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AEROSPACE RECOMMENDED PRACTICE

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MINIMUM REQUIREMENTS FOR AIR CARGO UNIT LOAD DEVICE GROUND HANDLING AND TRANSPORT SYSTEMS

1. PURPOSE: This Aerospace Recommended Practice (ARP) 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. SCOPE: The requirements of this document 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 ARP 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 ARP 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 ARP to specify minimum ULD handling and restraint features to ensure future interchange capability.

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 cargo deck and load them into the aircraft. The loader also serves the unloading function by receiving ULDs from the aircraft main 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.

3. (Continued):

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 Unit Load Devices: The following unit load device specifications or applicable portions thereof should be considered.

SAE AS 832 - Air and Air/Surface (Intermodal) General Purpose Containers
IATA 50/6 - Main Deck 8' x 8' Air/Surface (Intermodal) Container for High Capacity Aircraft
IATA 50/9 - 20' Pallet for NAS 3610 Class II Restraint System
ISO 1496 - Part VII - 1974 Series I Freight Containers, Part VII Air Mode Containers
ISO/DIS 4128 - Air Cargo Modular Containers

3.1.1 Additional Applicable Documents: The following additional ULD specifications or applicable portions thereof may be considered for handling by the system.

AS 1491 - Interline Air Cargo Pallets
IATA 50/1 - Pallet for NAS 3610 Class II Restraint Systems
IATA 50/4 - Aircraft Container
AS 1130 - Air Land Demountable Cargo Pallets
ISO/DIS 4117 - Air Land Cargo Pallets
ISO/DIS 7715 - Minimum Requirement for Air Cargo Unit Load Devices Ground Handling and Transport Systems

3.1.2 Outsize Cargo: Cargo which exceeds the dimensions of 3.1 cargo 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:

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 or one 20-ft air cargo container or pallet, as well as mixed loads of 20-ft or 10-ft air cargo containers or pallets and other ULDs.

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

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 Applicable Documents: Reference should be made to the following applicable specifications:

SAE ARP 1247 - General Requirements for Aerospace Ground Support Equipment Motorized and Non-Motorized

SAE ARP 1334 - Ground Equipment Requirements for Compatibility with Aircraft Unit Load Devices (ISO 4116 and IATA AHM 911 are equivalent)

(ISO 6966 - Basic Requirements for Aircraft Loading Equipment and IATA AHM 910 Basic Requirements for Aircraft Handling Equipment are Equivalent.)

3.2.3.1 Air Cargo ULD 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. (1220 to 1575 mm). 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 SAE ARP 1247. (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.

d) Manual override shall be accomplished by the operator without the use of tools and within the time period of one 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.

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.

3.2.8.2 (Continued):

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 b 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 Sections 4.2 and 4.4.

3.3.1 Applicable Documents: In addition to the specifications listed in 3.2.3, reference should be made to the following documents:

IATA AHM 932 - Main Deck Pallet/Container Loader
ISO 6967 - Main Deck Container/Pallet Loader

3.3.2 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.

3.3.3 Environment: Aircraft loader systems shall be capable of operation under the environmental conditions specified in SAE ARP 1247. (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 lengths shall be restrained to chassis of Types I and II by one of the following means:

a) Bottom corner fittings in accordance with SAE AS 832 (Type B containers only) or SAE AS 1130 (Type B pallets only).

b) End slots in accordance with SAE AS 832 (Type A and B containers) or SAE AS 1130 (Type A, B and C pallets).

4.1.3 Restraints for Type III Chassis: Unit load devices of the 10, 20, and 40-ft lengths shall be restrained to Type III chassis by one of the following means:

a) End slots in accordance with SAE AS 832 (Type A and B containers) and SAE AS 1130 (Type A, B and C pallets).

b) Bottom corner fittings in accordance with SAE AS 832 (Type B containers only) and SAE AS 1130 (Type B pallets only) are also acceptable.

4.1.4 Support: Air cargo unit load devices of the 10, 20, and 40-ft lengths shall either be 1) fully supported on the base as in the case of a conveyorized deck per ARP 1334, 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 SAE ARP 1334. 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 Fig. 4 and Table I). 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. (1372 mm) with an acceptable range of 48 - 62 in. (1220 to 1575 mm). In specific instances, compatibility with 20 in. (508 mm) systems may be necessary (Fig. 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 SAE ARP 1334.

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 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 (Fig. 2). Positive indication should be provided to determine that the loader is properly aligned at the aircraft interface.

4.4.1.1 Preferred system maximum height to be 218 in. (5537 mm) 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.

4.4.1.4 It should not be a facility requirement to position and tether the nose of the aircraft during loading/unloading of unitized cargo.

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/MAINTAINABILITY/SAFETY/MATERIALS/WORKMANSHIP:

6.1 Requirements: System equipment shall meet the requirements of SAE ARP 1247.

PREPARED BY
SAE COMMITTEE AGE-2, CIVIL AIRCRAFT GROUND SUPPORT EQUIPMENT

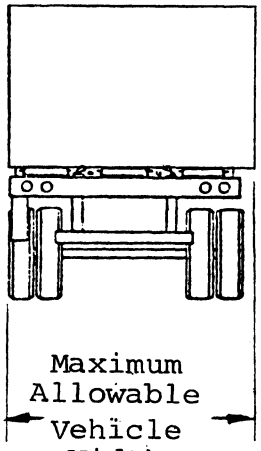

Figure 1
Lateral Positioning Tolerance

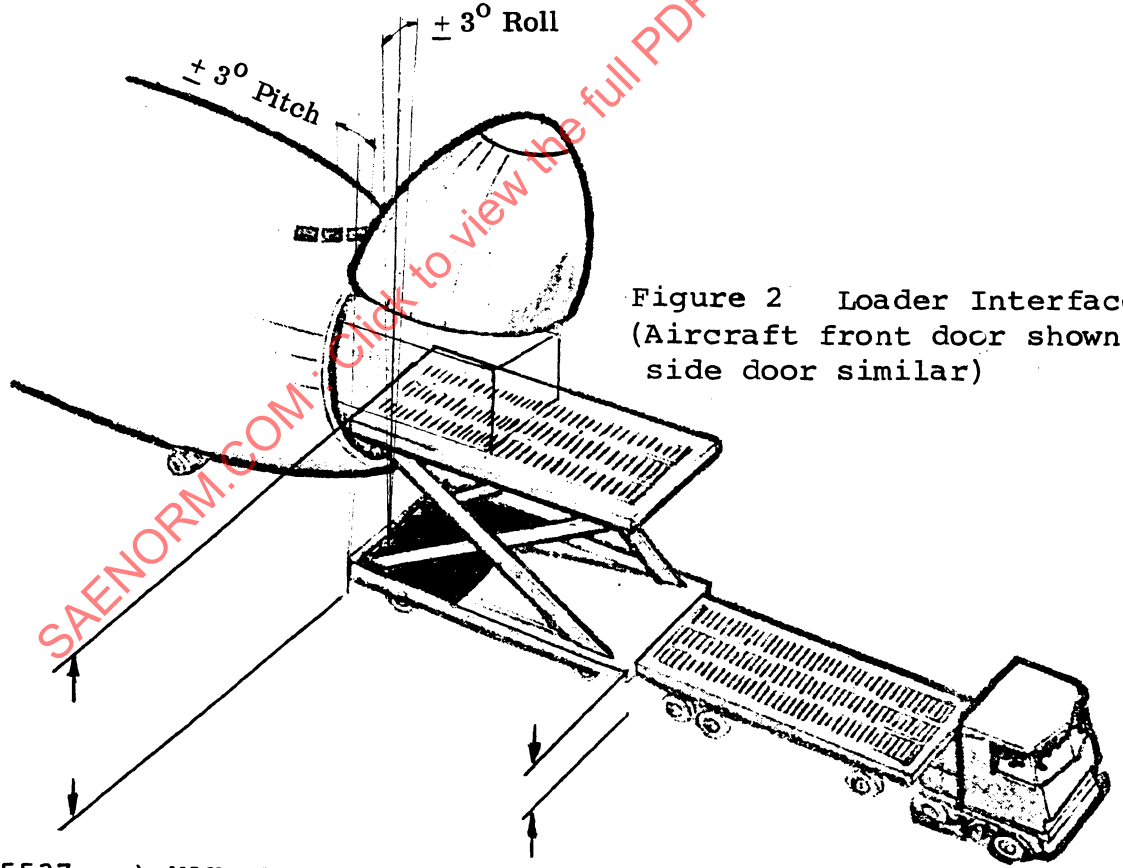

Figure 2 Loader Interfaces (Aircraft front door shown - side door similar)