BS EN 4701-001:2014

BSI Standards Publication

Aerospace series — Connectors, optical, rectangular, modular, operating temperature 125 °C, for EN 4531-101 contacts

Part 001: Technical specification

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National foreword

This British Standard is the UK implementation of EN 4701-001:2014. It supersedes BS EN 4701-001:2013 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ACE/6, Aerospace avionic electrical and fibre optic technology.

A list of organizations represented on this committee can be obtained on request to its secretary.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 4701-001:2014) 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 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of an identical text or by endorsement, at the latest by June 2015, and conflicting national standards shall be withdrawn at the latest by June 2015.

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Introduction

This family of fibre optic connectors is derived from EN 4165-001 with EN 4531-101 optical contacts. It is suitable for use on aerospace on board applications. It provides easy access for optical contact end face cleaning.

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 EN 4165 rectangular connectors with removable optical modules using EN 4531-101 contacts.

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.

EN 2591 (all parts), *Aerospace series — Elements of electrical and optical connection — Test methods*

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

EN 4529 (all parts), *Aerospace series — Elements of electrical and optical connection — Sealing plugs*

EN 4531 (all parts), *Aerospace series — Connectors, optical, circular, single and multipin, coupled by threaded ring — Flush contacts*

EN 4165 (all parts), *Aerospace series — Connectors, electrical, rectangular, modular — Operating temperature 175 °C continuous*

EN 4701-002, *Aerospace series — Connectors, optical, rectangular, modular, operating temperature 125 °C, for EN 4531-101 contacts — Part 002: Specification of performance*

EN 4701-003, *Aerospace series — Connectors, optical, rectangular, modular, operating temperature 125 °C, for EN 4531-101 contacts — Part 003: Module series 2 — Product standard*

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

SAE-AS-81969/14-04, *Installing and removal tools, connector electrical contact, type III, class 2, composition B* [1)]

TR 4684, *Aerospace series — Electrical and Optical technology and component definitions* [2)]

3 Terms and definitions

For the purposes of this document, the terms and definitions given in TR 4684 apply.

1) Published by: SAE National (US) Society of Automotive Engineers http://www.sae.org/

2) In preparation at the date of publication of this standard.

4 Description

4.1 General

This document describes an optical connector module to be installed in plug and receptacle housings.

Plug and receptacle housings conform to EN 4165-001.

The connectors use rear removable optical contacts with a ferrule diameter of 2,5 mm in accordance with EN 4531-101.

The precise alignment of the optical contacts is accomplished by a central alignment pin/socket and alignment sleeves.

The receptacles and plugs contain either male or female module. The male module is characterised by alignment pin.

The inserts can be installed and removed from the shell by mean of a tool as specified EN 4165-022.

Keying system conform to EN 4165-001.

Connector type designation as specified in EN 4165-001.

Not compatible with back shells and cable clamp defined in EN 4165-002.

4.2 Receptacle

Receptacle description as specified in EN 4165-001.

4.3 Plug

Plug description as specified in EN 4165-001.

4.4 Module

Mechanical interface and polarization between housings and modules conform to EN 4165-001.

The module assembly shall be single-bloc type design complete with a keyed contact retention system and appropriate seals.

The male and female modules use hermaphroditic contacts as specified in EN 4531-101.

4.5 Materials and surface treatment

4.5.1 General

See EN 4165-001.

4.5.2 Housings

The connector housing description is specified in EN 4165-001.

4.5.3 Optical contacts and alignment sleeves

The contacts shall be of suitable materials as specified in the product standard EN 4531.

The optical alignment sleeves shall be of suitable materials as specified in the product standard EN 4701-002.

The optical contacts are spring-loaded. The spring force is defined in the product standard EN 4531.

4.5.4 Metallic or non-metallic materials

The materials used for modules, seals and grommets shall have a hardness and mechanical characteristics consistent with the required use.

5 Design

5.1 Housing

The connector housing design is specified in EN 4165-001.

5.2 Modules

The modules carrying the optical 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 is mechanically held in the connector housing by retention clips, and removable with the use of an extraction tool.

The mechanical contacts retention system shall be integrated in the hard module.

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

Sealing of the rear face of the module is provided by the contact boot.

The design shall permit individual installation of the contacts without removal of the module.

Insertion and removal of the contacts shall be from the rear. For ease of operation, tools as per M81969/14-04 standard (P/N for size 12) may be used.

Contact identification shall be permanent and contrasted on the rear face of the insert.

5.3 Connector mating sequence

5.3.1 Centre coupling mechanism

The mating sequence shall be:

— face to face positioning;

— keyways polarization guide;

— plug – receptacle shell;

— central thread coupling;

— alignment pin engagement;

— contact alignment;

— optical physical contact;

— sealed interface compression;

— metal/metal or composite shell to shell bottoming.

5.3.2 Push-pull latching mechanism

The connector mating sequence should be as follows:

— face to face positioning;

— plug receptacle shell;

— keyways polarization guide;

— alignment pin engagement;

— contact alignment;

— optical physical contact;

— locking mechanism alignment;

— sealed interface compression maintaining;

— locking mechanism engagement.

5.4 Connector mating

Housing design shall prevent incorrect mating of the plug onto receptacle.

6 Definition drawings

6.1 General

The general dimensions and the masses of receptacles, plugs and protective covers are given in the product standards.

6.2 Receptacle

All housing dimensions are defined in EN 4165-001.

6.3 Plug

All housing dimensions are defined in EN 4165-001.

6.4 Modules

6.4.1 General

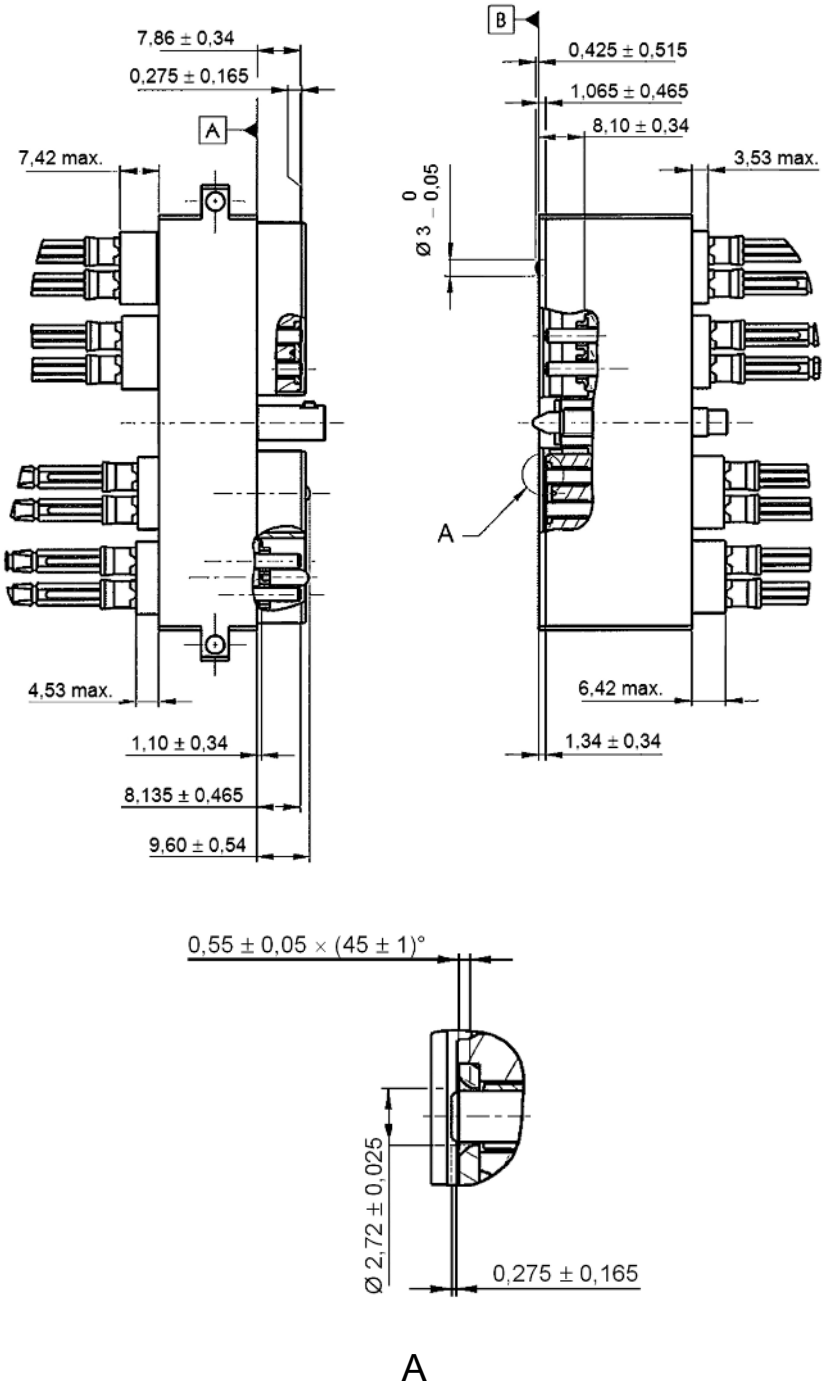
All dimensions are defined in EN 4701-003.

6.4.2 Plug and receptacle, series 2

Insert and contact position.

See Figure 1.

Dimensions and tolerances in millimetres.



NOTE Others dimensions are in accordance with EN 4165 standards.

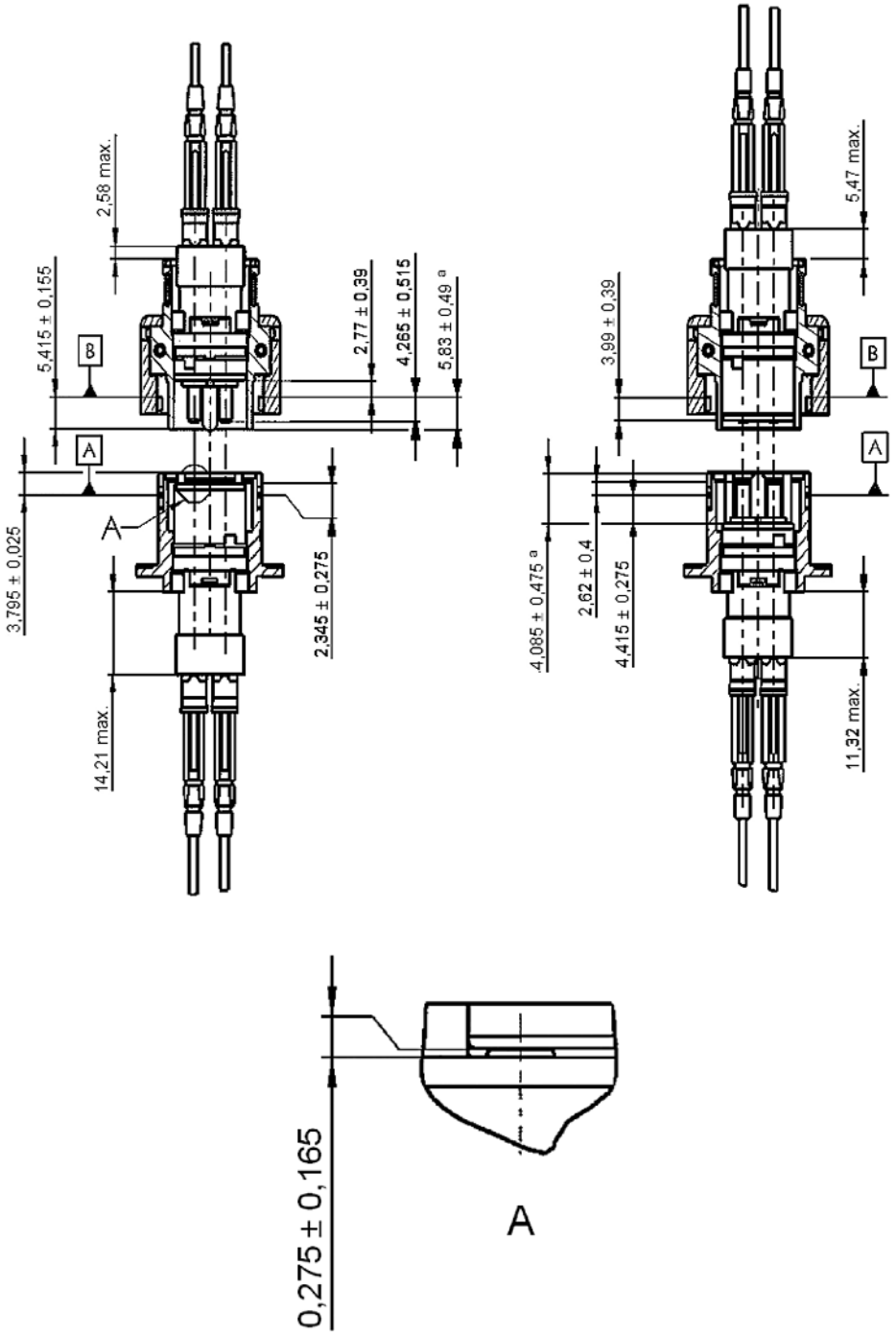
Figure 1

6.4.3 Plug and receptacle single module

Insert and contact position.

See Figure 2.

Dimensions and tolerances in millimetres.



[a] Guinding pin

NOTE Others dimensions are in accordance with EN 4165 standards.

Figure 2

6.5 Mating dimensions

6.5.1 Plug, series 2, contact bayonet position

See Figure 3 for plug with female module and Figure 4 for plug with male module.

Dimensions in millimetres.

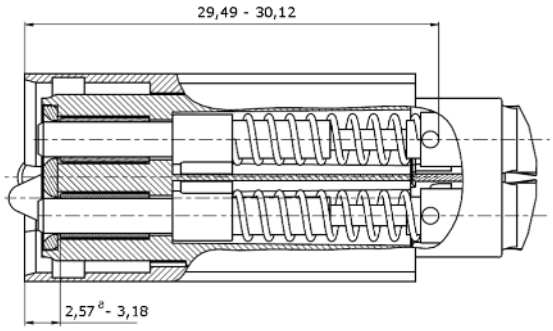


Figure 3

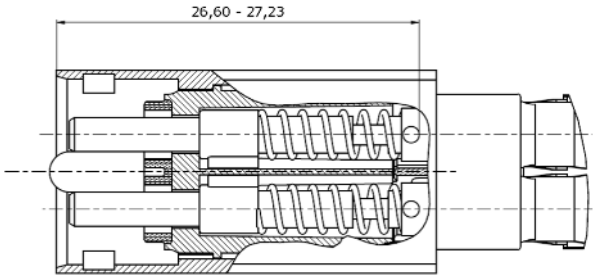


Figure 4

[a] When sleeve is in rear position.

6.5.2 Receptacle, series 2, contact bayonet position

See Figure 5 for receptacle with male module and Figure 6 for receptacle with female module.

Dimensions in millimetres.

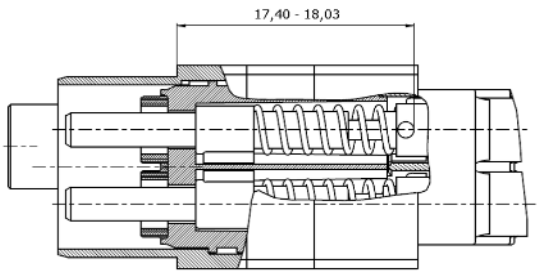
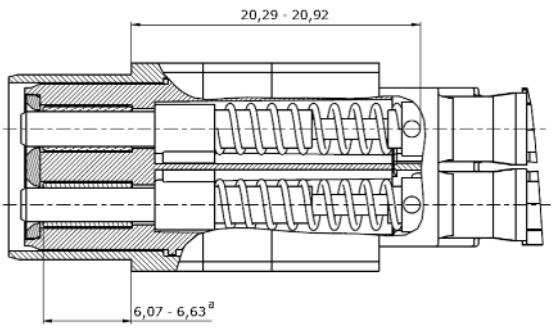


Figure 5



[a] When sleeve is in rear position.

Figure 6

6.5.3 Plug, single module, contact bayonet position

See Figure 7 for plug with male module and Figure 8 for plug with female module.

Dimensions in millimetres.

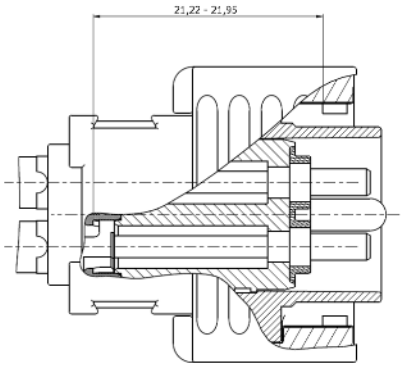
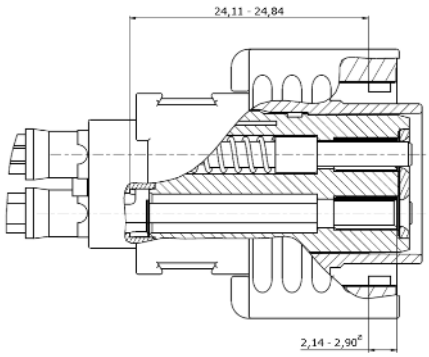


Figure 7



[a] When sleeve is in rear position.

Figure 8

6.5.4 Receptacle, single module, contact bayonet position

See Figure 9 for receptacle with male module and Figure 10 for receptacle with female module.

Dimensions in millimetres.

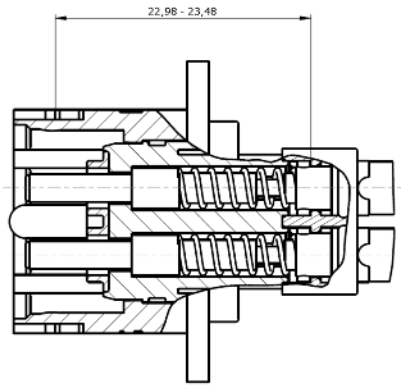
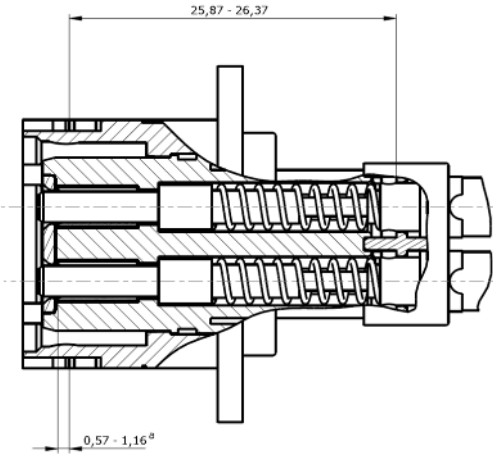


Figure 9

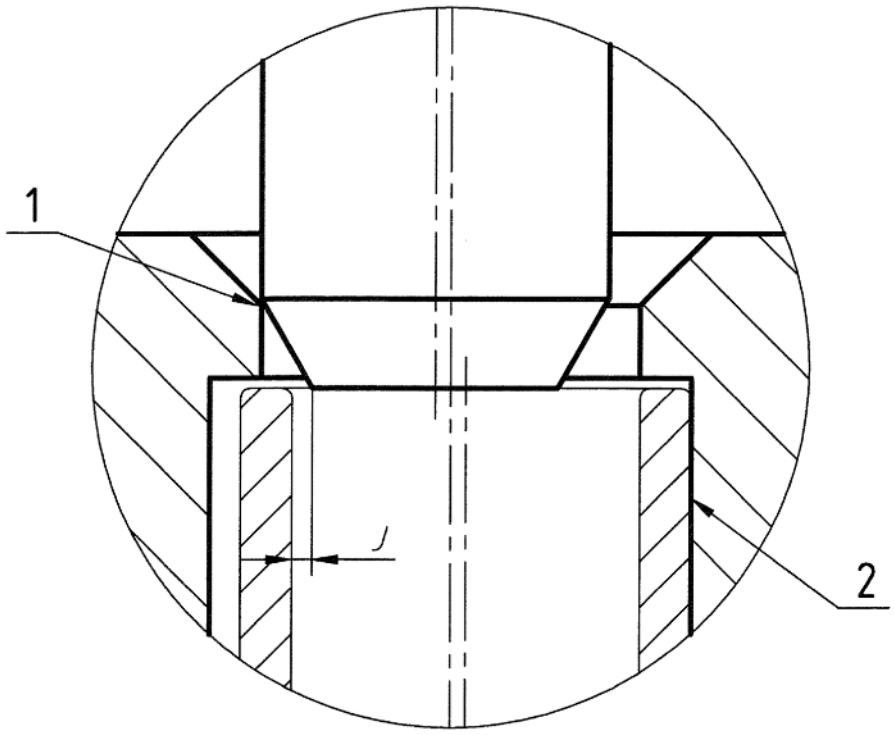


[a] When sleeve is in rear position.

Figure 10

6.5.5 Coupling contact position

See Figure 11.



Condition: In every case, $J > 0$

The different shapes and dimensions
of the sleeve cavity must be defined to warranty this condition

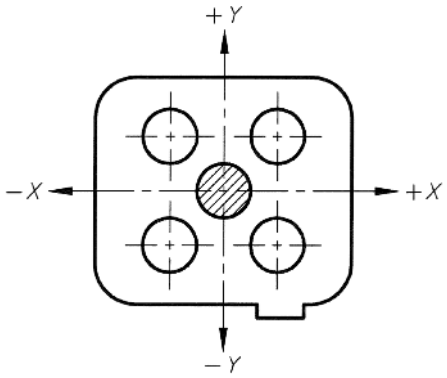
Key

1 Optical contact to sleeve holder stop
2 Sleeve to sleeve holder cavity stop

Figure 11

6.5.6 Contact arrangements

Contact arrangements: See Figure 12.



Y mm	*X* mm		
	− 3	0	+ 3
	Coordinate positions of contacts		
+ 2,75	1	–	2
0	–	Guide	–
− 2,75	3	–	4

Figure 12

7 Tests

7.1 Tests according to EN 2591-100

The tests of EN 2591, applicable in the context of this standard as well as the details necessary for implementing them and for inspecting connector characteristics, are given in Table 1.

Table 1 *(1 of 5)*

EN 2591-	Designation of the test	Details
6101	Optical elements – Visual examination	End-face optical examination at 200 × magnification minimum. — At the beginning of life: optical face undamaged and free from contamination, — After tests: no cracks, excessive scratches and detached parts, — After tests: pictures of permanent defects shall be recorded.
102	Examination of dimensions and mass	According to Clause 6 and product standard. The checking of inaccessible dimensions on the finished product shall be carried out on part pieces or given by the quality organization of the manufacturer concerned.
6301	Optical elements – Endurance at temperature	For performance and test method requirements refer to the applicable product standard for the component and cable under test.
6303	Optical elements – Cold/low pressure and damp heat	Duration: 5 (five) cycles Minimum temperature: (– 65 ± 2) °C Measurement during test: at each transition point.
306	Mould growth	Method A
6305	Optical elements – Rapid change of temperature	For performance and test method requirements refer to the applicable product standard for the component and cable under test.
6307	Optical elements – Salt mist	Connectors should be submitted to 50 cycles of mating/ unmating at a rate which shall not exceed 5 (five) cycles per minute. — Samples shall be placed in salt mist chamber during 452 h in mated position; — Then insertion loss measurement; — 48 h in unmated position.
308	Sand and dust	Connector mated and positioned such that rear of free plug faces into the wind direction. Wind velocity in duct: (3,5 ± 0,5) m/s. Number of cycles: 1 (one)
309	Dry heat	Not applicable.

Table 1 *(2 of 5)*

EN 2591-	Designation of the test	Details
310	Cold	Not applicable.
311	Low air pressure	Not applicable.
312	Air leakage	Method A Differential pressure: 40 kPa during two hours Maximum leakage flow: 16 cm^3/h/module
313	Driving rain (artificial)	Not applicable.
6314	Optical elements – Immersion at low air pressure	Applicable at 2 kPa
6315	Optical elements – Fluid resistance	See Table 2 for fluids, number of cycles, temperature and time of immersion, and temperature of third phase.
6316	Optical elements – Ozone resistance	Not applicable.
6317	Optical elements – Flammability	Method A
6318	Optical elements – Fire resistance	Not applicable.
319	Gastightness of solderless wrapped connections	Not applicable.
320	Simulated solar radiation at ground level	Not applicable.
6321	Optical elements – Damp heat, cyclic test	Connector mated, 10 cycles
6323	Optical elements – Thermal shock (hermetically sealed devices)	Not applicable.
6324	Optical elements – Interfacial sealing	Not applicable.
325	Ice resistance	Not applicable.
6401	Optical elements – Acceleration steady state	Not applicable.
6402	Optical elements – Shock	Method A, severity 100 Number of shocks: One each way for each of the three directions (six shocks in all).
6403	Optical elements – Vibrations	Connector mated Method A: Figure 1, 20 g_n, one octave per minute Duration: 4 (four) h/axis Method B: Figure 2, Table 1, level E Duration: 1 (one) h/axis
6404	Optical elements – Transverse load	For performance and test method requirements refer to the applicable product standard for the component and cable under test.

Table 1 *(3 of 5)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></tr>
<tr><td>6405</td><td>Optical elements – Axial load</td><td>For performance and test method requirements refer to the applicable product standard for the component and cable under test.</td></tr>
<tr><td>6406</td><td>Optical elements – Mechanical endurance</td><td>Number of mating and unmating operations: 500
The rate shall not exceed 5 (five) cycles/min
Optical faces must be cleaned every 20 cycles.</td></tr>
<tr><td>407</td><td>Durability of contact retention system and seals (maintenance ageing)</td><td>Applicable.</td></tr>
<tr><td>408</td><td>Mating and unmating forces</td><td>Screw plug: Method A
a) Mating and unmating of pairs of connectors
Apply, on the coupling screw, the coupling torque indicated in the table.
Then check that the connectors are at the mechanical stop.
Measure the uncoupling torque of the coupling screw. This torque shall be within the limits indicated in the table. Pre-couple the connectors and apply.
The over tightening torque indicated in the table to the coupling screw.
<table>
<tr><th rowspan="2">Housing size</th><th rowspan="2">Coupling torque
Nm
± 0,1</th><th colspan="2">Uncoupling torque
Nm</th><th>Overtightening torque
Nm
± 0,1</th></tr>
<tr><th>min.</th><th>max.</th></tr>
<tr><td>2 modules</td><td>1,1</td><td>0,7</td><td>1,7</td><td>3,00</td></tr>
<tr><td>4 modules</td><td>1,3</td><td>0,7</td><td>2,2</td><td>3,00</td></tr>
</table>
b) Checking the self-locking system on the plugs only. The rotation torque of the coupling device in the uncoupling direction shall not be < 0,01 N.m during a 360° rotation. The ratio between the torque (uncoupling direction/coupling direction) shall not be less than 1,25.
Push-pull latching mechanism
Method A
Mating force: 150 N max.
Unmating force: < 150 N</td></tr>
<tr><td>409</td><td>Contact retention in insert</td><td>11 daN</td></tr>
</table>

Table 1 *(4 of 5)*

EN 2591-	Designation of the test	Details
410	Insert retention in housing (axial)	Connector not fitted with contacts. The force applied shall be 25,4 daN, and distributed by a spacer on the front surface of the module. Displacement < 0,25 mm during and after application of the load. If the module retention mechanism is identical on the male and female module, only the female module must be tested. Push-pull latching mechanism: displacement < 0,25 mm during and after application of the load.
420	Mechanical strength of rear accessories	Not applicable.
506	Use of tools	Force to be applied on tool: 13 N
515	Hydrolytic stability	Method A Increase of mass: ≤ 0,75 %
601	Optical elements – Insertion loss	Method 2 Initial: ≤ 0,3 dB for 95 % of the samples After test: ≤ 0,5 dB max. at 25 °C.
602	Optical elements – Variation of attenuation and optical discontinuity	Method B No optical discontinuity < 1 dB over time duration > 1 µs accepted
603	Optical elements – Change of power distribution	Not applicable.
604	Optical elements – Cleaning capability of the optical face	For performance and test method requirements refer to the applicable product standard for the component and cable under test.
605	Optical elements – Return loss	For performance and test method requirements refer to the applicable product standard for the component and cable under test.
607	Optical elements – Immunity to ambient light coupling	Not applicable.
608	Optical elements – Nuclear radiation	Not applicable.
609	Optical elements – Effectiveness of cable attachment – Cable cyclic flexing	Method C For performance and test method requirements refer to the applicable product standard for the component and cable under test.
610	Optical elements – Effectiveness of cable attachment – Cable pulling	For performance and test method requirements refer to the applicable product standard for the component and cable under test.
611	Optical elements – Effectiveness of cable attachment – Cable torsion	For performance and test method requirements refer to the applicable product standard for the component and cable under test.

Table 1 *(5 of 5)*

EN 2591-	Designation of the test	Details
612	Optical elements – Effectiveness of cable attachment – Cable axial compression	For performance and test method requirements refer to the applicable product standard for the component and cable under test.
613	Optical elements – Impact test	For performance and test method requirements refer to the applicable product standard for the component and cable under test.
614	Optical elements – Connector radial compression	Applicable.

7.2 Special tests

See Table 2.

Table 2 — Resistance to fluids

Fluid		Immersion		Stoving	Number of cycles
Category	Number in EN 3909	Duration	Temp. °C	Temp. °C	
Fuel	2	5 min	25	85	1
Mineral hydraulic fluid	5	15 min	85	100	1
Synthetic hydraulic fluid	3	15 min	85	100	5
Mineral lubricant	7	15 min	120	125	1
Synthetic lubricant	9	15 min	150	125	5
Cleaning products	11	15 min	25	25	1
	12	5 min			
	13				
De-icing fluid	15	15 min	50	100	5
Extinguishing fluid	17	10 s	25	65	5
Cooling fluid	19	15 min	50	25	1

8 Quality assurance

8.1 General

Quality assurance shall conform to EN 9133.

8.2 Qualification

8.2.1 General

Qualification of a model is obtained:

— either when the specimens of this model as defined in 8.2.2 have satisfied the applicable tests in groups 0 to 8;

— by extension of qualification: qualification of a model very similar to a model already qualified, may be obtained by performing a small number of additional tests or by analogy by structural similarity.

8.2.2 Sampling and definition of specimens

If more than one fibre/cable arrangement is being tested, there shall equal quantities for each group.

Table 3

Test group No.	Number of complete specimens (receptacle, plug and pro-caps) as applicable
0	All specimens pairs.
1	One specimen fully populated; one specimen with half-populated; one specimen with one contact.
2	One specimen fully populated; one specimen with half-populated; one specimen with one contact.
3	One specimen fully populated; one specimen with half-populated; one specimen with one contact.
4	One complete specimen for each test fluid.
5	One specimen fully populated; one specimen with half-populated; one specimen with one contact.
6	One specimen fully populated; one specimen with half-populated; one specimen with one contact.
7	One specimen fully populated; one specimen with half-populated; one specimen with one contact.
8	One specimen fully populated; one specimen with half-populated; one specimen with one contact.

8.2.3 Preparation of specimens

All specimens shall be terminated, using typically 2 m length of cable.

8.2.4 Programme of qualification tests

The qualification approval tests are defined in Table 1 and shall be carried out in the sequence specified in Table 4.

Table 4 *(1 of 4)*

Tests	EN 2591-	Remarks
Group 0		
Examination of dimensions and mass	102	–
Insertion loss	601	After termination.
Return loss	605	–
Visual examination	6101	–
Mating and unmating forces	408	–
Insertion loss	601	After termination.
Group 1		
Visual examination	**6101**	–
Contact retention in insert	**409** *6101*	*Visual examination*
Insertion loss	**601**	–
Mechanical endurance	**6406** *6101* *408* *601*	*Visual examination* *Mating and unmating forces* *Insertion loss*
Durability of contact retention system and seals	**407** *6101* *409* *6101* *601*	*Visual examination* *Contact retention in insert* *Visual examination* *Insertion loss*
Rapid change of temperature	**6305** *6101* *408* *601*	*Visual examination* *Mating and unmating forces* *Insertion loss*
Immersion at low air pressure	**6314** *601*	*Insertion loss*
Contact retention in insert	**409** *6101*	*Visual examination*
Visual examination	**6101**	–
Flammability	**6317** *6101*	*Visual examination*

Table 4 *(2 of 4)*

Tests	EN 2591-	Remarks
Group 2		
Visual inspection	**6101**	–
Contact retention in insert	**409** *6101*	 *Visual examination*
Cold/low pressure and damp heat	**6303** *6101* *601*	 *Visual examination* *Insertion loss*
Rapid change of temperature	**6305** *6101* *408* *601*	 *Visual examination* *Mating and unmating forces* *Insertion loss*
Durability of contact retention system and seals	**407** *6101* *409* *6101* *601*	 *Visual examination* *Contact retention in insert* *Visual examination* *Insertion loss*
Mechanical endurance	**6406** *6101* *408* *601*	 *Visual examination* *Mating and unmating forces* *Insertion loss*
Vibrations	**6403** *602* *6101* *408* *601*	 *Optical discontinuity (During test)* *Visual examination* *Mating and unmating forces* *Insertion loss*
Shock	**6402** *602* *6101* *408* *601*	 *Optical discontinuity (During test)* *After test: Visual examination* *Mating and unmating forces* *Insertion loss*
Salt mist	**6307** *6101* *601* *408*	 *Visual examination* *Insertion loss* *Mating and unmating forces*
Contact retention in insert	**409** *6101*	 *Visual examination*
Visual examination	**6101**	–

Table 4 *(3 of 4)*

Tests	EN 2591-	Remarks
Group 3		
Visual examination	**6101**	–
Contact retention in insert	**409** *6101*	 *Visual examination*
Endurance at temperature	**6301** *601* *6101* *409*	 *Insertion loss* *Visual examination* *Contact retention in insert*
Hydrolytic stability	**515**	–
Visual examination	**6101**	–
Group 4		
Visual examination	**6101**	–
Contact retention in insert	**409** *6101*	 *Visual examination*
Fluid resistance	**6315** *601* *6101* *408* *409*	 *Insertion loss* *Visual examination* *Mating and unmating forces* *Contact retention in insert*
Visual examination	**6101**	–
Group 5		
Visual examination	**6101**	–
Cleaning capability	**604** *601*	 *Insertion loss*
Effectiveness of cable attachment – Cable cyclic flexing	**609** *6101* *601*	 *Visual examination* *Insertion loss*
Effectiveness of cable attachment – Cable pulling	**610** *601*	 *Insertion loss*
Effectiveness of cable attachment – Cable torsion	**611** *6101* *601*	 *Visual examination* *Insertion loss*
Effectiveness of cable attachment – Cable axial compression	**612** *6101* *601*	 *Visual examination* *Insertion loss*
Insertion loss	**601**	–
Radial compression	**614** *6101* *408* *601*	 *Visual examination* *Mating and unmating forces* *Insertion loss*
Visual examination	**6101**	–

Table 4 *(4 of 4)*

Tests	EN 2591-	Remarks
Group 6		
Visual examination	**6101**	–
Contact retention in insert	**409** *6101*	 *Visual examination*
Use of tools	**506** *6101* *409*	 Visual examination Contact retention in insert
Insert retention in housing (axial)	**410**	–
Transverse load	**6404** *602* *6101* *408* *601*	 *Variation of attenuation method A (During test)* *Visual examination* *Mating and unmating forces* *Insertion loss*
Axial load	**6405** *602* *6101* *408* *601*	 *Variation of attenuation method A (During test)* *Visual examination* *Mating and unmating forces* *Insertion loss*
Visual examination	**6101**	–
Damp heat, cyclic test	**6321** *602* *408* *6101*	 *Variation of attenuation method A (During test)* *Mating and unmating forces* *Visual examination*
Impact	**613** *6101* *601* *408*	 *Visual examination* *Insertion loss* *Mating and unmating forces*
Visual examination	**6101**	–
Group 7		
Visual examination	**6101**	–
Mould growth	**306**	–
Visual examination	**6101**	–
Group 8		
Visual examination	**6101**	–
Air leakage	**312**	–
Sand and dust	**308** *408*	 *Mating and unmating forces*
Insertion loss	**601**	–
Visual examination	**6101**	–

8.2.5 Numbers of active channels

The number of active channels for measurement purposes is given in Table 5.

Table 5

Shell size	No. of active channels for measurement	Remarks
1 (single)	4 minimum	Remaining cavities to be populated with dummy contacts or sealing plugs per EN 4529.
2 (dual)	8 minimum (4 per insert)	Remaining cavities to be populated with dummy contacts or sealing plugs per EN 4529.

8.3 Maintenance of qualification

8.3.1 Tests

The following tests shall be carried out every 36 months (or manufacturing interval, if longer) on specimens taken at random.

The manufacturer shall submit, to the mandated body, a table of tests which shall be carried out in accordance with Table 6.

8.3.2 Sampling distribution

All models shall be divided between the two groups of Table 6.

Table 6

Tests	EN 2591-
Group 1	
Visual examination	6101
Examination of dimensions and mass	102
Insertion loss	601
Mating and unmating forces	408
Mechanical endurance	6406
Damp heat, cyclic test	321
Group 2	
Visual examination	6101
Examination of dimensions and mass	102
Endurance at temperature	6301
Mating and unmating forces	408
Visual examination	6101

8.3.3 Acceptance

This inspection shall be done systematically on all production prior to delivery: Test EN 2591-6101 – Visual examination.

8.3.4 Quality control

Inspections which are intended to maintain the required quality level are in their entirety the responsibility of the manufacturer, ranging from materials through delivery of the product.

The quality department of the manufacturer shall be able to demonstrate, at any given time, that the product complies with the manufacturing documentation and with the product standard concerned.

There shall be a monitoring system in place for the various inspection phases. This shall be evidenced by documents being kept available by the manufacturer for a period of five years and, if required submitted to the national supervising inspectorate on request.

9 Designation and marking

9.1 Connectors (receptacle or plug)

See EN 4165-001.

9.2 Modules

See EN 4701-003.

9.3 Optical contact

See EN 4531-101.

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