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Air cargo equipment — Automobile transport devices — Basic requirements

Équipement pour le fret aérien — Dispositifs de transport d'automobiles à bord des aéronefs — Caractéristiques fondamentales

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8268 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles.*

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Air cargo equipment — Automobile transport devices — Basic requirements

0 Introduction

During the preparation of this International Standard, the following design objectives for automobile transport devices were borne in mind :

a) accommodating as many automobile types and sizes as feasible within the aircraft envelope, with emphasis on those most frequently shipped;

b) ensuring profitable return haul usage with general air cargo;

c) ensuring accessibility and compatibility to meet minimum restricted article requirements for preparation of automobiles for shipment;

d) protection of automobiles from damage;

e) maintainability using standard high-quality aerospace practices.

NOTE — For the purposes of this International Standard, in accordance with part 3 of the *Directives for the technical work of ISO* and in line with the practice adopted by IATA, the minimum essential criteria are identified by use of the key word "shall". Recommended criteria are identified by use of the key word "should", and, while not mandatory, are considered to be of primary importance in providing dependable, economical and practical automobile transport devices. Deviation from recommended criteria should occur only after careful consideration, extensive testing and thorough service evaluations have shown alternative methods to be satisfactory.

1 Scope and field of application

This International Standard provides functional, dimensional, structural and environmental requirements for automobile transport devices used to transport automobiles in wide-body aircraft. These devices are intended to be used in conjunction with pallets compatible with existing aircraft restraint systems or with pallets matching the width of automobiles to ensure maximum use of aircraft volume. The devices shall be easily convertible so that they can carry general cargo on return haul flights.

The purpose of this International Standard is to specify minimum air and ground handling features and to ensure interchangeability and compatibility with present and future air transport and ground handling systems. It is not intended to specify equipment designs in this International Standard.

The devices specified in this International Standard shall be designed primarily for transporting automobiles and secondarily for transporting general air cargo in an acceptable and profitable manner.

IMPORTANT NOTE — This International Standard is not intended to provide criteria applicable to the safe air transport of automobiles as far as hazardous materials/restricted articles regulations are concerned. Details of applicable regulations can be found in

— International Civil Aviation Organization (ICAO), *Annex 18 to the Chicago Convention on International Civil Aviation,* and the attached Technical Instructions for the carriage of dangerous goods by air;

— IATA *Dangerous Goods Regulations.*

2 References

The following International Standards will be needed to apply this International Standard :

ISO 1161, *Series 1 freight containers — Corner fittings — Specifications.*

ISO 4116, *Ground equipment requirements for compatibility with aircraft unit load devices.*

ISO 4117, *Air and air-land cargo pallets — Specification and testing.*

ISO 4171, *Interline air cargo pallets.*

ISO 7166, *Aircraft — Rail and stud configuration for passenger equipment and cargo restraint.*

ISO 8097, *Aircraft — Minimum airworthiness requirements and test conditions for certified air cargo unit load devices.* [1)]

The following reference documents provide complementary information to this International Standard :

ISO 6833, *Air cargo — Minimum requirements for future wide-body aircraft cargo systems and compartments (intermodal).*

ISO 7715, *Air cargo equipment — Ground handling and transport systems for unit load devices — Minimum requirements.*

1) *De facto* NAS 3610.

IATA Standard Specification 50/0, *Condition requirements for interlining of ULDs.*

IATA Standard Specification 50/1, *Pallet for ISO 8097 class II restraint systems.*

IATA Standard Specification 50/9, 20 ft *pallet for ISO 8097 class II restraint systems.*

IATA Airport Handling Manual AHM 911, *Ground equipment requirements for compatibility with aircraft unit load devices.*

3 Types of transport device

This International Standard specifies three types of transport devices for carrying automobiles :

— type A (lower deck) and type B (main deck) shall be used for carrying one automobile in conjunction with an air cargo pallet complying with ISO 4171, primarily in a random intermix with general cargo pallets;

— type C (main deck) shall be used, in order to maximize cubage utilization, for carrying two or more automobiles as a full or part charter operation.

3.1 Type A

Type A automobile transport devices shall be used for carrying one automobile on the lower deck of both freighter and/or passenger wide-body aircraft, in conjunction with either a 1 534 mm × 3 175 mm (60.4 in × 125.0 in) or a 2 235 mm × 3 175 mm (88.0 in × 125.0 in) air cargo pallet complying with ISO 4171.

3.2 Type B

Type B automobile transport devices shall be used for carrying one automobile in a slanted configuration on the main deck of freighter wide-body aircraft, in conjunction with a 2 235 mm × 3 175 mm (88.0 in × 125.0 in) or 2 438 mm × 3 175 mm (96.0 in × 125.0 in) air cargo pallet complying with ISO 4171.

3.3 Type C

Type C automobile transport devices shall be used for carrying two or four automobiles in a double-level configuration on the main deck of freighter wide-body aircraft, in conjunction with either

— (an) air cargo pallet(s) complying with ISO 4117 or ISO 4171, or

— (a) specially designed air cargo pallet(s) matching the width of automobiles in order to ensure maximum use of aircraft volume.

3.4 Cargo loading

As an alternative application, it shall be possible to use type A, B and C devices for carrying general cargo on return haul flights. The cargo shall be general in nature, both unitized and non-unitized.

4 General requirements

4.1 Dimensions

4.1.1 Type A

Type A devices shall be adaptable to a pallet length of 3 175 mm (125.0 in) and should have an adjustable width range from 1 473 mm (58.0 in) to 2 235 mm (88.0 in).

4.1.2 Type B

Type B devices shall be adaptable to a pallet length of 3 175 mm (125.0 in) and should have an adjustable width of 2 235 mm (88.0 in) or 2 438 mm (96.0 in).

4.1.3 Type C

Type C devices shall be adaptable to a pallet length of 4 978 mm (196.0 in) and should have an adjustable width range with, at least, fixed positions of 2 235 mm (88.0 in) and 2 438 mm (96.0 in).

4.2 Construction

Devices shall be rugged, weatherproof and lightweight.

Components shall not permit liquids, sand or debris to accumulate inside.

Device construction shall provide sufficient structural strength to withstand, without permanent deformation, the static and dynamic loads and the impact shock and racking stresses resulting from over-the-road carriage at highway speeds, forklift handling and, if applicable, top lifting while loaded to maximum capacity, and anticipated in-flight loads.

4.3 Base

4.3.1 The device design shall ensure that, when fully loaded, the loading of the base foot imprint area on the pallet does not exceed 2 000 kPa (400 lb/ft^2) for type B and C devices. The loading of the base foot imprint area for type A devices shall not exceed 1 000 kPa (200 lb/ft^2).

4.3.2 The device shall be equipped with a flat and continuous drip-pan that would also form a base. The bottom surface of the drip-pan shall not point-load or have sharp edges in contact with the pallet. Clean-out openings should be provided of a size such that waste material may be flushed out of the pan.

4.3.3 No structure, fittings or other objects shall protrude below the bottom surface of the base.

4.3.4 The base shall be structurally adaptable to any pallet which is equipped with a continuous seat track along the edge-rail and which has the designed nominal length appropriate to the device type.

4.3.5 The base to the pallet shall be attached by means of a universal seat track fitting complying with ISO 7166. It shall be

possible to install or remove the base from the pallet without modification or the use of tools. Attachment fittings shall meet or exceed the minimum restraint requirements laid down in ISO 8097 for class II systems.

4.3.6 The number of attachment fittings shall be kept to a minimum. There shall be no less than one attachment fitting per corner area of the pallet.

4.3.7 Attachment fittings shall be designed so as to provide a means to prevent all vertical and horizontal movements greater than ± 3,2 mm (0.125 in) which may occur between the device and pallet.

4.3.8 When attached to a pallet, the base of the device shall provide for support and ease of movement at the maximum distributed load specified in 4.3.1 and 11.3.1 and when used in conjunction with a minimum conveyor system as outlined in ISO 4116.

4.3.9 Base design shall take into account in-plane conveyor power-drive systems and their inability to move a unit load device when the pallet flexes away from the conveyor friction-drive devices.

4.4 Automobile support

4.4.1 The automobile shall be supported by its tyres. Wheel trays shall provide full support for each tyre imprint area.

4.4.2 Overall dimensions of wheel trays shall be kept to a minimum. Automobiles and/or supporting structure which overhang the pallet will be acceptable if it can be proved that no damage to the aircraft and/or shipment will occur if normal pallet-handling practices are used.

4.4.3 Automobile support structures, which cannot be dismantled, fully collapsed and bundled for return haul flights, shall be collapsible within the overall dimensions of the pallet the device rests on. When collapsed, the base shall facilitate cargo loading and the pallet edge-rail shall be fully accessible for net attachment and aircraft restraint.

4.4.4 Wheel trays for supporting the automobile shall permit placement/rolling of the automobile onto the wheel tray without the use of the forklifts and/or other lifting devices which may damage the automobile. It is recognized that accessory loading ramps may form a part of this device.

4.4.5 Each wheel tray shall be equipped with fork tineways suitable for moving and/or assembling the fixture with an automobile of the maximum allowable weight[1] in position on the wheel tray. Tineways shall be fully enclosed or equivalent so as to ensure against damage to the automobile and provide tipping restraint. Type C devices shall be forkable from either upper or lower level when loaded to maximum weight capacity on both levels.

4.4.6 Tineway dimensions shall be in accordance with figure 1.

4.4.7 Type C devices should preferably be also equipped with ISO 1161 top lifting fittings suitable for moving the fixture with the maximum allowable weight in position on the device. Fittings shall be located 3 067 mm (120.75 in) apart longitudinally and symmetrically in relation to the centreline. Fitting loads should take into account that as much as 60 % of the load may be at one end of the device. A minimum alternative to the ISO 1161 fittings would be to fit apertures in the post structures that allow for attachment by a 25,4 mm (1.0 in) diameter clevis bolt. The locations of top lifting fittings in relation to the unit overall dimensions are illustrated in figure 2.

4.4.8 Each wheel tray shall be equipped with a minimum of two wheel chocks and/or equivalent to control forward and reverse wheel movement. Chock-locking positions shall allow the automobile to be placed on the centre of the device regardless of wheel base designs or axle locations.

4.4.9 In order to accommodate the maximum possible range of automobile wheel bases and at the same time keep the length of the wheel tray to a minimum, wheel chocks shall be located on the inboard side of the wheels for type A and C devices. Wheel chocks for type B devices shall be located as shown in figure 4.

4.4.10 If continuous wheel channels are used to support the automobile, channel end-stops shall be provided to prevent the automobile from rolling off the far end during loading.

4.4.11 Wheel-tray loading ramps shall permit manual loading on the ground before the pallets are loaded into the aircraft.

4.4.12 Wheel curb-rails and/or restraints shall be provided to control lateral movement of the automobile.

5 Specific requirements for device types

5.1 Type A device (Lower deck) (see figure 3)

5.1.1 Type A devices shall include compatibility with small cargo door aircraft and be adaptable to a 1 534 mm × 3 175 mm (60.4 in × 125.0 in) pallet to facilitate transportation of automobiles occupying only two side-by-side container positions on the lower deck or a 2 235 mm × 3 175 mm (88.0 in × 125.0 in) pallet to facilitate transportation of wider automobiles on aircraft with full-size pallet cargo doors.

1) It should be noted that throughout this International Standard the term "weight" is used instead of the term "mass" in conformity with current commercial practice and international conventions.

5.1.2 Wheel trays shall provide a simple means of adjusting the height of an automobile and supporting it at maximum allowable weight while in transit. The range of height adjustment shall be from 102 mm (4.0 in) to 305 mm (12.0 in) as measured from the conveyor roll plane.

5.1.3 So as to allow for carrying automobiles wider than 1 534 mm (60.4 in), but less than 1 778 mm (70.0 in), on the lower deck of aircraft, and which occupy only two container positions of the aircraft, wheel trays shall be designed so as to extend over the edge-rail of the pallet on one side only. The adjustment range of wheel trays shall extend from the 1 534 mm (60.4 in) pallet edge-rail dimension to 1 715 mm (67.5 in). The automobile and supporting structure shall be no closer than 25 mm (1.0 in) inboard of the pallet edge-rail on the other side.

5.1.4 The overall length of wheel trays for use on the lower deck should not exceed 3 175 mm (125.0 in).

5.1.5 Either longitudinal side of the device shall function facing forward or aft in the aircraft and shall not interfere with other unit load devices or automobile transport devices in adjoining aircraft positions. This requirement shall apply on one side only when automobiles exceeding pallet width are carried as laid down in 5.1.3.

5.1.6 Where applicable, the design objective for spacing between automobiles in adjoining positions shall be 51 mm (2.0 in).

5.2 Type B device (Main deck — slanted) (see figure 4)

5.2.1 Type B devices shall be adaptable to a 2 235 mm × 3 175 mm (88.0 in × 125.0 in) or 2 438 mm × 3 175 mm (96.0 in × 125.0 in) pallet. The overall height of the devices in the lowered (horizontal) or erected (fully slanted) position shall be less than 2 438 mm (96.0 in) measured over the conveyor plane, not including the height of the automobile.

5.2.2 Wheel trays shall include simple mechanical or hydraulic means to be raised into a slanted position up to a 40° angle from the horizontal position.

5.2.3 It shall be possible for one man without an external power source to operate the raising device from inside or outside the aircraft, using a crank, lever or hand tool with a manual effort not exceeding 317 N (70 lbf) at maximum car weight capacity.

5.2.4 It is recognized that longer types of automobiles, when installed on the device in the slanted position, will exceed the 3 175 mm (125.0 in) pallet length and require limited contours on the adjoining pallet positions, if loaded with general cargo. However, design shall provide for end-to-end location of the base pallets, regardless of automobile length, whenever two or more type B devices are adjacent to each other.

5.2.5 The overall length of the wheel trays should not exceed 3 175 mm (125.0 in) in order to facilitate their use on return haul flights. It is recognized that, in the operative horizontal position, part of the raisable end of the wheel trays will overhang from the pallet.

5.2.6 Either short side of the device shall function facing forward or aft in the aircraft and shall not interfere with restraint of other unit load devices or automobile transport devices in adjoining aircraft positions.

5.2.7 The raisable end of each wheel tray shall be equipped with stops, adjustable by 51 mm (2.0 in) increments in order to limit the position of the automobile, once raised, to a height clearance of either 2 438 mm (96.0 in) or 2 997 mm (118.0 in).

5.2.8 Wheel chocks taking a minimum of 80° angle of the wheels shall be provided in order to ensure protection against automobile movement in the maximum slanted position.

5.2.9 Where applicable, the design objective for spacing between automobiles in adjoining positions or between an automobile and a structural member shall be a minimum of 51 mm (2.0 in).

5.3 Type C device (Main deck — two levels) (see figure 5)

5.3.1 Type C devices shall be adaptable to any pallet or combination of pallets having an overall length of 4 978 mm (196.0 in) and having an overall width range between 1 588 mm (62.5 in) and 2 438 mm (125.0 in).

5.3.2 The upper level of this device shall be designed to maximize the use of the aircraft internal cross-section available so as to accommodate the maximum possible height, length and width of automobile(s).

5.3.3 The lower level of this device shall permit flow-through capability of the lower automobile(s) and allow the frame of the automobile(s) to extend over the pallet edge-rails in both longitudinal directions during transit. So as to allow for carrying automobiles longer than 4 978 mm (196.0 in), it is recognized that automobiles may extend into aircraft walkways.

5.3.4 The automobile tray on the upper level shall provide lightweight liquid spill/drip protection to protect the automobile on the lower level. The protective shield used shall be able to withstand and be compatible with all types of liquids, lubricants and/or acids normally used in connection with automobiles.

5.3.5 Horizontal movements and/or racking of the device when subject to side loads, as specified in table 2, shall not exceed 38 mm (1.5 in), as measured at the intersection of the top and side of the device or its load.

5.3.6 Structural supports for the upper level shall be narrow in profile so as to afford maximum clearance for automobiles on

the lower level and to minimize loss in aircraft volume. Supports shall be offset on opposite sides and designed so as to integrate with automobile transport devices in adjoining aircraft positions, thus preventing redundant volume loss.

Either longitudinal side of the device shall function facing forward or aft in the aircraft and shall not interfere with other unit load devices or automobile transport devices in adjoining aircraft positions.

5.3.7 Where applicable, the design objective for spacing between automobiles in adjoining positions or between an automobile and a structural member shall be a minimum of 51 mm (2.0 in). Structural members shall be incorporated in the allowable spacing in order to prevent loss of usable space.

5.3.8 The overall height of the fully assembled and loaded device shall not exceed 2 997 mm (118.0 in), as measured from the conveyor roll plane (pallet included).

5.3.9 The surface of the wheel trays on the upper level shall be located 1 524 mm (60.0 in) above the roll plane (pallet base included). As an option, a vertical adjustment of ± 102 mm (4.0 in) in 25,4 mm (1.0 in) increments shall be possible on this height.

5.3.10 The lower level shall provide a clearly defined envelope for an automobile measuring 1 448 mm (57.0 in) in height. This envelope shall allow vertical clearance for deflections and racking while in transit and freedom of movement during assembly and dismantling/loading and offloading operations.

6 Assembly and dismantling of devices

6.1 Attachment fittings

6.1.1 Fittings shall be located so that they cannot damage or be damaged by aircraft hardware and/or adjacent devices should they inadvertently be left open or come open in transit.

6.1.2 No tools or equipment shall be required to secure fittings.

6.1.3 Means should be provided to indicate visually and mechanically that fittings have been positively secured.

6.1.4 Where possible, fittings and assembly components should be interchangeable.

6.1.5 Handles, straps, fittings, etc. shall withstand a minimum pull of 22,25 kN (5 000 lbf) in any direction.

6.1.6 When assembled or dismantled, there shall be no loose parts which could easily be lost. Small assembly components and parts shall be attached by means of a chain.

6.2 Loading and preparation for shipment

The number of personnel, equipment and time required for assembling and dismantling the devices should be kept to a minimum. The minimum objectives are given in table 1.

Table 1 — Minimum objectives for loading operations and preparation of devices for shipment

Automobile transport device	Maximum requirements for		
	manning	equipment	assembly/ dismantling time
Type A (1 automobile, lower deck)	1 man	1 forklift or equivalent machinery with a capacity of 13,35 kN (3 000 lbf)	5 min
Type B (1 automobile, main deck, slanted)			10 min[1)]
Type C (2 or 4 automobiles, main deck, two levels)	2 men		15 min

1) Including operation to raise device to the required angle.

6.3 Dismantling and use of devices for return haul flights

Once devices have been dismantled and/or collapsed, they shall take up as little space as necessary so as to optimize cargo loading of the aircraft.

The optimum designs should allow for complete dismantling and bundling together of one or more devices for return haul flights. It is intended that pallets used to support the base of the devices may be detached and used for carrying general cargo.

7 Tare weight limits

The tare weight shall be kept to a minimum consistent with the requirements and within limits of good design practices. The tare weight objectives (excluding pallet) are as follows :

a) type A : 113 kg (250 lb);

b) type B : 159 kg (350 lb);

c) type C : 227 kg (500 lb) for two-automobile devices, or 317 kg (700 lb) for four-automobile devices.

8 Restraint provisions

8.1 Aircraft restraint provisions

8.1.1 The usual aircraft restraint provisions for the pallet being used shall be retained. Wheel trays and attachment fittings shall not bar access required by aircraft restraints nor prevent one man, without the use of tools, from setting nor the required aircraft restraints.

8.1.2 Provision shall be made to allow the automobile and transport device to be tied down directly to the pallet and/or aircraft, should the operator deem it necessary.

8.1.3 The load path of the device restraint system shall conform to the restraint system as specified in ISO 8097 for class II systems. The restraint load path should be kept to a minimum, where possible.

8.1.4 The device design shall be such that the fully loaded device, when adequately restrained in the aircraft systems, conforms to appropriate restraint parameters set out in ISO 8097.

8.1.5 Where possible, restraint devices/fittings should be designed to perform multiple functions.

8.2 Automobile restraint provisions

8.2.1 Provision shall be made to secure the automobile to the device using design attachment points and fittings as provided and/or specified by each automobile manufacturer.

8.2.2 Provision shall be made to secure the automobile to the device and/or pallet using overthrow straps over the automobile floor when attachment fittings have not been provided by the automobile manufacturers. If overthrow straps over the automobile floor prevent the closing or latching of doors, a positive door restraint device shall be provided.

8.2.3 Restraint attachment fittings shall permit the use of take-up devices to collapse the automobile suspension system as necessary to stabilize the automobile while in transit.

8.2.4 Restraint attachment fittings shall be designed so as to withstand repeated rhythmic loads which might occur in the event of an automobile not being stabilized during transit.

9 Environmental criteria

9.1 Operating conditions

Devices should be capable of operating under the following conditions :

a) temperature range of − 32 °C to + 60 °C (− 25 °F to + 140 °F);

b) 100 % relative humidity;

c) exposure to salt-sea atmosphere;

d) vibration incidental to service use;

e) sand and dust particles, wind velocity of 97 km/h (60 mile/h);

f) exposure to rain, snow and sleet;

g) all fluids normally contained on automobiles and on aircraft;

h) conveyor support criteria as laid down in ISO 4116.

9.2 Materials and processes

9.2.1 As far as the choice of materials and processes are concerned, consideration should be given to the extremely hard conditions of service to which the device will be subjected so as to ensure maximum service life.

9.2.2 All metal parts should be protected against corrosion.

9.2.3 All non-metallic parts and/or joints which are liquid-absorbent should be sealed and/or treated.

9.2.4 All materials shall be flame-resistant in accordance with the applicable regulatory requirements.

9.2.5 All materials and/or components shall be protected against deterioration or loss of strength in service due to exposure, weathering, corrosion or other causes in cases where the type of material used requires such protection.

10 Loads

10.1 Automobile loads

Automobile trays shall withstand the loads specified in this clause on any 203 mm × 203 mm (8.0 in × 8.0 in) tyre imprint area without permanent deformation.

As much as 60 % of the total automobile weight can be supported on one axle. This added weight may appear on either the forward or rear axle, i.e. on either end of the unit. It is envisaged that on type C devices automobiles on the lower and upper level may have to be loaded in opposite directions in order to establish the centre of gravity within limits.

10.2 Load ratings

Maximum load capacity of the automobile tray and, where applicable, all interchangeable parts shall be permanently identified. The load ratings shall be as follows :

a) **Type A**
Minimum automobile load capacity : 1 724 kg (3 800 lb)
[Gross weight, approximately : 1 950 kg (4 300 lb)]

b) **Type B**
Minimum automobile load capacity : 2 268 kg (5 000 lb)
[Gross weight, approximately : 2 540 kg (5 600 lb)]

c) **Type C**
Minimum load capacity per automobile position : 2 268 kg (5 000 lb)
[Gross weight, approximately,
— for a 2-automobile device : 4 990 kg (11 000 lb)
— for a 4-automobile device : 9 615 kg (21 200 lb)]

10.3 Ultimate load criteria for aircraft

The accelerations given in table 2, expressed as multiples of the acceleration due to gravity, g, should be taken into account when determining ultimate loads in order to obtain airworthiness certification of the devices from the competent regulatory authorities.

10.4 Centre of gravity eccentricity

For design purposes, the limits given in table 3 should be assumed for the location of the centre of gravity of a loaded unit.

10.5 Operating loads — Ground transportation minimum requirements

Ground transportation requirements shall meet or exceed those laid down by the applicable national authorities regulations.

11 Testing

11.1 General

The tests are static in nature to minimize complexity and cost of required testing facilities. As far as practical, applied static loads should take into account the combined static and dynamic loads anticipated in service.

It is intended that tests shall be non-destructive in nature and not result in damage unless ultimate load conditions are used.

Test equipment and methods of testing described are not meant to be restrictive. Alternative equivalent methods to achieve the desired results may be used.

In selected cases, tests may be repeated under ultimate load conditions when required for substantiation of analytical data for airworthiness certification purposes. If this becomes necessary, any device submitted to such tests may not be used in service until all component parts have been inspected and those that show permanent deformation have been replaced.

Table 2 — Accelerations for determining ultimate loads

Automobile transport device	Acceleration				
	Forward	Aft	Sideways	Upwards	Downwards
Type A	1,5 g*	1,5 g*	1,5 g*	3,0 g	6,0 g
Types B and C				2,5 g	5,1 g

* In combination with a down load equal to 1,5 times the force of gravity.

Table 3 — Limits for the location of the centre of gravity

Automobile transport device	Centre of gravity Eccentricity %		Height
	Longitudinal	Lateral	mm (in)
Type A	± 10	± 10	915 (36.0) max.
Types B and C			1 219 (48.0) max.

11.2 Test criteria

11.2.1 A device shall be considered satisfactory if, on inspection before and after testing, its dimensions fall within tolerance limits specified on the applicable manufacturing drawings.

11.2.2 On completion of the subject test(s), the device shall show neither permanent deformation nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and/or interchange shall be satisfied.

11.2.3 Permanent deformation is permitted under ultimate load conditions. A device shall be considered within acceptable limits if it shows permanent deformation but does not deform to the extent of discharging an automobile or cargo, or breaking free from the restraint system under such loads. The deflection in the sideways direction shall not exceed the requirements laid down in 5.3.5.

11.3 Recommended test equipment

11.3.1 When restraint or movement on conveyor systems is assessed, the test equipment and set-up shall comply with the following requirements :

— rows of rollers on approximately 673 mm (26.5 in) centres, with each row composed of 38 mm (1.5 in) diameter rolls, 76 mm (3.0 in) long uncrowned, with an edge radius of 1,5 mm (0.06 in) spaced on 254 mm (10.0 in) centres;

— the device shall travel both longitudinally and perpendicularly to roller axis;

— latches and guide-rails of suitable strength shall be provided to guide the device along the conveyor and secure it at its restraint points.

11.3.2 When carrying out structural tests, sufficient payload to meet test load requirements shall be provided. When appropriate, load-producing devices may be used.

11.4 Tests at full capacity loads

11.4.1 Assembly

Determine the time, manning levels and equipment required to assemble the device.

11.4.2 Loading

Demonstrate the ability to load and prepare an automobile for shipment. Determine the time, manning levels and equipment required for loading the device.

11.4.3 Lifting

Demonstrate the top lifting and forklift capability required and ability to control the load during

a) assembly;

b) positioning of trays with automobiles in position on the device;

c) placing of loaded devices with pallet attached on conveyorized ramp equipment.

11.4.4 Dismantling and preparation for return haul flights

Demonstrate that the device and components can be dismantled and bundled for return haul flights.

11.4.5 Over-the-road transportation

Demonstrate the ability of the device to withstand normal over-the-road driving conditions using full-size truck/semi-trailer with air-brakes and/or equivalent. The device shall be subjected to the following test conditions :

a) vibration;

b) severe road surface shock loads;

c) emergency stop;

d) sudden acceleration;

e) sharp turns at 56 km/h (35 mile/h).

11.4.6 Aircraft loading

Demonstrate that the device can be moved in and out using aircraft powered systems without manual assistance. Give proof of the ability to lock and/or restrain properly the complete device in the aircraft without special tools and/or assistance.

11.4.7 In-flight restraint

Demonstrate the integral capability of the fully loaded device to conform to appropriate restraint parameters as laid down in ISO 8097 for class II systems.