BS EN 4165-001:2015

BSI Standards Publication

Aerospace series — Connectors, electrical, rectangular, modular — Operating temperature 175 °C continuous

Part 001: Technical specification

bsi.

...making excellence a habit.™

National foreword

This British Standard is the UK implementation of EN 4165-001:2015. It supersedes BS EN 4165-001:2007 which is withdrawn.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.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Published by BSI Standards Limited 2015

ISBN 978 0 580 89129 8

ICS 49.060

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 October 2015.

Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 4165-001

October 2015

ICS 49.060

Supersedes EN 4165-001:2007

English Version

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 continu - Partie 001: Spécification technique

This European Standard was approved by CEN on 5 March 2015.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

Figures

Tables

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.

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 2591-100[1)], *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 4165-021, *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)]

3 Terms and definitions

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).

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).

4.7.2 Push-pull latching mechanism

Polarization of the connector shells provides a means of preventing mismating 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.

4.8.2 Contacts

Removable contacts (see EN 3155-002).

4.8.3 Non-metallic materials

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;

— 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.

5.4 Connector mating

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

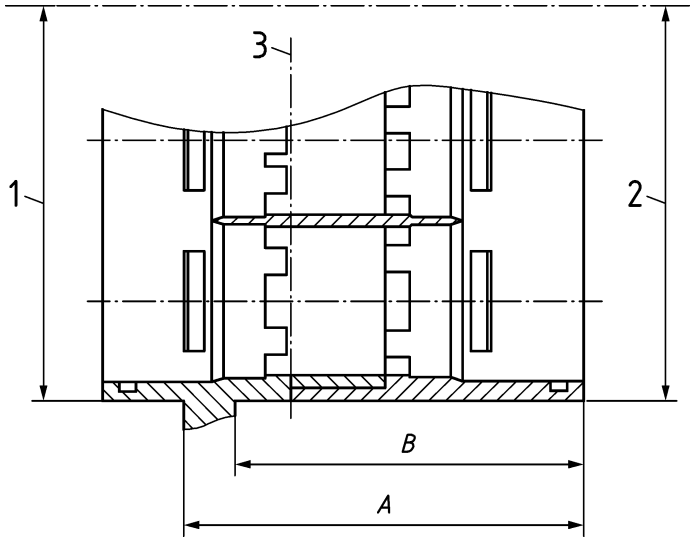
6 Definition drawings and masses

The general dimensions and the masses are given in the product standards.

6.1 Receptacle and plug mating dimensions

6.1.1 Connector mated conditions, series 2 and 3

Dimensions are in millimetres, see Figure 1, Figure 2 and Table 1.



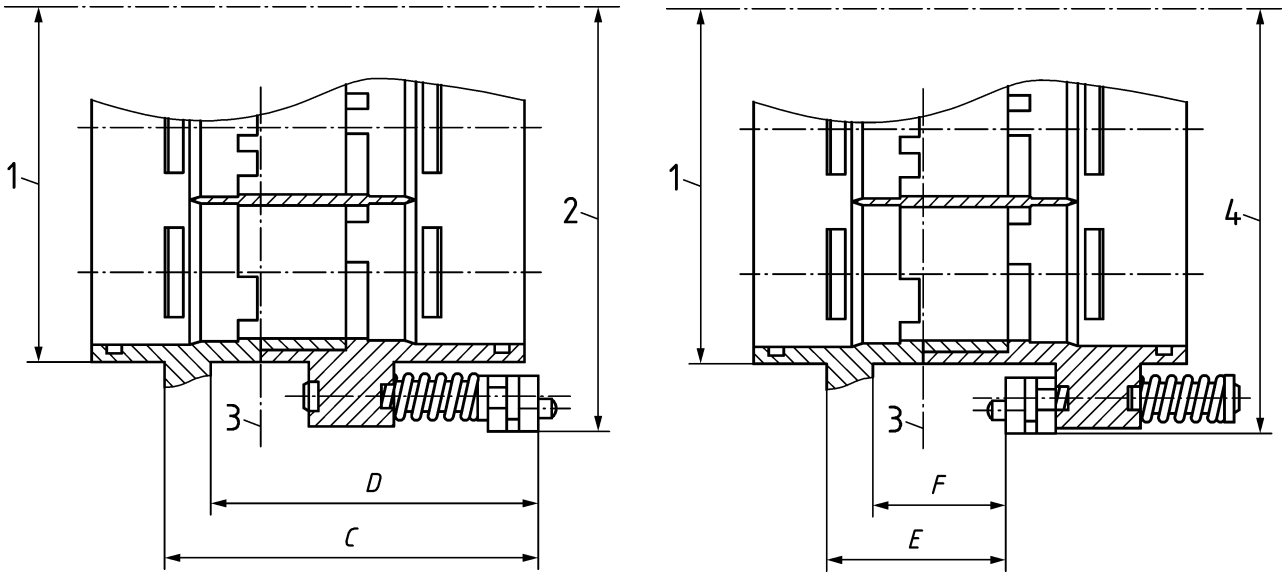
Key

1 Receptacle assembly

2 Standard plug assembly

3 Mechanical bottoming plate

Figure 1 — Standard plug mated with receptacle



a) Standard rack and panel plug **b) Reversed rack and panel plug**

Key

1 Receptacle assembly
2 Standard rack and panel plug assembly
3 Mechanical bottoming plate
4 Reserved rack and panel plug assembly

Figure 2 — Rack and panel plugs mated with receptacle

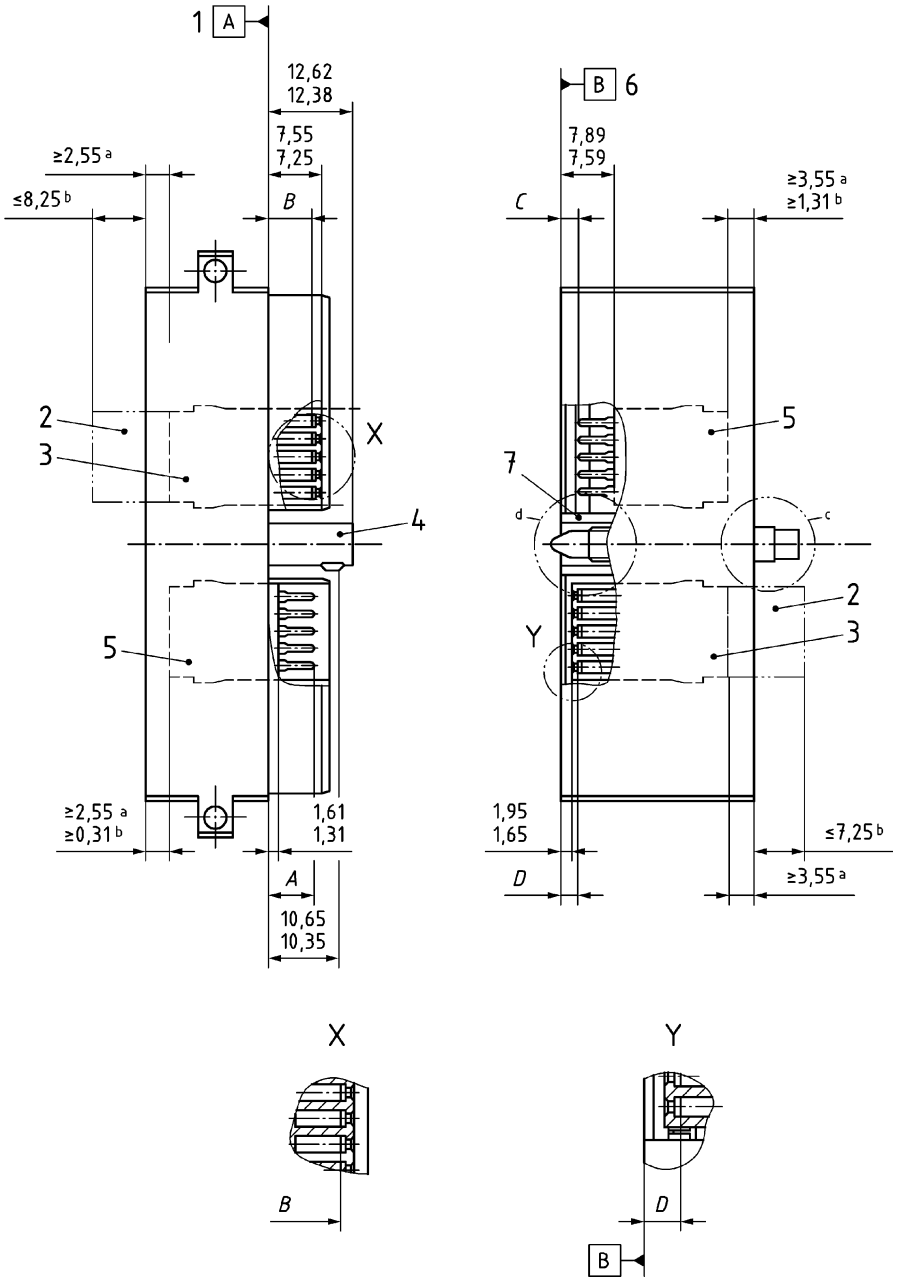
Table 1 — Mated dimensions

	A	B	C	D	E	F
Series 2	38,5 37,8	33,4 32,9	19,3 17,9	14,2 13,0	40,0 36,0	34,9 30,9
Series 3	47,1 46,4	42,0 41,5	19,65 18,25	14,55 13,35	40,0 36,0	34,9 30,9

6.1.2 Plug and receptacle, series 2

Module and contact position

Dimensions are in millimetres, see Figure 3 and Table 2.



Key

1	Mechanical bottom of receptacle	5	Male module assembly (all sizes)
2	Female module assembly (size 8)	6	Mechanical bottom of plug
3	Female module assembly (sizes 22 – 20 – 16 – 12)	7	See EN 4165-021.
4	See EN 4165-020		
a	For sizes 22 – 20 – 16 – 12 modules	b	For size 8 module
c	See Figure 7	d	See Figures 5 and 6

Figure 3 — Module and contact position inside plug and receptacle, series 2

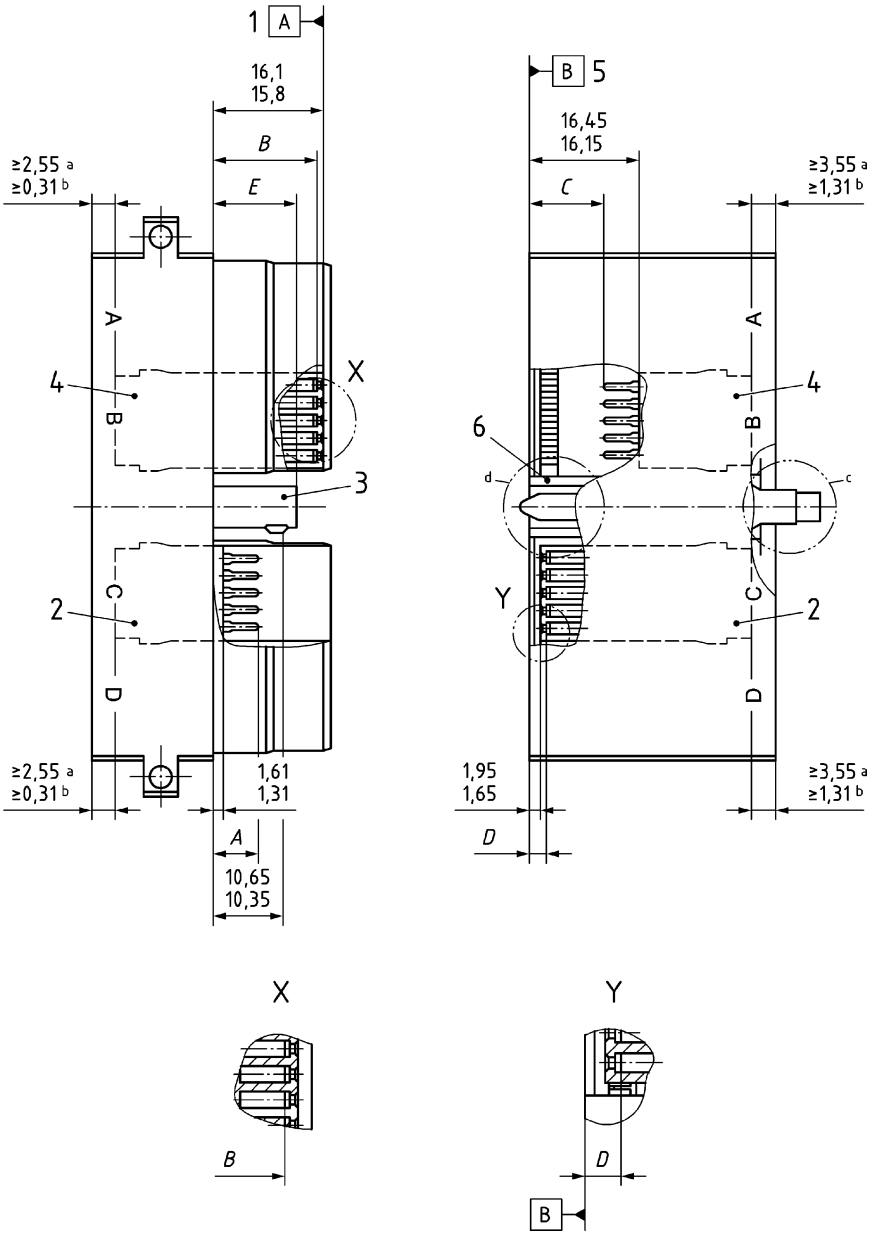
Table 2 — Contact position

	A	B	C	D
Sizes 22 – 20 – 16 – 12	6,66 6,20	6,38 5,93	3,00 2,54	3,27 2,82
Size 8	6,79 6,33	6,51 5,93	2,87 2,41	3,27 2,69

6.1.3 Plug and receptacle, series 3

Module and contact position

Dimensions are in millimetres, see Figure 4 to Figure 7, Table 3 and Table 4.



Key

1	Mechanical bottom of receptacle	4	Male module assembly (all sizes)
2	Female module assembly (all sizes)	5	Mechanical bottom of plug
3	See EN 4165-020 for series 2 and EN 4165-024 for series 3	6	See EN 4165-021
a	For sizes 22 – 20 – 16 – 12 modules	b	For size 8 module
c	See Figure 7.	d	See Figures 5 and 6

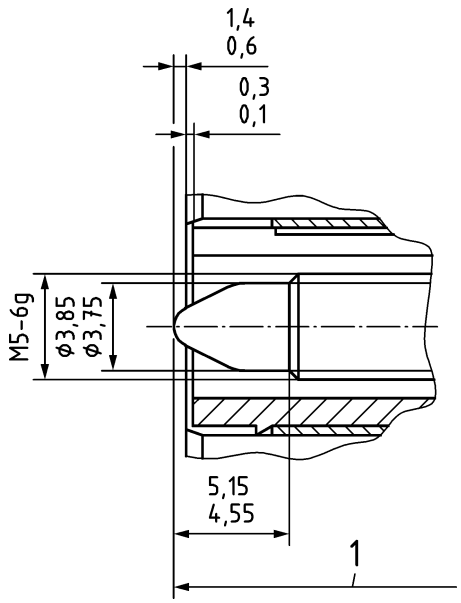
Figure 4 — Module and contact position inside plug and receptacle, series 3

Table 3 — Contact position

	A	B	C	D
Sizes 22 – 20 – 16 – 12	6,66 6,20	14,94 14,49	11,56 11,10	3,27 2,82
Size 8	6,79 6,33	15,07 14,49	11,43 10,97	3,27 2,69

Table 4 — Coding pin position

	E
Coupling with clicker-nut plug	12,62 12,38
Coupling with rack and panel plug series 3	21,18 20,94



Key

1 Active thread 12,6 min.

Figure 5 — Coupling screw position inside plugs series 2 and series 3

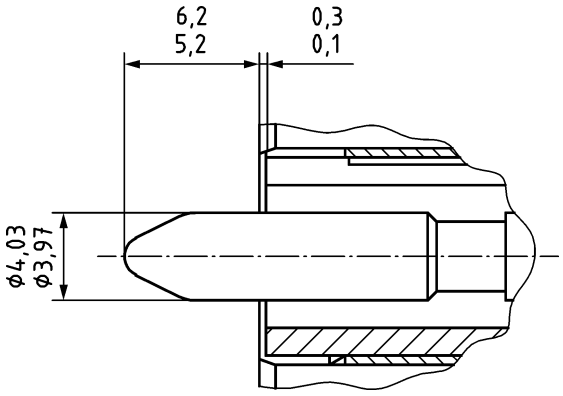
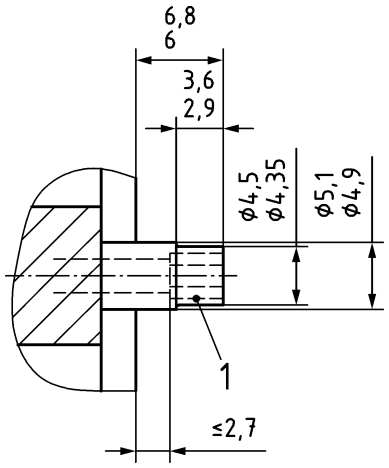


Figure 6 — Guiding pin position inside rack and panel plugs series 2 and series 3



Key

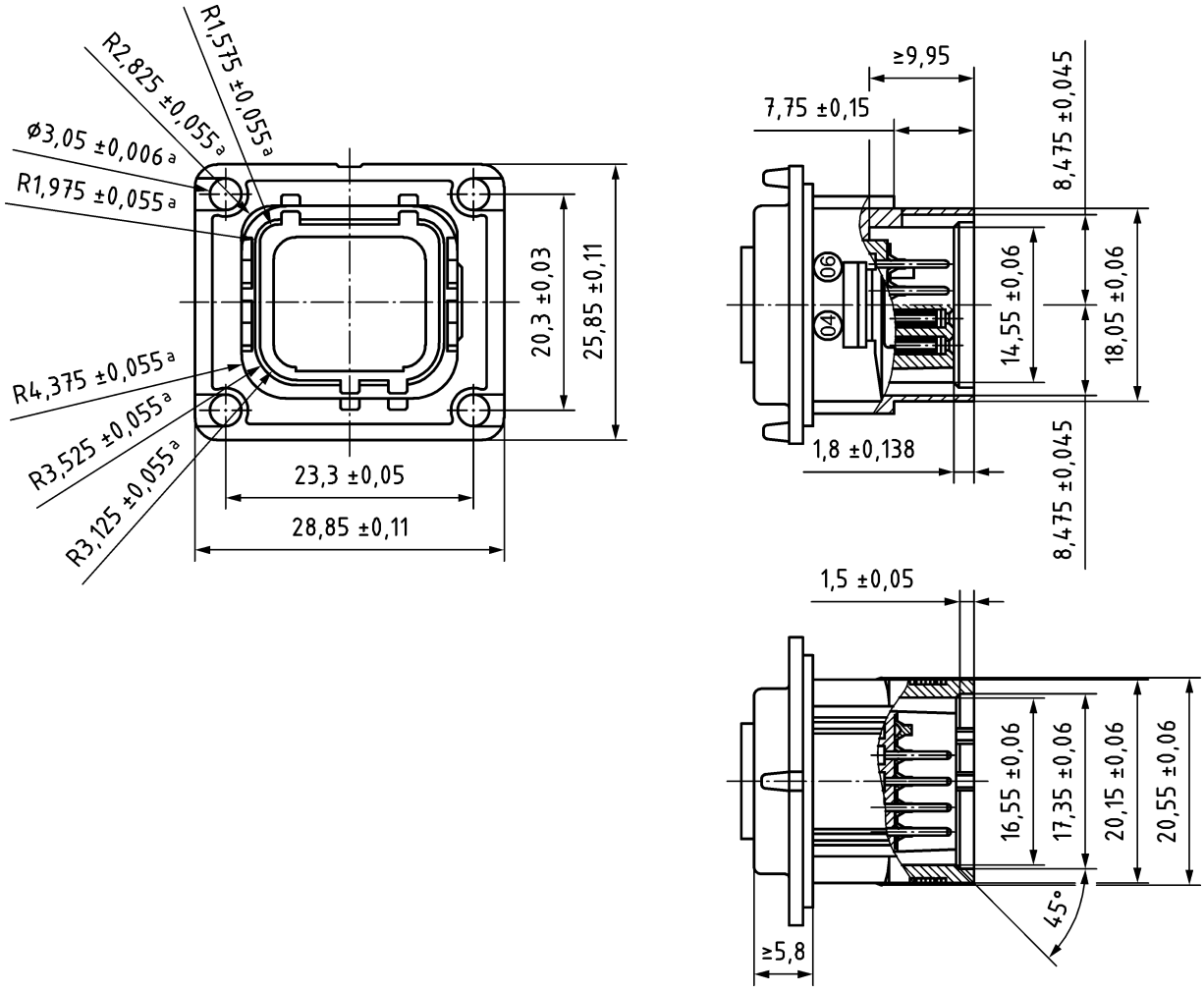
1 Hexagonal groove 3,02 – 3,08/flat

Figure 7 — Head of coupling screw

6.1.4 Plug and receptacle single module

6.1.4.1 Receptacle

Dimensions are in millimetres, see Figure 8.



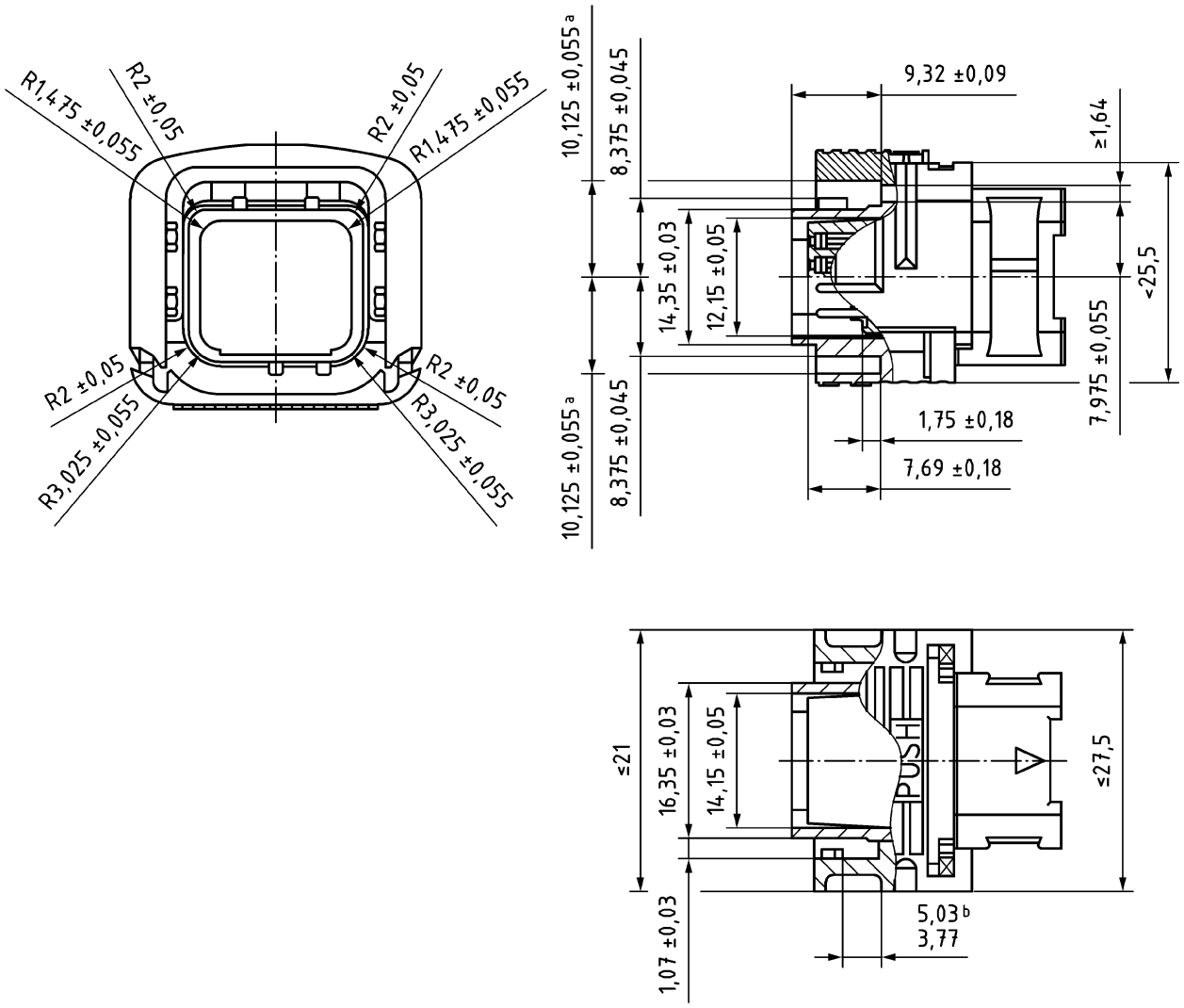
Key

a Type

Figure 8 — Single module receptacle dimensions

6.1.4.2 Plug

Dimensions are in millimetres, see Figure 9.



Key

a Locking slide down: 9,1 min.
b Unlocked position: 3,9 ± 0,13

(continued)

Alternative design:

Rigid coupling

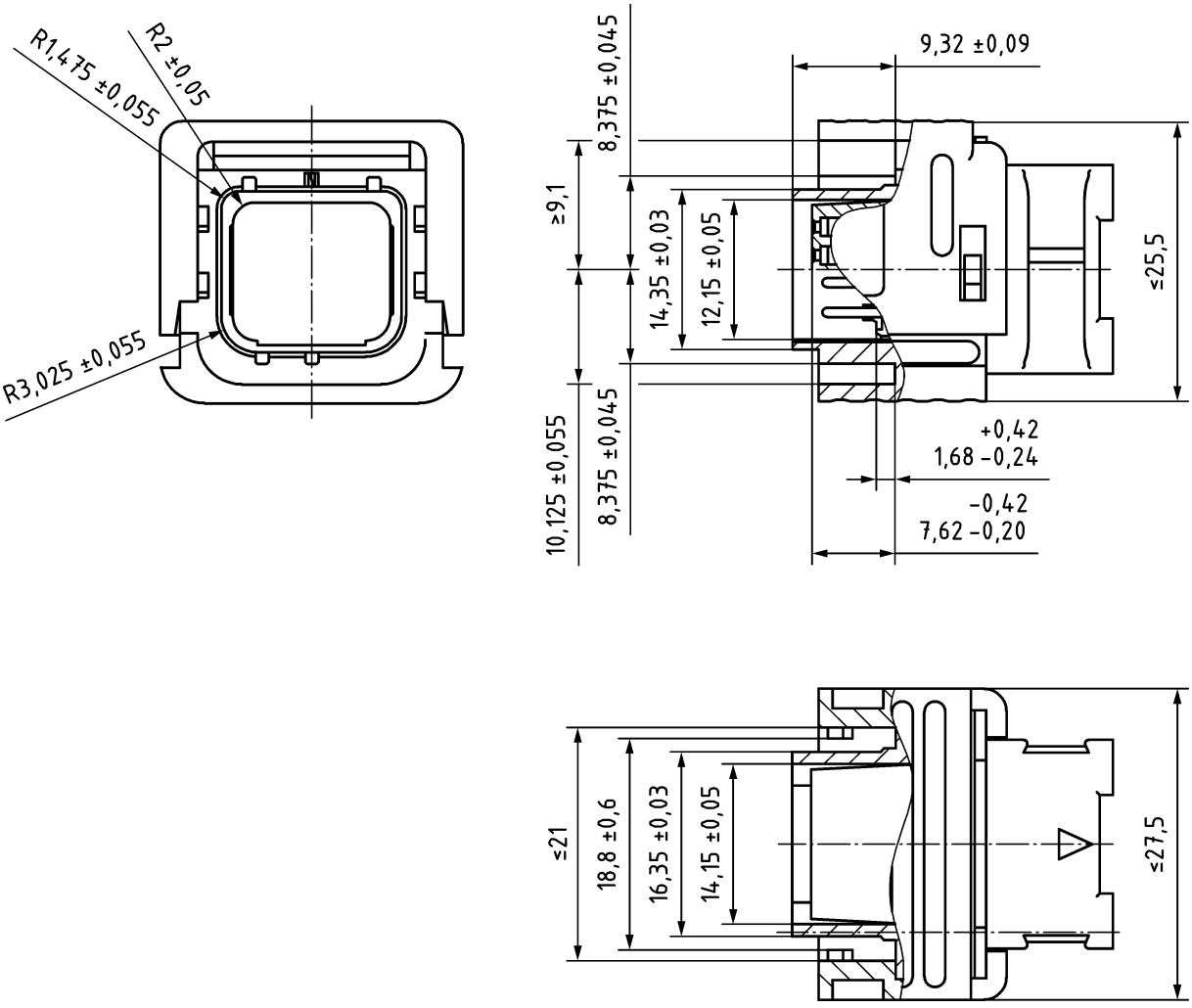
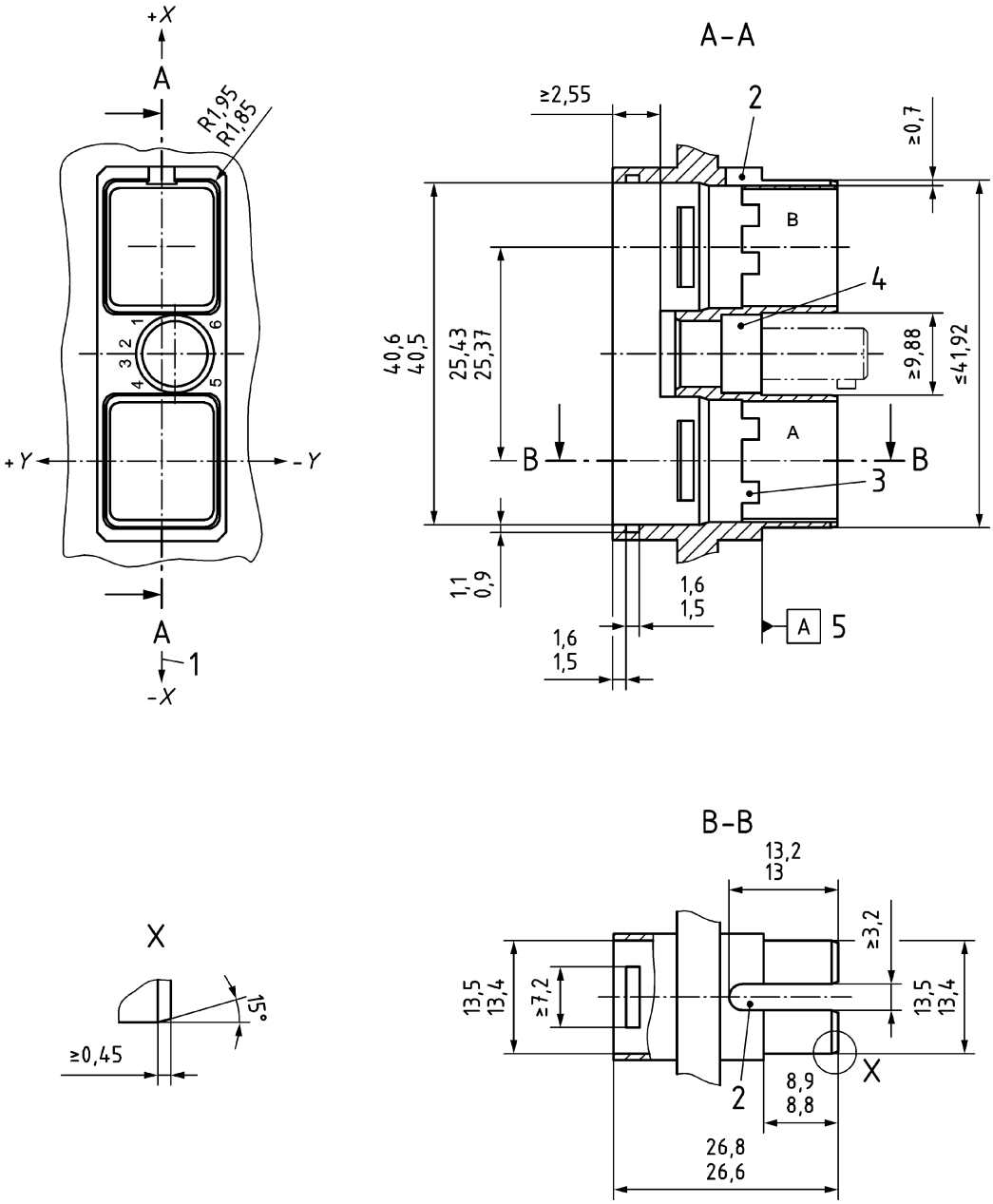


Figure 9 — Single module plug dimensions

6.2 Receptacle dimensions

6.2.1 2 cavities receptacle dimensions, series 2

Dimensions are in millimetres, see Figure 10.



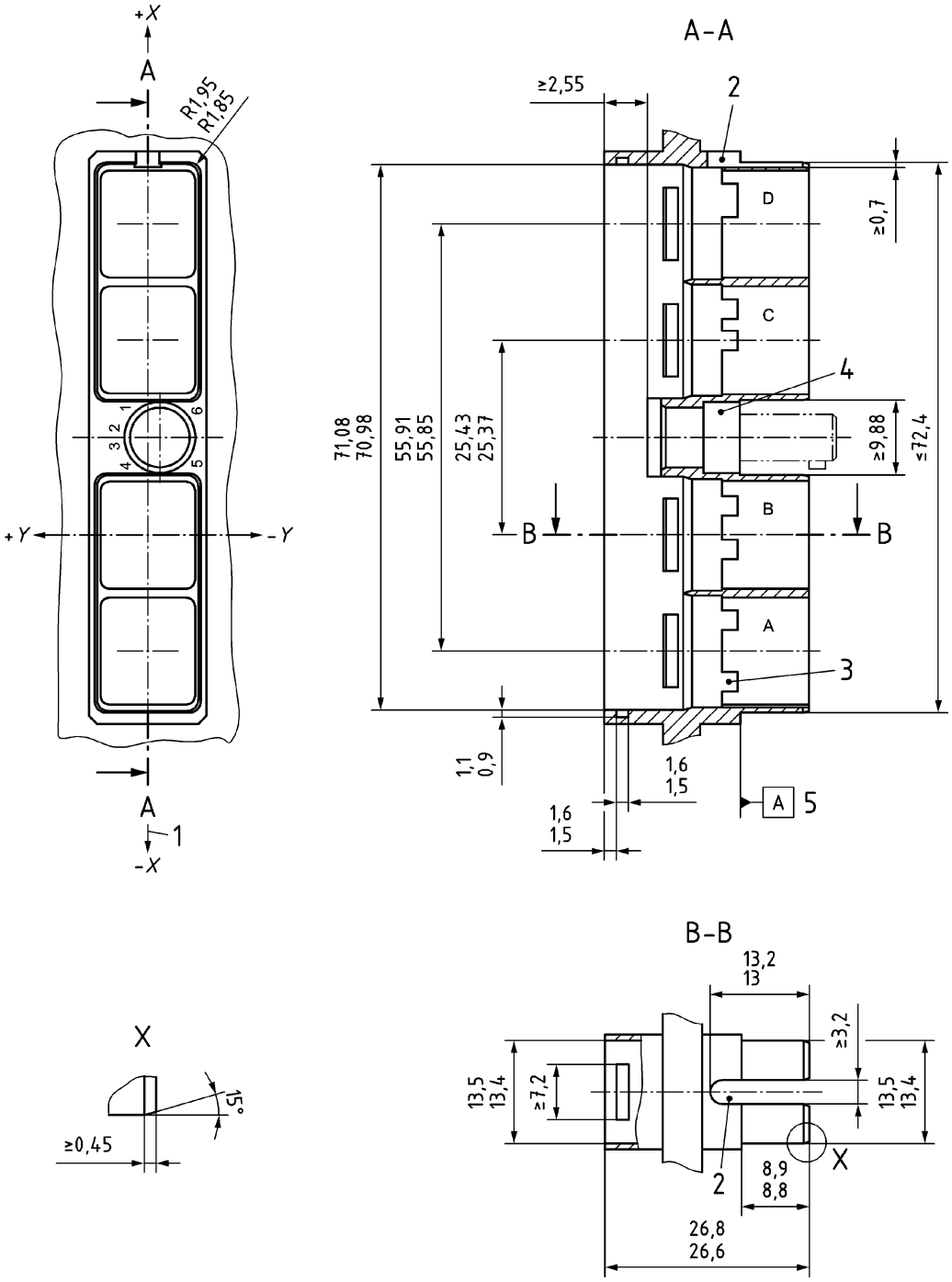
Key

1	Centre line
2	Groove only for classes F, W and A
3	Module cavities coding, see Figure 22
4	Coding pin cavity (see Figure 14)
5	Mechanical bottom of receptacle

Figure 10 — 2 cavities receptacle dimensions, series 2

6.2.2 4 cavities receptacle dimensions, series 2

Dimensions are in millimetres, see Figure 11.



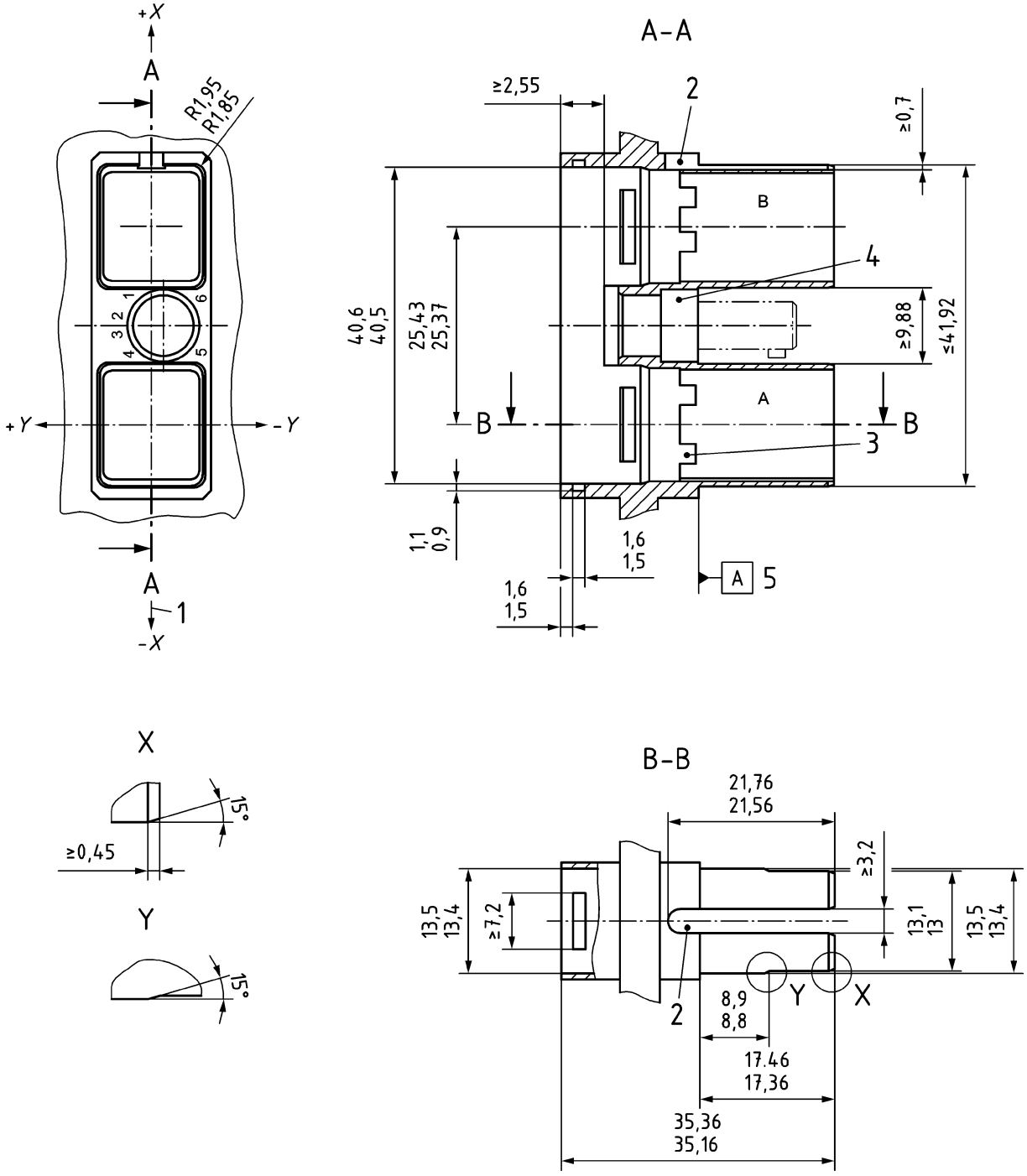
Key

1 Centre line
2 Groove only for classes F, W and A
3 Module cavities coding, see Figure 22
4 Coding pin cavity, see Figure 14
5 Mechanical bottom of receptacle

Figure 11 — 4 cavities receptacle dimensions, series 2

6.2.3 2 cavities receptacle dimensions, series 3

Dimensions are in millimetres, see Figure 12.



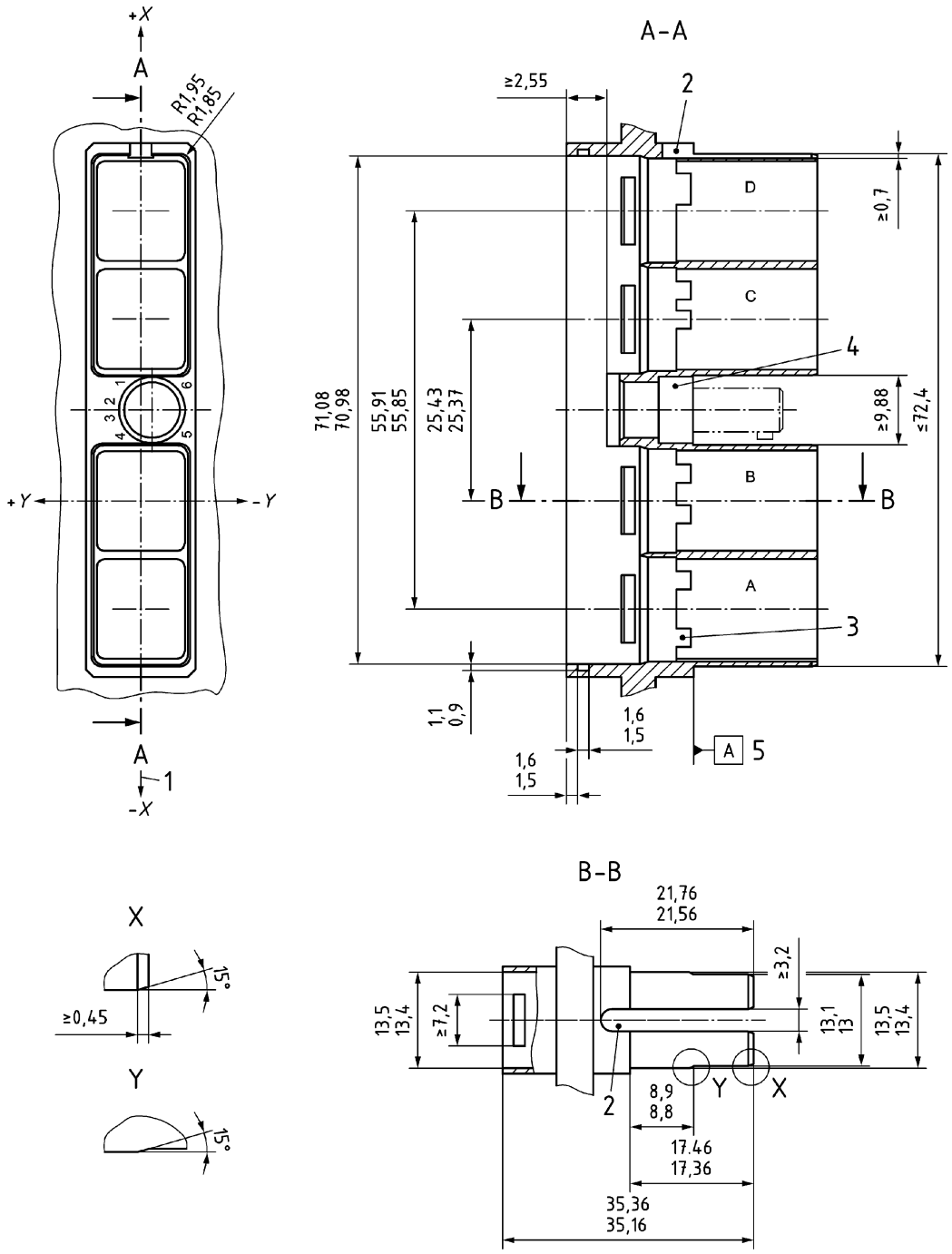
Key

1 Centre line
2 Groove only for classes F, W and A
3 Module cavities coding, see Figure 22
4 Coding pin cavity, see Figure 14
5 Mechanical bottom of receptacle

Figure 12 — 2 cavities receptacle dimensions, series 3

6.2.4 4 cavities receptacle dimensions, series 3

Dimensions are in millimetres, see Figure 13.



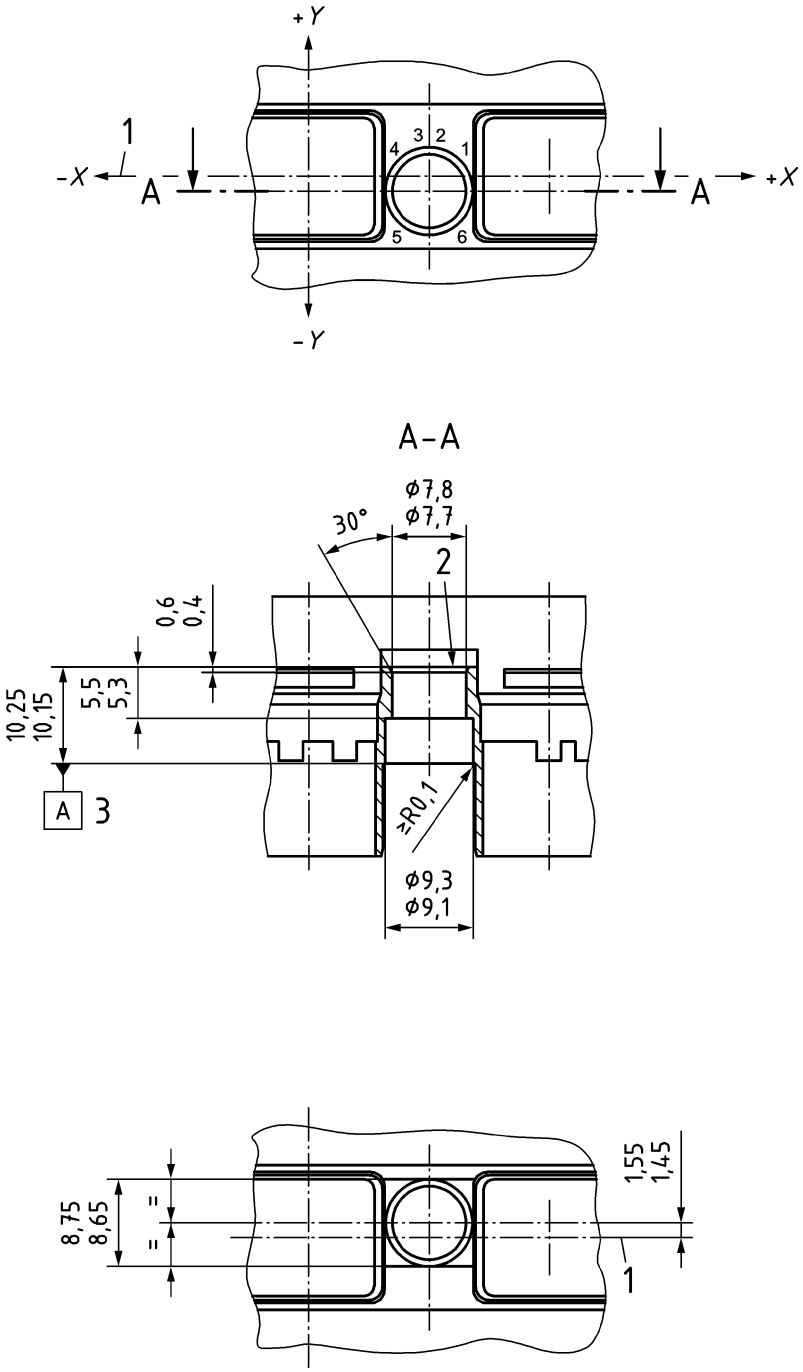
Key

1 Centre line
2 Groove only for classes F and W
3 Module cavities coding, see Figure 22
4 Coding pin cavity, see Figure 14
5 Mechanical bottom of receptacle

Figure 13 — 4 cavities receptacle dimensions, series 3

6.3 Receptacle coding pin cavity dimensions, series 2 and series 3

Dimensions are in millimetres, see Figure 14.



Key

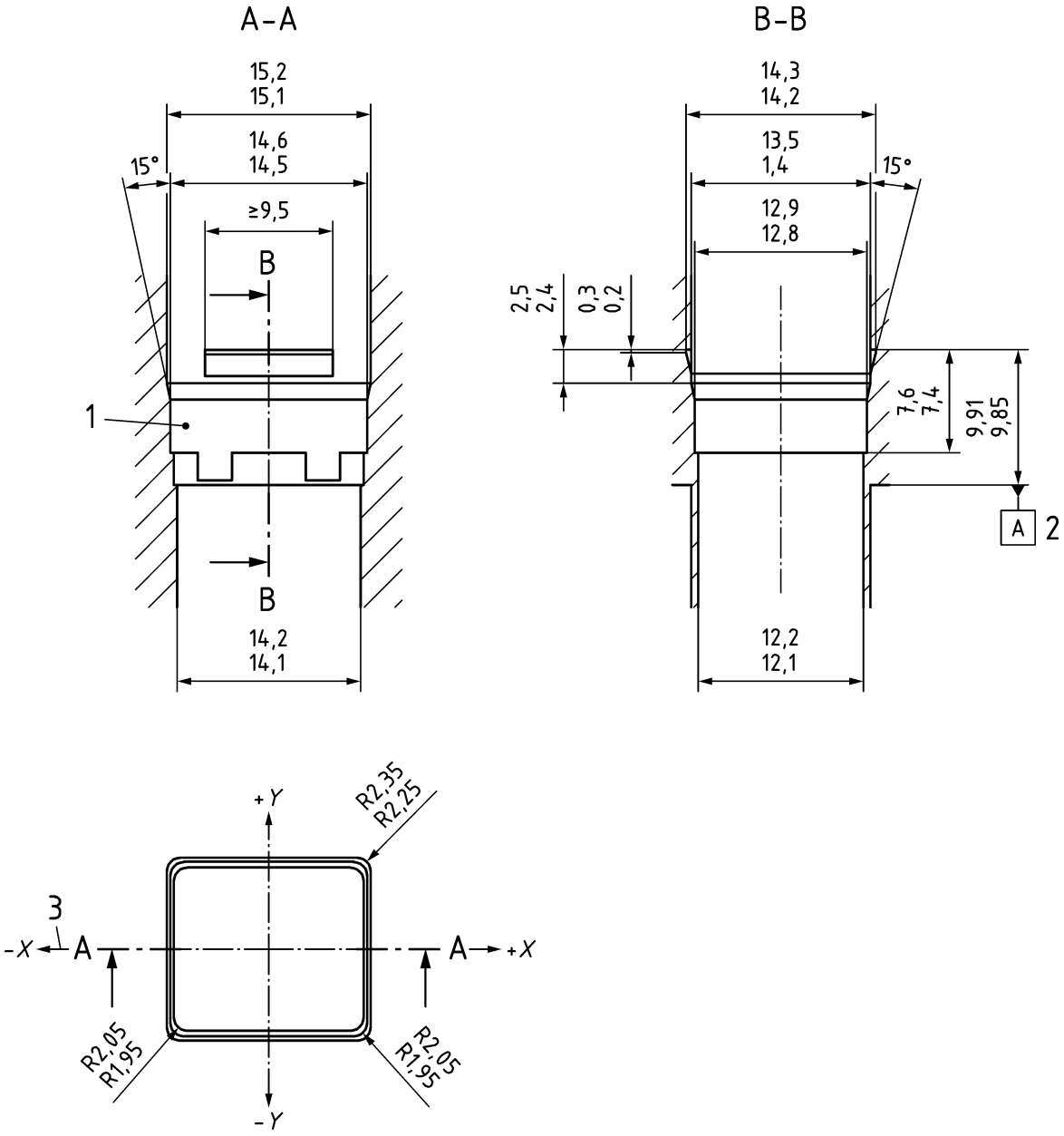
1 Centre line

2 Bottoming plate for coding pin

3 Mechanical bottom of receptacle

Figure 14 — Receptacle coding pin cavity dimensions, series 2 and series

6.4 Receptacle module cavities dimensions, series 2 and series 3



Key

1 Module cavity coding see Figure 22

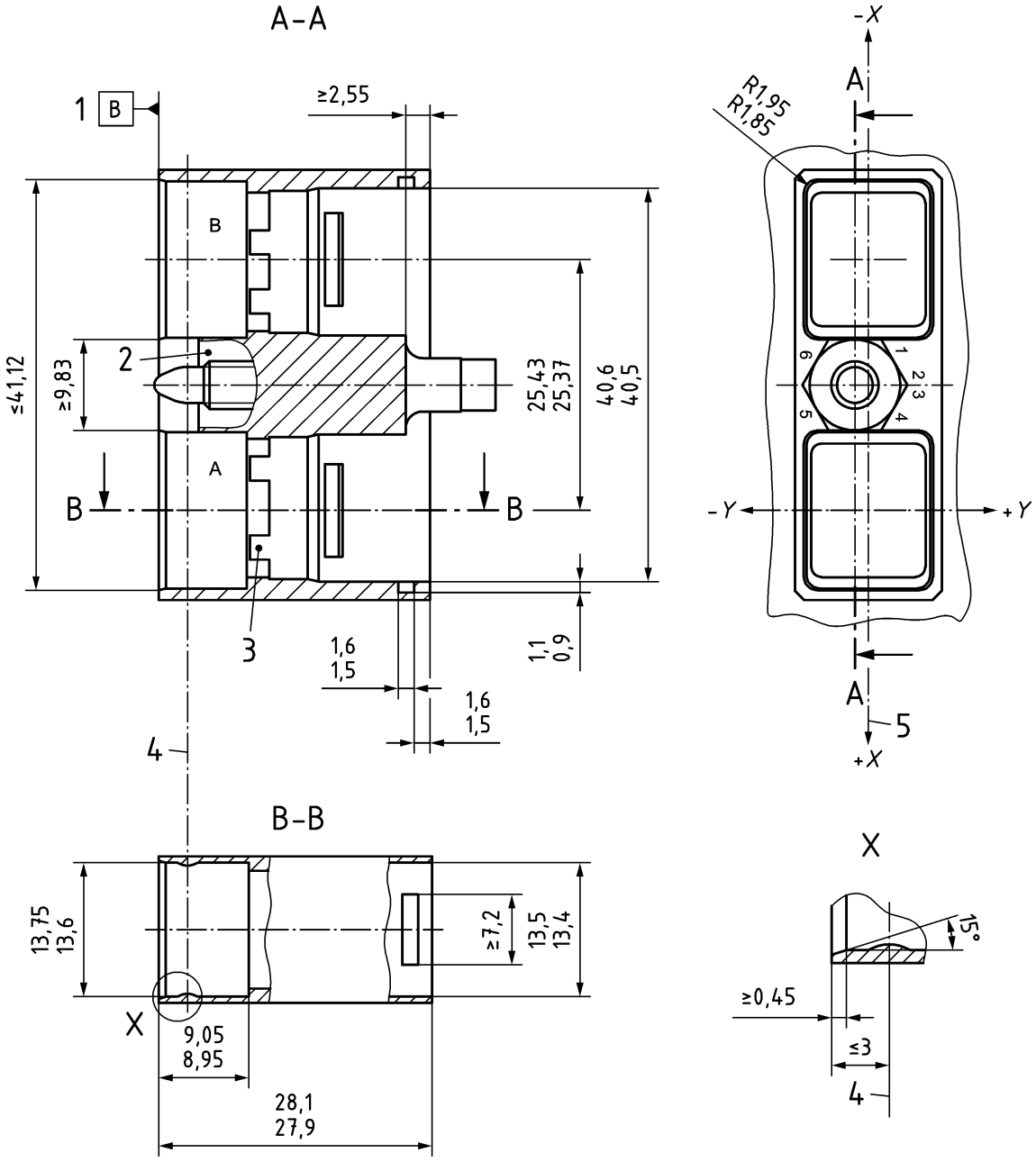
2 Mechanical bottom of receptacle

3 Centre line

Figure 15 — Receptacle module cavity dimensions, series 2 and 3

6.5 2 cavities plug dimensions, series 2

Dimensions are in millimetres, see Figure 16.



Key

1 Mechanical bottom of plug

2 Coding key cavity, see Figure 20

3 Module cavities coding, see Figure 22

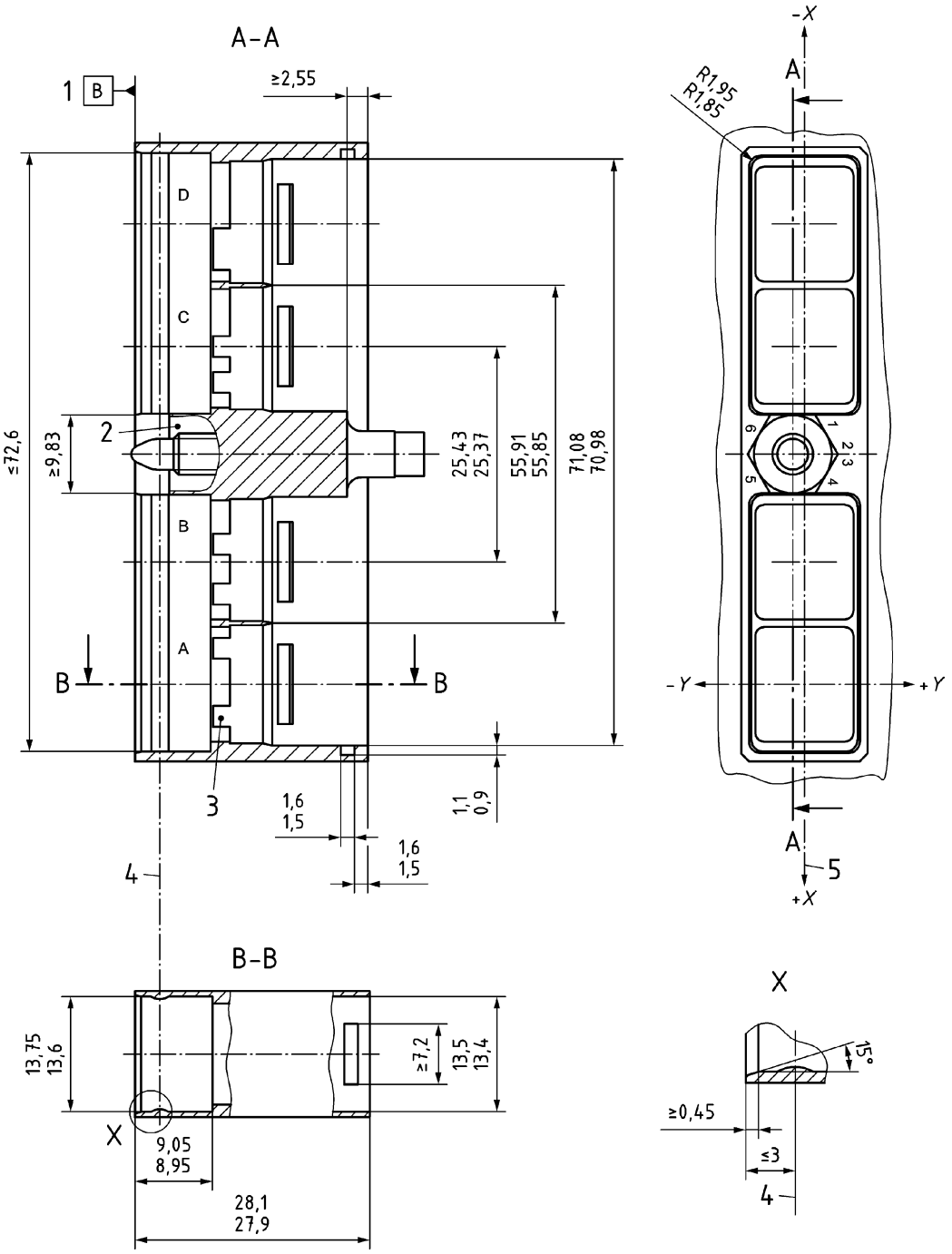
4 Point of engagement EMI feature

5 Centre line

Figure 16 — 2 cavities plug dimensions, series 2

6.6 4 cavities plug dimensions, series 2

Dimensions are in millimetres, see Figure 17.



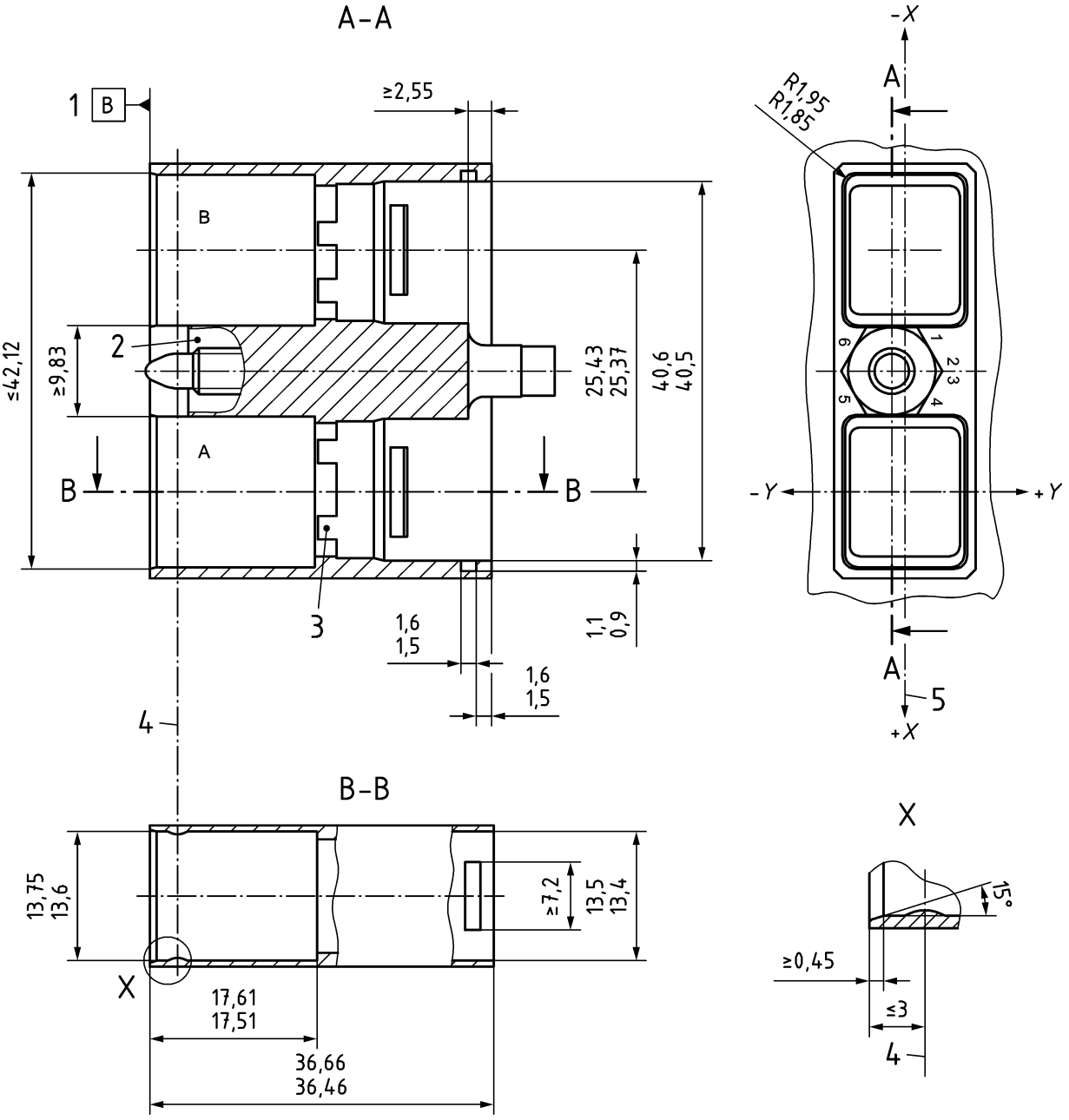
Key

1 Mechanical bottom of plug
2 Coding key cavity, see Figure 20.
3 Module cavities coding, see Figure 22.
4 Point of engagement EMI feature
5 Centre line

Figure 17 — 4 cavities plug dimensions, series 2

6.7 2 cavities plug dimensions, series 3

Dimensions are in millimetres, see Figure 18.



Key

1 Mechanical bottom of plug

2 Coding key cavity, see Figure 20.

3 Module cavities coding, see Figure 22.

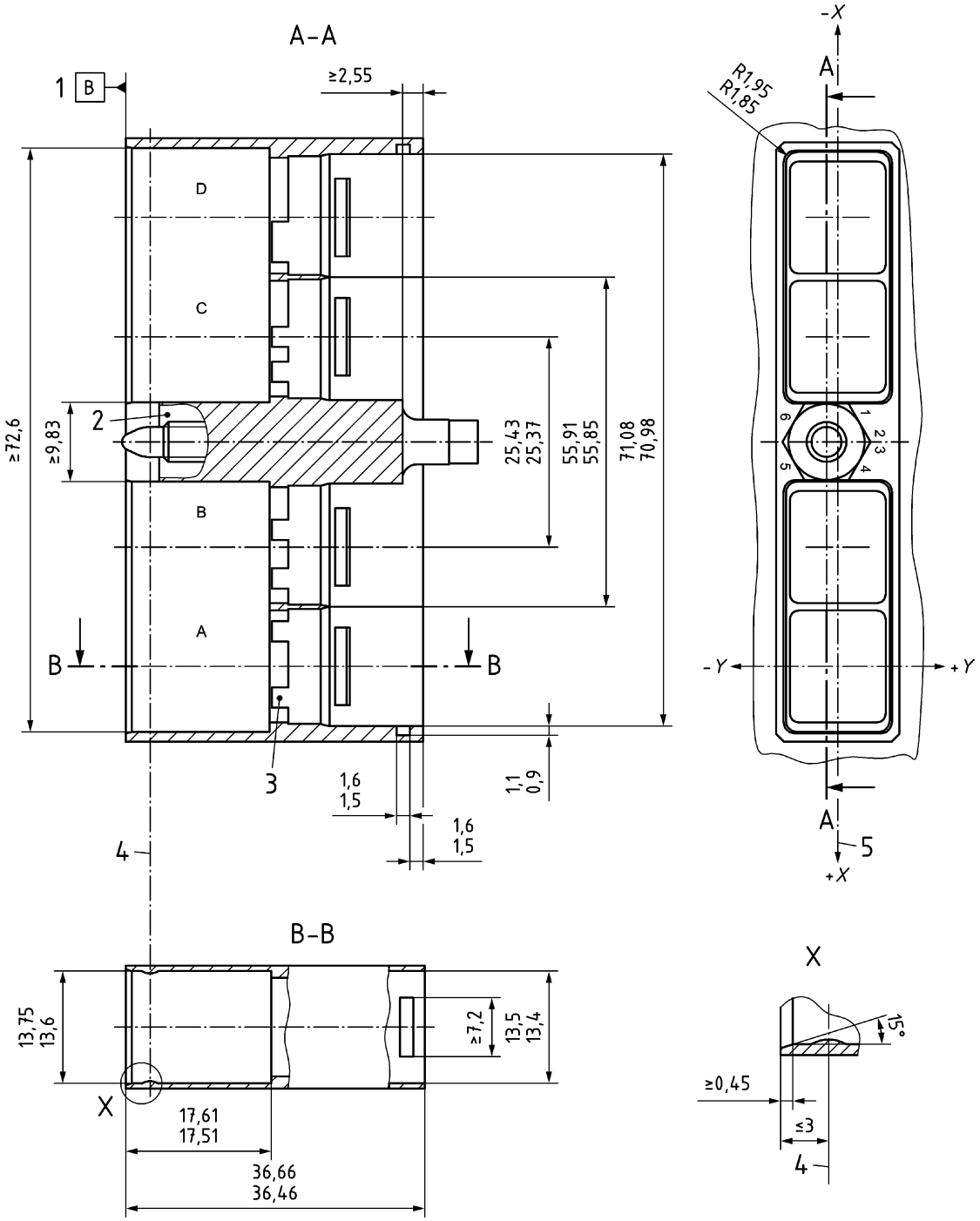
4 Point of engagement EMI feature

5 Centre line

Figure 18 — 2 cavities plug dimensions, series 3

6.8 4 cavities plug dimensions, series 3

Dimensions are in millimetres, see Figure 19.



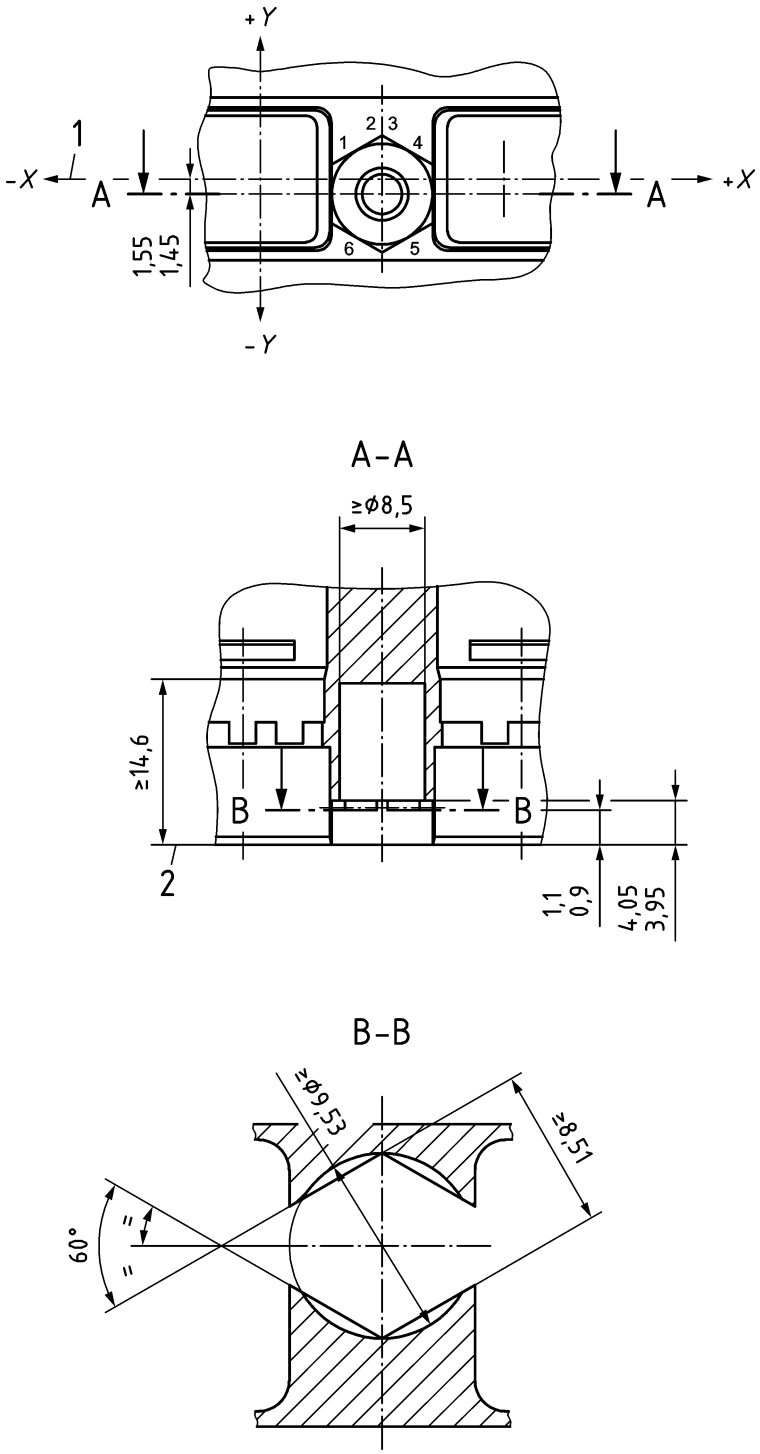
Key

1 Mechanical bottom of plug
2 Coding key cavity, see Figure 20.
3 Module cavities coding, see Figure 22.
4 Point of engagement EMI feature
5 Centre line

Figure 19 — 4 cavities plug dimensions, series 3

6.9 Plug coding key cavity dimensions, series 2 and series 3

Dimensions are in millimetres, see Figure 20.



Key

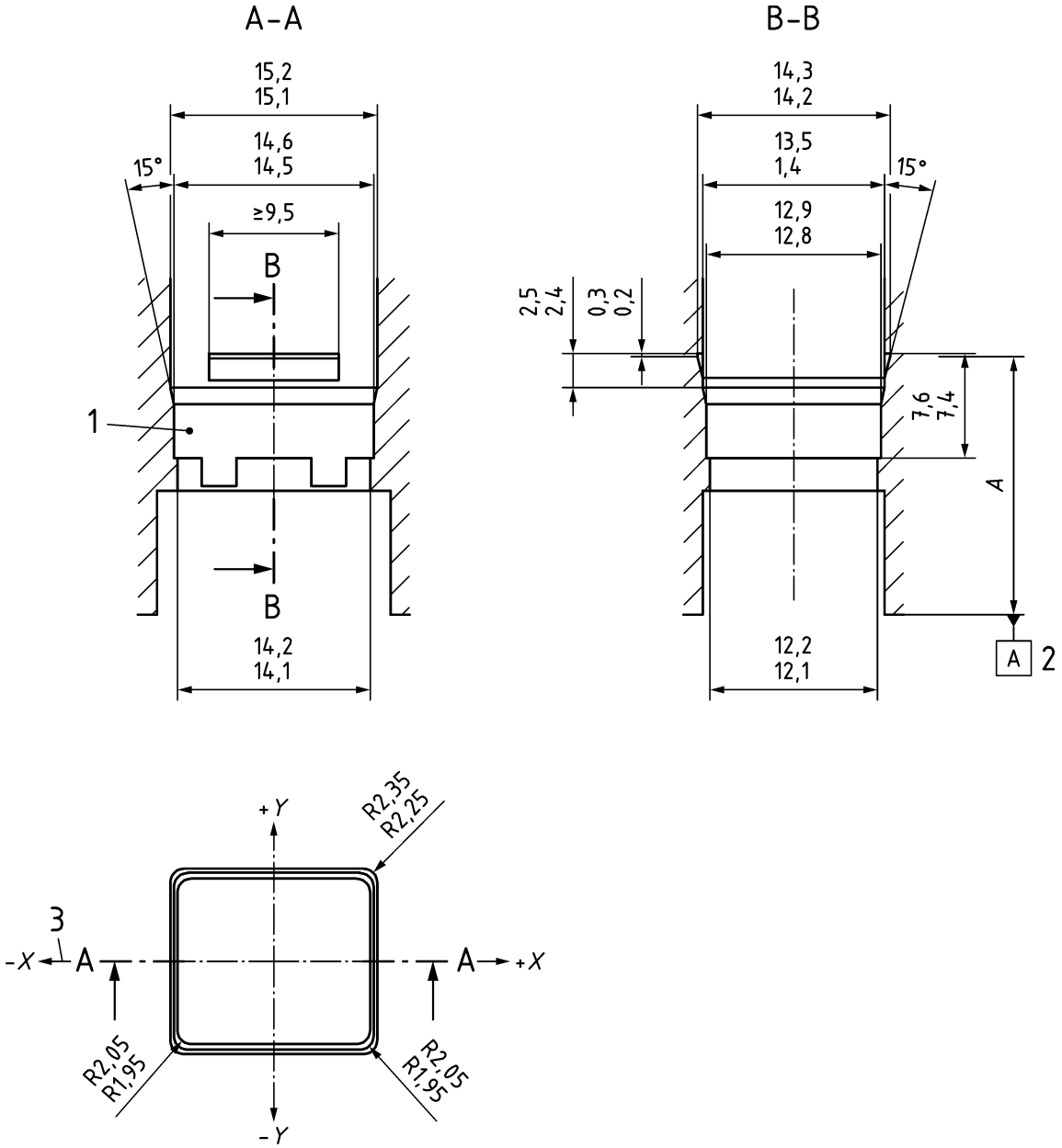
1 Centre line

2 Mechanical bottom of plug

Figure 20 — Plug coding key cavity dimensions – Series 2 and series 3

6.10 Plug module cavity dimensions, series 2 and series 3

Dimensions are in millimetres, see Figure 21 and Table 5.



Key

1 Module cavity coding, see Figure 22

2 Mechanical bottom of plug

3 Centre line

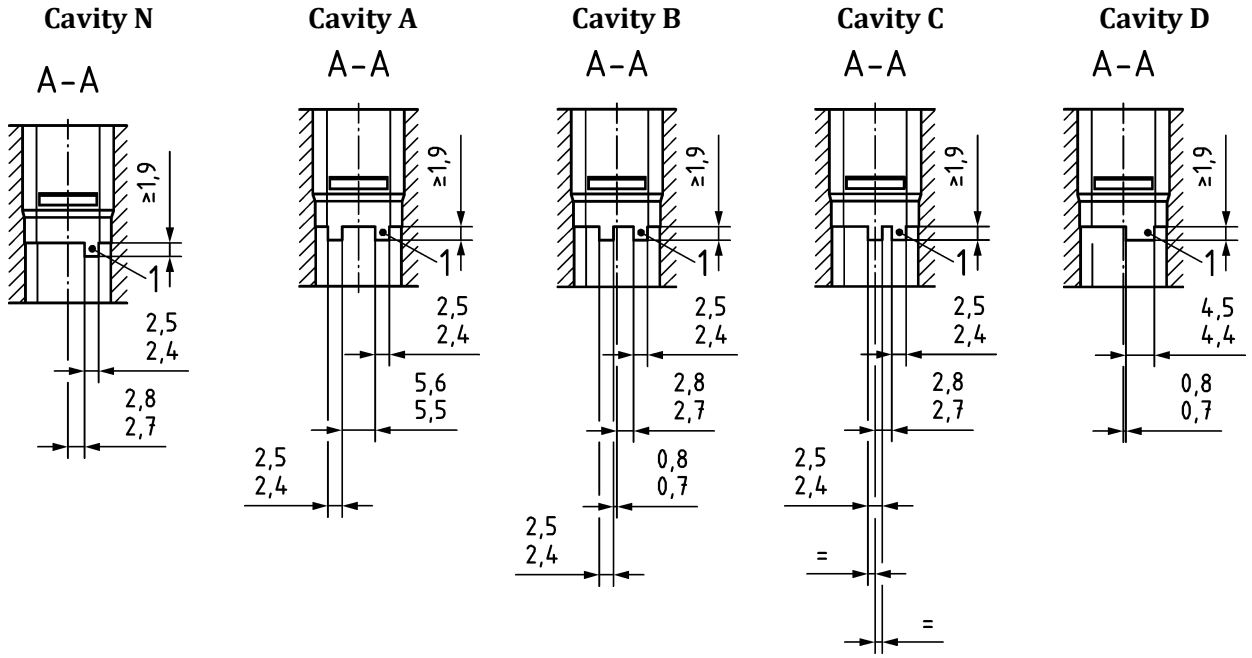
Figure 21 — Plug module cavity dimensions, series 2 and 3

Table 5 — Plug module cavity dimensions, series 2 and 3

	A
Series 2	19,11 19,05
Series 3	27,67 27,61

6.11 Receptacle and plug module cavity dimensions, series 2 and series 3

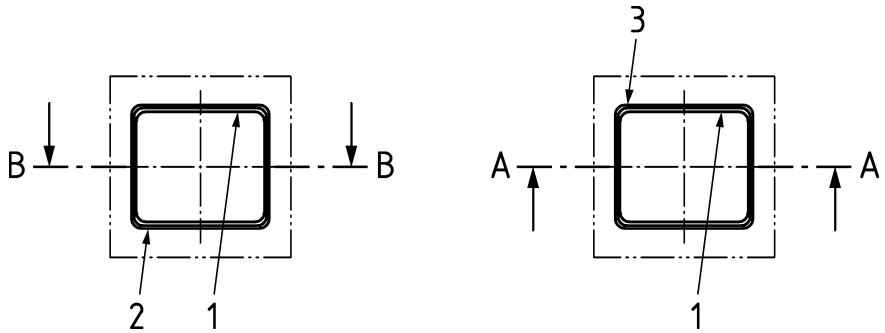
Dimensions are in millimetres, see Figure 22.



Key

1 Key N

The N key is present on all cavities



Key

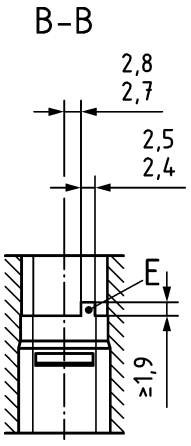
1 Key N

2 Keys E F

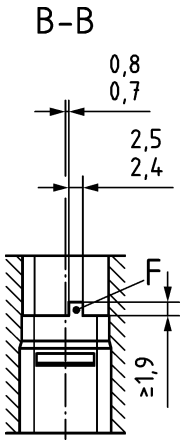
3 Keys A B C D

(continued)

Cavity E

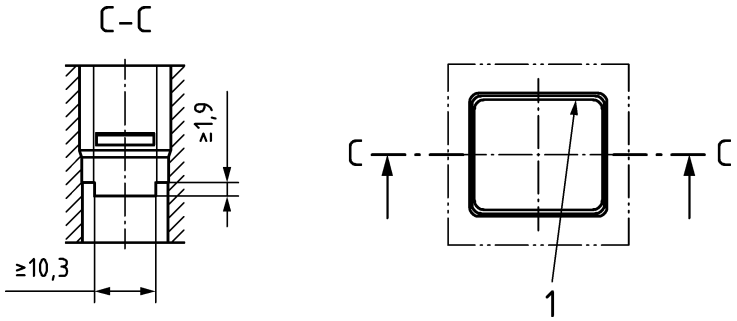


Cavity F



NOTE Modules polarized E and F have no shell corresponding.

Cavity for shells EN 4165-024 and EN 4165-025:



Key

1 Key N

This cavity accepts only modules keyed: A; B; C; D; N

Figure 22 — Receptacle and plug module cavity dimensions, series 2 and series 3 *(concluded)*

7 Details on contact and module interface

7.1 Male module and contact interfacial sealing dimensions

Dimensions are in millimetres, see Figure 23 and Table 6.

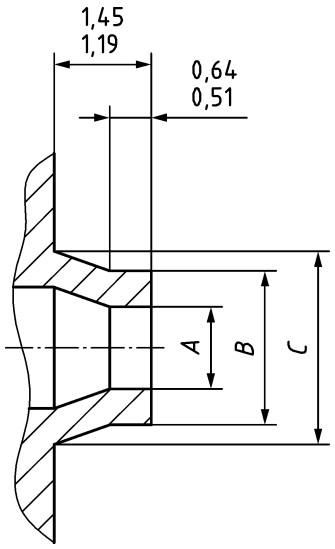


Figure 23 — Male module and contact interfacial sealing dimensions

Table 6 — Male module and contact interfacial sealing dimensions

Size	∅ *A* max.	∅ *B*	∅ *C*
22	0,73	1,35 1,27	1,88 1,75
20	0,97	1,91 1,83	2,44 2,31
16	1,54	2,49 2,41	3,02 2,89
12	2,34	3,31 3,23	3,84 3,71
08	5,51	6,79 6,40	7,13 6,91

7.2 Female module and contact interface dimensions

Dimensions are in millimetres, see Figure 24 and Table 7.

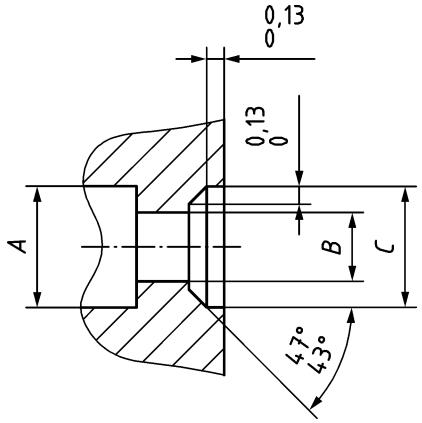


Table 7 — Female module and contact interface dimensions

Size	∅ *A*	∅ *B*	∅ *C*
22	1,69 1,60	0,97 0,89	1,70 1,60
20	2,18 2,10	1,32 1,24	2,26 2,16
16	3,10 2,92	1,88 1,80	2,84 2,74
12	4,30 4,10	2,70 2,62	3,66 3,56
08	7,46 7,33	5,84 5,76	6,87 6,77

Figure 24 — Female module and contact interface dimensions

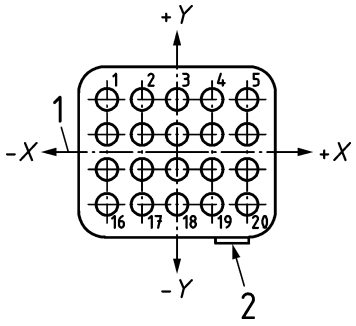
8 Contact arrangements

The contact arrangements in the modules are specified by Figures (25 to 42) and Tables (8 to 38) which show the interfacial face of the male or female modules.

The following tolerances apply to the modules:

— Centre of each hole: ⌖ | 0,02 | **x** | **y** ;

Identification of the contact position shall be permanently designed in contrasting colour on the front face of the module or interfacial seal and on the rear face of the wire sealing grommet. Identification shall not be recessed or raised on the sealing surfaces.



Key

1 Centre line

2 Coding location

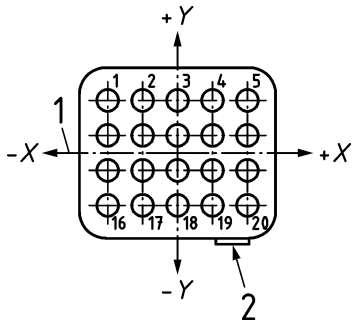
Figure 25 — Interfacial view of 20-22 male module

Table 8 — Arrangement position of 20-22 modules

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 9 — Contact information of 20-22 modules

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20



Key

1 Centre line

2 Coding location

Figure 26 — Interfacial view of 20A22 male module

This module arrangement shall be fitted only with EN 3155-070 and EN 3155-071 contacts.

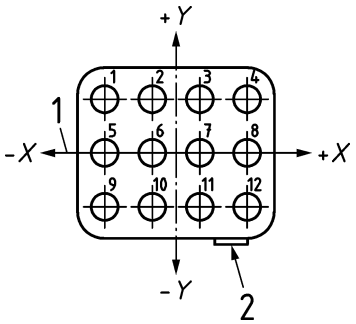
Table 10 — Arrangement position of 20A22 modules

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 11 — Contact information of 20A22 modules

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20

Contact arrangement *(continued)*



Key

1 Centre line

2 Coding location

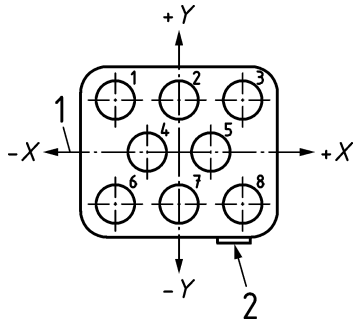
Figure 27 — Interfacial view of 12-20 male module

Table 12 — Arrangement position of 12-20 modules

Y mm	*X* mm			
	– 5,07	– 1,69	+ 1,69	+ 5,07
	Coordinate positions of contacts			
+ 3,89	1	2	3	4
0	5	6	7	8
– 3,89	9	10	11	12

Table 13 — Contact information of 12-20 modules

Contacts		
Size	**Number**	**Cavities**
20	12	1 to 12



Key

1 Centre line

2 Coding location

Figure 28 — Interfacial view of 08-16 male module

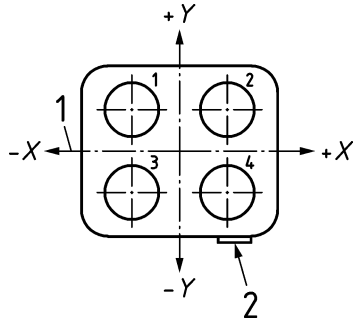
Table 14 — Arrangement position of 08-16 modules

Y mm	*X* mm				
	– 4,62	– 2,31	0	+ 2,31	+ 4,62
	Coordinate positions of contacts				
+ 3,77	1	–	2	–	3
0	–	4	–	5	–
– 3,77	6	–	7	–	8

Table 15 — Contact information of 08-16 modules

Contacts		
Size	**Number**	**Cavities**
16	8	1 to 8

Contact arrangement *(continued)*



Key

1 Centre line

2 Coding location

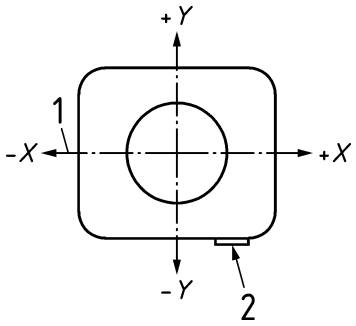
Figure 29 — Interfacial view of 04-12 male module

Table 16 — Arrangement position of 04-12 modules

Y mm	*X* mm	
	− 3,475	+ 3,475
	Coordinate positions of contacts	
+ 2,975	1	2
− 2,975	3	4

Table 17 — Contact information of 04-12 modules

Contacts		
Size	**Number**	**Cavities**
12	4	1 to 4



Key

1 Centre line

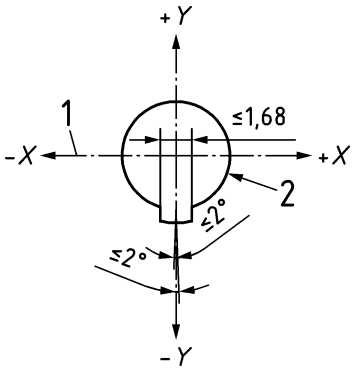
2 Coding location

Figure 30 — Interfacial view of 01-08 male module

Table 18 — Contact information of 01-08 modules

Contacts		
Size	**Number**	**Cavity**
8	1	1

Contact arrangement *(continued)*



Key

1 Centre line

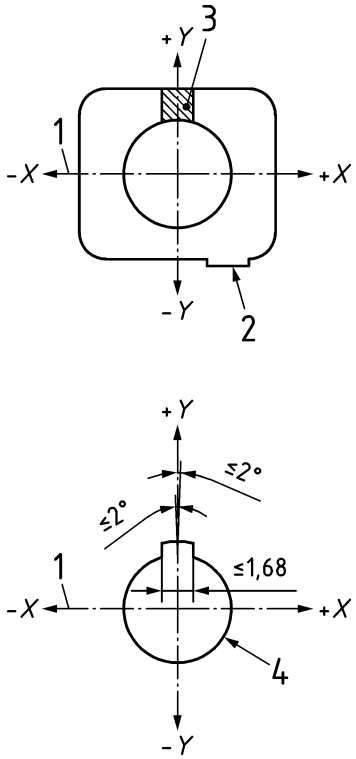
2 Insert cavity

Figure 31 — Interfacial view of 01Q18 and 01L18 male module

Table 19 — Contact information of 01Q18 and 01L18 modules

Contacts		
Size	**Number**	**Cavity**
8	1	1

Contact arrangement *(continued)*



Key

1 Centre line

2 Coding location

3 Coding contact location

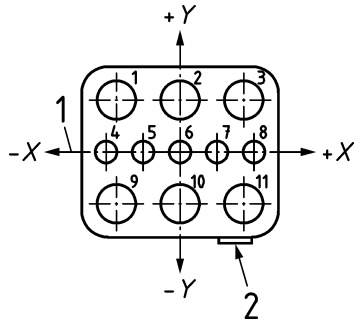
4 Insert cavity

Figure 32 — Interfacial view of 01Q28 and 01L28 male module

Table 20 — Contact information of 01Q28 and 01L28 modules

Contacts		
Size	**Number**	**Cavity**
8	1	1

Contact arrangement *(continued)*



Key

1 Centre line

2 Coding location

Figure 33 — Interfacial view of 99-01 and 99A01 male module

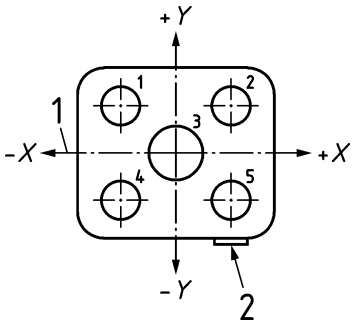
The size 22 cavities of 99A01 module arrangement shall be fitted only with EN 3155-070 and EN 3155-071 contacts.

Table 21 — Arrangement position of 99-01 and 99A01 modules

Y mm	*X* mm						
	– 5,24	– 4,40	– 2,62	0	+ 2,62	+ 4,40	+ 5,24
	Coordinate positions of contacts						
+ 3,50	–	1	–	2	–	3	–
0	4	–	5	6	7	–	8
– 3,50	–	9	–	10	–	11	–

Table 22 — Contact information of 99-01 and 99A01 modules

Contacts		
Size	**Number**	**Cavities**
16	6	1 to 3, 9 to 11
22	5	4 to 8



Key

1 Centre line

2 Coding location

Figure 34 — Interfacial view of 99-02 male module

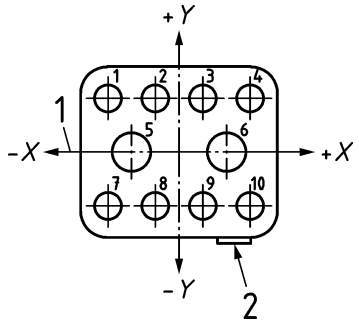
Table 23 — Arrangement position of 99-02 modules

Y mm	*X* mm				
	– 4,40	+ 4,40	0	– 4,40	+ 4,40
	Coordinate positions of contacts				
+ 3,50	1	–	–	–	–
+ 3,50	–	2		–	–
0	–	–	3	–	–
– 3,50	–	–	–	5	–
– 3,50	–	–	–	–	6

Table 24 — Contact information of 99-02 modules

Contacts		
Size	**Number**	**Cavities**
16	4	1, 2, 4 and 5
12	1	3

Contact arrangement *(continued)*



Key

1 Centre line

2 Coding location

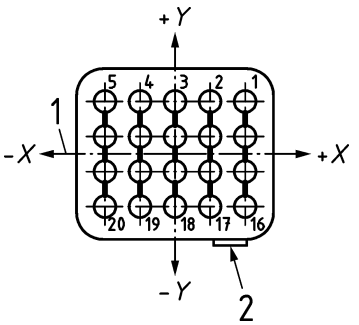
Figure 35 — Interfacial view of 99-10 male module

Table 25 — Arrangement position of 99-10 modules

Y mm	*X* mm					
	− 5,07	− 3,38	− 1,69	+ 1,69	+ 3,38	+ 5,07
	Coordinate positions of contacts					
+ 3,79	1	–	2	3	–	4
0	–	5	–	–	6	–
− 3,79	7	–	8	9	–	10

Table 26 — Contact information of 99-10 modules

Contacts		
Size	**Number**	**Cavities**
20	8	1 to 4, 7 to 10
16	2	5 to 6



Key

1 Centre line

2 Coding location

Figure 36 — Interfacial view of 20Y22 female module

This module is only available in female version.

This module arrangement shall be fitted only

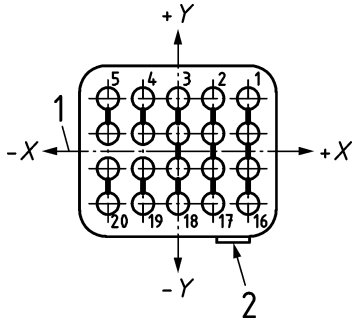
Table 27 — Arrangement position of 20Y22 module

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 28 — Contact information of 20Y22 module

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20

Contact arrangement *(continued)*



Key

1 Centre line

2 Coding location

Figure 37 — Interfacial view of 2AY22 female module

This module is only available in female version.

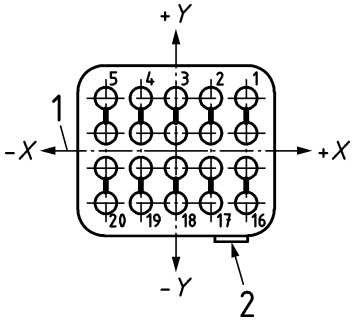
This module arrangement shall be fitted only with EN 3155-082 contacts.

Table 29 — Arrangement position of 2AY22 module

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 30 — Contact information of 2AY22 module

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20



Key

1 Centre line

2 Coding location

Figure 38 — Interfacial view of 2BY22 female module

This module is only available in female version.

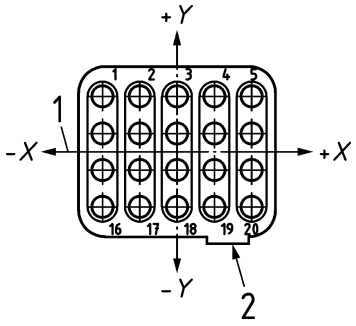
Table 31 — Arrangement position of 2BY22 module

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 32 — Contact information of 2BY22 module

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20

Contact arrangement *(continued)*



Key

1 Centre line

2 Coding location

Figure 39 — Interfacial view of 20Z22 male module

This module is only available in male version.

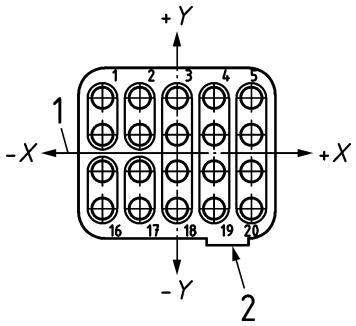
This module arrangement shall be fitted only with EN 3155-008 contacts with non-selective gold plating.

Table 33 — Arrangement position of 20Z22 module

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 34 — Contact information of 20Z22 module

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20



Key

1 Centre line

2 Coding location

Figure 40 — Interfacial view of 2AZ22 male module

This module is only available in male version.

This module arrangement shall be fitted only with EN 3155-008 contacts with non-selective gold plating.

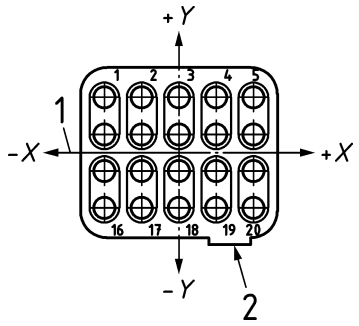
Table 35 — Arrangement position of 2AZ22 module

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 36 — Contact information of 2AZ22 module

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20

Contact arrangement *(concluded)*



Key

1 Centre line

2 Coding location

Figure 41 — Interfacial view of 2BZ22 male module

This module is only available in male version.

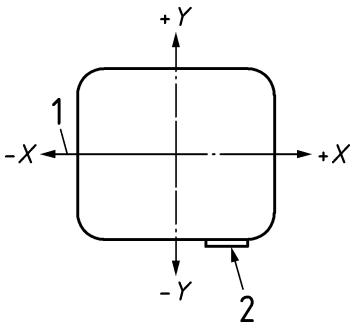
This module arrangement shall be fitted only with EN 3155-008 contacts with non-selective gold plating.

Table 37 — Arrangement position of 2BZ22 module

Y mm	*X* mm				
	− 5,08	− 2,54	0	+ 2,54	+ 5,08
	Coordinate positions of contacts				
+ 3,81	1	2	3	4	5
+ 1,27	6	7	8	9	10
− 1,27	11	12	13	14	15
− 3,81	16	17	18	19	20

Table 38 — Contact information of 2BZ22 module

Contacts		
Size	**Number**	**Cavities**
22	20	1 to 20



Key

1 Centre line

2 Coding location

Figure 42 — Interfacial view of N and NL blank module

This module is only available in male version.

9 Tests

9.1 Tests according to EN 2591-100

The tests of EN 2591-100, applicable in the context of this European Standard as well as the details necessary for implementing them and for inspecting connector characteristics, are given in Table 39.

NOTE The relationship between the numerical numbering system and the former alphanumerical numbering system for parts of EN 2591-100 is given in TR 4257.

Table 39 — Tests according to EN 2591-100 *(1 of 9)*

EN 2591-	Designation of the test	Details
101	Visual examination	Initial examination; examination of connectors, housing, module loose parts (contacts, etc.) Details to be examined: – identification; – appearance; – marking; – surface finish. Final examination: no loosening of parts, crack, excessive wear or detached part shall be observed.
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.
201	Contact resistance - low level	Test applicable to contact defined by the standards for contacts specified in EN 4165-003. For shunted modules: Rc between two contacts in the same column, 8 mΩ initial, Rc < 12 mΩ after test.
202	Contact resistance at rated current	Test applicable to contact defined by the standards for contacts specified in EN 4165-003. For shunted modules, *I*n = 5A: Rc between two contacts in the same column, 8 mΩ initial, Rc < 12 mΩ after test.
203	Electrical continuity at microvolt level	Applicable for coaxial contacts
204	Discontinuity of contacts in the microsecond range	Method B Duration of micro-discontinuity: Standard contact: ≤ 1 µs Coaxial contact: ≤ 100 ns Quadrax contact: ≤ 2 ns Test duration: throughout the duration of the tests EN 2591-402 shock and EN 2591-403 vibrations.

Table 39 — Tests according to EN 2591-100 *(2 of 9)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></tr>
<tr><td>205</td><td>Housing (shell) electrical continuity</td><td>Measuring points: on the rear of the receptacle and plug, by contact point.
a) Between mated connectors
<table>
<tr><th>Maximum resistance</th><th>Initial
mΩ</th><th>After test
mΩ</th></tr>
<tr><td>Class F</td><td>1</td><td>2</td></tr>
<tr><td>Class W</td><td>2,5</td><td>5</td></tr>
<tr><td>Classes J and M</td><td>3</td><td>6</td></tr>
<tr><td>Class C</td><td colspan="2">NOT APPLICABLE</td></tr>
</table>
b) Between shell and grounding contacts (G)
Measuring points: on the outer contact, flush with the module and on the body shell.
Maximum resistance all classes.
Initial: 10 mΩ
After test: 20 mΩ
c) Between end of chimney and backshell
<table>
<tr><th>Maximum resistance</th><th>Initial
mΩ</th><th>After test
mΩ</th></tr>
<tr><td>Class F</td><td>2</td><td>4</td></tr>
<tr><td>Class W</td><td>2,5</td><td>5</td></tr>
<tr><td>Classes J and M</td><td>3</td><td>6</td></tr>
<tr><td>Class C</td><td colspan="2">NOT APPLICABLE</td></tr>
</table>
d) Between backshell and plug (or receptacle)
<table>
<tr><th>Maximum resistance</th><th>Initial
mΩ</th><th>After test
mΩ</th></tr>
<tr><td>Class F</td><td>1</td><td>2</td></tr>
<tr><td>Class W</td><td>2,5</td><td>5</td></tr>
<tr><td>Classes J and M</td><td>3</td><td>6</td></tr>
<tr><td>Class C</td><td colspan="2">NOT APPLICABLE</td></tr>
</table></td></tr>
<tr><td>206</td><td>Measurement of insulation resistance</td><td>Method A – Minimum insulation resistance:
– at ambient temperature: 5 000 MΩ (unmated connectors);
– at maximum operating temperature: 1 000 MΩ (unmated connectors);
– after tests EN 2591-314, and during EN 2591-324: 1 000 MΩ (mated connectors);
– after tests EN 2591-315: 1 000 MΩ (unmated connectors) except conductive fluids;
– during tests EN 2591-301: 100 MΩ (mated connectors).</td></tr>
</table>

Table 39 — Tests according to EN 2591-100 *(3 of 9)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></tr>
<tr><td>207</td><td>Voltage proof test</td><td>Method A, connectors mated and unmated except after test EN 2591-314, where they shall be mated. For tests at low pressure, voltage is applied after 30 min at the pressure indicated.
Voltage value: If connectors are not mated, follow EN 3197.
<table>
<tr><th rowspan="2">Max. leakage current</th><th rowspan="2">Pressure</th><th colspan="2">Connectors</th></tr>
<tr><th>Mated
V r.m.s.</th><th>Unmated
V r.m.s.</th></tr>
<tr><td rowspan="4">2 mA</td><td>Sea level</td><td>(size 22) 1 300
(other) 1 500</td><td>(size 22) 1 300
(other) 1 500</td></tr>
<tr><td>12,1 kPa (15 000 m)</td><td>1 000</td><td>600</td></tr>
<tr><td>4,7 kPa (21 000 m)</td><td>1 000</td><td>400</td></tr>
<tr><td>1,1 kPa (30 000 m)</td><td>1 000</td><td>200</td></tr>
</table></td></tr>
<tr><td>208</td><td>Temperature rise due to rated current</td><td>Applicable for shunted modules only: In = 5 A and Δ θ°C ≤ 40 °C</td></tr>
<tr><td>209</td><td>Current temperature derating</td><td>Not applicable for qualification</td></tr>
<tr><td>210</td><td>Electrical overload</td><td>
<table>
<tr><th>Contact size</th><th>Current A</th><th>Duration S</th></tr>
<tr><td>22</td><td>10
50</td><td>40
0,6</td></tr>
<tr><td>20</td><td>15
75</td><td>40
0,6</td></tr>
<tr><td>16</td><td>26
130</td><td>40
0,6</td></tr>
<tr><td>12</td><td>46
230</td><td>40
0,6</td></tr>
<tr><td>8</td><td>92
460</td><td>40
0,6</td></tr>
</table></td></tr>
<tr><td>211</td><td>Capacitance</td><td>Not applicable</td></tr>
<tr><td>212</td><td>Surface transfert impedance</td><td>Initial and after tests connector mated with accessories.
Except class C.
<table>
<tr><td>1 Khz</td><td>1 Mhz</td><td>10 Mhz</td><td>100 Mhz</td></tr>
<tr><td>5 mΩ</td><td>10 mΩ</td><td>20 mΩ</td><td>150 mΩ</td></tr>
</table></td></tr>
</table>

Table 39 — Tests according to EN 2591-100 *(4 of 9)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></tr>
<tr><td>213</td><td>Shielding effectiveness from 100 MHz to 1 GHz</td><td>Initial and after tests connector mated with accessories.
Except class C
<table><tr><th rowspan="2">Frequency
MHz</th><th>Minimum attenuation
(dB)</th></tr><tr><th>Classes J, M, F and W</th></tr><tr><td>100</td><td>50</td></tr><tr><td>200</td><td>45</td></tr><tr><td>300</td><td>45</td></tr><tr><td>400</td><td>40</td></tr><tr><td>800</td><td>35</td></tr><tr><td>1 000</td><td>30</td></tr></table>
Remark: alternative method such as IEC 61726 (stirred mode chamber) can be proposed.</td></tr>
<tr><td>214</td><td>Lightning strike, current and voltage pulse</td><td>Not applicable for class C
Classes F and W: Current pulse F
Classes J and M: Current pulse B with waveform 1</td></tr>
<tr><td>216</td><td>Engagement of contacts</td><td>Applicable ≥ 1,27 mm (only for standard contact)</td></tr>
<tr><td>301</td><td>Endurance at temperature</td><td>Method B, test under load
Temperature: 175 °C except when specimen contains quadrax contact, maximum temperature $T_A = (150\ ^{+5}_{0})$ °C.
Duration: 1 000 h</td></tr>
<tr><td>302</td><td>Climatic sequence</td><td>Applicable. Connectors mated
Minimum temperature: (– 55 ± 2) °C
Maximum temperature: (175 ± 2) °C except when specimen contains quadrax contact, maximum temperature $T_A = (150\ ^{+5}_{0})$ °C.</td></tr>
<tr><td>303</td><td>Cold/low pressure and damp heat</td><td>Connectors mated
Five cycles. Minimum temperature: (– 55 ± 2) °C</td></tr>
<tr><td>304</td><td>Damp heat steady state</td><td>Not applicable</td></tr>
<tr><td>305</td><td>Rapid change of temperature</td><td>Connectors mated
$T_A = (175\ ^{+5}_{0})$ °C except when specimen contains quadrax contact, maximum temperature $T_A = (150\ ^{+5}_{0})$ °C.
$T_B = (-55\ ^{0}_{-5})$ °C</td></tr>
<tr><td>306</td><td>Mould growth</td><td>Method A
Duration: 28 d
Growth 0
No prior washing
No surface etching</td></tr>
</table>

Table 39 — Tests according to EN 2591-100 *(5 of 9)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></tr>
<tr><td>307</td><td>Salt mist</td><td>The connectors shall be suspended in the test chamber with non-metallic cords, so that no accumulation of condensed saline solution can occur.
Classes W, J, M and C
The connectors shall be:
– subjected to 50 cycles of mating and unmating at a rate five cycles/min;
– exposed to the salt mist:
- mated for 452 h,
- then unmated for 48 h;
– subjected to 200 cycles of mating and unmating at the rate five cycles/min.
Model F
The connectors shall be:
– subjected to 50 cycles of mating and unmating at a rate five cycles/min;
– exposed to the salt mist: mated for 96 h;
– subjected to 200 cycles of mating and unmating at the rate ≤ five cycles/min.</td></tr>
<tr><td>308</td><td>Sand and dust</td><td>The mated connectors shall be arranged so that their longitudinal axis is parallel to the wind direction, with the rear of the plug facing into the wind.
Wind velocity in the duct: (3,5 ± 0,5) m/s.
Number of cycles: one</td></tr>
<tr><td>309</td><td>Dry heat</td><td>Not applicable</td></tr>
<tr><td>310</td><td>Cold</td><td>Not applicable</td></tr>
<tr><td>311</td><td>Low air pressure</td><td>Not applicable</td></tr>
<tr><td>312</td><td>Air leakage</td><td>Applicable, Method A – only peripheral sealing module and sealed flange receptacle including sealed coupling nut.
Differential pressure: 100 kPa
Maximum leakage flow: 4 cm3/h/module</td></tr>
<tr><td>313</td><td>Driving rain (artificial)</td><td>Not applicable</td></tr>
<tr><td>314</td><td>Immersion at low air pressure</td><td>Applicable – Pressure 1,1 kPa
Grounded modules, applicable with coaxial contact unsealed between central contact and outer body, at sea level only.
Leakage current and insulation resistance to be measured between central contact and outer body.
<table>
<tr><th>Module size</th><th>Contact P/N</th><th>Insulation resistance</th><th>Leakage current</th></tr>
<tr><td>#16</td><td>M39029/76
M39029/78</td><td>1 GΩ min.
at 250 V</td><td>2 mA max.
at 750 V</td></tr>
<tr><td>#12</td><td>M39029/28
M39029/27</td><td>1 GΩ min.
at 500 V</td><td>2 mA max.
at 1 000 V</td></tr>
<tr><td>#8</td><td>EN3155-068
EN3155-069</td><td>1 GΩ min.
at 500 V</td><td>2 mA max.
at 1 000 V</td></tr>
</table></td></tr>
<tr><td>315</td><td>Fluid resistance</td><td>For types of fluids, number of cycles, temperature and duration of immersion and temperature for the third phase: see Table 39.</td></tr>
<tr><td>316</td><td>Ozone resistance</td><td>Not applicable</td></tr>
</table>

Table 39 — Tests according to EN 2591-100 *(6 of 9)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></tr>
<tr><td>317</td><td>Flammability</td><td>Test applicable. Connectors mated. Method A</td></tr>
<tr><td>318</td><td>Fire-resistance</td><td>Not applicable</td></tr>
<tr><td>319</td><td>Gastightness of solderless wrapped connections</td><td>Not applicable</td></tr>
<tr><td>320</td><td>Simulated solar radiation at ground level</td><td>Not applicable</td></tr>
<tr><td>321</td><td>Damp heat, cyclic test</td><td>Not applicable</td></tr>
<tr><td>322</td><td>Hermeticity</td><td>Not applicable</td></tr>
<tr><td>323</td><td>Thermal shock</td><td>Not applicable</td></tr>
<tr><td>324</td><td>Interfacial sealing</td><td>Applicable – Pressure 1,1 kPa</td></tr>
<tr><td>401</td><td>Acceleration, steady state</td><td>Not applicable</td></tr>
<tr><td>402</td><td>Shock</td><td>Method A
Receptacle is front mounted on panel with screw (coupling torque: 0,15/0,20 daN). For rack and panel version the spring compression value shall be 1 mm.
Severity 100
Number of shocks: one each way for each of the three directions (i.e. six shocks in total).</td></tr>
<tr><td>403</td><td>Sinusoidal and random vibration</td><td>Same mounting configuration as EN 2591-402 connectors mated
Method B
Figure 3 and Table 2, level G
Duration: 8 h/axe on the three axis
After test: Check manually the mechanical clearance between rear accessory and connector and report the value.</td></tr>
<tr><td>404</td><td>Transverse load (external bending moment)</td><td>Bending moment: Connector is tested in worse case position (horizontal or vertical)
<table>
<tr><th>Housing size</th><th>Torque N.m Force rear plug</th><th>Torque N.m Rear accessory (body extremity)</th></tr>
<tr><td>Single module class M</td><td>–</td><td>5</td></tr>
<tr><td>2 and 4 modules classes F, W</td><td>50</td><td>14</td></tr>
<tr><td>2 and 4 modules classes J, M</td><td>15</td><td>7</td></tr>
<tr><td>2 and 4 modules class C</td><td>15</td><td>4</td></tr>
</table>
Force is applied along y axis of the connector. Metallic receptacle with metallic or composite plug and accessory.
For class C, final measurement EN 2591-205 is not applicable.</td></tr>
<tr><td>405</td><td>Axial load</td><td>Not applicable</td></tr>
<tr><td>406</td><td>Mechanical endurance</td><td>Number of mating and unmating operations: 500
The rate shall not exceed five cycles/min.</td></tr>
<tr><td>407</td><td>Durability of contact retention system and seals (Maintenance ageing)</td><td>Applicable
50 cycles insertion/extraction for contacts in shunted modules.</td></tr>
</table>

Table 39 — Tests according to EN 2591-100 *(7 of 9)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></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 overtightening torque indicated in the table to the coupling screw.
<table>
<tr><th rowspan="2">Housing size</th><th>Coupling torque
N.m</th><th colspan="2">Uncoupling torque
N.m</th><th>Overtightening torque
N.m</th></tr>
<tr><th>± 0,1</th><th>min.</th><th>max.</th><th>± 0,1</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.
Coupling force shall be measured without pushing on latching mechanism.
The coupling sequence shall not exceed 6 s.
The uncoupling sequence shall not exceed 6 s.
Mating 100 N max. for electrical modules
Unmating force: 60 N max.
NOTE For optical modules see adequate EN standard.</td></tr>
<tr><td>409</td><td>Contact retention in insert</td><td>Preload: 1 daN
<table>
<tr><th>Contact size</th><th>Axial load
N</th><th>Number of tested contact</th></tr>
<tr><td>22</td><td>44</td><td>50 %</td></tr>
<tr><td>20</td><td>67</td><td>50 %</td></tr>
<tr><td>16</td><td>110</td><td>50 %</td></tr>
<tr><td>12</td><td>110</td><td>100 %</td></tr>
<tr><td>8</td><td>110</td><td>100 %</td></tr>
</table>
Displacement < 0,3 mm during and after application of the load.</td></tr>
<tr><td>410</td><td>Insert retention in housing (axial)</td><td>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 modules, only the female modules shall be tested.
Push-pull latching mechanism: displacement < 0,25 mm during and after application of the load.</td></tr>
</table>

Table 39 — Tests according to EN 2591-100 *(8 of 9)*

<table>
<tr><th>EN 2591-</th><th>Designation of the test</th><th>Details</th></tr>
<tr><td>411</td><td>Insert retention in housing (torsional)</td><td>Not applicable</td></tr>
<tr><td>412</td><td>Contact insertion and extraction forces</td><td>
<table>
<tr><th rowspan="2">Contact size</th><th colspan="2">Maximum force
N</th><th rowspan="2">Number of tested contacts</th></tr>
<tr><th>Insertion</th><th>Extraction</th></tr>
<tr><td>22</td><td>30</td><td>30</td><td>50 %</td></tr>
<tr><td>20</td><td>67</td><td>67</td><td>50 %</td></tr>
<tr><td>16</td><td>67</td><td>67</td><td>50 %</td></tr>
<tr><td>12</td><td>100</td><td>100</td><td>100 %</td></tr>
<tr><td>8</td><td>25</td><td>25</td><td>100 %</td></tr>
</table>
</td></tr>
<tr><td>413</td><td>Holding force of grounding spring system</td><td>Sizing and measurement gauges: See Figures 43 and 44 and Tables 41 and 42.
Gauge retention force:
<table>
<tr><th rowspan="3">Housing size</th><th colspan="4">Axial Force
N</th></tr>
<tr><th colspan="2">Models W and F</th><th colspan="2">Models J and M</th></tr>
<tr><th>min.</th><th>max.</th><th>min.</th><th>max.</th></tr>
<tr><td>2 modules</td><td>5</td><td>10</td><td>10</td><td>20</td></tr>
<tr><td>4 modules</td><td>10</td><td>20</td><td>20</td><td>40</td></tr>
</table>
Not applicable on accessories and on push-pull latching mechanism.</td></tr>
<tr><td>414</td><td>Unmating of lanyard release connectors</td><td>Not applicable</td></tr>
<tr><td>415</td><td>Test probe damage (female contacts)</td><td>Not applicable</td></tr>
<tr><td>416</td><td>Contact bending strength</td><td>Not applicable</td></tr>
<tr><td>417</td><td>Tensile strength (crimped connection)</td><td>Not applicable</td></tr>
<tr><td>418</td><td>Gauge insertion/extraction forces (female contacts)</td><td>Not applicable</td></tr>
<tr><td>419</td><td>Stability of male contacts in insert</td><td>Gauges for test: see Figure 45 and Table 43.
<table>
<tr><th>Contact size</th><th>Permitted deflection
max.
mm</th><th>Force

daN</th></tr>
<tr><td>22</td><td>0,76</td><td>1,2</td></tr>
<tr><td>20</td><td>1,37</td><td>2,4</td></tr>
<tr><td>16</td><td>1,91</td><td>4,9</td></tr>
<tr><td>12</td><td>1,91</td><td>4,9</td></tr>
<tr><td>8</td><td>2,54</td><td>9,7</td></tr>
</table>
</td></tr>
<tr><td>420</td><td>Mechanical strength of rear accessories</td><td>Applicable. Phase A: See EN 2591-404 – Without EN 2591-204 for class C only.
Phase B, for all classes: 100 N
Phases C and D, for all classes: not applicable.</td></tr>
</table>

Table 39 — Tests according to EN 2591-100 *(9 of 9)*

EN 2591-	Designation of the test	Details
421	Free fall	Not applicable
422	Locking wire hole strength	Not applicable
424	Stripping force, solderless wrapped connections	Not applicable
425	Unwrapping capability, solderless wrapped connections	Not applicable
426	Contact retention system effectiveness (removable contact walkout)	Not applicable
427	Robustness of protective cover attachment	Force to be applied: 10 N
501	Soft solderability	Not applicable
502	Restricted entry	Not applicable
503	Contact deformation after crimping	Not applicable
505	Contact protection effectiveness (scoop-proof)	Applicable only on the series 3, Method B
506	Use of tools	Force to be applied on tool: 13 N
507	Plating porosity	Not applicable
508	Measurement of thickness of coating on contacts	Not applicable
509	Adhesion of coating on contacts	Not applicable
513	Magnetic permeability	< 2
515	Hydrolytic stability	Applicable on housing only, Class J, M before. Surface treatment, and C method B Percentage of water absorbed: 0,75 % maximum

Table 40 — Resistance to fluids

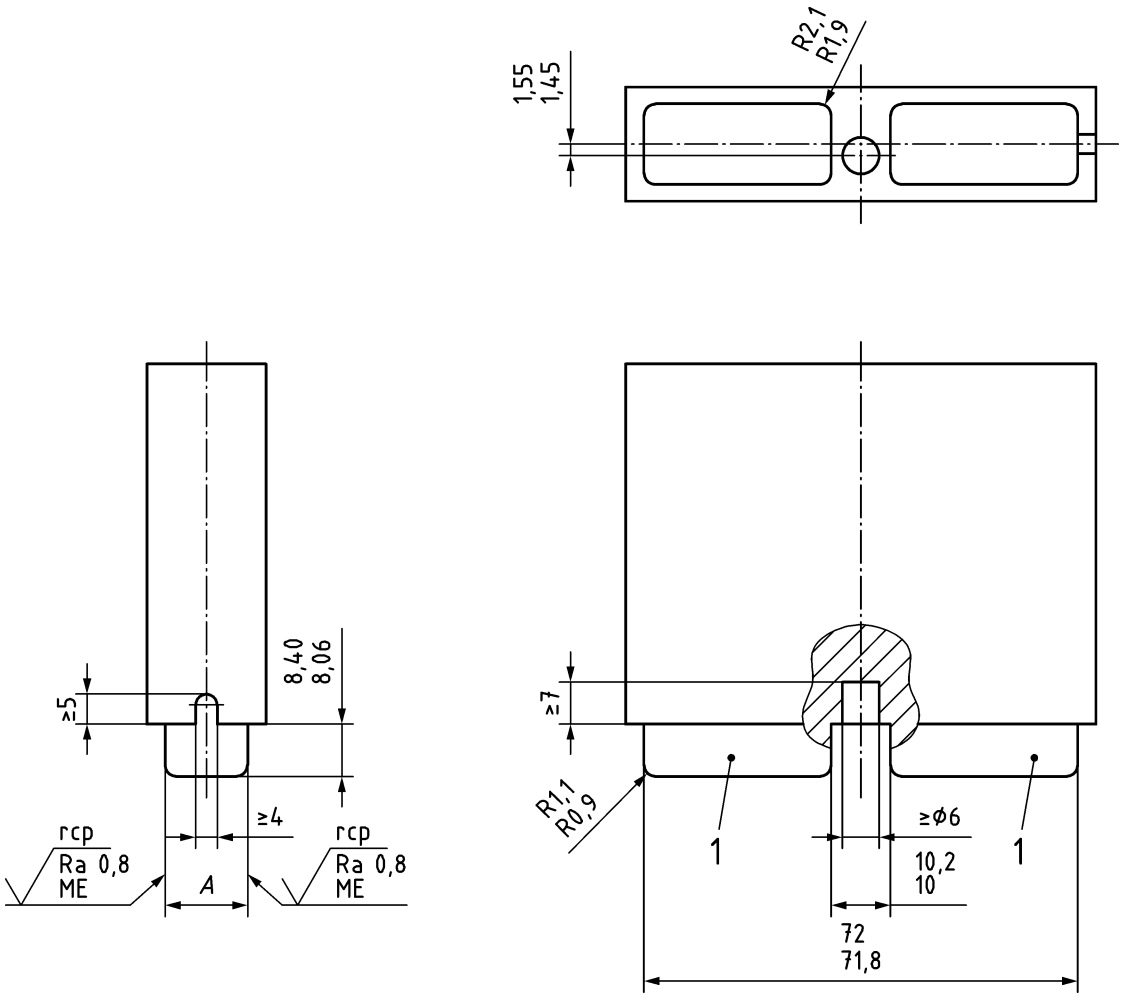
Fluid		Immersion		Storage	Number of cycles
Category	Test fluid number see EN 3909	Duration min	Temp. °C	Temp. °C	
Fuel for type 1 and 2 modules	2	5^{+2}_{0}	25	85	7
Fuel for type 3 and 4 modules	2	$3\,600^{+10}_{0}$	25	85	1
Mineral hydraulic fluid	5	15^{+5}_{0}	85	100	5
Synthetic hydraulic fluid	3	15^{+5}_{0}	85	100	5
Mineral lubricant	7	15^{+5}_{0}	120	125	5
Synthetic lubricant	9	15^{+5}_{0}	150	125	5
Cleaning products	11	15^{+5}_{0}	25	25	5
	12				5
	13	5^{+2}_{0}			2
De-icing fluid	15	15^{+5}_{0}	50	100	5
Extinguishing fluid	17	15^{+5}_{0}	15	25	5
Cooling fluid	19	15^{+5}_{0}	50	25	5

10 Tooling testing

10.1 Gauges to test the holding force of the grounding spring system of the housing

10.1.1 Gauges for 4 cavities housing series 2 and 3

Dimensions are in millimetres, see Figure 43 and Table 41.



Key

1 HB hardness: 229

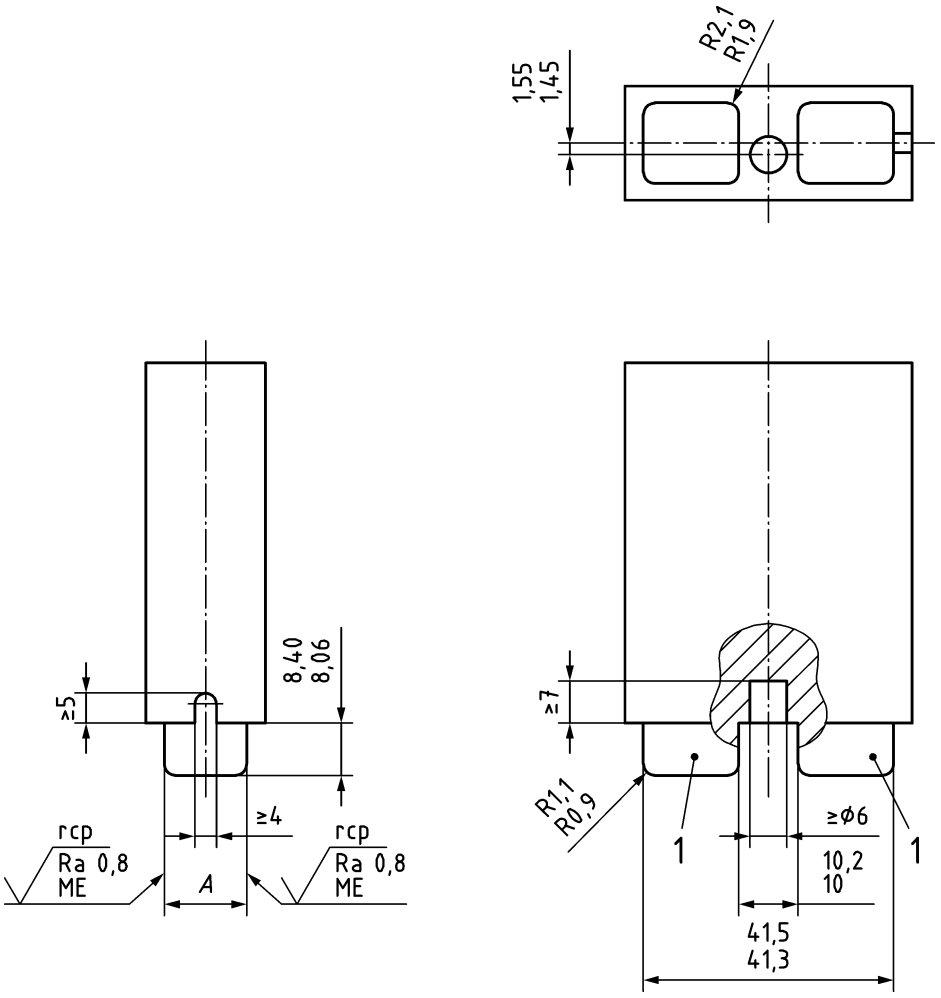
Figure 43 — Gauges dimensions for 4 cavities housing series 2 and 3

Table 41 — Gauges dimensions for 4 cavities housing series 2 and 3

	A
Sizing gauge	13,50 13,49
Measuring gauge	13,41 13,40

10.1.2 Gauges for 2 cavities housing series 2 and 3

Dimensions are in millimetres, see Figure 44 and Table 42.



Key

1 HB hardness: 229

Figure 44 — Gauges dimensions for 2 cavities housing series 2 and 3

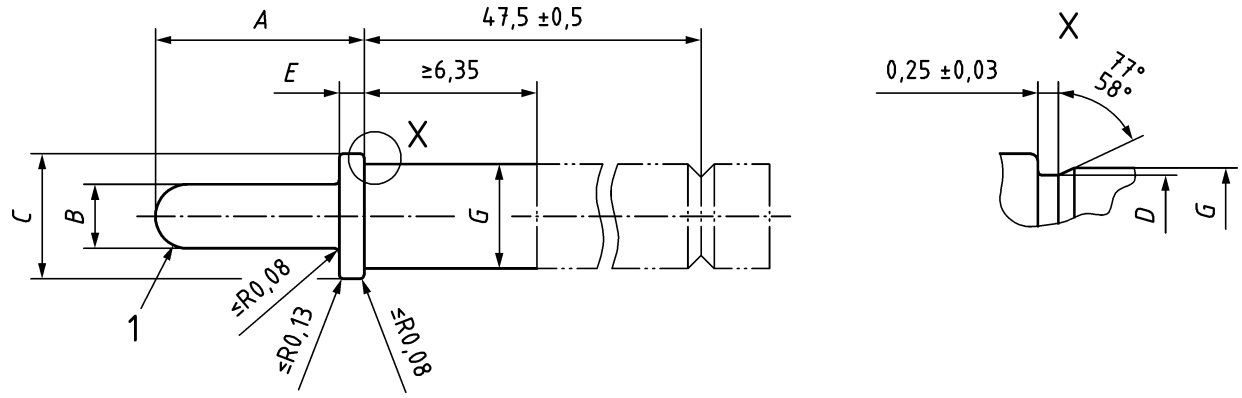
Table 42 — Gauges dimensions for 2 cavities housing series 2 and 3

	A
Sizing gauge	13,50 13,49
Measuring gauge	13,41 13,40

10.2 Gauges to test the stability of male contacts in module

See Figure 45 and Table 43.

Dimensions and tolerances are in millimetres.



Key

1 Blend radius

X For size 22 only

Figure 45 — Gauges dimensions to test the stability of male contacts in module

Table 43 — Gauges dimensions to test the stability of male contacts in module

Contact size	*A* $^{+0,013}_{0}$	*B* $^{+0,005}_{0}$	*C* $^{+0,005}_{0}$	*D* $^{0}_{-0,005}$	*E* $^{0}_{-0,005}$	*G* $^{0}_{-0,005}$
22	7,493	0,749	1,524	1,041	0,838	1,219
20		0,991	2,311	–		1,778
16		1,562	3,226			2,616
12		2,362	4,547			3,835
8		5,512	7,900			7,010

11 Quality assurance

See EN 9133.

12 Qualification

Qualification of a model (see EN 4165-002) is obtained when the specimens of this model as defined in Tables 44 to Tables 47 have satisfied the applicable tests in Groups 0 to Groups 6 (see Table 48).

12.1 Sampling and definition of specimens

12.1.1 Sampling for qualification of metallic housings and modules

Number of specimen is defined for one type of class.

All models of modules submitted to qualification shall be tested. The housings under test shall be fully equipped of modules, all cavities are equipped with wired contacts. See Table 44.

Table 44 — Sampling for qualification of metallic housings and modules

Housing description	Class	Group No.												
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Standard receptacle 2 and 4 modules	W and F	**8**	2[a]	2[a]	0	1	0	0	N/A	1	1	1	0	0
Flanged receptacle 2 and 4 modules		**6**	0	0	1	0	2[a]	1		0	0	0	0	2
Shielded rear accessory for receptacle 2 and 4 modules		**1**	0	0	0	0	1	0		0	0	0	0	0
Standard plug, 2 and 4 modules		**10**	1	1	1	1	1	1		1	1	1	1	0
Rack plug 2 and 4 modules		**3**	1	1	0	0	1	0		0	0	0	0	0
Shielded rear accessory for plug 2 and 4 modules		**3**	0	1	0	0	1	1		0	0	0	0	0
Protective covers		**2**	0	0	0	0	0	0		0	0	0	0	2

a If the standard plug and the rack plug qualified in the same time.

12.1.2 Sampling for qualification of composite housings and modules

Number of specimen is defined for one type of class.

All models of modules submitted to qualification shall be tested. The housings under test shall be fully equipped of modules, all cavities are equipped with wired contacts. See Table 45.

Table 45 — Sampling for qualification of composite housings and modules

Housing description	Class	Group No.												
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Standard receptacle 2 and 4 modules	W, J, M and C	**7**	1	1	0	1	0	0	1	1	1	1	0	0
Flanged receptacle 2 and 4 modules		**5**	0	0	1	0	1	1	0	0	0	0	0	2
Shielded rear accessory for receptacle 2 and 4 modules		**1**	0	0	0	0	1	0	0	0	0	0	0	0
Standard plug, 2 and 4 modules		**11**	1	1	1	1	1	1	1	1	1	1	1	0
Shielded rear accessory for plug 2 and 4 modules		**3**	0	1	0	0	1	1	0	0	0	0	0	0
Protective covers		**2**	0	0	0	0	0	0	0	0	0	0	0	2

12.1.3 Sampling for qualification of push-pull latching mechanism housing and modules

Number of specimen is defined for one type of class.

All models of modules submitted to qualification shall be tested. The housings under test shall be fully equipped of modules, all cavities are equipped with wired contacts. See Table 46.

Table 46 — Sampling for qualification of push-pull latching mechanism housing and modules

Housing description	Class	Group No.												
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Short receptacle	M	**9**	1	1	0	1	0	1	1	1	1	1	0	1
Extender receptacle		**3**	0	0	1	0	1	0	0	0	0	0	0	1
Shielded rear accessory		**4**	0	1	0	0	2	1	0	0	0	0	0	0
Plug		**11**	1	1	1	1	1	1	1	1	1	1	1	0
Protective covers		**2**	0	0	0	0	0	0	0	0	0	0	0	2

12.1.4 Sampling for qualification of a module new arrangement

Number of specimen is defined for one type of class.

All models of modules submitted to qualification shall be tested. The housings under test shall be fully equipped of modules, all cavities are equipped with wired contacts. See Table 47.

Table 47 — Sampling for qualification of a module new arrangement

Module description	Type	Group No.												
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Male module	1 and 3	**14**	2	1	1	2	0	2	N/A	2	2	2	0	0
Female module		**14**	2	1	1	2	0	2		2	2	2	0	0
Male module	2 and 4	**6**	0	1	1	0	2	0		0	0	0	2	0
Female module		**4**	0	1	1	0	2	0		0	0	0	0	0

12.2 Preparation of specimens

Five spares of each test sample (from the same manufacturing batch) shall be kept during the qualification for archiving purpose.

The connectors shall be wired with round cables free from any roughness likely to contribute to the penetration of humidity or liquid to the inside of the connector. Their length shall be adapted to the test.

Half of the specimens shall be provided with cable whose external diameter is closest to the maximum permissible diameter (see EN 4165-002); the other half shall be provided with cable whose external diameter is closest to the minimum permissible diameter.

12.3 Programme of qualification tests

The qualification tests are defined in Table 48 and shall be carried out in the sequence indicated.

Test EN 2591-306 is to be performed on materials and is not included in the groups below. If the materials used comply with group 1 of MIL-HDBK-454A, Requirement 4, test EN 2591-306 is not performed.

Table 48 — Qualification tests *(1 of 5)*

Designation of the test	EN 2591-	Remarks
Group 0		
Visual examination	**101**	
Examination of dimensions and mass	**102**	
Magnetic permeability	**513**	
Mating and unmating forces	**408**	
Module retention in housing (axial)	**410**	Female modules Sizes 22, 20, 16, 12 and 08 for 4 and 2 module connectors
	312	*Air leakage (only for modules with peripheral seals)*
Measurement of insulation resistance	**206**	
Voltage proof test	**207**	Normal air pressure
Visual examination	**101**	
Group 1		
Contact insertion and extraction forces	**412**	
	101	*Visual examination*
Mechanical endurance	**406**	Normal air pressure
	101	*Visual examination*
	202	*Contact resistance at rated current*
	205	*Housing (shell) electrical continuity not applicable for class C*
	206	*Measurement of insulation resistance*
	207	*Voltage proof test (normal air pressure)*
	408	*Mating and unmating forces*
Durability of contact retention system and seals	**407**	
	409	*Contact retention in module*
	412	*Contact insertion and extraction forces*
	101	*Visual examination*
Rapid change of temperature	**305**	
	207	*Voltage proof test (normal air pressure)*
	206	*Measurement of insulation resistance*
	101	*Visual examination*
	408	*Mating and unmating forces*
Immersion at low air pressure	**314**	
	206	*Measurement of insulation resistance*
	207	*Voltage proof test (normal air pressure)*
Visual examination	**101**	

Table 48 — Qualification tests *(2 of 5)*

Designation of the test	EN 2591-	Remarks
Group 2		
Housing (shell) electrical continuity	**205**	Not applicable for class C
Contact insertion and extraction forces	**412**	
Contact resistance at rated current	**202**	
	101	*Visual examination*
Cold low pressure and damp heat	**303**	
	206	*Measurement of insulation resistance*
Rapid change of temperature	**305**	
	207	*Voltage proof test (normal air pressure)*
	206	*Measurement of insulation resistance*
	101	*Visual examination*
	408	*Mating and unmating forces*
Durability of contact retention system and seals	**407**	
	409	*Contact retention in module*
	412	*Contact insertion and extraction forces*
	101	*Visual examination*
Mechanical endurance	**406**	
	101	*Visual examination*
	202	*Contact resistance at rated current*
	205	*Housing (shell) electrical continuity not applicable for class C*
	206	*Measurement of insulation resistance*
	207	*Voltage proof test (normal air pressure)*
	408	*Mating and unmating forces*
Shock	**402**	
	204	*Discontinuity of the contact in the microsecond range (during shock)*
	101	*Visual examination*
Sinusoidal and random vibrations	**403**	Ambient temperature
	204	*Discontinuity of the contact in the microsecond range (during shock)*
	101	*Visual examination*
	408	*Mating and unmating forces*
	202	*Contact resistance at rated current*
Temperature rise due to rated current	**208**	
	101	*Visual examination*
Salt mist	**307**	
	101	*Visual examination*
	205	*Housing (shell) electrical continuity not applicable for class C*
	408	*Mating and unmating forces*
Visual examination	**101**	

Table 48 — Qualification tests *(3 of 5)*

Designation of the test	EN 2591-	Remarks
Group 3		
Fluid resistance	**315**	
	101	*Visual examination*
	206	*Measurement of insulation resistance (except for conductive fluids)*
	408	*Mating and unmating forces*
	409	*Contact retention in module*
Housing (shell) electrical continuity		
	205	Not applicable for class C
Visual examination	**101**	
Group 4		
Contact resistance at rated current	**202**	
Electrical overload	**210**	
	202	*Contact resistance at rated current*
	206	*Measurement of insulation resistance*
	207	*Voltage proof test (normal air pressure)*
	408	*Mating and unmating forces*
	101	*Visual examination*
Endurance at temperature	**301**	
	201	*Contact resistance at low level*
	202	*Contact resistance at rated current*
	205	*Housing (shell) electrical continuity not applicable for class C*
	206	*Measurement of insulation resistance*
	409	*Contact retention in module*
Visual examination	**101**	
Group 5		
Contact insertion and extraction forces	**412**	
Contact resistance at rated current	**202**	
Engagement of contacts	**216**	
Use of tools	**506**	
	101	*Visual examination*
	409	*Contact retention in module*
Module retention in housing (axial)	**410**	Female modules, all variants for 4 and 2 module connectors
	312	*Air leakage*

Table 48 — Qualification tests *(4 of 5)*

Designation of the test	EN 2591-	Remarks
Group 5 *(concluded)*		
Climatic sequence	**302**	
	206	*Measurement of insulation resistance*
	207	*Voltage proof test (normal air pressure)*
	202	*Contact resistance at rated current*
	408	*Mating and unmating forces*
	101	*Visual examination*
Interfacial sealing	**324**	
	206	*Measurement of insulation resistance*
	207	*Voltage proof test (normal air pressure)*
Mechanical strength of rear accessories	**420**	Phase A + B (only for classes W, J, F, M and A)
	101	*Visual examination*
Axial load	**405**	Only for class C (as for other classes this test is included in EN 2591-420)
	408	*Mating and unmating forces*
Transverse load	**404**	Only for class C (as for other classes this test is included in EN 2591-420)
	408	*Mating and unmating forces*
Visual examination	**101**	
Group 6		Not applicable for class C
Contact protection effectiveness (scoop-proof)	**505**	For series 3 only
	207	*Voltage proof test during contact protection effectiveness*
Holding force of grounding spring system	**413**	For connectors and accessories
Mechanical endurance	**406**	
	101	*Visual examination*
	205	*Housing (shell) electrical continuity not applicable for class C*
	206	*Insulation resistance*
	207	*Voltage proof test (normal air pressure)*
	408	*Mating and unmating forces*
Shielding effectiveness	**213**	From 100 MHz to 1 GHz
Surface transfer impedance	**212**	From 1 KHz to 100 MHz
Lighting strike, current and voltage pulse	**214**	
	101	*Visual examination*
	205	*Housing (shell) electrical continuity not applicable for class C*
	408	*Mating and unmating forces*

Table 48 — Qualification tests *(5 of 5)*

Designation of the test	EN 2591-	Remarks
Group 7		
Hydrolytic stability	**515**	Classes J, M and C only
	101	*Visual examination*
Mating and unmating forces	**408**	
Visual examination	**101**	
Group 8		
Sand and dust	**308**	
	408	*Mating and unmating forces*
Visual examination	**101**	
Group 9		
Flammability	**317**	
	207	*Voltage proof test (normal air pressure)*
	101	*Visual examination*
	409	*Contact retention in module*
Group 10		
Mould growth	**306**	
Group 11		
Stability of male contact in module	**419**	
Group 12		Protective covers only
Rapid change of temperature	**305**	$T_A = (125\ ^{+5}_{0})$ °C and $T_B = (-55\ ^{0}_{-5})$ °C
	207	*Voltage proof test (normal air pressure) not applicable*
	206	*Measurement of insulation resistance not applicable*
	101	*Visual examination*
	408	*Mating and unmating forces not applicable*
Immersion at low air pressure	**314**	
	206	*Measurement of insulation resistance*
	207	*Voltage proof test (normal air pressure)*
Salt mist	**307**	
	101	*Visual examination*
	205	*Housing (shell) electrical continuity not applicable for class C*
	408	*Mating and unmating forces*
Robustness of protective cover attachment	**427**	No break to be observed
Shielding effectiveness	**213**	From 100 MHz to 1 GHz
Visual examination	**101**	

13 Maintenance of qualification

13.1 Tests

The tests shall be carried out every 36 months after qualification on specimens taken at random.

The manufacturer shall submit, to the mandated body, the results of tests which shall be carried out in accordance with Table 49.

13.2 Sampling distribution

All housing (shell) sizes and models taken shall be divided into the two groups of Table 49.

Check:

— The position of contact cavities, (module removed);

— The position of cavities of receptacle/plug;

— The polarization receptacle/plug.

Table 49 — Sampling distribution *(1 of 2)*

Designation of the test	EN 2591-	Remarks
Group 1		
Visual examination	**101**	
Examination of dimensions and mass	**102**	
Voltage proof test	**207**	Normal air pressure
Contact resistance at rated current	**202**	
Housing (shell) electrical continuity	**205**	Not applicable for class C
Cold low pressure and damp heat	**303**	
	206	*Measurement of insulation resistance*
Housing (shell) electrical continuity	**205**	Not applicable for class C
Measurement of insulation resistance	**206**	
Mating and unmating forces	**408**	
Mechanical endurance	**406**	
	101	*Visual examination*
	205	*Housing (shell) electrical continuity not applicable for class C*
	206	*Insulation resistance*
	207	*Voltage proof test (normal air pressure)*
	408	*Mating and unmating forces*
Salt mist	**307**	
	101	*Visual examination*
	205	*Housing (shell) electrical continuity not applicable for class C*
	408	*Mating and unmating forces*
Measurement of insulation resistance	**206**	Measurement of insulation resistance

Table 49 — Sampling distribution *(2 of 2)*

Designation of the test	EN 2591-	Remarks
Group 2		
Visual examination	**101**	
Examination of dimensions and mass	**102**	
Contact resistance at rated current	**202**	
Endurance at temperature	**301**	
	201	*Contact resistance at low level*
	202	*Contact resistance at rated current*
	205	*Housing (shell) electrical continuity not applicable for class C*
	206	*Measurement of insulation resistance*
	409	*Contact retention in module*
Mating and unmating forces	**408**	Mating and unmating forces

13.3 Acceptance

Unless otherwise specified by the user, the batch and production inspections are left to the manufacturer's option.

For acceptance, the test EN 2591-101 shall be carried out by the manufacturer, to 100 %, prior to delivery.

14 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 kept available by the manufacturer for a period of five years and submitted to the national official services on request.

15 Designation and marking

See product standard.

15.1 Modules

See product standard.

15.2 Marking

Marking shall be applied to the product.

This marking shall include:

— The identity block as defined in suitable product standard;

— The date of manufacture (year–week);

— The manufacturer's name or trade mark.

16 Delivery conditions

Housings may be delivered with or without coding component.

Housings delivered always without modules

Modules are delivered with or without contact.

17 Packaging

The housings with, if applicable their coding socket or pin shall be packed in transparent, inert plastic bags.

If applicable, the modules with or without their contacts and filler plugs shall be packed in transparent inert plastic bags.

The contacts and filler plugs shall be packed in a rigid box to prevent damage.

The designation required by the product standard shall be affixed on the packaging.

18 Storage

Storage shall be in a place free from ultra-violet rays.

Every five years, an inspection shall be made in accordance with EN 2591-101. The connector shall be repacked in accordance with Clause 11 and the date of inspection shall be marked on the packaging.

This page deliberately left blank

This page deliberately left blank

British Standards Institution (BSI)

BSI is the national body responsible for preparing British Standards and other standards-related publications, information and services.

BSI is incorporated by Royal Charter. British Standards and other standardization products are published by BSI Standards Limited.

About us

We bring together business, industry, government, consumers, innovators and others to shape their combined experience and expertise into standards -based solutions.

The knowledge embodied in our standards has been carefully assembled in a dependable format and refined through our open consultation process. Organizations of all sizes and across all sectors choose standards to help them achieve their goals.

Information on standards

We can provide you with the knowledge that your organization needs to succeed. Find out more about British Standards by visiting our website at bsigroup.com/standards or contacting our Customer Services team or Knowledge Centre.

Buying standards

You can buy and download PDF versions of BSI publications, including British and adopted European and international standards, through our website at bsigroup.com/shop, where hard copies can also be purchased.

If you need international and foreign standards from other Standards Development Organizations, hard copies can be ordered from our Customer Services team.

Subscriptions

Our range of subscription services are designed to make using standards easier for you. For further information on our subscription products go to bsigroup.com/subscriptions.

With **British Standards Online (BSOL)** you'll have instant access to over 55,000 British and adopted European and international standards from your desktop. It's available 24/7 and is refreshed daily so you'll always be up to date.

You can keep in touch with standards developments and receive substantial discounts on the purchase price of standards, both in single copy and subscription format, by becoming a **BSI Subscribing Member**.

PLUS is an updating service exclusive to BSI Subscribing Members. You will automatically receive the latest hard copy of your standards when they're revised or replaced.

To find out more about becoming a BSI Subscribing Member and the benefits of membership, please visit bsigroup.com/shop.

With a **Multi-User Network Licence (MUNL)** you are able to host standards publications on your intranet. Licences can cover as few or as many users as you wish. With updates supplied as soon as they're available, you can be sure your documentation is current. For further information, email bsmusales@bsigroup.com.

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Revisions

Our British Standards and other publications are updated by amendment or revision.

We continually improve the quality of our products and services to benefit your business. If you find an inaccuracy or ambiguity within a British Standard or other BSI publication please inform the Knowledge Centre.

Copyright

Useful Contacts:

Customer Services
Tel: +44 845 086 9001
Email (orders): orders@bsigroup.com
Email (enquiries): cservices@bsigroup.com

Subscriptions
Tel: +44 845 086 9001
Email: subscriptions@bsigroup.com

Knowledge Centre
Tel: +44 20 8996 7004
Email: knowledgecentre@bsigroup.com

Copyright & Licensing
Tel: +44 20 8996 7070
Email: copyright@bsigroup.com

bsi.

...making excellence a habit.™