
**Aircraft ground equipment — Upper deck
loader — Functional requirements**

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Exigences fonctionnelles*

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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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 27471 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

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Aircraft ground equipment — Upper deck loader — Functional requirements

1 Scope

This International Standard specifies the functional and performance requirements for a self-propelled container/pallet loader capable of raising air cargo unit load devices (ULDs) to the upper deck of very large capacity freighter (VLCF) aircraft and also to the main deck of any main-line freighter aircraft.

This International Standard does not intend to provide all the design requirements applicable for aircraft upper-deck loaders. Other requirements can be found in separate standards which are also applicable:

- ISO 4116 specifies the additional requirements applicable for conveying surfaces of aircraft ground support equipment intended for handling and loading of baggage and cargo ULDs;
- ISO 6966-1 and ISO 6966-2 specify, respectively, the general and safety-related requirements applicable to all aircraft ground support equipment.

The requirements of this International Standard were determined based on generally recognized assumptions as to:

- a) the normally intended use of aircraft ground support equipment, when used on the ramp of international civil airports in order to handle, service or maintain civil transport aircraft;
- b) the environmental (surface, slope, weather, lighting, operating rules, traffic infrastructure, staff qualification, etc.) conditions prevailing on the ramp area of the majority of international civil airports.

It is assumed that the manufacturers of aircraft upper-deck loaders define in the relevant documentation the specifically intended conditions of use and environment for each model, and that the purchasers systematically review their own specific conditions of use and environment in order to determine whether those stated are adequate, or negotiate with the manufacturer appropriate modifications to ensure they are.

This International Standard does not specify requirements applicable to:

- any adapters or ancillary/supplemental equipment additions to in-service main-deck loaders in order to allow their occasional upper-deck use;
- any main-deck loaders fitted with optional access to upper-deck height of the front platform only (ISO 6967:2006, 4.8).

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4116, *Air cargo equipment — Ground equipment requirements for compatibility with aircraft unit load devices*

ISO 6966-1, *Aircraft ground equipment — Basic requirements — Part 1: General design requirements*

ISO 6966-2, *Aircraft ground equipment — Basic requirements — Part 2: Safety requirements*

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 8097:2001, *Aircraft — Minimum airworthiness requirements and test conditions for certified air cargo unit load devices*

ISO 11532, *Aircraft ground equipment — Graphical symbols*

ISO 11995:1996, *Aircraft — Stability requirements for loading and servicing equipment*

ISO 14122-3, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

ISO 21100, *Air cargo unit load devices — Performance requirements and test parameters*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

cycle time

<loader> time elapsed between the moment the loader reaches any reference position (e.g. ground level) and the next moment it reaches the same position, after transferring a full complement of unit load devices (ULDs) on the ground level, raising, transferring the ULDs to the aircraft, and coming down again

NOTE 1 Cycle time depends on loader performance.

NOTE 2 The addition of the necessary loader cycles constitutes the (offloading and loading) aircraft turnaround time.

3.2

cycle time

<unit load device (ULD)> loader cycle time divided by the number of ULDs carried in one cycle

NOTE 1 ULD cycle time represents the mean time to load or offload a ULD into or from the aircraft.

NOTE 2 ULD cycle time depends on both loader performance and size.

3.3

lower deck

lowest deck of either a two-deck or a three-deck very large capacity (VLCA) main-line aircraft

3.4

main deck

the highest deck of a two-deck main-line aircraft, or the intermediate deck of a three-deck very large capacity aircraft (VLCA)

3.5

main-line aircraft

civil passenger and/or freight transport aircraft with a maximum ramp mass over 50 000 kg (110 000 lb)

3.6

turnaround time

<aircraft loading> total elapsed time between the moment a fully loaded aircraft starts being offloaded and the moment it is fully loaded again

NOTE Turnaround time constitutes the primary economic objective of the operating airline.

3.7

unit load device

ULD

device for grouping, transferring and restraining cargo for transit

NOTE A ULD may consist of a pallet with a net or it may be a container.

3.8

upper deck

highest deck of a three-deck very large capacity aircraft (VLCA)

3.9**very large capacity aircraft****VLCA**

main-line aircraft with three decks and a maximum ramp mass over 453 600 kg (1 000 000 lb)

3.10**very large capacity freighter****VLCF**

freighter version of a very large capacity aircraft, including an upper deck load of unit load devices (ULDs)

4 Requirements**4.1 General**

4.1.1 Upper deck loaders defined by this International Standard shall be capable of raising and transferring air cargo ULDs with base dimensions and maximum masses as follows:

ISO 8097/ISO 21100 Base size code	Length mm (in)	Width mm (in)	Max. gross mass kg (lb) Main deck	Max. gross mass kg (lb) Upper deck
A	3 175 (125)	2 235 (88)	6 804 (15 000)	4 080 (9 000)
M	3 175 (125)	2 438 (96)	6 804 (15 000)	4 445 (9 800)
N ^a	2 438 (96)	1 562 (61,5)	3 402 (7 500)	2 220 (4 900)
R	4 978 (196)	2 438 (96)	11 340 (25 000)	8 980 (19 800)
S ^a	2 235 (88)	1 562 (61,5)	3 402 (7 500)	2 040 (4 500)
G	6 058 (238,5)	2 438 (96)	13 600 (30 000) ^b	Not allowable

^a Optional (see 5.11).
^b Or higher, on customer request (see 5.13 and 5.14).

4.1.2 On an adequate chassis, the loader shall provide at least two platforms, and may provide three:

- an aircraft interface platform capable of operating between 2 590 mm (102 in) to at most 2 900 mm (114 in) (see 4.1.4 and 4.1.9) and 8 380 mm (330 in) above the ground, which is positioned at the applicable aircraft door and shall remain at this position during the complete loading/unloading operation;
- optionally, an intermediate platform shuttling between the aircraft interface and main platforms;
- a main platform for up and down movement between 480 mm (19 in) and either 8 380 mm (330 in) or, if an intermediate shuttling platform is provided, 5 540 mm (218 in) above the ground.

4.1.3 The overall dimensions of the unit shall be kept to a minimum consistent with its intended use and performance. See 4.5.6 for turning-radius requirements.

4.1.4 The overall height of the entire unit when being driven should not exceed 4 000 mm (157 in), in order to be compatible with usually encountered airport infrastructure. See 4.1.9 for foldable guard-rails if needed.

It is recommended not to exceed this value. Loaders may however exceed it, subject to verification of available height clearances in the intended movement zone at the airport of use, but should not in any event exceed 5 000 mm (197 in), in order to prevent the risk of interference with the aircraft wing trailing edge while positioning at main-deck doors aft of it.

4.1.5 The loader shall simultaneously support, at their maximum gross mass, at least:

- one 2 438 mm × 3 175 mm (96 in × 125 in) ULD in either direction on the aircraft interface platform;

- two 2 438 mm × 3 175 mm (96 in × 125 in) ULDs in either direction on the main platform;
- where applicable, one 2 438 mm × 3 175 mm (96 in × 125 in) ULD in either direction on an intermediate platform.

Where the intermediate platform provides more than one ULD position, the aircraft interface platform may be smaller than one position. However, in such a case, an increased hazard may result from personnel working near to the aircraft door area being too close to the platform's edge: a retractable safety barrier (see 5.9) shall then be provided aft of the platform as a guard-rail across the whole width whenever the adjacent platform is not level with the aircraft interface platform.

4.1.6 The aircraft interface platform shall be adjustable to changes in aircraft attitude:

- a) pitch and roll: within a minimum range of $\pm 2^\circ$ (3,5 %);
- b) height: with an accuracy of ± 6 mm (0,25 in).

4.1.7 The aircraft interface platform shall be designed not to interfere with the opening and closing of the aircraft doors, either from a safe position on the loader or from inside the aircraft, up to a door width of 4 320 mm (170 in), with no less than 100 mm (4 in) clearance on each side. All component parts that may come into contact with the aircraft should be covered with protective padding, e.g. rubber tube or "D" section. See Reference [12] for information on protective materials.

4.1.8 The aircraft interface platform shall include adjustable side guides that can be aligned with those of the aircraft and locked into position. The platform should be:

- either overhanging by at least 305 mm (12 in) forward of the front vertical end of the chassis;
- or
- fitted on its forward edge with a telescoping element with rollers, in order to bridge the gap to the aircraft door sill where this is not achieved by an aircraft cargo door sill folding-out element.

The telescopic element extension, if applicable, shall have a minimum 3 300 mm (130 in) width, be powered and extend no less than 305 mm (12 in) forward of the fixed platform edge. It shall not be possible to lift or lower the platform, except for small adjustments to aircraft door sill height, prior to the telescopic element being fully retracted.

4.1.9 Fixed safety guard-rails (side panels) shall be fitted to both outer sides of the aircraft interface platform and shall have a minimum height of 1 100 mm (43 in), in accordance with ISO 14122-3, up to 1 400 mm (55 in). Guard-rails shall be adjustable to fully close any gap between the loader and the aircraft, including when the platform's telescopic element (see 4.1.8), if provided, is fully extended, and on the aircraft door opening.

Safety guard-rails/side panels shall be lockable in either deployed or stored position and provide a continuous kick plate at least 150 mm (6 in) high. They should preferably be filled with continuous material.

When the guard-rails are higher than 1 100 mm (43 in), a continuous hand rail should be provided along the inner sides at a 1 000 mm (40 in) height. Where necessary, to meet the overall driving height objective (see 4.1.4), the top part of the guard-rails may fold down in the driving mode. In such a case, the top part of the guard-rails shall fold down inward, fail-safe mechanical locking shall be provided for each guard-rail section in the deployed position, and the driver's position shall remain protected.

4.1.10 Where an intermediate platform is provided and is authorized for use in lifting personnel to the aircraft's upper or main deck, safety guard-rails shall also be fitted to its sides to constitute a full enclosure for this purpose and prevent personnel from walking near an unprotected platform edge.

4.1.11 The ground shall be accessible from the aircraft interface platform at all times (see emergency evacuation provision, 4.7.4). If a telescopic ladder is provided either for this purpose or for normal personnel access to the loader, it shall be fitted with a continuous back-brace protection above a height of 3,0 m (10 ft) from the ground, extending at least 1,0 m (40 in) over the top landing.

4.1.12 In addition, the loader's design shall meet all applicable requirements of:

- a) ISO 6966-1; and
- b) ISO 6966-2.

NOTE For intended operation in Europe, additional EU Machinery Directive requirements also apply. They can be met by complying with the requirements of the following European standards (see Bibliography):

- EN 1915-1;
- EN 1915-2;
- EN 1915-3;
- EN 1915-4;
- EN 12312-9.

4.2 Guide rails and stops

4.2.1 Longitudinal side guide rails shall be provided on each platform to accommodate the ULD widths it was designed for, with an additional 50 mm to 127 mm (2 in to 5 in) clearance:

- a) Aircraft interface platform: fixed height guide rails along the whole length of both sides of the platform to accurately guide ULDs into the aircraft. They shall be adjustable laterally to align with the appropriate in-aircraft guides, and lockable in this position (see 4.1.8 for telescopic elements, if applicable);
- b) Optional intermediate platform: fixed height guide rails along the whole length of both sides of the platform. They may be at fixed positions, based on the largest ULD dimension to be accommodated;
- c) Main platform: retractable guide rails along the full length of both sides of the platform. The guide rails shall consist of sections positioned adjacent to each powered conveyor section of the platform and able to operate independently. All sections shall automatically rise when the main platform starts moving upward over 559 mm (22 in) and remain in this position. When the main platform is being lowered and reaches the height of 559 mm (22 in) from the ground, it shall become possible for the operator to control the retraction of the guide rails.

For a unit with optional truck bed height transfer capability (see 5.12), it should be possible for the operator to control the retraction of the guide rails at any height below 1 520 mm (60 in) from the ground.

For a unit with optional ULD rotation capability (see 5.3), the side guide rails shall be able to be operated independently and/or simultaneously, and shall still automatically rise when the main platform starts moving upward and remain in this position.

4.2.2 Automatic ULD stops shall be provided as follows:

- a) Aircraft interface platform: at the end adjacent to the intermediate, if applicable, or main platform. These stops shall rise from the moment this platform starts moving down and shall fully retract when the upcoming platform is level with the aircraft interface platform. These stops shall remain raised at any position other than level with the adjacent platform. They shall effectively restrain all numbers and sizes (including sizes N and S if applicable) of ULDs possible on the platform;
- b) Optional intermediate platform: at the forward and aft ends. Each of these stops shall rise from the moment the adjacent platform starts moving either up or down relative to the intermediate platform. Each stop shall remain raised at any position other than level with the adjacent platform; They shall effectively restrain all numbers and sizes (including sizes N and S if applicable) of ULDs possible on the platform;