INTERNATIONAL STANDARD

ISO 10842

First edition
2006-11-01

Aircraft — Ground service connections — Locations and types

Aéronefs — Prises de service au sol — Emplacements et types

Reference number
ISO 10842:2006(E)

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Published in Switzerland

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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 10842 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 9, *Air cargo and ground equipment*.

Introduction

This International Standard 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 as a vehicle for sources of utilities. In standardizing the locations of aircraft service connections, they must, 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:

— to reduce ramp congestion and equipment interference around the aircraft, and to minimize the chance of aircraft damage from mobile GSE;

— to allow 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;

— to standardize 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 GSE that connects to the aircraft.

It is not the intent of this International Standard 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 International Standard,

— 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.

Each of these cases will result in increased aircraft servicing constraints and operating cost.

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 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 alternative methods to provide an equivalent level of efficiency.

Aircraft — Ground service connections — Locations and types

1 Scope

This International Standard specifies the locations and types of aircraft ground service connections in order to optimize ground services, both fixed and mobile, for the following seven services:

— 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 International Standard applies to any new type of main line commercial transport category aircraft designed or built after its publication.

In addition, it applies to any substantially modified new derivative aircraft type in the same category (derived from a previously existing type), insofar as technically and economically practical, if specified in the aircraft type specification established between customer airline(s) and manufacturer.

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 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, *Aircraft — Main-deck passenger doors — Interface requirements for connection with passenger-boarding bridge or transfer vehicle*

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

NOTE Informative references for this International Standard are given in the Bibliography.

3 Terms and definitions

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

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
aircraft ground support equipment
GSE
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

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 all services are rendered by mobile GSE/vehicles. The objectives shall be to minimize ramp congestion and the possibility of servicing vehicles interfering with each other or with the aircraft's structure.

— Passenger boarding bridge parking, 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 possibility of their interference with each other or with mobile GSE/vehicles still required.

4.1.2 All connections shall be of the type specified according to their purpose in Clauses 5 to 7 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 cases given in 4.2.2 and 4.2.3.

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).

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 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).

NOTE Aircraft main-deck passenger doors are numbered 1, 2, 3, etc., from the aircraft's nose toward its tail, with index L if they are on the aircraft's left-hand side and R if they are on its right-hand side.

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 International Standard 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 requirement in 4.3.1 applies at least to the interphone (headset) connection(s).

4.3.3 The requirement in 4.3.1 does not apply to the aircraft fuelling connections.

5 Connections locations and types (all aircraft)

5.1 Electrical power

5.1.1 As regards 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 or receptacles 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 pin misalignment under the weight of the cable. When power requirements dictate two or more connections, minimum clearance requirements shall be considered, and it shall remain possible to perform aircraft towing using only one of the connections.

5.1.3 The connection(s) shall be located no more than 1,5 m (5 ft) from the aircraft's nose landing gear.

5.2 Interphone (headset)

5.2.1 As regards 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 two headset female connections shall be provided for interphone connection.

5.2.3 These connections shall be located on or left of the lower centre line of the fuselage, not more than 1,5 m (5 ft) from the aircraft's nose landing gear.

5.3 Fuelling

5.3.1 A pressure fuelling connection or connections meeting the requirements of ISO 45 [63 mm (2,5 in) 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 the 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 service connection may be located within the space envelope defined in 6.1. The requirements in 5.4.4 apply.

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 service connection meeting the requirements of ISO 17775 shall be provided.

5.5.2 The potable water service 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 service connection may be located within the space envelope defined in 6.1. The requirements in 5.5.3 apply.

5.5.3 The potable water service 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 pneumatic power, 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.

6.2 Pneumatic power

6.2.1 No more than two pneumatic power connections, meeting the requirements of ISO 2026 [76 mm (3 in) in diameter], shall be provided. When two connections are provided, they should not be located more than 1,5 m (5 ft) apart, 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 side engine air intake hazard area, after disconnecting with engines running.

6.3 Preconditioned air

6.3.1 No more than two preconditioned air supply connections, meeting the requirements of ISO 1034 [203 mm (8 in) in diameter], shall be provided. When two connections are provided, they shall not be located more than 1,5 m (5 ft) apart, and minimum clearance requirements shall be considered.

6.3.2 The preconditioned 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.

7.2 Pneumatic power

7.2.1 No more than three pneumatic power connections, meeting the requirements of ISO 2026 [76 mm (3 in) in diameter], shall be provided. If two connections are provided, they should not be located more than 1,5 m (5 ft) apart. In the event of three connections being provided, no two connections should be located more than 2,4 m (8 ft) apart. When there are multiple connections, minimum clearance requirements shall be considered. Where three pneumatic connections are provided, it will not be feasible or economical to install three hoses on passenger loading bridges at airports. Hence, it shall remain possible to start the aircraft's engines using only two of the three pneumatic connections, with appropriate input air flow capabilities.

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 side engine air intake hazard area, after disconnecting with engines running.

7.3 Preconditioned air

7.3.1 No more than two preconditioned air supply connections, meeting the requirements of ISO 1034 [203 mm (8 in) 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. When there are two connections, minimum clearance requirements shall be considered. Where more than two connections are provided, use of only two connectors should be considered, with the appropriate air mass flow and temperatures.

7.3.2 The preconditioned 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 in the above-defined areas so that they are accessible to mobile GSE under the following conditions (see Figure 3):

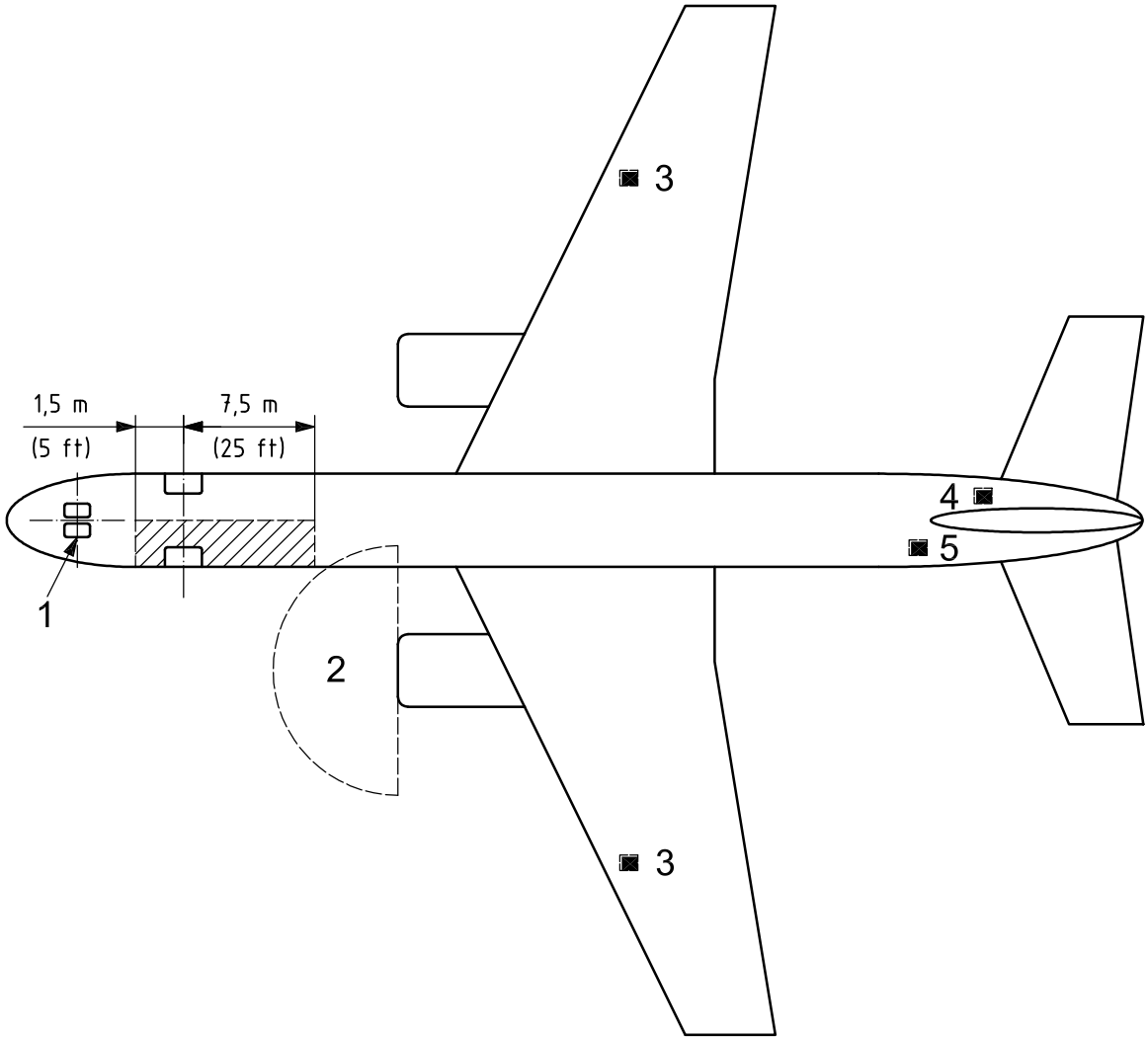
— when passenger boarding bridges or fixed utilities are not available;

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

8.2 Accommodation for mobile GSE of 2,5 m (8 ft) width is required within an accessible distance of each connection point, and 0,6 m (2 ft) minimum clearance shall be allowed for between positioned mobile GSE, and from any part of the aircraft.

8.3 Before determining the locations of connection points, the dangerous areas in front of and behind 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.

Not to scale



Key

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

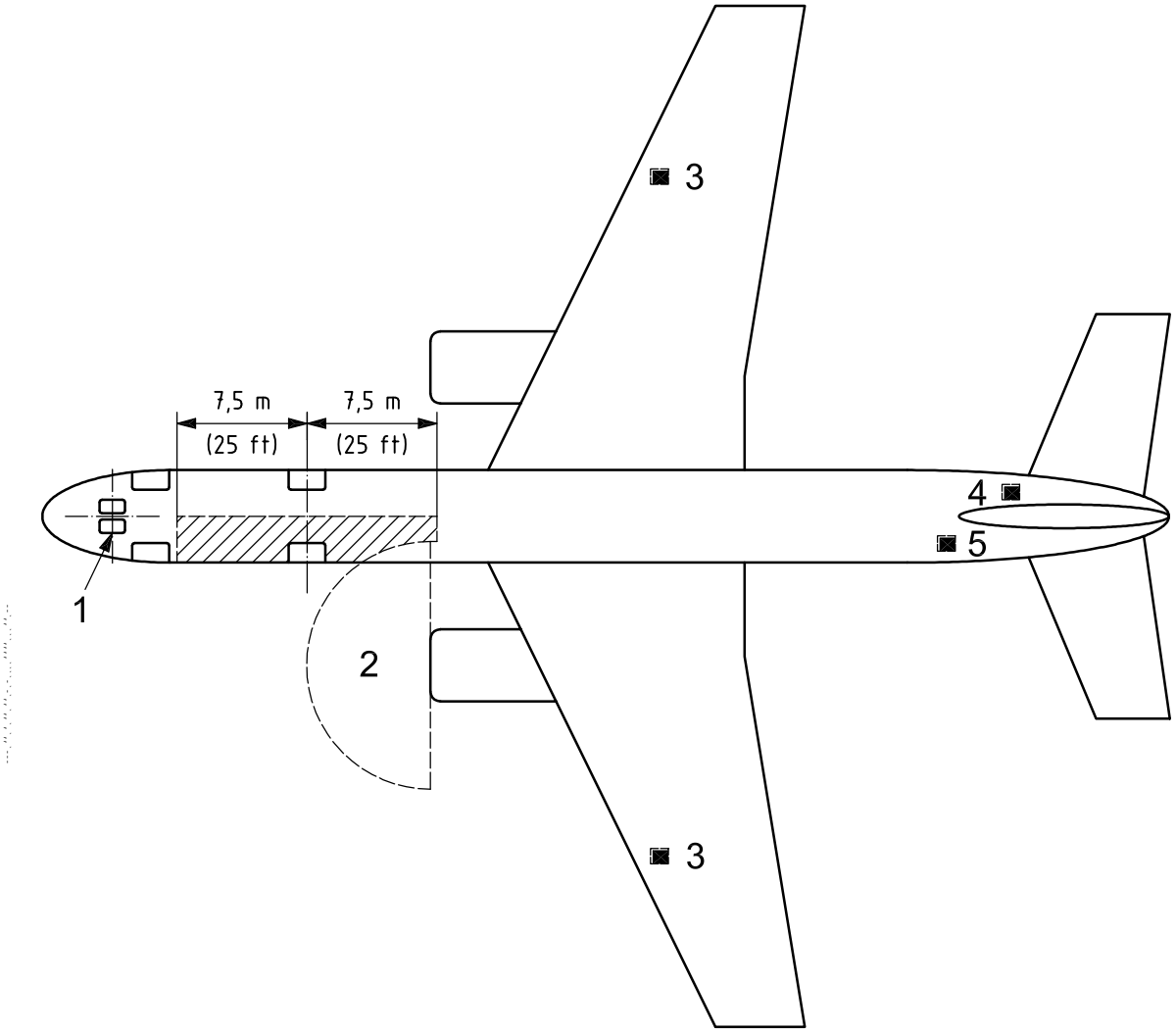
The 400 Hz electrical power and headset connection points shall be located on the left side of the fuselage centre line within 1,5 m (5 ft) of the nose landing gear.

The shaded area indicates the location area for the following connection points:

— pneumatic power;
— preconditioned air.

Figure 1 — Aircraft utilizing one passenger boarding door forward of wing

Not to scale



Key

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

The 400 Hz electrical power and headset connection points shall be located on the left side of the fuselage centre line within 1,5 m (5 ft) of the nose landing gear.

The shaded area indicates the location area for the following connection points:

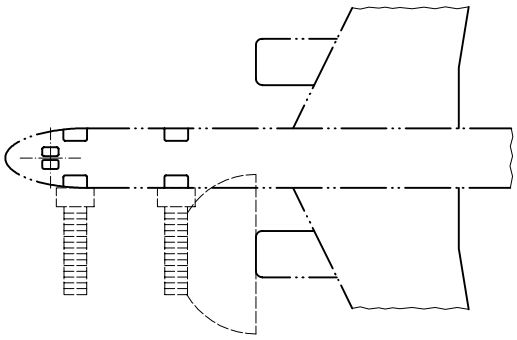
— pneumatic power;

— preconditioned air.

Figure 2 — Aircraft utilizing two passenger boarding doors forward of wing

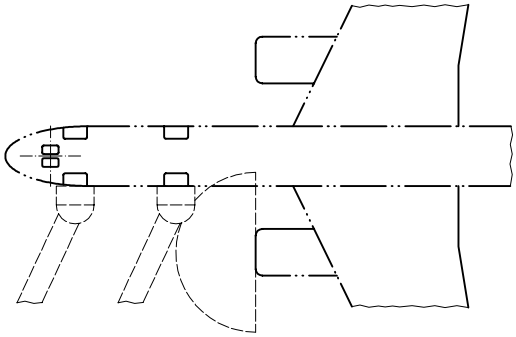
a) Open ramp

The object is to minimize congestion/interference.



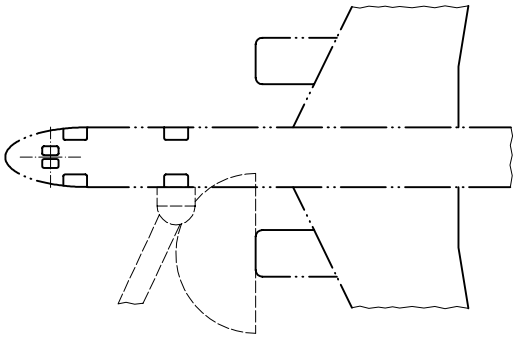
b) Two bridges

Airport fixed facilities optimized for aircraft with two doors.



c) One bridge door 2L

Airport fixed facilities optimized for aircraft with one or two doors, except 400 Hz cable length.



d) One bridge door 1L

Airport fixed facilities optimized for aircraft with one door, not necessarily with two doors (air hoses length); but this is the less frequent case.

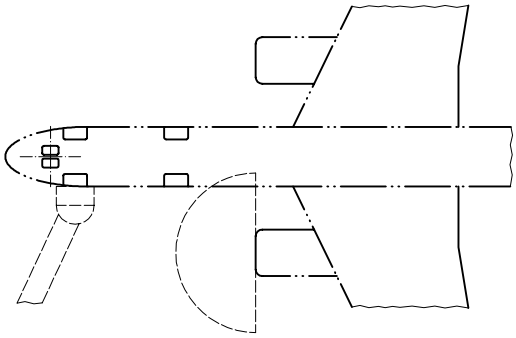


Figure 3 — Typical ramp servicing layouts in the four basic servicing layouts (aircraft utilizing two passenger boarding doors forward of wing)

Bibliography

[1] ISO 16004, *Aircraft ground equipment — Passenger boarding bridge or transfer vehicle — Requirements for interface with aircraft doors*

[2] SAE Aerospace Recommended Practice ARP 4084 A, *Aircraft Ground Service Connections Locations and Type* [1), 2)]

[3] ATA 400 Hz Fixed power systems design guidebook [3)]

[4] IATA Airport Handling Manual AHM 922, *Basic requirements for passenger loading bridge or transfer vehicle interface with aircraft* [4)]

[5] IATA Guidelines for Airport Consultative Committees (ACC), Section 15[4)]

[6] IATA Airport Development Reference Manual, Section 5.4, *Apron — Aircraft servicing facilities*[4)]

1) Corresponding to this International Standard.

2) SAE Standards and Recommended Practices can be obtained from:

Society of Automotive Engineers,
400 Commonwealth Drive,
Warrendale PA 15096-0001,
U.S.A.

3) ATA mauals can be obtained from:

Air Transport Association of America,
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