
**Aircraft ground equipment — De-icers
— Functional requirements**

*Matériel au sol pour aéronefs — Dégivreuses — 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.

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 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 11077:1993), which has been technically revised.

Introduction

This International Standard specifies the functional and personnel safety requirements to be taken into account by manufacturers for the design of aircraft de-icing and anti-icing vehicles (de-icers).

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 on the ramp of international civil airports in order to handle, service, or maintain civil transport aircraft, or
- b) the environmental (surface, slope, weather, lighting, operating rules, staff qualification, etc.) conditions prevailing on the ramp area of the majority of international civil airports. In addition to customary environment conditions in this context, it is to be assumed that de-icers will be operated on snowy, icy, muddy, or slushed ramp surfaces and under freezing precipitation conditions.

It is assumed that the manufacturers of de-icers define in the relevant documentation the specifically intended conditions of use and environment for their equipment, and 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.

NOTE Negotiation between manufacturer and purchaser/user is considered essential to establish or verify the adequate conditions of use and design parameters.

The requirements of this International Standard are expressed in the applicable SI units, with approximate inch-pound unit 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 — De-icers — Functional requirements

1 Scope

This International Standard specifies the general functional, performance, and safety requirements for a self-propelled vehicle equipped with a boom type aerial device and aircraft de-icing/anti-icing fluid (ADF) spraying systems, hereinafter designated as “de-icer”.

This International Standard does not specify a comprehensive set of technical design criteria for aircraft de-icing/anti-icing vehicles, but only those relating to the main functional, safety, and performance requirements.

This International Standard is not applicable to stationary equipment, e.g. gantries, cranes, used to perform de-icing/anti-icing operations on aircraft.

Throughout this International Standard, 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 safe, economical, and usable aircraft de-icers. 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.

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 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 10254, *Air cargo and ground equipment — Vocabulary*

ISO 11075, *Aircraft — De-icing/anti-icing fluids — ISO type I*

ISO 11076, *Aircraft — De-icing/anti-icing methods on the ground*

ISO 11078, *Aircraft — De-icing/anti-icing fluids — ISO types II, III and IV*

ISO 11532, *Aircraft ground equipment — Graphical symbols*

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

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

EN 12312-6, *Aircraft ground support equipment — Specific requirements — Part 6: De-icers and de-icing/anti-icing equipment*

DIN 51130:2010, *Testing of floor coverings — Determination of the anti-slip property — Workrooms and fields of activities with slip danger, walking method — Ramp test*

NOTE 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 10254 and the following apply.

3.1 de-icer

self-propelled mobile unit, used to perform de-icing or anti-icing operations by means of fluids spraying on aircraft on the ground

Note 1 to entry: It is fitted with an operator cabin or basket mounted on a boom in order to raise the operator at the height of aircraft surfaces to be sprayed.

3.2 driver

person located in the cabin (driving station) of a de-icer's chassis and driving the vehicle around the aircraft

3.3 operator

person(s) located in the boom mounted operator's cabin or basket, operating its movements relative to the de-icer's chassis as well as the fluid spraying system(s)

3.4 cabin (operator's)

completely enclosed work station at the end of the de-icer's boom, where the operator is located to perform de-icing/anti-icing operations on the aircraft

3.5 basket (operator's)

non-enclosed work station at the end of the boom where the operator stands alternatively to a cabin

3.6 boom

structural element supporting the operator's cabin or basket at a height

Note 1 to entry: Not to be mistaken for "spraying boom", an element extending from the operator's station to support spraying hoses and brings the nozzles as close as possible to the aircraft being de-iced, which does not support persons.

4 Requirements

4.1 General

4.1.1 The de-icer's design and construction shall meet the applicable requirements of ISO 6966-1 and ISO 6966-2, and the requirements stated hereafter. Where these requirements are in excess of those in the general aircraft ground equipment standards, they shall take precedence.

NOTE For operation in Europe, the EU Machinery Directive essential safety requirements legally apply. They can be met by complying with the requirements of the following European Standards (see [Clause 2](#) and Bibliography):

- EN 1915-1, *Aircraft ground support equipment — General requirements — Part 1: Basic safety requirements*
- EN 1915-2, *Aircraft ground support equipment — General requirements — Part 2: Stability and strength requirements, calculations and test methods*

- EN 1915-3, *Aircraft ground support equipment — General requirements — Part 3: Vibration measurement methods and reduction*
- EN 1915-4, *Aircraft ground support equipment — General requirements — Part 4: Noise measurement methods and reduction*
- EN 12312-6, *Aircraft ground support equipment — General requirements — Part 6: De-icers and de-icing equipment*

4.1.2 The de-icer's structural strength shall meet the applicable stability and strength requirements of EN 1915-2 and EN 12312-6 and be demonstrated by testing in accordance with them.

4.1.3 Particular attention shall be paid to the fatigue strength requirements for the boom and attachments thereto, which shall be based on minimum 2×10^4 stress cycles or 10 000 h operating life expectancy, whichever is highest.

NOTE Consultation between manufacturer and purchaser is required to substantiate a realistic life expectancy, stress cycle definition, and fatigue spectrum.

4.1.4 The de-icer and all associated systems shall be designed and constructed to operate satisfactorily between temperatures of -30 °C and 50 °C (-20 °F and 120 °F) and in continuous relative humidity of up to 95 % or as stipulated between purchaser and manufacturer.

NOTE Lower temperatures, requiring special design and operating measures, can be agreed between manufacturer and purchaser. See Note in the Introduction.

4.2 Functions

4.2.1 The primary function of the de-icer shall be to apply heated de-icing/anti-icing fluid from a variable height boom to the surfaces of stationary aircraft while traversing their perimeter. A hose shall also be fitted for ground use. The vehicle shall be acceptable for use around terminal gate areas, airport service roads, and aircraft service ramps.

NOTE A secondary function can also be to provide access when required to high elevation parts of the aircraft.

4.2.2 The maximum width and overall height with the boom in the stowed position shall be kept to a minimum. The maximum overall width should be minimum compatible with stability objectives, and the overall height in the stowed position shall not exceed 4,0 m (13 ft, 1 in). Overall turning radius in this position should not exceed 12 m (40 ft), though maximum possible manoeuvrability is recommended.

NOTE Over the road regulations in a majority of states allow a maximum width of 2,5 m (8 ft 2 1/2 in). A number of states allow 2,6 m (8 1/2 ft) width. Conversely, some local road traffic regulations can require narrower widths. Depending on the airport of use, a lower height can also be necessary. See Note in the Introduction.

4.2.3 On an appropriate self-propelled chassis with an enclosed driver's cabin, meeting the requirements of 4.3, the de-icer shall provide

- a) an aerial device with operator's cabin or basket, including safe access means from the ground in the stowed position, meeting the requirements of 4.4,
- b) (a) fluid storage and supply tank(s), large enough to accommodate the fluid capacity necessary for servicing standard-body and/or wide-body or large capacity aircraft as required by the purchaser, meeting the requirements of 4.5.2, and
- c) fluid pumping systems for applying heated de-icing fluid and heated or unheated anti-icing fluid to aircraft surfaces, meeting the requirements of 4.5.1.

See [Clause 6](#) for optional features.

4.2.4 A two-way vocal communication system shall be installed between the operator's cabin or basket and the driver's cabin, if separate. The operator's cabin or basket headset, if applicable, shall be integrated or compatible with protective ear mufflers, and its wiring's routing shall be ergonomically designed in order to avoid any hazard or entanglement.

4.2.5 De-icers are intended to spray aircraft under freezing conditions with the following appropriate fluids mixed with water (if applicable) and heated as necessary, in order to enable operators to de-ice/anti-ice aircraft in accordance with the detailed methods stated in ISO 11076:

- a) ISO type I de-icing/anti-icing fluid (see ISO 11075);
- b) ISO type II, III, or IV de-icing/anti-icing fluid (see ISO 11078).

4.2.6 De-icers can also be used, without spraying, as a means of technical staff access to elevated parts of aircraft, e.g. for maintenance. Reduced performance requirements can apply in such a case where identified in the present International Standard, but personnel safety requirements remain applicable.

4.3 Vehicle

4.3.1 The de-icer shall be based on a chassis rated and approved by the chassis manufacturer for the maximum intended loads and speeds of the de-icer. Alternately, a custom built chassis is allowable under the manufacturer's responsibility and shall substantiate loads and speeds ratings in an at least equivalent manner.

4.3.2 The de-icer with operator's cabin or basket in the stowed position should be capable of being driven at normal road speeds in accordance with applicable local airport regulations, or at least 32 km·h⁻¹ (20 mph). When the operator's cabin or basket is lifted from the stowed position, maximum speed shall be limited to no more than 1,7 m·s⁻¹ (6 km·h⁻¹, 4 mph) or, if lower, local safety regulations. Where this is ensured by interlocking, the corresponding safety device shall ensure a performance level "b" in accordance with ISO 13849-1.

4.3.3 The drive train of the vehicle shall be designed for as smooth and jerk free driving as possible. It is further recommended to consider manoeuvring close to the aircraft. For this purpose, the possibility of driving with an inching/creeping speed should be considered.

4.3.4 An enclosed heated cabin for the driver, and optionally a passenger, shall be provided. The cabin shall be fitted with windshield wipers and a defroster/heater system. The design of the vehicle shall be such that no de-icing/anti-icing vapours can enter the chassis cabin (with windows closed) under any weather conditions. The cabin shall, as a minimum, be equipped with a mechanical filter on the air intake, for removal of aerosols produced. All seats shall be fitted with automotive type 3 points inertia reel safety belts.

4.3.5 The driver's position shall have maximum unobstructed visibility, including of the operator's cabin or basket under all operating conditions. This requires at least a large overhead transparent panel fitted with wipers and defrosting.

NOTE Where blind spots are unavoidable by design, e.g. at the rear of the vehicle, indirect means of vision such as mirrors or closed circuit television (CCTV) can be used to provide the driver with visibility in those areas.

4.3.6 Power steering as well as a power-assisted dual circuit service braking system and a parking brake shall be provided.

4.3.7 Mud/snow tires shall be provided on drive wheels. Drive wheels tire clearances shall be adequate for the installation and operation of snow chains. Any vulnerable components shall be suitably protected against projections of snow or ice.

4.3.8 The fuel tank(s) shall be located for protection against collision damage, and so that any overflow during filling, or any leakage from the tank, fuel lines, or fittings, will not impinge on engines exhaust system, electrical system, or other ignition sources, or enter the driver's cabin.

4.3.9 Tow hooks shall be installed on the chassis structure, with at least one at the front and one at the rear. The tow hooks shall be usable with the operators' cabin or basket in any position.

4.3.10 Storage electrical batteries shall be of the heavy duty type, and alternators shall be dimensioned bearing in mind that de-icing units often operates in engine idle condition but with all electrical consumers switched on.

4.4 Aerial device

4.4.1 The de-icer shall provide an aerial device including a supporting boom, to which shall be attached either an enclosed operator's cabin fitted with windshield wipers and a defroster/heater system, or (see Note in the Introduction) an open operator's basket entirely surrounded by full guard-rails up to a height of at least 1,1 m (43 in) over its floor. Cabin or basket shall be rated for a minimum of two persons (minimum load capacity of 204 kg/450 lb), to provide for operators training and possible visual de-icing control by a separate qualified person. Where these objectives are not retained, a cabin or basket intended for a single person shall be rated for a minimum load capacity of 160 kg (350 lb).

4.4.2 The operator's cabin or basket and its supporting boom shall be designed to position an operator to effectively apply de-icing/anti-icing fluid to the upper areas of aircraft control surfaces, wings, vertical and horizontal stabilizers, and fuselage. Consideration shall be given to the height of these surfaces on aircraft types intended to be serviced while designing or selecting any de-icer type.

4.4.3 The operator's cabin or basket shall have a self-adjusting mechanism to maintain a vertical operating attitude for all boom positions.

4.4.4 The operator's cabin or basket shall allow safe access from the ground in the stowed position, and provide for safe and easy entry and exit. The cabin door or basket gate shall not fold or open outwards, and shall be constructed to either be automatically self-closing and latching, or boom movements, including lifting from the stowed position, be prohibited unless the cabin door or basket gate is closed and fully latched. Where this is ensured by interlocking, the corresponding safety device shall ensure a performance level "c" in accordance with ISO 13849-1.

4.4.5 The design of the operator's cabin shall be such as to strictly minimize, in as much as possible, entry of de-icing/anti-icing fluids aerosols (with windows closed). See [Annex A](#) for toxicological hazards. The cabin shall, as a minimum, be equipped with a mechanical filter on the air intake, for removal of aerosols produced.

4.4.6 The cabin's inner operator envelope shall take into account the likeliness of operators wearing heavy winter clothing, boots, and gloves. The cabin, unless fitted with seats with safety belts for all occupants, or basket shall be fitted with harness anchorage points for personal protective equipment (PPE) harness(es). If provided, operator seat(s) shall be fitted with automotive type 3 points inertia reel safety belts.

4.4.7 (A) lighting projector(s), adjustable from the operator's cabin or basket, shall be provided to illuminate the spraying area for night operation. The minimum total luminous flux shall be 1000 lm (equivalent to approximately 100 W incandescent lamp power).

4.4.8 The structural and fatigue strength of the cabin or basket, its attachment to the boom, the boom itself, and its attachment to the chassis shall be in accordance with the requirements of [4.1.2](#) and [4.1.3](#). The aerial device, including the cabin, the boom, and its attachment to the chassis shall be designed in such a manner that periodic structural inspection can readily be carried out without major disassembly.