
**Aircraft ground equipment — Basic
requirements —**

**Part 2:
Safety requirements**

Matériel au sol pour aéronefs — Exigences de base —

Partie 2: Exigences de sécurité
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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

This second edition cancels and replaces the first edition (ISO 6966-2:2005), which has been technically revised for increased harmonization with EN 1915-1:2013.

ISO 6966 consists of the following parts, under the general title *Aircraft ground equipment — Basic requirements*:

- Part 1: *General design requirements*
- Part 2: *Safety requirements*

[Annex A](#) of this part of ISO 6966 is for information only.

Introduction

This part of ISO 6966 specifies the safety requirements to be taken into account by manufacturers for the design of aircraft ground support equipment. It identifies the various concerns to be taken into consideration to ensure ground equipment safety for operators and aircraft.

Throughout this International Standard, the minimum essential criteria are identified by use of the keyword “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 safe, economical, and usable aircraft ground support equipment. Deviation from recommended criteria should only occur after careful consideration and thorough service evaluation have shown alternate methods to provide an equivalent level of safety.

The requirements of this International Standard are expressed in the applicable SI units, with approximate inch-pound units conversion between brackets for convenience in those countries using that system. Where it is deemed necessary to use exact values, the SI unit ones are to be used.

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Aircraft ground equipment — Basic requirements —

Part 2: Safety requirements

1 Scope

This part of ISO 6966 specifies the minimum design requirements applicable to all aircraft ground support equipment (GSE), as defined in [3.1](#) hereafter, in order to ensure

- a) safety of staff operating or maintaining the equipment or in its vicinity, and
- b) protection of aircraft against interference or damage.

An informative list of the most commonly used pieces of ground equipment is provided in [Annex A](#) hereafter. Nevertheless, the requirements of this part of ISO 6966 apply to any piece of aircraft ground support equipment, as defined, used on airports.

This part of ISO 6966 does not intend to provide all the design requirements applicable for aircraft ground support equipment. Other requirements apply, and can be found in separate International Standards:

- ISO 6966-1 specifies the general, other than safety-related, requirements applicable to all aircraft ground support equipment;
- ISO 4116 specifies the additional requirements applicable for conveying surfaces of those pieces of aircraft ground support equipment intended for handling and loading of baggage and cargo unit load devices;
- specific International Standards, listed in the Bibliography, define the functional and performance requirements for certain types of aircraft ground support equipment.

In most countries, standing Government Health and Safety laws and regulations apply to machinery, implicitly or explicitly, including aircraft ground support equipment. Nothing in this part of ISO 6966, however, shall be deemed or otherwise used to supersede any locally applicable law or regulation, unless a specific exemption has been obtained for this purpose from the appropriate Authority.

This part of ISO 6966 does not apply to automotive vehicles or parts thereof approved for public vehicles, when used on aircraft ground support equipment for the purpose for which they are designed.

2 Normative references

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

ISO 3411, *Earth-moving machinery — Physical dimensions of operators and minimum operator space envelope*

ISO 3457, *Earth-moving machinery — Guards — Definitions and requirements*

ISO 3746, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

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ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls*

ISO 6966-1:2005, *Aircraft ground equipment — Basic requirements — Part 1: General design requirements*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 7731:2003, *Ergonomics — Danger signals for public and work areas — Auditory danger signals*

ISO 10254, *Air cargo and ground equipment — Vocabulary*

ISO 11228-2, *Ergonomics — Manual handling — Part 2: Pushing and pulling*

ISO 11532, *Aircraft ground equipment — Graphical symbols*

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

ISO 13849-1, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850, *Safety of machinery — Emergency stop function — Principles for design*

ISO 14121-1, *Safety of machinery — Risk assessment — Part 1: Principles*

ISO 14122-1:2001, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of fixed means of access between two levels*

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

IEC 60825-1, *Safety of laser products — Part 1: Equipment classification and requirements*

ECE 43¹⁾, *Uniform provisions concerning the approval of safety glazing and glazing material*

ECE 79¹⁾, *Uniform provisions concerning the approval of vehicles with regard to steering equipment*

ECE 104¹⁾, *Uniform provisions concerning the approval of retro-reflective markings for heavy and long vehicles and their trailers*

EN 1915-1:2013²⁾, *Aircraft ground support equipment - General requirements — Part 1: Basic safety requirements*

EN 1915-2²⁾, *Aircraft ground support equipment — General requirements — Part 2: Stability and strength requirements, calculations and test methods*

EN 1915-3²⁾, *Aircraft ground support equipment — General requirements — Part 3: Vibration measurement methods and reduction*

DIN 51130:2014³⁾, *Testing of floor coverings — Determination of the anti-slip property — Workrooms and fields of activities with slip danger, walking method — Ramp test*

1) ECE 43, 79, and 104 are part of the United Nations Economic Commission for Europe agreement concerning the adoption of uniform conditions of approval and reciprocal recognition of approval for motor vehicles equipment and parts, and can be obtained from any United Nations office.

2) CEN European standards can be obtained from: Comité Européen de Normalization, Avenue Marnix 17, B-1000 Brussels, Belgium, or any of the European national standardization institutes, members of C.E.N.: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, and United Kingdom.

3) DIN 51130 can be obtained from: Deutsches Institut für Normen, Burggrafenstrasse 6, D-10787 Berlin, Germany.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6966-1 and ISO 10254 and the following apply.

3.1 aircraft ground support equipment

GSE

ground equipment

ramp equipment, en US

any piece of mobile equipment, whether or not powered or self-propelled, purpose designed, built, and used for ground handling, servicing, or field maintenance of civil transport aircraft on the ramp area of an airport

Note 1 to entry: A non-comprehensive informative list of the most commonly used pieces of ground equipment is provided in [Annex A](#) hereafter.

3.2

ramp area

traffic area

apron, en GB

zone of an airport where aircraft manoeuvre and park for ground handling purposes

3.3

ramp

apron, en GB

tarmac, en US

surface of the ground in the ramp area

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3.4

equipment restraint area

ERA

part of the ramp area located less than 7,5 m (25 ft) away from a parked aircraft, as defined by Airports Council International (ACI) Apron Markings and Signs Handbook (see Reference [20]), where vehicles and equipment are not to exceed a walking speed

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3.5

service road

restricted access roadway used by airport equipment and vehicles to reach parts of the ramp area, as opposed to public roads

3.6

back-up

alternate system, which can include additional means exterior to the GSE, to ensure a GSE function in the event of failure of the system concerned

3.7

emergency

hazardous situation where time is of the essence to protect safety of persons and/or the aircraft

Note 1 to entry: Emergencies can include a need for immediate evacuation of persons.

3.8

braking ratio

ratio of the sum of the braking forces on the wheels circumference, divided by GSE weight (including maximum payload if designed for being driven with it), multiplied by 100

Note 1 to entry: It is expressed in per cent (%).

**3.9
rated load**

maximum mass (including persons) a vehicle is intended to carry

Note 1 to entry: It is the lowest of applicable constraints, general structural strength (including lifting), capability of usable floor surfaces, vehicle's driving gross mass, maximum allowable occupancy (e.g. emergency exits), etc.

**3.10
aircraft contact**

position where a part of the equipment is less than 120 mm (5 in) away from the aircraft fuselage skin

Note 1 to entry: It includes positions where actual physical contact is achieved.

4 Requirements

4.1 General

4.1.1 Considerable importance is attached to having aircraft ground support equipment into which the essential safety aspects have been incorporated as part of the basic design (design to safety). It is particularly necessary when designing aircraft GSE to take into account the adverse conditions which frequently prevail in airport ramp areas, e.g. congested vehicle movement, exposure to weather, night operation, noise from aircraft and other vehicles, and difficult communications.

4.1.2 Design to safety should be based on a specific comprehensive risk assessment for each type of aircraft GSE, to be conducted by the manufacturer in accordance with ISO 14121-1. The retained design should be commensurate with the results of the risk assessment, as well as take into account, if applicable, each area of potential concern listed hereafter.

4.1.3 Design should aim at providing intrinsically safe equipment, i.e. one where potentially unsafe occurrences are prevented by basic design features such as equipment and components geometry, layout, or mode of operation, minimizing inasmuch as feasible the necessity to use additive safety devices or circuits. Where such additional devices or circuits dedicated to safety purposes cannot be avoided, risk assessment shall include an evaluation of any potential drawbacks or unforeseen additional hazards resulting from this addition.

4.1.4 All equipment or any component thereof, the failure of which could be hazardous, shall be designed to be fail-safe, or, where impractical, duplicated. In the event of duplication, each of the duplicated components shall separately be capable of safely performing its function in the event of its alternate's failure.

4.1.5 The contents of this part of ISO 6966 were determined taking into account generally recognized assumptions as to the following:

- 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 foreseeable risks of equipment misuse evidenced by operating experience;
- c) the environmental (surface, slope, weather, lighting, operating rules, staff qualification, etc.) conditions prevailing on the ramp area of the majority of international civil airports.

Manufacturers of aircraft ground support equipment should define in the relevant documentation (see [Clause 6](#)) the specifically intended conditions of use and environment for each equipment, and 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.

NOTE For intended operation in Europe, additional EU Machinery Directive (see Reference [31]) requirements also legally apply. They can be met by complying with the requirements of European standards EN 1915-1, EN 1915-2, EN 1915-3, and EN 1915-4.

4.2 Personnel accommodation

4.2.1 Work areas

4.2.1.1 All personnel working surfaces, including work platforms, walkways, steps, landings, and crossings as well as stairs, ramps, ladder rungs, cleats, or treads shall be self-draining and have a high traction (non-slip) surface.

The operator's workplace as well as all work platform areas, including standing areas and walkways where staff is allowed at least in certain circumstances, shall have a durably slip-resistant floor surface, with a minimum R11 slip-resistance classification in accordance with DIN 51130:2014, Table 3.

Surfaces not allowed to staff shall as far as possible be made inaccessible, or if not possible be clearly marked.

4.2.1.2 Walkways shall have a minimum width of 0,4 m (16 in), except on unit load devices conveying surfaces where they shall have a minimum width of 0,3 m (12 in), and elbow/shoulder minimum passage width of 0,6 m (24 in) in a height range of 0,8 m (32 in) to 1,6 m (64 in) over the floor. Standing areas and landings shall have minimum floor dimensions of 0,4 m × 0,5 m (16 in × 20 in), and the elbow/shoulder space minimum criteria shall be met.

4.2.1.3 Ladder and stair treads shall be designed to support a minimum load of 890 N (200 lb). Landings and all personnel working surfaces shall be designed to support a minimum load of 1 100 N (250 lb) for each person occupying said landing and/or working surface at the same time, and withstand a minimum distributed load of 3 000 N·m⁻² (63 lb/ft²) over their whole surface, without incurring permanent deflection.

4.2.1.4 All operational personnel work platforms and walkways where there is a possibility of falling from a height exceeding 1,0 m (40 in) shall be protected against this risk in accordance with [4.5.2](#).

4.2.1.5 On vehicles with an open cabin, a hip guard shall be provided on the outside edge of the outer seat(s), with a minimum height of 80 mm (3 in) above the seat surface.

4.2.1.6 The access means to be used while operating the equipment shall meet the requirements of [4.5.3](#). Additional exterior access means may be used where access is needed for maintenance purposes only.

4.2.2 Driver/operator cabin

4.2.2.1 Where a cabin is provided, the minimum size of the driver's or operator's space envelope shall conform to the requirements of ISO 3411. For seated accommodation, individual restraint systems (safety belts) should be provided in accordance with locally applicable regulations.

4.2.2.2 Where transport of persons other than the driver/operator is specified, the GSE shall be equipped with

- seats, with a restraint system when located in the outer position directly behind the windshield, or
- standing accommodation with appropriate handholds.

4.2.2.3 All glass in doors and windows shall be safety glass meeting the requirements of ECE 43, or alternative material (e.g. polycarbonate) with at least the same performance characteristics. The windshield and all windows considered to be important for the driver's field of view when travelling shall be transparent and as distortion-free as possible.

4.2.2.4 When selecting driver or operator seats, consideration should be given to

- providing adjustment to the person's size and weight, and maintaining ergonomic access to controls regardless of the person's size, and
- protection against the vibrations encountered during vehicle travelling or operation (see [4.5.6](#)).

4.2.2.5 The floor, upholstery, and insulation of enclosed cabins shall consist of flame retardant material that has a horizontal burning rate not greater than 250 mm (10 in) per min in accordance with ISO 3795.

4.2.2.6 The inside of the cabin shall not include any sharp edges or protrusions. All corners or edges shall be chamfered or rounded with a minimum radius of 6 mm (1/4 in), unless smooth corners are provided by the intrinsic design of the standard material profiles used in the construction.

4.2.2.7 Fully enclosed driver/operator cabins with doors shall meet the following additional requirements.

- a) Devices, e.g. wiper, washing units, demister, window de-icing systems, etc., shall be provided to keep clear the windshield (see [4.2.3.2](#)) and all windows necessary for operating the GSE, taking into account the operational and climatic conditions of the intended place of use.
- b) Outward opening doors shall not open backward. All doors shall be provided with securing devices to retain them in the closed and, where required, in the open position (see [4.4.1.1](#)).
- c) Door mechanisms shall be designed and fitted in such a way that opening is only possible on intentional action and risk of injury is avoided.
- d) An adequately sized system for cabin ventilation shall be provided. Provisions shall be made for heating and/or air conditioning where appropriate for the intended place of use. If fuel heaters are used, combustion air shall not be taken from the interior of the cabin, and it shall not be possible for exhaust fumes to escape into the heating air. In the event of burner flame-out, fuel supply shall be automatically cut off. Open flame heaters are prohibited in the vicinity of aircraft.

4.2.3 Visibility

4.2.3.1 Vehicle drivers and operators shall have clear and unimpaired visibility when travelling or operating the unit. The shape and arrangement of any driver's or operator's cabin shall not restrict the field of view for travel or operation. Where this cannot be achieved directly or through mirrors, other means such as closed-circuit TV shall be considered. There shall at least be mirrors designed and fitted in such a way that the driver is able to observe the rear sideward areas.

4.2.3.2 Any vehicle equipped with a windshield shall be provided with a powered windshield wiper giving a wipe area of no less than 60 % of the glazed area. A sun visor of suitable size shall be provided. Overhead view panels should also be fitted with wiping and, where climatic conditions require, defroster mechanisms.

4.2.3.3 All windows affecting the driver's or operator's field of view shall be transparent and distortion free. On vehicles equipped with an enclosed cabin, the windshield shall be provided with a defogger and/or defroster.

4.2.3.4 Lighting shall be arranged in such a way that no disturbing dazzling effect is caused in conjunction with the windshield and other windows that are in the driver's field of view.