shall incorporate suitable guides to insure smooth continuous transfer of containers. These guides may be retractable in order to conform with 3.2.4.
- 4.2 Chassis to Loader System:
- 4.2.1 Alignment: The loader system shall include, if required, provision for such vertical and horizontal alignment of the bed to insure smooth continuous transfer of ULDs between the vehicles.
- 4.2.1.1 The loader system shall provide any necessary accommodation to the chassis to negate suspension, tire or structural deflections of the chassis detrimental to the exchange of ULDs between these two units.
- 4.2.2 Spacing: The distance between the outermost support of the transporter and the outermost support of the loader shall be consistent with ARP1334. To help preclude equipment docking damage, the spacing should be at the maximum allowable distance between these support elements.
- 4.2.2.1 To control the spacing at this interface and prevent equipment damage, an accessory stop assembly on the loader should be employed.
- 4.2.3 Docking Positions: Minimum possible ULD transfer attitudes should be: between either side of Type A or B loaders and either side of Type I or II, Class B chassis; between the aft end of Type A or B loaders and the aft end of Type I or II, Class A chassis; and between either side or the aft end of Type A or B loaders and the aft end of Type III, Class A chassis (see Figure 4 and Table 1). Other attitudes may be optional.
- 4.2.3.1 The chassis design must provide the necessary clearance to allow "pick up" or "deposit" of containers onto the chassis with a lifting device.

4.2.4 Height: The recommended loader transfer elevations for interfacing with transporter equipment should be 54 in (1.37 m) with an acceptable range of 48 to 62 in (1,22 to 1,57 m). In specific instances, compatibility with 20 in (508 mm) systems may be necessary (Figure 2).

4.3 ULD to Loader System:

4.3.1 Transfer: The loader system shall provide all the necessary power and mechanism to transfer ULDs between the chassis and aircraft.

4.3.2 Contact Surfaces: All contact surfaces such as guides, restraints, and drive mechanisms shall be compatible with each container or ULD type specified in 3.1. Minimum clearance between the conveying surface and fixed parts of the loader shall conform with ARP1334.

4.3.2.1 Contact surfaces intended for smaller ULDs and which interfere with transit of larger ULDs shall retract with a minimum of force and present a minimum resistance to continued transit.

4.3.2.2 There shall be no parts of the loader which can damage the ULDs.

4.3.3 Guides: The loader system shall incorporate suitable guides to ensure smooth, continuous transfer of ULDs.

4.3.4 Speed: The loader shall be capable of transferring ULDs in any powered direction at a minimum rate of 60 fpm (0,3 m/s).

4.4 Loader System to Aircraft:

4.4.1 Alignment: The high and low limits of the lift system shall be such as to always provide a smooth, continuous transfer of ULDs even during extreme airplane attitudes and poor ramp or climatic conditions (Figure 2). Positive indication should be provided to determine that the loader is properly aligned at the aircraft interface.

4.4.1.1 Anticipated system maximum height to be 218 in (5,53 m) for maindeck and 330 in (8,40 m) for upperdeck, with infinitely variable interface positioning.

4.4.1.2 Roll attitude adjustment range shall be ± 3 degrees.

4.4.1.3 Pitch attitude adjustment range shall be ± 3 degrees.

4.4.2 ULD Transfer: The loader shall provide for the alignment of the ULD to the aircraft loading system and power it onto the aircraft.

4.4.2.1 The loader design shall consider multidirectional ULD movement across the interface and minimize resultant scuffing.

5. SYSTEM PERFORMANCE:

5.1 Turnaround Time:

The total air cargo ULD ground handling and transport system shall be designed to meet minimum aircraft turnaround cycles consistent with those aircraft which it is intended to serve.

6. RELIABILITY/MNINTAINABILITY/SAFETY/MATERIALS/WORKMANSHIP:

6.1 Requirements:

6.2 System equipment shall meet the requirements of ARP1247.

7. NOTES:

- 7.1 The change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document.

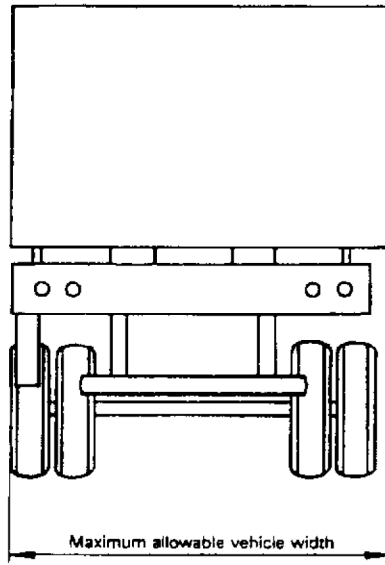
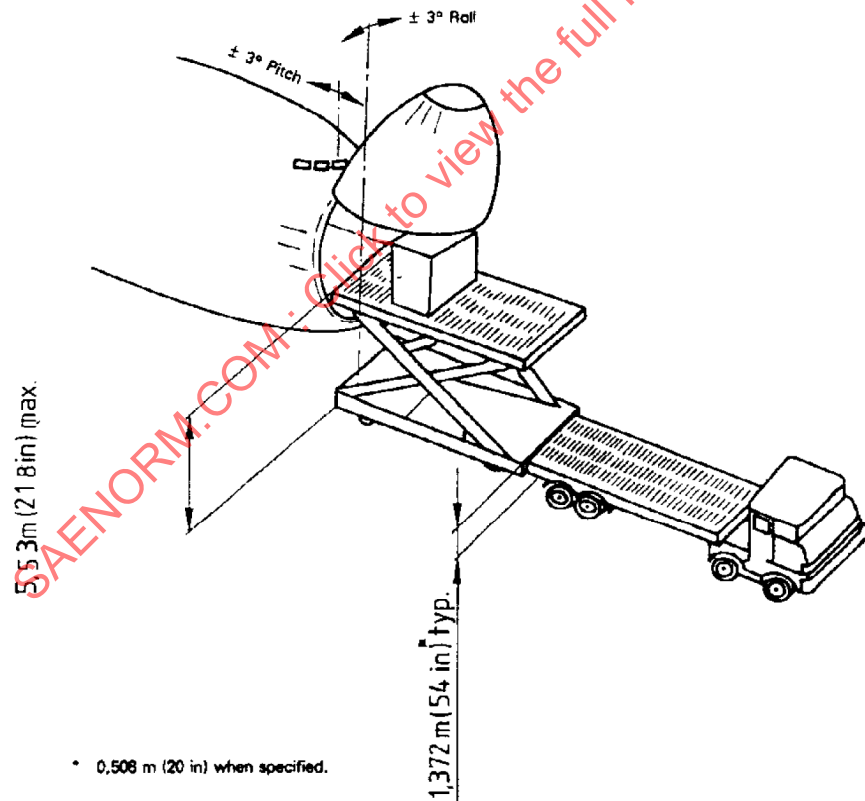


FIGURE 1 - Lateral Positioning Tolerance

FIGURE 2 - Loader Interfaces
(aircraft front door shown - side door similar)