

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes –

Part 1: General requirements

Fiches, socles fixes de prise de courant, prises mobiles et socles de connecteur pour usages industriels –

Partie 1: Exigences générales



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2021 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

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

Tel.: +41 22 919 02 11
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 corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

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 It also gives information on projects, replaced and withdrawn publications.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 once a month by email.

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: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, ...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC online collection - oc.iec.ch

Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes –
Part 1: General requirements**

**Fiches, socles fixes de prise de courant, prises mobiles et socles de connecteur pour usages industriels –
Partie 1: Exigences générales**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.120.30

ISBN 978-2-8322-9841-1

Warning! Make sure that you obtained this publication from an authorized distributor. Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.
--

CONTENTS

FOREWORD	5
1 Scope	7
2 Normative references	7
3 Terms and definitions	9
4 General	16
4.1 General requirements	16
4.2 General notes on tests	16
5 Standard ratings	17
6 Classification of accessories	17
7 Marking	18
8 Dimensions	22
9 Protection against electric shock	23
10 Provision for earthing	27
11 Terminals and terminations	27
11.1 Common requirements for terminals and terminations	27
11.2 Screw type terminals	31
11.3 Screwless type terminals	34
11.4 Insulation piercing terminals (IPT)	38
11.5 Mechanical tests on terminals	39
11.6 Voltage drop test for screwless type terminals and for insulation piercing terminals	42
11.7 Tests for insulation piercing terminals transmitting contact pressure via insulating parts	44
11.7.1 Temperature-cycling test	44
11.7.2 Short-time withstand current test	44
12 Interlocks	44
13 Resistance to ageing of rubber and thermoplastic material	45
14 Construction	45
14.1 General construction	45
14.2 Construction of contacts	46
15 Construction of fixed socket-outlets	46
16 Construction of plugs and portable socket-outlets	48
17 Construction of appliance inlets	49
18 Degrees of protection	49
19 Insulation resistance and dielectric strength	50
20 Breaking capacity	52
21 Normal operation	54
22 Temperature rise	55
23 Flexible cables and their connection	57
23.1 Cable anchorage	57
23.2 Requirements for plugs and portable socket-outlets	57
23.2.1 Non-rewireable plugs and portable socket-outlets	57
23.2.2 Rewireable plugs and portable socket-outlets	59
23.3 Pull test	59

24	Mechanical strength	63
25	Screws, current-carrying parts and connections	69
26	Creepage distances, clearances and distances through sealing compound	72
26.1	General	72
26.2	Sealing compound	75
27	Resistance to heat, to fire and to tracking	75
28	Corrosion and resistance to rusting	76
29	Conditional short-circuit current withstand test	77
29.1	Minimum prospective short-circuit current	77
29.2	Ratings and test conditions	77
29.2.1	General	77
29.2.2	Test-circuit	77
29.2.3	Calibration	78
29.2.4	Test procedure	78
29.2.5	Acceptance conditions	78
30	Electromagnetic compatibility	81
30.1	Immunity	81
30.2	Emission	82
Annex A	(normative) Guidance and description of test apparatus	83
A.1	Pendulum and mount	83
A.2	Impact energy and release angle	83
A.3	Description of test apparatus	84
Bibliography		90
Figure 1	– Diagram showing the use of the accessories	10
Figure 2	– Pillar terminals	11
Figure 3	– Screw terminals	12
Figure 4	– Stud terminals	12
Figure 5	– Saddle terminals	12
Figure 6	– Lug terminals	13
Figure 7	– Mantle terminals	13
Figure 8	– Screwless terminals	13
Figure 9	– Insulation piercing terminals	14
Figure 10	– Test piston	21
Figure 11	– Gauge "A" for checking shutters	25
Figure 12	– Gauge "B" for checking shutters	26
Figure 13	– Gauges for testing insertability of round unprepared conductors having the maximum specified cross-section	33
Figure 14	– Information for the bending test	36
Figure 15	– Test arrangement for terminals	40
Figure 16	– Circuit diagrams for breaking capacity and normal operation tests	53
Figure 17	– Apparatus for testing the cable anchorage	60
Figure 18	– Arrangement for mechanical strength test for plugs and portable socket-outlets	66
Figure 19	– Apparatus for flexing test	67

Figure 20 – Diagram of the test circuit for the verification of short-circuit current withstand of a two-pole accessory on a single-phase AC or DC	79
Figure 21 – Diagram of the test circuit for the verification of short-circuit current withstand of a three-pole accessory	80
Figure 22 – Diagram of the test circuit for the verification of short-circuit current withstand of a four-pole accessory	81
Figure A.1 – Impact test fixture – Pendulum assembly	85
Figure A.2 – Impact test fixture – Pendulum masses – Quantity: 4	86
Figure A.3 – Impact test fixture – Pendulum shaft end	87
Figure A.4 – Impact test fixture – Pendulum anvil	87
Figure A.5 – Impact test fixture – Pendulum shaft	88
Figure A.6 – Impact test fixture – Pendulum pivot	88
Figure A.7 – Impact test apparatus – Back and mounting plates	89
Table 1 – Preferred rated currents	17
Table 2 – Colour coding	22
Table 3 – Size for connectable conductors	30
Table 4 – Deflection test forces	37
Table 5 – Pulling test values on terminals	41
Table 6 – Pulling force	42
Table 7 – Test current	44
Table 8 – Dielectric strength test	51
Table 9 – Breaking capacity	54
Table 10 – Normal operation	55
Table 11 – Temperature rise test	56
Table 12 – Types of cables	58
Table 13 – Dimensions of cables	61
Table 14 – Torque test values	63
Table 15 – Blow test impact energy	65
Table 16 – Flexing test load values	67
Table 17 – Test values for screwed glands	68
Table 18 – Pulling force on insulated end caps	69
Table 19 – Tightening torques	70
Table 20 – Creepage distances, clearances and distances through sealing compound	73
Table A.1 – Impact test release angles	86

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PLUGS, FIXED OR PORTABLE SOCKET-OUTLETS AND
APPLIANCE INLETS FOR INDUSTRIAL PURPOSES –****Part 1: General requirements****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 60309-1 has been prepared by subcommittee SC 23H: Plugs, socket-outlets and couplers for industrial and similar applications, and for electric vehicles, of IEC technical committee 23: Electrical accessories.

This fifth edition cancels and replaces the fourth edition published in 1999, Amendment 1:2005 and Amendment 2:2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of classification, requirements and tests for accessories with shutters;
- b) additional marking to indicate neutral terminal and/or earthing terminal;
- c) replacement of the term "connector" by the term "portable socket-outlet".

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

FDIS	Report on voting
23H/480/FDIS	23H/486/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

In this document, the following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type;*
- notes: in smaller roman type.

Subsequent parts of IEC 60309 deal with the requirements of particular types of accessories. The clauses of these particular requirements supplement or modify the corresponding clauses in this document.

A list of all parts in the IEC 60309 series, published under the general title *Plugs, fixed or portable socket-outlets and appliance inlets for industrial purposes*, 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 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.