

# INTERNATIONAL STANDARD

# IEC 60309-1

**Edition 4.1**  
2005-12

Edition 4:1999 consolidated with amendment 1:2005

---

---

## **Plugs, socket-outlets and couplers for industrial purposes –**

### **Part 1: General requirements**

© IEC 2005 Copyright - all rights reserved

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 the publisher.

International Electrotechnical Commission, 3, rue de Varembe, PO Box 131, CH-1211 Geneva 20, Switzerland  
Telephone: +41 22 919 02 11 Telefax: +41 22 919 03 00 E-mail: [inmail@iec.ch](mailto:inmail@iec.ch) Web: [www.iec.ch](http://www.iec.ch)

---

---



Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

## CONTENTS

FOREWORD .....	7
INTRODUCTION .....	11
1 Scope .....	13
2 Definitions .....	13
3 Normative references .....	21
4 General .....	23
5 Standard ratings .....	25
6 Classification .....	27
7 Marking .....	29
8 Dimensions .....	35
9 Protection against electric shock .....	37
10 Provision for earthing .....	37
11 Terminals and terminations .....	43
12 Interlocks .....	67
13 Resistance to ageing of rubber and thermoplastic material .....	67
14 General construction .....	69
15 Construction of socket-outlets .....	71
16 Construction of plugs and connectors .....	73
17 Construction of appliance inlets .....	77
18 Degrees of protection .....	79
19 Insulation resistance and dielectric strength .....	81
20 Breaking capacity .....	83
21 Normal operation .....	87
22 Temperature rise .....	89
23 Flexible cables and their connection .....	93
24 Mechanical strength .....	103
25 Screws, current-carrying parts and connections .....	109
26 Creepage distances, clearances and distances through sealing compound .....	115
27 Resistance to heat, fire and tracking .....	117
28 Corrosion and resistance to rusting .....	121
29 Conditional short-circuit current withstand test .....	123
30 Electromagnetic compatibility .....	127
Annex A (normative) Guidance and description of test apparatus .....	167
Annex B (informative) List of the clause numbers that require re-testing .....	183

Figure 1 – Diagram showing the use of the accessories .....	129
Figure 2 – Standard test finger.....	131
Figure 3 – Spray apparatus.....	133
Figure 4 – Splash apparatus .....	135
Figure 5 – Circuit diagrams for breaking capacity and normal operation tests .....	137
Figure 6 – Apparatus for testing the cable anchorage .....	139
Figure 7 – Impact-test apparatus .....	141
Figure 8 – Arrangement for mechanical strength test for plugs and connectors .....	141
Figure 9 – Apparatus for flexing test .....	143
Figure 10 – Ball-pressure apparatus .....	143
Figure 11a – Test apparatus (example).....	145
Figure 11b – Glow-wire and position of the thermocouple .....	147
Figure 12 – Arrangement and dimensions of the electrodes for the tracking test .....	149
Figure 13 – Gauges for testing insertability of round unprepared conductors having the maximum specified cross-section.....	151
Figure 14 – Examples of terminals .....	153
Figure 15 – Equipment test arrangement .....	157
Figure 16 – Diagram of the test circuit for the verification of short-circuit current withstand of a two-pole equipment on a single-phase a.c. or d.c. ....	159
Figure 17 – Diagram of the test circuit for the verification of short-circuit current withstand of a three-pole equipment .....	161
Figure 18 – Diagram of the test circuit for the verification of short-circuit current withstand of a four-pole equipment .....	163
Figure 19 – Information for the bending test.....	165
Figure A.1 – Impact test fixture – Pendulum assembly .....	171
Figure A.2 – Impact test fixture – Pendulum masses – Quantity: 4 .....	175
Figure A.3 – Impact test fixture – Pendulum shaft end .....	177
Figure A.4 – Impact test fixture – Pendulum anvil .....	177
Figure A.5 – Impact test fixture – Pendulum shaft .....	179
Figure A.6 – Impact text fixture – Pendulum pivot .....	179
Figure A.7 – Impact test apparatus – Back and mounting plates .....	181

## INTERNATIONAL ELECTROTECHNICAL COMMISSION

### **PLUGS, SOCKET-OUTLETS AND COUPLERS 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 provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.
- 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 23H: Industrial plugs and socket-outlets, of IEC technical committee 23: Electrical accessories.

This consolidated version of IEC 60309-1 consists of the fourth (1999) [documents 23H/88/FDIS and 23H/91/RVD] and its amendment 1 (2005) [documents 23H/174/FDIS and 23H/182/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 4.1.

A vertical line in the margin shows where the base publication has been modified by amendment 1.

Annex A forms an integral part of this standard.

Annex B is for information only.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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

## INTRODUCTION

International Standard IEC 60309 is divided into several parts:

*Part 1: General requirements*, comprising clauses of a general character.

Subsequent parts: Particular requirements dealing with particular types. The clauses of these particular requirements supplement or modify the corresponding clauses in part 1. Where the text of subsequent parts indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of part 1, these changes are made to the relevant text of part 1, which then becomes part of the standard. Where no change is necessary, the words "This clause of part 1 is applicable" are used.

## **PLUGS, SOCKET-OUTLETS AND COUPLERS FOR INDUSTRIAL PURPOSES –**

### **Part 1: General requirements**

#### **1 Scope**

This standard applies to plugs and socket-outlets, cable couplers and appliance couplers, with a rated operating voltage not exceeding 690 V d.c. or a.c. and 500 Hz a.c., and a rated current not exceeding 250 A, primarily intended for industrial use, either indoors or outdoors.

The list of preferred ratings is not intended to exclude other ratings.

This standard applies to plugs and socket-outlets, cable couplers and appliance couplers, hereinafter referred to as accessories, for use when the ambient temperature is normally within the range of  $-25\text{ °C}$  to  $+40\text{ °C}$ . These accessories are intended to be connected to cables of copper or copper alloy only.

This standard applies to accessories with screwless type terminals or insulation piercing terminals, with a rated current up to and including 16 A for Series I and 20 A for Series II.

The use of these accessories on building sites and for agricultural, commercial and domestic applications is not precluded.

Socket-outlets or appliance inlets incorporated in or fixed to electrical equipment are within the scope of this standard. This standard also applies to accessories intended to be used in extra-low voltage installations.

This standard does not apply to accessories primarily intended for domestic and similar general purposes.

In locations where special conditions prevail, for example on board ship or where explosions are liable to occur, additional requirements may be necessary.