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# Aircraft — Ground service connections — Locations and types

*Aéronefs — Prises de service au sol — Emplacements et types*



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ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

 

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# Foreword

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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).

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For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by 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 10842:2006), which has been technically revised.

The main changes compared to the previous edition are as follows:

— 5.1, 5.2, 6.1, 7.2 and 7.3 has been technically revised;

— a new subclause (8.4) has been added.



# Introduction

This document specifies standardized locations and types of main line transport aircraft ground service connections to accommodate the growing trend toward fixed systems which use the passenger boarding bridge and/or underground “pop-up” or pit systems as a vehicle for sources of utilities. In standardizing the locations of aircraft service connections, they should, however, continue to be served efficiently in those instances where mobile ground support equipment (GSE) is used.

The objectives of standardizing the locations of aircraft servicing connections are:

— reducing ramp congestion and equipment interference around the aircraft, and minimizing the chance of aircraft damage from mobile ground support equipment (GSE);

— allowing for optimization of ground services, both fixed and mobile, specifically 400 Hz electric power, preconditioned air for cabin conditioning, pneumatic power for jet engine start, potable water, lavatory service (draining, flushing), aircraft refuelling, and interphone (headset) connections;

— standardizing the locations of service points around the aircraft to allow airport planners and facility engineers to design fixed servicing systems to serve all aircraft easily and efficiently, as well as to provide additional standards and parameters for mobile ground support equipment (GSE) that connects to the aircraft.

Throughout this document, 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 serviceable, economical and practical aircraft ground service connections layouts. Deviation from recommended criteria should only occur after careful consideration and thorough service evaluation have shown alternate methods to provide an equivalent level of efficiency.

# Aircraft — Ground service connections — Locations and types

## 1 Scope

This document specifies the locations and types of aircraft ground service connections in order to optimize ground services both fixed and mobile, for the seven different services hereafter:

— 400 Hz electrical power;

— preconditioned air for cabin conditioning;

— pneumatic power for jet engine start;

— potable water;

— lavatory service (draining, flushing);

— aircraft refuelling;

— interphone (headset) connections.

It focuses on these aircraft services because:

— these connections are those most frequently used during aircraft airport turnaround operations;

— in terms of economic benefit, they have the greatest impact through improved efficiency.

This document is intended to apply to any new type of main line commercial transport category aircraft designed or built after its publication.

In addition, it is expected that any substantially modified new derivative aircraft type in the same category (derived from a previously existing type) will, insofar as technically and economically practical, meet the requirements of this document, if specified in the aircraft type specification established between customer airline(s) and manufacturer.

It is not the intent of this document to restrict in any way the basic design of any future types of civil passenger transport aircraft. It aims, however, at clarifying for aircraft design engineers the design characteristics which would make it difficult or impossible for a new type of aircraft to be adequately serviced from existing airport facilities. Should basic aircraft design requirements impose on a future model certain characteristics not complying with the present document:

— either alternative methods of servicing the aircraft will have to be implemented; or

— existing facilities in the airports where such a new type of aircraft is to operate will require some degree of modification/rework; or

— additional interface devices/equipment will be required in order to service such a new type of aircraft;

in either case resulting in increased aircraft servicing constraints and operating cost.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 45, *Aircraft — Pressure refuelling connections*

ISO 461-1, *Aircraft — Connectors for ground electrical supplies — Part 1: Design, performance and test requirements*

ISO 461-2, *Aircraft — Connectors for ground electrical supplies — Part 2: Dimensions*

ISO 1034, *Aircraft — Ground air-conditioning connections*

ISO 2026, *Aircraft — Connections for starting engines by air*

ISO 7718-1, *Aircraft — Passenger doors interface requirements for connection of passenger boarding bridge or passenger transfer vehicle — Part 1: Main deck doors*

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

ISO 17775, *Aircraft — Ground-service connections — Potable water, toilet-flush water and toilet drain*

## 3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at http://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**main line aircraft**
civil passenger and/or freight transport aircraft with a maximum ramp mass over 50 000 kg (110 000 lb)

**3.2**
**maximum ramp mass**
**MRW**
maximum Ramp Weight
maximum mass allowable for an aircraft type when leaving its parking position either under its own power or towed, comprising maximum structural take-off mass (MTOW) and taxiing fuel allowance

**3.3**
**nose landing gear**
**NLG**
aircraft nose landing gear in a conventional tricycle landing gear layout

**3.4**
**passenger doors**
<aircraft> main deck doors from the aircraft's nose to its tail

Note 1 to entry: Passenger doors are numbered 1, 2, 3 (sequentially) followed with index L if they are on the aircraft's left hand side and R if they are on its right hand side.

# 4 Requirements

## 4.1 General

**4.1.1** The standardized ground service connections locations shall provide efficient servicing configurations in either of the two possible airport gate layouts (see Figure 3):

— open ramp parking, where most services are rendered by mobile GSE/vehicles. The objectives shall be to minimize ramp congestion and the possibilities of servicing vehicles interference with each other or with the aircraft's structure; or

— passenger boarding bridge parking and/or underground "pop-up" or pit systems, where services can be rendered either by mobile GSE/vehicles, or by fixed facilities conveyed by the bridge. The objectives shall be to minimize the length of the various cables/hoses concerned and the possibilities of their interference with each other or with mobile GSE/vehicles still required.

**4.1.2** All connections shall be of the type and should be placed at the locations specified according to their purpose in Clauses 5 to 7.

**4.1.3** In addition, the ground service connections shall be selected in order to minimize the resulting design, weight and space occupancy penalties on board the aircraft itself.

## 4.2 Location reference

**4.2.1** Since the passenger boarding bridge constitutes the primary means to convey certain utilities to the aircraft, unless otherwise specified the aircraft main deck passenger door(s) shall be used as the reference point for the location of connections appropriate for these utilities. As a result, it is necessary to separately consider the two following cases:

**4.2.2** Aircraft with a single main deck door capable of being used for passenger access located forward of the wing (see Clause 6); or

**4.2.3** Aircraft with two main deck doors capable of being used (separately or simultaneously) for passenger access located forward of the wing (see Clause 7). Such aircraft can, depending on the airport gate layout, be serviced either with two main deck passenger boarding bridges, or with one located at the most forward door (number 1L), or with one located at the most aft door (number 2L).

**4.2.4** For two utilities, electrical power supply and interphone connection, the appropriate reference point is not the passenger doors but the aircraft's nose landing gear for all aircraft (see Clause 5).

## 4.3 Connections height

**4.3.1** With reference to the ground, the connections for all services covered by this document should be located, whenever the aircraft structure's height allows, at a point where ground personnel can easily make connection from a standing position on the ground, without the use of ancillary access equipment.

**4.3.2** The above requirement shall at least apply to the following connection(s):

— interphone (headset).

**4.3.3** The above requirement shall not apply to:

— aircraft fuelling connections.

# 5 Connections locations and types (all aircraft)

## 5.1 Electrical power

**5.1.1** With regards to the location of 400 Hz electrical power connection(s), the most critical case is considered to be aircraft towing with 400 Hz power being provided from the tractor. Accordingly, the reference point used shall be the aircraft's nose landing gear.

**5.1.2** (A) 90 kVA connection receptacle(s) meeting the requirements of ISO 461-1 and ISO 461-2 (6 pin connector) shall be provided for 400 Hz electrical power. The connection(s) should preferably be vertical so as to avoid the possibility of pins misalignment under the weight of the cable. When power requirements dictate two or more connections, minimum clearance requirements shall be considered.

**5.1.3** The connection(s) shall be located at a distance not exceeding 1,5 m (5 ft) from aircraft's nose landing gear.

## 5.2 Interphone (headset)

**5.2.1** With regards to the location of ground interphone (headset) connection(s), the most critical case is considered to be aircraft towing with an interphone link being established with the tractor. Accordingly, the reference point used shall be the aircraft's nose landing gear.

**5.2.2** At least one headset female connection shall be provided for interphone connection.

**5.2.3** This connection shall be located on or left of the lower centre line of the fuselage, at a distance not exceeding 1,5 m (5 ft) from the aircraft's nose landing gear.

## 5.3 Fuelling

**5.3.1** (A) pressure fuelling connection(s) meeting the requirements of ISO 45 (63 mm/2,5 in diameter) shall be provided.

**5.3.2** One or two fuelling connections should be provided on each wing, as dictated by the design minimum fuelling flow requirements and appropriate to minimize ramp congestion.

**5.3.3** The fuelling connection(s) location on the wing shall be determined in order to minimize access height and the possibilities of interference with mobile GSE/vehicles performing other services on the aircraft in the course of usual cargo or passenger operations. As a general rule, the most efficient location for these connections is on the forward edge of the wing box (fuel tank), as far from fuselage centre line (outboard) as made allowable by maximum access height.

## 5.4 Lavatory service

**5.4.1** Lavatory service (draining and flushing) connections meeting the requirements of ISO 17775 shall be provided. The drainage connection(s) shall be complemented by an additional internal plug type valve in order to avoid the risks of either fluid leakage leading to highly hazardous in-flight icing, or waste dumping over the ramp when connecting the servicing vehicle.

**5.4.2** A single set (draining and flushing) of lavatory service connections should be provided, whenever allowed by aircraft systems design.

**5.4.3** The set of lavatory service connections shall be located in the aft part of the aircraft. Its location shall be determined in order to minimize access height and the possibilities of interference with mobile



GSE/vehicles performing other services on the aircraft in the course of usual cargo or passenger operation.

On freighter aircraft, the lavatory servicing connection may be located within the space envelope defined in 6.1. The requirements in 5.4.4 shall be complied with.

**5.4.4** Any lavatory service connections shall be adequately separated from, and not located forward of or above, any potable water service connection.

### 5.5 Potable water

**5.5.1** A single potable water servicing connection meeting the requirements of ISO 17775 shall be provided.

**5.5.2** The potable water connection shall be located in the aft part of the aircraft. Its location should be determined in order to minimize access height and the possibilities of interference with mobile GSE/vehicles performing other services on the aircraft in the course of usual cargo or passenger operation.

On freighter aircraft, the water servicing connection may be located within the space envelope defined in 6.1. The requirements in 5.5.3 shall be complied with.

**5.5.3** The potable water connection shall be adequately separated from, and not located aft of or below, any lavatory service connection. It shall also be protected from any risk of contamination from drain masts.

## 6 Connections locations and types (aircraft with a single door forward of the wing)

### 6.1 Location area

**6.1.1** For aircraft with a single main deck passenger door, capable of being used for passenger access, located forward of the wing, the centre line of the number 1L passenger boarding door shall be used as a reference point. The service connection points for preconditioned air and, as an option, potable water on freighter aircraft, shall be located at a point accessible from the centre line of number 1L passenger boarding door, on or left of the lower centre line of the fuselage.

**6.1.2** For aircraft defined in 6.1.1, an accessible location shall be defined as any point within a space envelope extending 1,5 m (5 ft) forward and 7,5 m (25 ft) aft of the centre line of the number 1L passenger boarding door (see Figure 1), excluding any part of the obstacle free zone around the door defined by ISO 7718-1.

### 6.2 Pneumatic power

**6.2.1** No more than two pneumatic power connections, meeting the requirements of ISO 2026 (76 mm/3 in diameter), shall be provided. When two connections are provided, they should not be located more than 1,5 m (5 ft) apart from each other, and minimum clearance requirements shall be considered.

**6.2.2** The pneumatic power connection(s) shall be located within the envelope defined in 6.1.

**6.2.3** In addition, in the event of wing mounted engines, the pneumatic power connection(s) location should be determined in order to allow an entirely safe path for the operator, away from the aircraft inboard left or right hand sides engine air intake hazard area, after disconnecting with engines running.

### 6.3 Pre-conditioned air

**6.3.1** No more than two pre-conditioned air supply connections, meeting the requirements of ISO 1034 (203 mm/8 in diameter), shall be provided. When two connections are provided, they shall not be located more than 1,5 m (5 ft) apart from each other, and minimum clearance requirements shall be considered.

**6.3.2** The pre-conditioned air connection(s) shall be located within the envelope defined in 6.1.

## 7 Connections locations and types (aircraft with two doors forward of the wing)

### 7.1 Location area

**7.1.1** For aircraft with two main deck passenger doors, capable of being used for passenger access, located forward of the wing, the centre line of the number 2L passenger boarding door shall be used as a reference point. The service connection points for pneumatic power and preconditioned air shall be located at a point accessible from the centre line of number 2L passenger boarding door, on or left of the fuselage centre line.

**7.1.2** For aircraft defined in 7.1.1, an accessible location shall be defined as any point within a space envelope extending 7,5 m (25 ft) forward and aft of the centre line of the number 2L passenger door (see Figure 2), excluding any part of the obstacle free zone around the door defined by ISO 7718-1.

### 7.2 Pneumatic power

**7.2.1** No more than three pneumatic power connections, meeting the requirements of ISO 2026 (76 mm/3 in diameter), shall be provided. If two connections are provided, they should not be located more than 1,5 m (5 ft) apart from each other. In the event of three connections being provided, no two connections should be located more than 2,4 m (8 ft) apart from each other. When there are multiple connections, minimum clearance requirements shall be considered.

**7.2.2** The pneumatic power connection(s) shall be located within the envelope defined in 7.1.

**7.2.3** In addition, in the event of wing mounted engines, the pneumatic power connection(s) location should be determined in order to allow an entirely safe path for the operator, away from the aircraft inboard left or right hand sides engine air intake hazard area, after disconnecting with engines running.

### 7.3 Pre-conditioned air

**7.3.1** (A) pre-conditioned air supply connection(s), meeting the requirements of ISO 1034 (203 mm/8 in diameter), shall be provided. In the event of two connections being provided, they shall not be located more than 1,5 m (5 ft) apart from each other. When there are two connections, minimum clearance requirements shall be considered.

**7.3.2** The pre-conditioned air connection(s) shall be located within the envelope defined in 7.1.

## 8 Prevention of GSE interference

**8.1** The service locations shall be located in the above defined areas so that they are accessible to mobile GSE under the following conditions (see Figure 3):

— when passenger boarding bridges or fixed utilities are not available;

— when passenger access stairs are used in an open ramp situation.



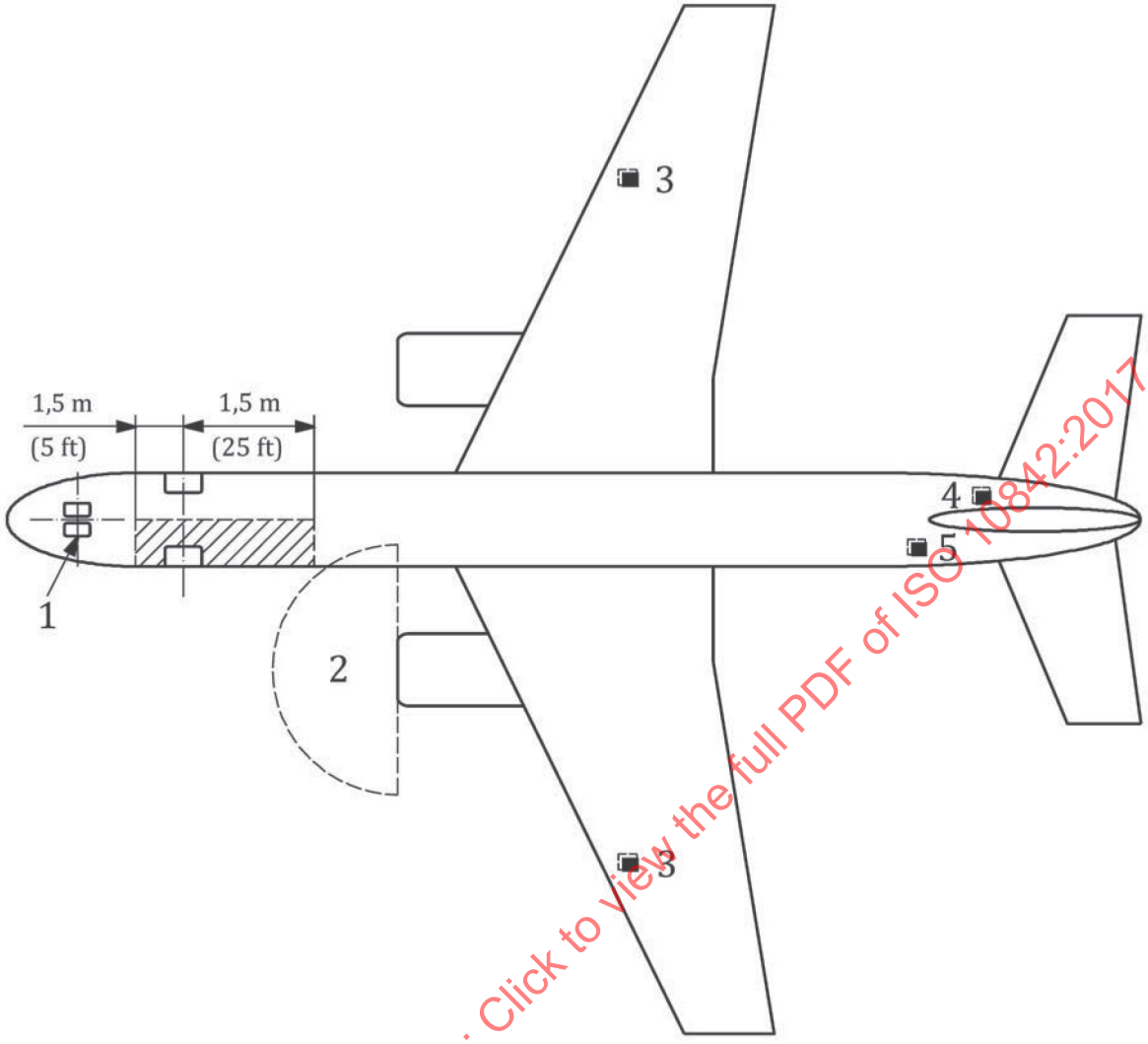
 

**8.2** Accommodations for service vehicles of 2,5 m (8 ft) width are required within accessible distance from each connection point.

**8.3** A clearance of 0,6 m (2 ft) shall be allowed for between positioned vehicles.

**8.4** A clearance of 1 m (3.3 ft) should be allowed between the GSE and aircraft engines and wing trailing edge including flaps.

**8.5** Before determining the locations of connection points, the dangerous areas in front and in the rear of aircraft engines have to be taken into consideration. It shall be possible to connect/disconnect the couplings and handle the aircraft without entering these dangerous areas. The extent of the dangerous areas should be determined with the engines running at idle power.






**Key**

1 nose landing gear
2 engine intake safety area
3 fuel
4 lavatory
5 water

400 Hz electrical power and headset connection points to be located on left side or fuselage centre line within 1,5 m (5 ft) distance from nose landing gear

Shaded area indicates location area for the following connection points:

— pneumatic power
— pre-conditioned air

**Figure 1 — Aircraft utilizing one passenger boarding door forward of wing (drawing not to scale)**