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## Aircraft — Electrical connectors — Design requirements

*Aéronefs — Connecteurs électriques — Caractéristiques*



Reference number
ISO 1949 : 1987 (E)

## 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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 1949 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles.*



This second edition cancels and replaces the first edition (ISO 1949 : 1973), of which it constitutes a technical revision.



Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.



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# Aircraft — Electrical connectors — Design requirements

## 0 Introduction

This International Standard has been prepared to provide a statement of the design features, performance requirements and test methods shown to be desirable for aircraft electrical connectors suitable for airframe use.

For a specific range of connectors to be considered as being in conformity with this International Standard, it is necessary to prepare a "detail specification" for the range. The detail specification should include the information listed in annex A.

The tests referred to in this International Standard are specified in ISO 2100.



## 1 Scope and field of application

**1.1** This International Standard lays down the general performance requirements and standardization principles for aircraft connectors. It is intended to cover types of connectors designed to use crimped, soldered and welded contacts accommodating aircraft cables. It does not define a particular type of connector dimensionally.

**1.2** This International Standard outlines the basic design, mechanical and electrical requirements for the connectors and the basic environmental conditions of operation.

**WARNING — As far as explosion proofness is concerned, the engaged connectors complying with this International Standard are not defined as explosion proof. They do constitute an explosion hazard and shall NOT be disengaged while carrying current.**

## 2 References

ISO 1966, *Crimped joints for aircraft electric cables.*

ISO 2100, *Aircraft — Electrical connectors — Tests.* [1)]

ISO/TR 2685, *Aircraft — Environmental conditions and test procedures for airborne equipment — Resistance to fire in designated fire zones.*

IEC Publication 50(581), *International Electrotechnical Vocabulary — Chapter 581: Electromechanical components for electronic equipment.*

IEC Publication 130-1, *Connectors for frequencies below* 3 MHz *— Part 1: General requirements and measuring methods.*

## 3 Definitions

For the purposes of this International Standard, the following definitions apply. [See also IEC Publication 50(581).]

**3.1 conductor barrel**: That part of the contact which is designed to accommodate the conductor.

**3.2 insulation barrel; insulation bucket**: That part of the contact which is designed to accommodate the conductor insulation.

**3.3 bunch rating**: The current rating (derating) applied to specific numbers of cables when formed into looms, i.e. bunched together.

**3.4 cable clamp**: A part of a connector or an accessory attached to the connector body to support the cable or wire to provide strain relief and absorb mechanical stress which would otherwise be transmitted to the termination.

**3.5 cable outlet**: A part of a connector or an accessory consisting of straight or angled rigid housing for attachment to the connector body. It may incorporate provision for a cable clamp or seal for terminating screens and provide shielding to electrical interference.

**3.6 connector**: A device which facilitates the connection and disconnection of electrical circuits for access or transport.

1) Cross-references to ISO 2100 apply to the second edition published in 1987.

**3.7 fixed connector; receptacle**: A connector for attachment to a chassis, panel, wall, bulkhead or to a piece of apparatus, and having male or female contacts.

**3.8 free connector; plug connector**: A connector for attachment to the free end of a wire or a cable, and having male or female contacts.

**3.9 free coupler connector**: A connector that mates with a free connector in a cable-to-cable application.

**3.10 connector interface**: The two surfaces of the contact side of a pair of connectors which face each other when the connectors are mated.

**3.11 contact holding force**: That force which is required to retain a male contact gauge of specified mass and size in a female contact.

**3.12 male contact; pin**: A contact having an engaging end which makes contact by insertion into a female contact.

**3.13 contact retention force**: The axial force in either direction which a contact can withstand without being permanently displaced from its position within the insulator.

**3.14 female contact; socket**: A contact having an engaging end which will accept entry of male contact.

**3.15 coupling**: The mechanical device used to mate and retain a pair of connectors in engagement with each other.

**3.16 crimped contact**: A contact with the conductor barrel designed to be physically compressed (deformed) around the conductor to make electrical and mechanical contact.

**3.17 dimensional checks**: Checks designed to establish that all parts of the specimens are in conformity with the detail drawings.

**3.18 generic type**: Type having the same general characteristics.

**3.19 connector insert**: An insulating element designed to support and position contacts in a connector.

**3.20 insert retention**: Ability of the insert to withstand specified axial load in either direction without being dislodged from its normal position within the shell.

**3.21 key**: A projection which engages with a keyway, to provide guidance and alignment.

**3.22 keyway**: The slot or groove in which a key engages.

**3.23 mated pair**[1]: A combination, when mated, of two connectors designed to be coupled.

**3.24 orientation**: The angular position of an insert within a circular shell, constituting the whole or part of a connector polarization system.

Identification of the orientation is from a specified datum point on the interface to a specified datum on the shell, such as a major key or keyway.

**3.25 polarization**: The provision of features (e.g. keys and keyways) on mating connectors to prevent incorrect mating.

**3.26 restricted entry**: Female contact or insert contact cavity design, which prevents the insertion of an oversize male contact or test probe.

**3.27 scoop**: The action of touching contacts with the front edge of the mating shell during the search for correct engagement of connectors.

**3.28 shell**: The outside case of a connector into which the insert and contacts are assembled.

**3.29 type approval**[1]: Decision by the proper authority (the customer himself or his nominee) that the manufacturer can be considered able to produce components in reasonable quantities meeting the relevant specification.

**3.30 type tests**[1]: All the tests to be carried out on a number of specimens representative of the type of component of one manufacturer, with the object of determining whether the manufacturer can be considered able to produce components meeting the relevant specification.

**3.31 interchangeable**: A component is interchangeable when it meets the original performance specifications and is intermountable. In the case of connectors, interchangeability applies only to connector mated sets, since individual connectors are not necessarily intermateable.

**3.32 intermateable**: Two connectors are intermateable when they are capable of being connected electrically and mechanically but without regard to their performance and intermountability.

**3.33 intermountable**: Two components are intermountable when their mechanical mounting parameters are identical without regard to intermateability or interchangeability.

1) As defined in IEC Publication 130-1.

# Section one : Design requirements

## 4 General

### 4.1 Materials and finishes

Materials and finishes shall be laid down in the control drawings; however, where these are not so specified they shall be selected so as to satisfy the performance requirements of the detail specification. Dissimilar metals shall not be used in intimate contact unless protection is afforded to prevent electrolytic corrosion.

### 4.2 Performance

The connectors and their accessories (not including contact insertion/removal and unwired contact removal tools) shall attain the performance detailed in this International Standard when subjected to any one or any natural combination of the environmental conditions specified in clause 5.

## 5 Environmental conditions

### 5.1 Temperature range

Connectors shall be classified as follows, according to the maximum working temperature for which they are suitable:

Class 1: −40 to +105 °C

Class 2: −55 to +125 °C

Class 3: −65 to +200 °C

Class 4: −65 to +260 °C

Class 5: −65 to +350 °C

NOTE — See designation examples given in the note to 5.3.

The upper temperature is the maximum internal hot spot temperature resulting from any combination of electrical load and ambient temperature. Electrical connectors shall be capable of continuous operation within the declared temperature range. Any limitations shall be declared in the detail specification.

### 5.2 Altitude

Connectors shall be suitable for use at altitudes up to 24 000 m.

### 5.3 Sealing classifications

The sealing classifications for connectors are as follows:

**Class N**

An environmentally sealed connector, which, although meeting the requirements for immersion at low air pressure and climatic tests (see ISO 2100) laid down in this International Standard, may have a leakage rate exceeding 1 $cm^3/h$ at a differential pressure of 1 atm[1)].

**Class S**

Connector sealed (unmated) to a leakage rate of 1 $cm^3/h$ at a differential pressure of 1 atm[1)].

**Class H**

Connector (fixed connector or bulkhead types only) hermetically sealed to a leakage rate of $1 \times 10^{-7}$ $cm^3/s$ at a differential pressure of 1 atm[1)].

**Class K**

A fireproof connector meeting the requirements for a class N connector and those laid down for the resistance to fire (fireproofness) test specified in ISO 2100, test No. 21 (see also ISO/TR 2685).

**Class U**

Unsealed connector.

NOTE — Temperature, sealing and fireproofness are the only classifications imposed by this International Standard. The following designation examples are given for clarification purposes.

*Designation examples:*

**Class 3H**

A fixed connector which is hermetically sealed to operate within the temperature range from −65 to +200 °C.

**Class 3N**

A normally sealed connector to operate within the temperature range from −65 to +200 °C.

**Class 3K**

A normally sealed connector to operate within the temperature range from −65 to +200 °C and which meets the resistance to fire (fireproofness) requirements laid down in ISO 2100, test No. 21.

1) Normal atmospheric pressure is equivalent to 96 to 103 kPa (960 to 1 029 mbar).