

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Plugs, socket-outlets and couplers for industrial purposes –
Part 1: General requirements**

**Prises de courant pour usages industriels –
Partie 1: Règles générales**



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CONTENTS

FOREWORD.....	5
INTRODUCTION.....	7
1 Scope.....	8
2 Definitions.....	8
3 Normative references.....	12
4 General.....	13
5 Standard ratings.....	14
6 Classification.....	14
7 Marking.....	15
8 Dimensions.....	18
9 Protection against electric shock.....	19
10 Provision for earthing.....	19
11 Terminals and terminations.....	22
12 Interlocks.....	34
13 Resistance to ageing of rubber and thermoplastic material.....	34
14 General construction.....	34
15 Construction of socket-outlets.....	35
16 Construction of plugs and connectors.....	36
17 Construction of appliance inlets.....	38
18 Degrees of protection.....	38
19 Insulation resistance and dielectric strength.....	40
20 Breaking capacity.....	41
21 Normal operation.....	42
22 Temperature rise.....	44
23 Flexible cables and their connection.....	46
24 Mechanical strength.....	51
25 Screws, current-carrying parts and connections.....	54
26 Creepage distances, clearances and distances through sealing compound.....	57
27 Resistance to heat, to fire and to tracking.....	58
28 Corrosion and resistance to rusting.....	59
29 Conditional short-circuit current withstand test.....	60
30 Electromagnetic compatibility.....	61
Annex A (normative) Guidance and description of test apparatus.....	76
Annex B (informative) List of the clause numbers that require re-testing.....	84

Figure 1 – Diagram showing the use of the accessories	62
Figure 2 – Standard test finger.....	63
Figure 3 – Void	64
Figure 4 – Void	64
Figure 5 – Circuit diagrams for breaking capacity and normal operation tests	64
Figure 6 – Apparatus for testing the cable anchorage	65
Figure 7 – Impact-test apparatus (see also annex A)	66
Figure 8 – Arrangement for mechanical strength test for plugs and connectors	66
Figure 9 – Apparatus for flexing test	67
Figure 10 – Void	67
Figure 11a – Void	67
Figure 11b – Void	67
Figure 12 – Void	67
Figure 13 – Gauges for testing insertability of round unprepared conductors having the maximum specified cross-section	68
Figure 14 – Examples of terminals	69
Figure 15 – Equipment test arrangement	71
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.	72
Figure 17 – Diagram of the test circuit for the verification of short-circuit current withstand of a three-pole equipment	73
Figure 18 – Diagram of the test circuit for the verification of short-circuit current withstand of a four-pole equipment	74
Figure 19 – Information for the bending test.....	75
Figure A.1 – Impact test fixture – Pendulum assembly.....	78
Figure A.2 – Impact test fixture – Pendulum masses – Quantity: 4	80
Figure A.3 – Impact test fixture – Pendulum shaft end	81
Figure A.4 – Impact test fixture – Pendulum anvil	81
Figure A.5 – Impact test fixture – Pendulum shaft	82
Figure A.6 – Impact text fixture – Pendulum pivot	82
Figure A.7 – Impact test apparatus – Back and mounting plates	83
Table 1	14
Table 2	18
Table 3 – Size for connectable conductors.....	21
Table 4-1 – Deflection test forces	27
Table 4-2	30
Table 4-3	31
Table 4-4	33
Table 5	40
Table 6 – Breaking capacity.....	42
Table 7 – Normal operation.....	44
Table 8	45
Table 9	47
Table 10	49

Table 11	50
Table 12	52
Table 13	53
Table 14	54
Table 15	55
Table 16	57
Table A.1 – Impact test release angles	79

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PLUGS, SOCKET-OUTLETS AND COUPLERS FOR INDUSTRIAL PURPOSES –

Part 1: General requirements

FOREWORD

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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], its amendment 1 (2005) [documents 23H/174/FDIS and 23H/182/RVD] and its amendment 2 (2012) [documents 23H/282/FDIS and 23H/285/RVD].

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

It bears the edition number 4.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

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 stability 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 1 000 V d.c. or a.c. and 500 Hz a.c., and a rated current not exceeding 800 A, primarily intended for industrial use, either indoors or outdoors.

These accessories are intended to be installed by instructed persons (IEC 60050-195:1998, Amendment 1:2001, 195-04-02) or skilled persons (IEC 60050-195:1998, Amendment 1:2001, 195-04-01) only.

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 $-25\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$. 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 32 A for series I and 30 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.

2 Definitions

Where the terms voltage and current are used, they imply the d.c. or the a.c. r.m.s. values.

For the purpose of this part of IEC 60309, the following definitions apply.

The application of accessories is shown in Figure 1.

2.1

plug and socket-outlet

a means enabling the connection at will of a flexible cable to fixed wiring. It consists of two parts:

2.1.1

socket-outlet

the part intended to be installed with the fixed wiring or incorporated in equipment.

A socket-outlet may also be incorporated in the output circuit of an isolating transformer

2.1.2

plug

the part integral with or intended to be attached directly to one flexible cable connected to the equipment or to a connector

2.2

cable coupler

a means enabling the connection at will of two flexible cables. It consists of two parts:

2.2.1

connector

the part integral with or intended to be attached to one flexible cable connected to the supply

NOTE In general, a connector has the same contact arrangement as a socket-outlet.

2.2.2

plug

the part integral with or intended to be attached to one flexible cable connected to the equipment or to a connector

NOTE The plug of a cable coupler is identical to the plug of a "plug and socket-outlet".

2.3

appliance coupler

a means enabling the connection at will of a flexible cable to the equipment. It consists of two parts:

2.3.1

connector

the part integral with, or intended to be attached to, one flexible cable connected to the supply

NOTE In general, the connector of an appliance coupler is identical to the connector of a cable coupler.

2.3.2

appliance inlet

the part incorporated in, or fixed to, the equipment or intended to be fixed to it

NOTE In general, an appliance inlet has the same contact arrangement as a plug.

2.4

rewirable plug or connector

an accessory so constructed that the flexible cable can be replaced

2.5

non-rewirable plug or connector

an accessory so constructed that the flexible cable cannot be separated from the accessory without making it permanently useless

2.6

mechanical switching device

a switching device designed to close and open one or more electric circuits by means of separable contacts

2.7

switched socket-outlet

a socket-outlet with an associated switching device to disconnect the supply from the socket-outlet contacts

2.8

integral switching device

a mechanical switching device constructed as a part of an accessory covered by this standard

2.9

interlock

a device, either electrical or mechanical, which prevents the contacts of a plug from becoming live before it is in proper engagement with a socket-outlet or connector, and which either prevents the plug from being withdrawn while its contacts are live or makes the contacts dead before separation

2.10

retaining device

a mechanical arrangement which holds a plug or connector in position when it is in proper engagement, and prevents its unintentional withdrawal

2.11

rated current

the current assigned to the accessory by the manufacturer

2.12

insulation voltage

the voltage assigned to the accessory by the manufacturer and to which dielectric tests, clearances and creepage distances are referred

2.13

rated operating voltage

the nominal voltage of the supply for which the accessory is intended to be used

2.14

basic insulation

the insulation necessary for the proper functioning of the accessory and for basic protection against electric shock

2.15

supplementary insulation (protective insulation)

an independent insulation provided in addition to the basic insulation, in order to ensure protection against electric shock in the event of a failure of the basic insulation

2.16

double insulation

insulation comprising both basic insulation and supplementary insulation

2.17

reinforced insulation

an improved basic insulation with such mechanical and electrical qualities that it provides the same degree of protection against electric shock as double insulation

2.18

terminal

a conductive part provided for the connection of a conductor to an accessory

2.18.1**pillar terminal**

a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws. The clamping pressure may be applied directly by the shank of the screw or through an intermediate clamping member to which pressure is applied by the shank of the screw (see Figure 14a)

2.18.2**screw terminal**

a terminal in which the conductor is clamped under the head of the screw. The clamping pressure may be applied directly by the head of the screw or through an intermediate part, such as a washer, clamping plate or anti-spread device (see Figures 14b and 14c)

2.18.3**stud terminal**

a terminal in which the conductor is clamped under a nut. The clamping pressure may be applied directly by a suitably shaped nut or through an intermediate part, such as a washer, clamping plate or anti-spread device (see Figure 14d)

2.18.4**saddle terminal**

a terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts (see Figure 14e)

2.18.5**lug terminal**

a screw terminal or a stud terminal, designed for clamping a cable lug or bar by means of a screw or nut (see Figure 14f)

2.18.6**mantle terminal**

a terminal in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut. The conductor is clamped against the base of the slot by a suitably shaped washer under the nut, by a central peg if the nut is a cap nut, or by equally effective means for transmitting the pressure from the nut to the conductor within the slot (see Figure 14g)

2.18.7**screwless type terminal**

a terminal for the connection and subsequent disconnection of one or more conductors, the connection being made, directly or indirectly, by other means than screws

NOTE Examples of screwless type terminals are given in Figure 14h.

2.18.8**insulation piercing terminal****IPT**

a terminal for the connection and subsequent disconnection of one or more conductors, the connection being made by piercing, boring through, cutting through, removing, displacing or making ineffective in some other manner the insulation of the conductor(s) without previous stripping

NOTE 1 The removal of the sheath of the cable, if necessary, is not considered as a previous stripping.

NOTE 2 Examples of IPT are given in Figure 14i.

2.19**clamping unit**

the part of a terminal necessary for the clamping and the electrical connection of the conductor

2.20

conditional short-circuit current

the prospective current that an accessory, protected by a specified short-circuit protective device, can satisfactorily withstand for the total operating time of that device under specified conditions of use and behaviour

NOTE This definition differs from IEC 441-17-20 by broadening the concept of current-limiting device into a short-circuit protective device, the function of which is not only to limit the current.

2.21

cap

a part separated or attached, which may be used to provide the degree of protection of a plug or appliance inlet when it is not engaged with a socket-outlet or connector

2.22

lid

a means to ensure the degree of protection on a socket-outlet or a connector

3 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-441:1984, *International Electrotechnical Vocabulary (IEV) – Chapter 441: Switchgear, controlgear and fuses*

IEC 60083:1997, *Plugs and socket-outlets for domestic and similar general use standardized in member countries of IEC*

IEC 60112:1979, *Method for determining the comparative and the proof tracking indices of solid insulating materials under moist conditions*

IEC 60227, (all parts) *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60228:1978, *Conductors of insulated cables*

IEC 60245-4:1994, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*

IEC 60269-1:1986, *Low-voltage fuses – Part 1: General requirements*

IEC 60269-2:1986, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) – Sections I to III*

IEC 60309-4, *Plugs, socket-outlets and couplers for industrial purposes – Part 4: Switched socket-outlets and connectors with or without interlock*

IEC 60320, (all parts) *Appliance couplers for household and similar general purposes*

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

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

IEC 60695-10-2, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test*

IEC 60947-3:1990, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

ISO 2081, *Metallic coatings – Electroplated coatings of zinc on iron or steel*

ISO 2093, *Electroplated coatings of tin – Specification and test methods*

ISO 1456, *Metallic coatings – Electrodeposited coatings of nickel plus chromium and of copper plus nickel plus chromium*

4 General

4.1 General requirements

Accessories shall be so designed and constructed that in normal use their performance is reliable and without danger to the user or surroundings.

Unless otherwise stated, the normal use environment in which the devices complying with this standard are normally used is pollution degree 3 according to IEC 60664-1.

If other pollution degrees are needed, creepage and clearance distances have to be in accordance with IEC 60664-1. The comparative tracking index (CTI) value shall be evaluated in accordance with IEC 60112.

Accessories shall have a minimum degree of protection IP23 according to IEC 60529.

Combinations of plugs, socket-outlets, appliance inlets and connectors that are intended for use together shall comply with the requirements of this standard and the relevant standard sheet, if any.

In general, compliance is checked by carrying out all the tests specified.

4.2 General notes on tests

4.2.1 Tests according to this standard are type tests. If a part of an accessory has previously passed tests for a given degree of severity, the relevant type tests shall not be repeated if the severity is not greater. When a part or a component is incorporated in a device or accessory according to IEC 60309 standard, and if this part or component meets an appropriate IEC standard, then no further test(s) or requirement(s) shall be required for this part or component, unless it is being used in a way significantly different from the intent of its own standard.

4.2.2 Unless otherwise specified, the samples are tested as delivered and under normal conditions of use, at an ambient temperature of $(20 \pm 5) ^\circ\text{C}$; the tests are made at rated frequency.

4.2.3 Unless otherwise specified, the tests are carried out in the order of the clauses of this standard.

4.2.4 Three samples are subjected to all the tests, except if necessary for the tests of 11.1.4 and Clause 29 where, for each clause, one new set of samples is tested. If, however, the tests of Clauses 20, 21 and 22 have to be made with both d.c. and a.c., the tests with a.c. are made on three additional samples.

4.2.5 Accessories are deemed to comply with this standard if no sample fails in the complete series of appropriate tests. If one sample fails in a test, that test and those preceding which may have influenced the test result are repeated on another set of three samples, all of which shall then pass the repeated tests.