

INTERNATIONAL STANDARD

**Connectors for electrical and electronic equipment – Product requirements –
Part 2-111: Circular connectors – Detail specification for power connectors with
M12 screw-locking**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2017 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

generated by EVS

INTERNATIONAL STANDARD

**Connectors for electrical and electronic equipment – Product requirements –
Part 2-111: Circular connectors – Detail specification for power connectors with
M12 screw-locking**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 31.220.10

ISBN 978-2-8322-5109-6

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	6
1 Scope.....	9
2 Normative references	9
3 Terms and definitions	11
4 Technical information	12
4.1 Systems of levels.....	12
4.1.1 Performance levels	12
4.1.2 Compatibility levels, according to IEC 61076-1	12
4.2 Classification into climatic categories.....	12
4.3 Creepage and clearance distances	12
4.4 Current-carrying capacity	12
4.5 Marking.....	13
4.6 Safety aspects	13
5 Dimensional information	13
5.1 General.....	13
5.2 Survey of styles and variants	14
5.2.1 General	14
5.2.2 Contact terminations.....	14
5.2.3 Number of contacts or contact cavities	14
5.2.4 Fixed connectors	15
5.2.5 Free connectors.....	21
5.3 Interface dimensions.....	28
5.3.1 E-coding	28
5.3.2 F-coding	31
5.3.3 K-coding	35
5.3.4 L-coding	39
5.3.5 M-coding	43
5.3.6 S-coding	47
5.3.7 T-coding	50
5.4 Engagement (mating) information	52
5.5 Gauges – Sizing gauges and retention force gauges.....	54
6 Characteristics	55
6.1 General.....	55
6.2 Contact assignment and other definitions.....	55
6.3 Classification into climatic category	55
6.4 Electrical characteristics	55
6.4.1 Creepage and clearance distances	55
6.4.2 Voltage proof.....	57
6.4.3 Rated voltage – Rated impulse voltage – Pollution degree.....	57
6.4.4 Current-carrying capacity.....	58
6.4.5 Contact resistance.....	58
6.4.6 Insulation resistance.....	59
6.4.7 Impedance.....	59
6.5 Mechanical characteristics	59
6.5.1 Mechanical operation.....	59
6.5.2 Effectiveness of connector coupling devices	59

6.5.3	Insertion and withdrawal forces	59
6.5.4	Contact retention in insert	59
6.5.5	Polarizing method	60
6.6	Other characteristics	60
6.6.1	Vibration (sinusoidal)	60
6.6.2	Shock	60
6.6.3	Degree of protection provided by enclosures (IP-code)	60
6.6.4	Screen and shielding properties	60
6.7	Environmental aspects – Marking of insulation material (plastics)	60
7	Test schedule	61
7.1	General	61
7.1.1	Overview	61
7.1.2	Climatic category	61
7.1.3	Creepage and clearance distances	61
7.1.4	Arrangement for contact resistance measurements	61
7.1.5	Arrangement for dynamic stress tests (vibration)	62
7.1.6	Arrangement for testing static load; axial	63
7.1.7	Wiring of specimens	63
7.2	Test schedule	63
7.2.1	Test group P – Preliminary	63
7.2.2	Test group AP – Dynamic/ Climatic	64
7.2.3	Test group BP – Mechanical endurance	67
7.2.4	Test group CP – Electrical load	68
7.2.5	Test group DP – Chemical resistivity	69
7.2.6	Test group EP – Connection method tests	69
Annex A (informative)	Diameter of the female connector body and orientation of coding	70
A.1	Diameter of the female connector body	70
A.2	Orientation of coding	70
Figure 1	Fixed connector, male contacts, mounting with thread M12 x 1, square flange 25 mm, front mounting	15
Figure 2	Fixed connector, male contacts, mounting with thread M12 x 1, square flange 20 mm, front mounting	16
Figure 3	Fixed connector, male contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M16 x 1,5	16
Figure 4	Fixed connector, male contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M20 x 1,5	17
Figure 5	Fixed connector, male contacts, mounting with thread M12 x 1 with wire ends, single hole mounting thread M16 x 1,5, mounting orientation	17
Figure 6	Fixed connector, male contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M20 x 1,5, mounting orientation	18
Figure 7	Fixed connector, female contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M16 x 1,5	18
Figure 8	Fixed connector, female contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M20 x 1,5	19
Figure 9	Fixed connector, female contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M16 x 1,5	19
Figure 10	Fixed connector, female contacts, mounting with thread M12 x 1, with wire ends, single hole mounting thread M20 x 1,5, mounting orientation	20

Figure 11 – Fixed connector, male contacts, mounting with thread M12 × 1, with wire ends, single hole mounting thread M16 × 1,5, mounting orientation	20
Figure 12 – Fixed connector, female contacts, mounting with thread M12 × 1, with wire ends, single hole mounting thread M16 × 1,5, mounting orientation	21
Figure 13 – Rewireable connector, male contacts, straight version, with locking nut	22
Figure 14 – Rewireable connector, male contacts, right angled version, with locking nut.....	23
Figure 15 – Non-rewireable connector, male contacts, straight version, with locking nut	23
Figure 16 – Non-rewireable connector, male contacts, right angled version, with locking nut	24
Figure 17 – Rewireable connector, female contacts, straight version, with locking nut	25
Figure 18 – Rewireable connector, female contacts, right angled version, with locking nut	26
Figure 19 – Non-rewireable connector, female contacts, straight version, with locking nut	27
Figure 20 – Non-rewireable connector, female contacts, right angled version, with locking nut	28
Figure 21 – Male side E-coding.....	29
Figure 22 – Female side E-coding.....	30
Figure 23 – Contact position for E-coding front view	31
Figure 24 – Male side F-coding.....	32
Figure 25 – Female side F-coding.....	33
Figure 26 – Contact position for F-coding front view	34
Figure 27 – K-coding male side.....	35
Figure 28 – K-coding female side.....	37
Figure 29 – Contact position K-coding front view	38
Figure 30 – L-coding male side with one female contact	39
Figure 31 – L-coding female side with one male contact	41
Figure 32 – Contact position L-coding front view	42
Figure 33 – M-coding male site	43
Figure 34 – M-coding female side	45
Figure 35 – Contact position M-coding front view	46
Figure 36 – S-coding male side.....	47
Figure 37 – S-coding female side.....	49
Figure 38 – Contact position S-coding front view	49
Figure 39 – T-coding male side.....	50
Figure 40 – Contact position T-coding front view.....	52
Figure 41 – Engagement (mating) information.....	52
Figure 42 – Gauge dimensions	54
Figure 43 – Contact resistance arrangement.....	62
Figure 44 – Dynamic stress test arrangement	63
Figure A.1 – Diameter of the female connector body	70
Figure A.2 – Orientation of cable outlet in relation to the coding – Free male connectors according to Table 4	71
Table 1 – Ratings of connectors.....	13

Table 2 – Connector coding and number of contacts	14
Table 3 – Styles of fixed connectors	15
Table 4 – Styles of free connectors	21
Table 5 – Dimensions of style JM, figure 13	22
Table 6 – Dimensions of style KM, figure 14	23
Table 7 – Dimensions of style LM, figure 15	24
Table 8 – Dimensions of style MM, figure 16	24
Table 9 – Dimensions of style JF, figure 17	25
Table 10 – Dimensions of style KF, figure 18	26
Table 11 – Dimensions of style LF, figure 19	27
Table 12 – Dimensions of style MF, figure 20	28
Table 13 – Dimensions for figure 21	29
Table 14 – Dimensions for Figure 22	30
Table 15 – Dimensions for Figure 24	32
Table 16 – Dimensions for Figure 25	33
Table 17 – Dimensions for Figure 27	36
Table 18 – Dimensions for Figure 28	37
Table 19 – Dimensions for Figure 30	40
Table 20 – Dimensions for Figure 31	41
Table 21 – Dimensions for Figure 33	44
Table 22 – Dimensions for Figure 34	45
Table 23 – Dimensions for Figure 36	48
Table 24 – Dimensions for Figure 37	49
Table 25 – Dimensions for Figure 39	51
Table 26 – Connectors dimensions in mated and locked position	53
Table 27 – Gauges	55
Table 28 – Climatic category	55
Table 29 – Creepage distances	56
Table 30 – Clearance distances	56
Table 31 – Voltage proof	57
Table 32 – Rated voltage – Rated impulse voltage – Pollution degree	58
Table 33 – Performance level and number of mechanical operations	59
Table 34 – Insertion and withdrawal forces	59
Table 35 – Polarizing insertion forces	60
Table 36 – Number of test specimens	61
Table 37 – Test group P	64
Table 38 – Test group AP	65
Table 39 – Test group BP	67
Table 40 – Test group CP	68
Table 41 – Test group DP	69
Table 42 – Test group EP	69
Table A.1 – Diameter of the female connector body, dimension x, coding E, F, K, L, M, S, and T	70

INTERNATIONAL ELECTROTECHNICAL COMMISSION

—————

**CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT –
PRODUCT REQUIREMENTS –**

**Part 2-111: Circular connectors –
Detail specification for power connectors with M12 screw-locking**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61076-2-111 has been prepared by subcommittee 48B: Electrical connectors, of IEC technical committee 48: Electrical connectors and mechanical structures for electrical and electronic equipment.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
48B/2601/FDIS	48B/2616/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61076 series, published under the general title *Connectors for electrical and electronic equipment – Product requirements*, can be found on the IEC website.

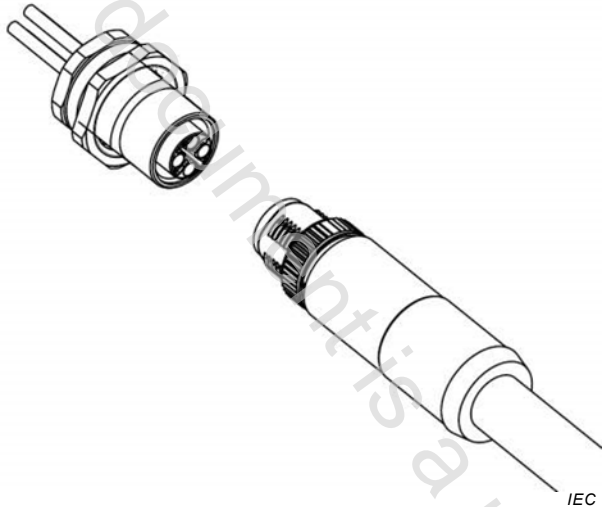
Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

This document is a preview generated by EVS

<p>IEC SC 48B – Electrical connectors Specification available from: IEC General secretariat Or from the addresses shown on the inside cover.</p>	<p>IEC 61076-2-111 Ed. 1</p>
<p>DETAIL SPECIFICATION in accordance with IEC 61076-1</p>	
	<p>Circular connectors</p> <p>Power connectors with M12 screw-locking</p> <p>Male and female connectors</p> <p>Male and female contacts</p> <p>Rewireable – Non-rewireable</p> <hr/> <p>Free cable connectors</p> <p>Straight and right angle connectors</p> <p>Fixed connectors</p> <p>Flange mounting</p> <p>Single hole mounting</p>

This document is a preview generated by EVS

CONNECTORS FOR ELECTRICAL AND ELECTRONIC EQUIPMENT – PRODUCT REQUIREMENTS –

Part 2-111: Circular connectors – Detail specification for power connectors with M12 screw-locking

1 Scope

This part of IEC 61076-2 specifies 4 to 6-way circular connectors with M12 screw-locking with current ratings up to 16 A and voltage ratings of 63 V or 630 V, that are typically used for power supply and power applications in industrial premises. These connectors consist of both fixed and free connectors either rewirable or non-rewirable, with M12 screw-locking. Male connectors have round contacts Ø1,0 mm and Ø1,5 mm.

The different codings provided by this document prevent the mating of accordingly coded male or female connectors to any other similarly sized interfaces, covered by other standards and the cross-mating between the different codings provided by this document.

NOTE M12 is the dimension of the thread of the screw-locking mechanism of these circular connectors.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

IEC 60050-581:2008, *International Electrotechnical Vocabulary – Part 581: Electromechanical components for electronic equipment*

IEC 60068-1, *Environmental testing – Part 1: General and guidance*

IEC 60068-2-60, *Environmental testing – Part 2-60: Tests – Test Ke: Flowing mixed gas corrosion test*

IEC 60352-2, *Solderless connections – Part 2: Crimped connections – General requirements, test methods and practical guidance*

IEC 60352-3, *Solderless connections – Part 3: Solderless accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-4, *Solderless connections – Part 4: Solderless non-accessible insulation displacement connections – General requirements, test methods and practical guidance*

IEC 60352-5, *Solderless connections – Part 5: Press-in connections – General requirements, test methods and practical guidance*

IEC 60352-6, *Solderless connections – Part 6: Insulation piercing connections – General requirements, test methods and practical guidance*

IEC 60352-7, *Solderless connections – Part 7: Spring clamp connections – General requirements, test methods and practical guidance*

IEC 60512-1-1, *Connectors for electronic equipment – Tests and measurements – Part 1-1: General examination – Test 1a: Visual examination*

IEC 60512-1-2, *Connectors for electronic equipment – Tests and measurements – Part 1-2: General examination – Test 1b: Examination of dimension and mass*

IEC 60512-2-1, *Connectors for electronic equipment – Tests and measurements – Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance – Millivolt level method*

IEC 60512-3-1, *Connectors for electronic equipment – Tests and measurements – Part 3-1: Insulation tests – Test 3a: Insulation resistance*

IEC 60512-4-1, *Connectors for electronic equipment – Tests and measurements – Part 4-1: Voltage stress tests – Test 4a: Voltage proof*

IEC 60512-5-1, *Connectors for electronic equipment – Tests and measurements – Part 5-1: Current-carrying capacity tests – Test 5a: Temperature rise*

IEC 60512-6-3, *Connectors for electronic equipment – Tests and measurements – Part 6-3: Dynamic stress tests – Test 6c: Shock*

IEC 60512-6-4, *Connectors for electronic equipment – Tests and measurements – Part 6-4: Dynamic stress tests – Test 6d: Vibration (sinusoidal)*

IEC 60512-9-1, *Connectors for electronic equipment – Tests and measurements – Part 9-1: Endurance tests – Test 9a: Mechanical operation*

IEC 60512-9-2, *Connectors for electronic equipment – Tests and measurements – Part 9-2: Endurance tests – Test 9b: Electrical load and temperature*

IEC 60512-11-1, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 11: Climatic tests – Section 1: Test 11a – Climatic sequence*

IEC 60512-11-4, *Connectors for electronic equipment – Tests and measurements – Part 11-4: Climatic tests – Test 11d: Rapid change of temperature*

IEC 60512-11-7, *Connectors for electronic equipment – Tests and measurements – Part 11-7: Climatic tests – Test 11g: Flowing mixed gas corrosion test*

IEC 60512-11-9, *Connectors for electronic equipment – Tests and measurements – Part 11-9: Climatic tests – Test 11i: Dry heat*

IEC 60512-11-10, *Connectors for electronic equipment – Tests and measurements – Part 11-10: Climatic tests – Test 11j: Cold*

IEC 60512-11-12, *Connectors for electronic equipment – Tests and measurements – Part 11-12: Climatic tests – Test 11m: Damp heat, cyclic*

IEC 60512-13-2, *Connectors for electronic equipment – Tests and measurements – Part 13-2: Mechanical operation tests – Test 13b: Insertion and withdrawal forces*

IEC 60512-13-5, *Connectors for electronic equipment – Tests and measurements – Part 13-5: Mechanical operation tests – Test 13e: Polarizing and keying method*

IEC 60512-16-5, *Connectors for electronic equipment – Tests and measurements – Part 16-5: Mechanical tests on contacts and terminations – Test 16e: Gauge retention force (resilient contacts)*

IEC 60512-19-3, *Electromechanical components for electronic equipment – Basic testing procedures and measuring methods – Part 19: Chemical resistance tests – Section 3: Test 19c – Fluid resistance*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC 60664-1, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60999-1, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm² up to 35 mm² (included)*

IEC 61076-1:2006, *Connectors for electronic equipment – Product requirements – Part 1: Generic specification*

IEC 61984, *Connectors – Safety requirements and tests*

IEC 62197-1, *Connectors for electronic equipment – Quality assessment requirements – Part 1: Generic specification*

ISO 1302, *Geometrical Product Specifications (GPS) – Indication of surface texture in technical product documentation*

ISO 11469, *Plastics – Generic identification and marking of plastics products*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61076-1, IEC 60050-581 as well as the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

protective conductor

PE

conductor provided for purposes of safety, for example protection against electric shock

Note 1 to entry: In an electrical installation, the conductor identified PE is normally also considered as protective earthing conductor.

[SOURCE: IEC 60050-581:2008, 581-27-26]