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Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 001: Technical specification

Luft- und Raumfahrt - Elektrischer Rechtecksteckverbinder in modularer Bauweise - Betriebstemperatur 175 °C - Teil 001: Technische Lieferbedingungen

Série aérospatiale - Connecteurs électriques rectangulaires modulaires - Température d'utilisation 175 °C continue - Partie 001: Spécification technique

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Betriebstemperatur 175 °C - Teil 001: Technische
Lieferbedingungen

Série aéronautique - Connecteurs électriques
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175 °C continu - Partie 001: Spécification technique

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Contents

	Page
European Foreword.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions	8
4 Description	8
5 Design.....	12
6 Definition drawings and masses.....	14
7 Details on contact and module interface.....	38
8 Contact arrangements.....	39
9 Tests.....	49
10 Tooling testing	58
11 Quality assurance.....	61
12 Qualification.....	61
13 Maintenance of qualification	69
14 Quality control	70
15 Designation and marking.....	70
16 Delivery conditions	71
17 Packaging.....	71
18 Storage	71

Figures

Figure 1 — Standard plug mated with receptacle	14
Figure 2 — Rack and panel plugs mated with receptacle	15
Figure 3 — Module and contact position inside plug and receptacle, series 2	16
Figure 4 — Module and contact position inside plug and receptacle, series 3	18
Figure 5 — Coupling screw position inside plugs series 2 and 3	19
Figure 6 — Guiding pin position inside rack and panel plugs series 2 and 3.....	20
Figure 7 — Head of coupling screw.....	20
Figure 8 — Single module receptacle dimensions	21
Figure 9 — Single module plug dimensions.....	23
Figure 10 — 2 cavities receptacle dimensions, series 2.....	24
Figure 11 — 4 cavities receptacle dimensions, series 2.....	25
Figure 12 — 2 cavities receptacle dimensions, series 3.....	26
Figure 13 — 4 cavities receptacle dimensions, series 3.....	27

Figure 14 — Receptacle coding pin cavity dimensions, series 2 and 3	28
Figure 15 — Receptacle module cavity dimensions, series 2 and 3	29
Figure 16 — 2 cavities plug dimensions, series 2	30
Figure 17 — 4 cavities plug dimensions, series 2	31
Figure 18 — 2 cavities plug dimensions, series 3	32
Figure 19 — 4 cavities plug dimensions, series 3	33
Figure 20 — Plug coding key cavity dimensions - Series 2 and 3	34
Figure 21 — Plug module cavity dimensions, series 2 and 3	35
Figure 22 — Receptacle and plug module cavity dimensions, series 2 and 3 (<i>concluded</i>).....	37
Figure 23 — Male module and contact interfacial sealing dimensions.....	38
Figure 24 — Female module and contact interface dimensions.....	38
Figure 25 — Interfacial view of 20-22 male module.....	39
Figure 26 — Interfacial view of 20A22 male module.....	39
Figure 27 — Interfacial view of 12-20 male module.....	40
Figure 28 — Interfacial view of 08-16 male module.....	40
Figure 29 — Interfacial view of 04-12 male module.....	41
Figure 30 — Interfacial view of 01-08 male module.....	41
Figure 31 — Interfacial view of 01Q18 and 01L18 male module.....	42
Figure 32 — Interfacial view of 01Q28 and 01L28 male module.....	43
Figure 33 — Interfacial view of 99-01 and 99A01 male module.....	44
Figure 34 — Interfacial view of 99-02 male module.....	44
Figure 35 — Interfacial view of 99-10 male module.....	45
Figure 36 — Interfacial view of 20Y22 female module.....	45
Figure 37 — Interfacial view of 2AY22 female module.....	46
Figure 38 — Interfacial view of 2BY22 female module.....	46
Figure 39 — Interfacial view of 20Z22 male module.....	47
Figure 40 — Interfacial view of 2AZ22 male module.....	47
Figure 41 — Interfacial view of 2BZ22 male module.....	48
Figure 43 — Gauges dimensions for 4 cavities housing series 2 and 3	59
Figure 44 — Gauges dimensions for 2 cavities housing series 2 and 3	60
Figure 45 — Gauges dimensions to test the stability of male contacts in module	61
Tables	
Table 1 — Mated dimensions	15
Table 2 — Contact position.....	17
Table 3 — Contact position.....	19
Table 4 — Coding pin position	19
Table 5 — Plug module cavity dimensions, series 2 and 3	36

EN 4165-001:2015 (E)

Table 6 — Male module and contact interfacial sealing dimensions	38
Table 7 — Female module and contact interface dimensions	38
Table 8 — Arrangement position of 20-22 modules	39
Table 9 — Contact information of 20-22 modules	39
Table 10 — Arrangement position of 20A22 modules.....	39
Table 11 — Contact information of 20A22 modules	39
Table 12 — Arrangement position of 12-20 modules.....	40
Table 13 — Contact information of 12-20 modules.....	40
Table 14 — Arrangement position of 08-16 modules.....	40
Table 15 — Contact information of 08-16 modules.....	40
Table 16 — Arrangement position of 04-12 modules.....	41
Table 17 — Contact information of 04-12 modules.....	41
Table 18 — Contact information of 01-08 modules.....	41
Table 19 — Contact information of 01Q18 and 01L18 modules	42
Table 20 — Contact information of 01Q28 and 01L28 modules	43
Table 23 — Arrangement position of 99-02 modules.....	44
Table 24 — Contact information of 99-02 modules.....	44
Table 27 — Arrangement position of 20Y22 module.....	45
Table 28 — Contact information of 20Y22 module.....	45
Table 29 — Arrangement position of 2AY22 module.....	46
Table 30 — Contact information of 2AY22 module.....	46
Table 31 — Arrangement position of 2BY22 module	46
Table 32 — Contact information of 2BY22 module	46
Table 33 — Arrangement position of 20Z22 module.....	47
Table 34 — Contact information of 20Z22 module.....	47
Table 35 — Arrangement position of 2AZ22 module.....	47
Table 36 — Contact information of 2AZ22 module.....	47
Table 37 — Arrangement position of 2BZ22 module.....	48
Table 38 — Contact information of 2BZ22 module.....	48
Table 39 — Tests according to EN 2591-100 (1 of 9).....	49
Table 40 — Resistance to fluids	58
Table 41 — Gauges dimensions for 4 cavities housing series 2 and 3	59
Table 42 — Gauges dimensions for 2 cavities housing series 2 and 3	60
Table 43 — Gauges dimensions to test the stability of male contacts in module	61
Table 44 — Sampling for qualification of metallic housings and modules	62
Table 45 — Sampling for qualification of composite housings and modules.....	62
Table 46 — Sampling for qualification of push-pull latching mechanism housing and modules	63

Table 47 — Sampling for qualification of a module new arrangement.....	63
Table 48 — Qualification tests (1 of 5)	64
Table 49 — Sampling distribution (1 of 2).....	69
Table 49 — Sampling distribution (2 of 2).....	70

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[SIST EN 4165-001:2015](https://standards.iteh.ai/catalog/standards/sist/38781b92-ad39-4673-9840-6fe03b4b9d42/sist-en-4165-001-2015)

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EN 4165-001:2015 (E)**European foreword**

This document (EN 4165-001:2015) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this European Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by April 2016, and conflicting national standards shall be withdrawn at the latest by April 2016.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 4165-001:2007.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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1 Scope

This European standard specifies the general characteristics, the conditions for qualification, acceptance and quality assurance, as well as the test programs and groups for rectangular connectors with one or multiple removable modules, intended for use in a temperature range from -55 °C to 175 °C continuous.

This family of connectors is particularly suitable for aeronautic use in zones of severe environmental conditions on board aircraft, applying EN 2282.

The maximum in-service temperature can be limited by maximum temperature of contacts.

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.

EN 2282, *Aerospace series — Characteristics of aircraft electrical supplies*

EN 2591-100¹⁾, *Aerospace series — Elements of electrical and optical connection — Test methods — Part 001: General*

EN 3155-002, *Aerospace series — Electrical contacts used in elements of connection — Part 002: List and utilization of contacts*

EN 3155-008, *Aerospace series — Electrical contacts used in elements of connection — Part 008: Contacts, electrical, male, type A, crimp, class S — Product standard*

EN 3155-070, *Aerospace series — Electrical contacts used in elements of connection — Part 070: Contacts, electrical, male, type A, crimp, class S — Product standard*

EN 3155-071, *Aerospace series — Electrical contacts used in elements of connection — Part 071: Contacts, electrical, female, type A, crimp, class S — Product standard*

EN 3155-082, *Aerospace series — Electrical contacts used in elements of connection — Part 082: Contacts, electrical, female, type A, crimp, class S — Product standard*²⁾

EN 3197, *Aerospace series — Design and installation of aircraft electrical and optical interconnection systems*

EN 3909, *Aerospace series — Test fluids and test methods for electric components and sub-assemblies*

EN 4165-002, *Aerospace series — Connectors, electrical, rectangular, modular — Operating temperature 175 °C continuous — Part 002: Specification of performance and contact arrangements*

EN 4165-003, *Aerospace series — Connectors, electrical, rectangular, modular — Operating temperature 175 °C continuous — Part 003: Modules series 2 and series 3 — Product standard*

EN 4165-020, *Aerospace series — Connectors, electrical, rectangular, modular — Operating temperature 175 °C continuous — Part 020: Coupling system keyway for receptacle — Product standard*

¹⁾ And all parts quoted in this European Standard.

²⁾ Published as ASD-STAN Prestandard at the date of publication of this European Standard (<http://www.asd-stan.org/>).

EN 4165-001:2015 (E)

EN 4165-021, *Aerospace series — Connectors, electrical, rectangular, modular — Operating temperature 175 °C continuous — Part 021: Coupling system keyway for plug — Product standard*

EN 4165-024, *Aerospace series — Connectors, electrical, rectangular, modular — Operating temperature 175 °C continuous — Part 024: Single module plug — Product standard*

EN 4165-025, *Aerospace series - Connectors, electrical, rectangular, modular - Operating temperature 175 °C continuous - Part 025: Module receptacle - Product Standard*

EN 4701 (all parts), *Aerospace series — Connectors, optical, rectangular, modular, operating temperature 12 °C, for EN 4531 contacts*

EN 4830 (all parts), *Aerospace series — Connectors, optical, rectangular, modular, operating temperature 125 °C, for EN 4639-10X contacts*¹⁾

EN 9133, *Aerospace series — Quality management systems — Qualification procedure for aerospace standard parts*

ISO 263, *ISO inch screw threads — General plan and selection for screws, bolts and nuts — Diameter range 0,06 to 6 in*

IEC 61726, *Cable assemblies, cables, connectors and passive microwave components — Screening attenuation measurement by the reverberation chamber method*

MIL-HDBK-454A, *General Guidelines for Electronic Equipment*³⁾

TR 4257, *Aerospace series — Elements of electrical and optical connection — Relationship between the numbering systems for parts of EN 2591*⁴⁾

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SIST EN 4165-001:2015

3 Terms and definitions <https://standards.iteh.ai/catalog/standards/sist/38781b92-ad39-4673-9840-6fe03b4b9d42/sist-en-4165-001-2015>

For the purposes of this document, the terms and definitions given in EN 2591-100 apply.

4 Description

4.1 General

Different variants of materials, housings, modules and contact arrangements are provided according to the Class depending on the service conditions.

These connectors have rectangular housings, with removable modules and contacts. They can be fitted with cable outlets. Male or female modules can be inserted or intermixed in plug or receptacle housings.

These connectors use different types of contacts (signal, power, coaxial, quadrax, optical, ...) defined in EN 3155-002.

These connectors can also be fitted with optical modules EN 4701 and EN 4830 with associated optical contacts.

³⁾ Published by: DoD National (US) Mil. Department of Defense (<http://www.defenselink.mil/>).

⁴⁾ Published as ASD-STAN Technical Report at the date of publication of this European Standard (<http://www.asd-stan.org/>).

This specification covers three variations in housing and coupling mechanisms to mate and unmate:

- centre coupling screw;
- rack and panel;
- push-pull latching.

4.1.1 Centre coupling

The connectors are mated and unmated by a centre coupling screw, which provides when the connectors are fully mated a shell to shell bottoming between plug and receptacle.

The plug contains a coupling screw and the receptacle a coupling nut.

This family of connectors provides two housing sizes (2 or 4 modules) and two series (series 2 and scoop proof series 3).

The connectors are polarized by centre keying mechanism; polarization shall be obtained before the male contacts enter the module of the female contacts and before the coupling system is engaged. Keying mechanism shall provide 36 position keying capabilities.

4.1.2 Rack and panel plug

The rack and panel plugs contain a clipped centre coding socket clipped with internal keyways. Polarization is ensured by the different positions which the secondary keyway may take and different positions which the centre coding socket may take clipped in the housing.

The centre coupling screw is replaced by a centre guide pin. The floating fixation with coupling spring ensures the alignment and the metal to metal bottoming between plug and receptacle.

4.1.3 Push-pull latching

The connectors are mated and unmated by a push-pull latching mechanism (for more detail, see 4.3.2 for receptacle and 4.4.3 for plug).

This family of connectors provides single housing size (1 module series 2).

The connectors are polarised by integral key and keyways mechanism associated with dedicated colour identification.

Polarization shall be obtained before the male contacts enter the module of the female contacts and before the coupling system is engaged.

4.2 Housing

All parts except module are considered "housing".

All " housings " models, except class C, shall meet electrical performances described in Table 39.

4.3 Receptacle

4.3.1 Centre coupling mechanism

The receptacle may be attached by:

- Rectangular flange with two mounting holes;
- Two end flanges with transversal holes (panel mounting) and lateral holes (stackable mounting).

EN 4165-001:2015 (E)

The receptacle contains a coupling nut which ensures also the polarization function (coding pin) by external keys. The main key fixed and is wider than the other. Polarization is ensured by the different positions which the secondary key may take and different positions which the coding pin may be fixed in the housing.

The module cavities are identified on the housing of the receptacle by letter A, B, C, D for size 4 (four modules) and letter A, B for size 2 (two modules). The cavities are polarized by two keyways location.

4.3.2 Push-pull latching mechanism

The receptacle can be attached by rectangular flange.

The receptacle shell design incorporates specific design feature that provides a mechanical and electrical interface to the plug. The electrical ground path established by the mounting design feature incorporated in the receptacle shell maintains a stable, low resistance electrical ground path for the life of the installation. This electrical ground path that is provided by the mechanical mounting feature shall require no preparations during the initial assembly processes or maintenance once in service.

4.4 Plugs

The plugs contain a clipped centre coding socket clipped with internal keyway options. Polarization is ensured by the different positions which the secondary keyway may take and different positions which the centre coding socket may take clipped in the housing.

4.4.1 Centre coupling mechanism

The coupling screw permanently fitted on the plug enables the connectors to be coupled and uncoupled. The internal thread of the coupling ring may be treated with a suitable lubricant compatible with the performance required in this European Standard.

The module cavities are identified on the housing of the plug by letter A, B, C, D for size 4 (four modules) and letter A, B for size 2 (two modules). The cavities are polarized with two keyway locations.

4.4.2 Rack and panel

The plug contains a clipped centre coding socket clipped with internal keyway options. Polarization is ensured by the different positions which the secondary keyway may take and different positions which the centre coding socket may take clipped in the housing.

The centre coupling screw is replaced by a centre guide pin. The floating fixations with coupling spring ensure the alignment and the metal to metal bottoming between plug and receptacle.

4.4.3 Push-pull latching mechanism

The plug shell is mated to the receptacle shell by sliding the plug into the receptacle where the two shells engage. The latch mechanism then engages the specific features located on the receptacle forcing the two connectors shells together creating a mechanically rigid assembly. The receptacle shell shall contain design features that interface to the plug shell providing not only a mechanically rigid assembly but a 360 degree enclosure essential to the EMI shielding performance. The coupling mechanism and connector shell design shall incorporate a means of providing a visual reference that the plug is fully mated to the receptacle. No tools shall be required to activate and release the latch mechanism to either mate or unmate the plug to the receptacle. The coupling mechanism shall withstand 500 mating and unmating cycles. This mechanism shall be self-lockable.

4.5 Rear accessories

The rear accessories used with this family are specified in product standards (see EN 4165-002).

4.6 Modules

The module shall be single-bloc type design complete with contact retention systems and appropriate seals.

The female modules use female contacts and male modules use male contacts. These modules use crimp or solder contacts of sizes 22, 20, 16, 12 and 8. They are rear release and held in the housing by two retention tines. They are removable from the rear with a specific tool.

The modules have two keys which engage in the keyways of the housing. Polarization is ensured by the different positions which the secondary keys may take. The module polarisation is identified by letter A, B, C, D, E, F or N (universal).

A blank module is installed in a cavity where no contacts are required. This module is a male module with a universal polarization (N) installable in all coding cavities (A, B, C, D, E, F) and in all housing types (plug or receptacle).

Modules shall be interchangeable in cavities of housing with different configurations.

Modules are available in four configurations:

- Without peripheral sealing and with standard fuel resistance : type 1;
- With peripheral sealing and with standard fuel resistance : type 2;
- Without peripheral sealing and with reinforced fuel resistance : type 3;
- With peripheral sealing and with reinforced fuel resistance : type 4.

4.7 Keying mechanism

4.7.1 Central coupling mechanism and rack and panel

4.7.1.1 Coding pin (receptacle)

Keying mechanism shall provide 36 position keying capabilities. These 36 positions are given with 6 different coding pins, identified by colour code. The main key is wider than the other, polarization is ensured by the different positions which the secondary key may take. Universal coding pin is compatible with all polarization codes. Coding pin shall be interchangeable between different housing models. They are fitted in the housing with a specific tool and the modification of coding position shall be made at the front face of the connector with specific tool.

4.7.1.2 Clipped coding socket (plug)

Keying mechanism shall provide 36 position keying capabilities. These 36 positions are given with 6 different coding sockets, identified by colour code. The main keyway is wider than the other; polarization is ensured by the different positions which the secondary keyway may take. Universal coding socket is compatible with all polarization codes. Coding socket shall be interchangeable between different housing models. They are front clipped in the housing without specific tool and the modification of coding position shall be either made by the front face of the connector with a new coding pin (a removed coding socket is not reusable).

EN 4165-001:2015 (E)**4.7.2 Push-pull latching mechanism**

Polarization of the connector shells provides a means of preventing mismatching connectors in close proximity to one another. Shell polarization of the connector should be accomplished by means of integral keys and keyways. It shall be impossible to mate a plug to a receptacle shell when these polarization keys are polarized differently. Polarization engagement shall occur after initial shell engagement and before the pin makes contact with the socket contact. The connector shells should use the code defined by this specification.

Colour and coding are defined in product standard EN 4165-024 and EN 4165-025.

4.8 Materials and surface treatment

When dissimilar metals are in close contact, adequate protection against corrosion shall be used for the electromotive force of the cell not to exceed 0,25 V.

4.8.1 Housings

The material of the housing for the connectors shall as follows (see EN 4165-002 for more details):

- Aluminium alloy with plating;
- Composite with plating;
- Composite without plating.

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4.8.2 Contacts

Removable contacts (see EN 3155-002).

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4.8.3 Non-metallic materials

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The materials used for module, seals and grommets shall have mechanical characteristics compliant with the required use.

5 Design**5.1 Housings**

The connector housings shall be a one piece construction. They shall accommodate the rear accessories and other fittings defined in this specification (see EN 4165-002). The rectangular flange receptacle can furthermore be fitted with a conductive gasket ensuring electrical continuity between the connector housing and panel.

For centre coupling mechanism, the threads shall conform to ISO 263, and the coupling mechanism shall be designed so that the male and female contacts engage when it is rotated clockwise the right and disengage when it is rotated anticlockwise to the left. The centre coupling screw shall be a hexagonal socket head screw and compatible with the coupling torque values defined in the product standard.

For push-pull latching mechanism, the locking mechanism shall be designed so that coupling is done by pushing the plug onto the receptacle. The mechanism has also a sliding perpendicular to the axis of engagement of the plug onto the receptacle.

Unlocking is done by pressure on the mechanism and perpendicular to the axis of engagement of the plug onto the receptacle.

The accessories shall be fixed by screw or clip on the rear of connectors.

5.2 Modules

The module carrying the male and female contacts shall be in hard material and have a cross section and radii such that no cracks, flaking or breaks can occur in normal operation.

The module for contacts shall be removable; it shall be mechanically held in the housing by two retention tines peripheral sealing can be provided between the housing and modules.

The front face of the modules shall be such that sealing is ensured when the connectors are coupled. The interfacial seal of the module of the male contacts shall be permanently fastened on the hard module.

The grommet shall permit sealing for all cable diameters indicated in EN 4165-002 and shall not be removable.

Module insertion shall be from the rear without tools and removal of the module shall be from the rear with the tools specified in the product standards. Module design shall prevent wrong mating.

The mechanical contacts retention system shall be integrated in the hard part of module. The design of module shall permit individual installation of the contacts without removal grommet. Fitting and removal of the contacts shall be from the rear with the tools specified in the product standards.

When mated, the minimum engagement of contact shall be 1,27 mm.

5.3 Connector mating sequence

5.3.1 Centre coupling mechanism

The mating sequence shall be:

- Face to face positioning; [SIST EN 4165-001:2015](https://standards.iteh.ai/catalog/standards/sist/38781b92-ad39-4673-9840-6fe03b4b9d42/sist-en-4165-001-2015)
- Keyways polarization guide;
- Central thread coupling;
- Grounding screening system;
- Electrical contact;
- Sealed interface compression;
- Metal/metal or composite shell to shell bottoming.

5.3.2 Push-pull latching mechanism

The connector mating sequence shall be as follow:

- Face to face positioning;
- Keyways polarization guiding;
- Grounding screening;
- Electrical contact;
- Sealed interface compression;
- Locking.