IEC 60309-5

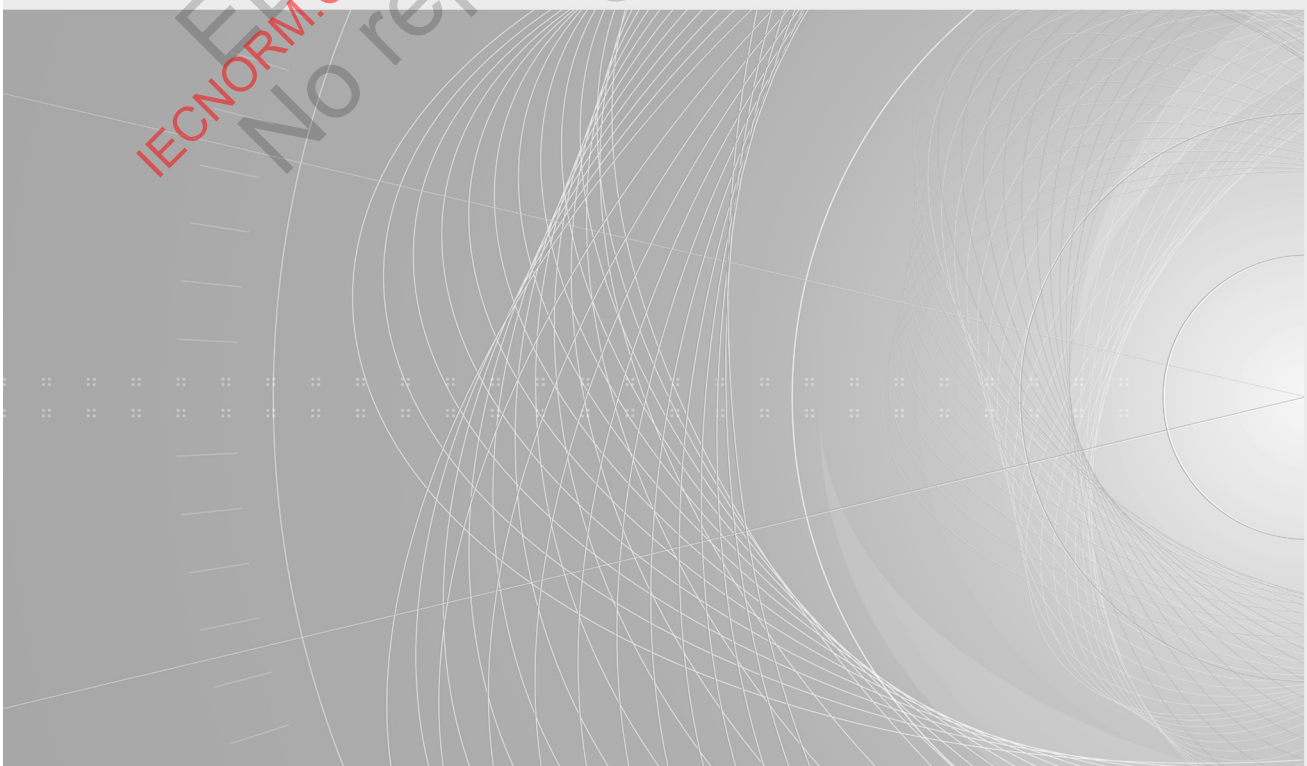
Edition 1.0 2017-01

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Plugs, socket-outlets and couplers for industrial purposes –
Part 5: Dimensional compatibility and interchangeability requirements for plugs, socket-outlets, ship connectors and ship inlets for low-voltage shore connection systems (LVSC)

Prises de courant pour usages industriels –
Partie 5: Exigences dimensionnelles de compatibilité et d'interchangeabilité pour les prises de courant et connecteurs de navire pour les systèmes basse tension de raccordement des navires à quai



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PLUGS, SOCKET-OUTLETS AND COUPLERS FOR INDUSTRIAL PURPOSES –

Part 5: Dimensional compatibility and interchangeability requirements for plugs, socket-outlets, ship connectors and ship inlets for low-voltage shore connection systems (LVSC)

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International Standard IEC 60309-5 has been prepared by subcommittee 23H: Plugs, socket-outlets and couplers for industrial and similar applications, and for electric vehicles, of IEC technical committee 23: Electrical accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
23H/368/FDIS	23H/371/RVD

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

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

A list of all the parts in the IEC 60309 series, under the general title *Plugs, socket-outlets and couplers for industrial purposes* can be found on the IEC website.

This part of IEC 60309 is to be read in conjunction with IEC 60309-1. The clauses of the particular requirements of this document supplement or modify the corresponding clauses of IEC 60309-1. Where the text indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of IEC 60309-1, these changes are made to the relevant text of IEC 60309-1, which then becomes part of the standard. Where no change is necessary, the words "Clause X of IEC 60309-1:1999 + A1:2005 + A2:2012 applies" are used.

Subclauses, figures, tables or notes which are additional to those in IEC 60309-1 are numbered starting from 501.

In this standard, the following print types are used:

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

The committee has decided that the contents of this publication 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 60309-5 has been written to address the needs in terms of plugs, socket-outlets and ship couplers (ship connectors and ship inlets), herein referred to as "accessories", of IEC/IEEE 80005-3[1]. The purpose of IEC/IEEE 80005-3 is to define requirements that allow compliant ships to connect to compliant low-voltage shore power supplies through standardized shore-to-ship connection accessories.

Ships that do not require connecting with standardized low-voltage shore power supplies as above may use accessories that are not covered by the standard sheets of IEC 60309-5 but they may find it impossible to connect to these shore supplies.

Other low-voltage plugs, socket-outlets, ship connectors and ship inlets used for the connection of certain ship types to low-voltage shore power supplies may be found in the IEC 60309 series.

International Standard IEC 60309 is divided into several parts: IEC 60309-1 is entitled *General requirements,* and comprises clauses of a general nature. The subsequent parts address requirements dealing with particular devices.

[1] Under preparation. Stage at the time of publication: IEC/IEEE CDV 80005-3:2016.

PLUGS, SOCKET-OUTLETS AND COUPLERS FOR INDUSTRIAL PURPOSES –

Part 5: Dimensional compatibility and interchangeability requirements for plugs, socket-outlets, ship connectors and ship inlets for low-voltage shore connection systems (LVSC)

1 Scope

This part of 60309 applies to a single type of plug, socket-outlet, ship connector and ship inlet, hereinafter referred to as accessories, intended to connect ships to dedicated shore supply systems described in IEC/IEEE 80005-3.

This part of IEC 60309 applies to three-phase accessories with an earth contact and with four pilot contacts.

NOTE 1 In the following countries the term “ground” is used instead of “earth”: US.

These accessories have a maximum rated current of 350 A and a maximum rated operating voltage not exceeding 690 V 50/60 Hz.

NOTE 2 The various operating currents, voltages and frequencies required for various types of ship are set by the shore supply system described in IEC/IEEE 80005-3.

These accessories are intended to be installed and operated 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.

This standard applies to accessories for primary use outdoors in a seawater environment when the ambient temperature is normally within the range of −25 °C to +40 °C.

NOTE 3 In some countries, other ambient temperatures may prevail and may need to be taken into account.

These accessories are intended to be connected to cables of copper or copper alloy only.

Socket-outlets or ship inlets incorporated in or fixed to electrical equipment which is part of the shore connection system are within the scope of this standard.

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

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.

Clause 2 of IEC/IEEE 80005-3:— and Clause 3 of IEC 60309-1:1999 + A1:2005 + A2:2012 apply with the following additions:

ISO 9227:2012, *Corrosion tests in artificial atmospheres – Salt spray tests*

ISO 15510:2014 *Stainless steels – Chemical composition*

IEC/IEEE 80005-3:—, *Utility connections in port – Part 3: Low Voltage Shore Connections (LVSC) Systems – General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in Clause 2 of IEC 60309-1:1999 + A1:2005 + A2:2012 and 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

3.501
accessory
plug, socket-outlet, ship connector or ship inlet

Note 1 to entry: The application of accessories is shown in Figure 501.

3.502
ship coupler
means enabling the connection at will of a flexible cable to the ship consisting of a ship connector and a ship inlet

[SOURCE: IEC 62613-1:2011, 3.4]

3.502.1
ship connector
part intended to be attached to one flexible cable connected to the supply and to be connected to the ship inlet

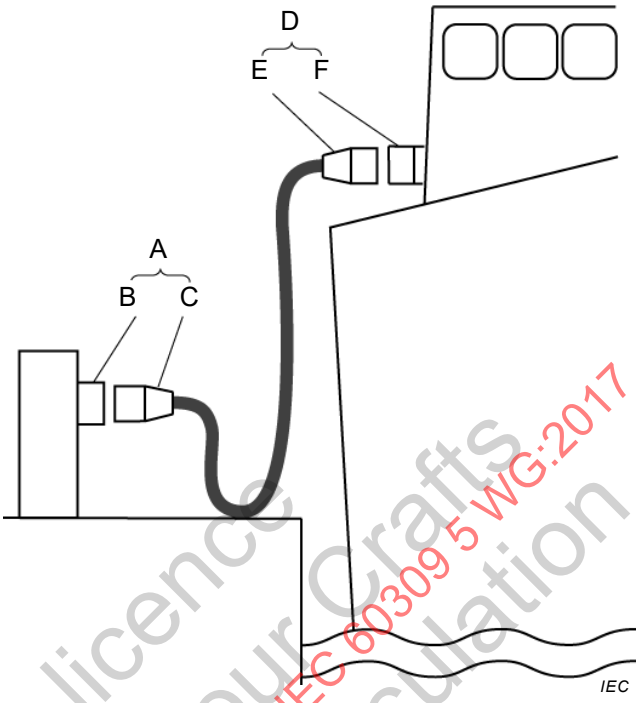
[SOURCE: IEC 62613-1:2011, 3.5 modified – The words “and to be connected to the ship inlet” have been added.]

3.502.2
ship inlet
part incorporated in, or fixed to, the ship

[SOURCE: IEC 62613-1:2011, 3.6]

3.503
shore connection system
system allowing the adequate supply of electricity from shore to ships during stays in port, allowing the shut-down of ship generators

Note 1 to entry: These systems are described in IEC/ISO/IEEE 80005 series: Utility connections in port.



A: (shore) plug and socket-outlet
B: (shore) socket-outlet
C: (shore) plug
D: ship coupler
E: ship connector
F: ship inlet

Figure 501 – Diagram showing the use of accessories

4 General

Clause 4 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies except as follows:

4.1 General requirements

Replacement of the fourth paragraph:

Accessories shall have a degree of protection IP66/IP67 according to IEC 60529.

Replacement of the fifth paragraph:

One type of plug, socket-outlet, ship inlet and ship connector shall be used for all types of ship.

Additional sixth paragraph:

Low-voltage shore connection system (LVSC-system) does not allow in-line connections unless a specific piece of equipment made for that purpose is used. It shall not be possible to connect the plug into the ship connector (see 8.501).

5 Standard ratings

Replacement:

5.1 The maximum AC operating voltage is 690 V 50/60 Hz

5.2 The maximum rated current is 350 A

New subclause:

5.501 The plug, socket-outlet, ship inlet and ship connector shall be rated with a minimum prospective short-circuit current withstand of 16 kA root mean square (RMS) for 1 s, and with a maximum rated peak withstand current of 40 kA (see 29.1).

6 Classification

Replacement:

6.1 Accessories are classified:

6.1.1 according to purpose: plug, socket-outlet, ship connector, ship inlet;

6.1.2 to **6.1.8**: these subclauses of IEC 60309-1:1999 + A1:2005 + A2:2012 do not apply.

7 Marking

Clause 7 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies except as follows:

7.1 *Replacement:*

Accessories shall be marked with:

- rated current in amperes;
- rated operating voltage in volts;
- symbol for nature of supply;
- either the name or trade mark of the manufacturer or of the responsible vendor;
- type reference, which may be a catalogue number;
- degree of protection;

Additionally, the insulation voltage may be marked.

Compliance is checked by inspection.

7.5 *Replacement:*

The contacts shall be indicated by the symbols:

- L1, L2, L3, or 1, 2, 3 for the phases,
- the symbol ⏚ for protective earth IEC 60417-5019 (2006-08),
- P1, P2, P3 and P4 for the pilot contacts.

These symbols shall be placed close to the relevant terminals; they shall not be placed on screws, removable washers or other removable parts.

The figures used with the letters may be written as an index.

Compliance is checked by inspection.

7.8 to **7.10:** these subclauses of IEC 60309-1:1999 + A1:2005 + A2:2012 do not apply.

8 Dimensions

Clause 8 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies except as follows:

8.1 *Replacement:*

Accessories shall comply with the appropriate standard sheet 5-I, 5-II, 5-III or 5-IV at the end of this document.

New subclause:

8.501 It shall not be possible to engage plugs into ship connectors, as in-line cable connections (cable couplers) are not allowed by the application.

Compliance is checked by inspection and test.

9 Protection against electric shock

Clause 9 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

10 Provision for earthing

Clause 10 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

11 Terminals and terminations

Clause 11 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies except as follows:

11.3, **11.4**, **11.6** and **11.7**: these subclauses of IEC 60309-1:1999 + A1:2005 + A2:2012 do not apply.

12 Interlocks

Clause 12 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

13 Resistance to ageing of rubber and thermoplastic material

Clause 13 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

14 General construction

Clause 14 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

15 Construction of socket-outlets

Clause 15 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

16 Construction of plugs and connectors

Clause 16 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

17 Construction of appliance inlets

Clause 17 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

18 Degrees of protection

Clause 18 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

19 Insulation resistance and dielectric strength

Clause 19 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

20 Breaking capacity

Clause 20 of IEC 60309-1:1999 + A1:2005 + A2:2012 does not apply.

21 Normal operation

Clause 21 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

22 Temperature rise

Clause 22 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

23 Flexible cables and their connection

Clause 23 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

24 Mechanical strength

Clause 24 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

25 Screws, current-carrying parts and connections

Clause 25 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

26 Creepage distances, clearances and distances through sealing compound

Clause 26 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

27 Resistance to heat, to fire and to tracking

Clause 27 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

28 Corrosion and resistance to rusting

Replacement:

Accessories and their mounting means shall be constructed to resist the corrosion induced by a seawater environment.

Ferrous parts, including enclosures, shall be adequately protected against rusting.

Compliance is checked with the following test:

Parts to be tested are subjected to a salt spray (fog) using the test method in Salt Spray (Fog) Testing, ISO 9227:2012, and employing a 5 % (by weight) salt solution, for 200 h. At the end of the test, the parts are removed from the chamber, and washed in clean running water not warmer than 38 °C, to remove salt deposits from the surface. Parts are dried immediately. Surface corrosion may be cleaned by light brushing, if required, to observe corrosion of the underlying surface.

Parts are acceptable if, upon completion of the test, they do not show pitting, cracking, or other deterioration more severe than that resulting from a similar test on passivated X5CrNI18-9 (ISO name 4301-304-00-I) stainless steel according to ISO 15510:2014.

Exception: an enclosure constructed of X5CrNI18-9 (ISO name 4301-304-00-I) or X3CrNiMo17-12-3 (ISO name 4436-316-00-I) stainless steel according to ISO 15510:2014 is not required to be subjected to this test.

29 Conditional short-circuit current withstand test

Clause 29 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies except as follows:

29.1 *Replacement:*

The socket-outlet and mating plug as well as the ship connectors and mating ship inlet shall have:

- a minimum prospective short circuit current withstand of 16 kA RMS/1 s,
- a maximum rated peak withstand current of 40 kA.

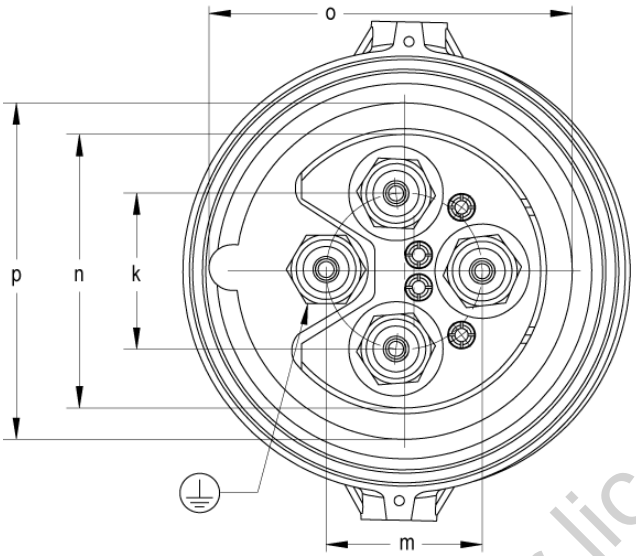
Compliance is checked by testing a socket-outlet and a mating plug with a new complementary socket-outlet and mating plug complying with this standard, and a ship connector and a mating ship inlet with a new complementary ship connector and mating ship inlet complying with this standard.

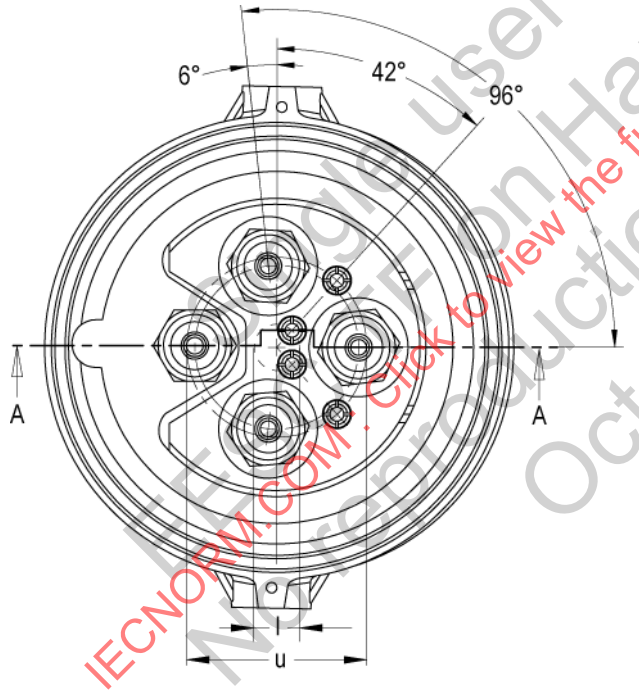
30 Electromagnetic compatibility

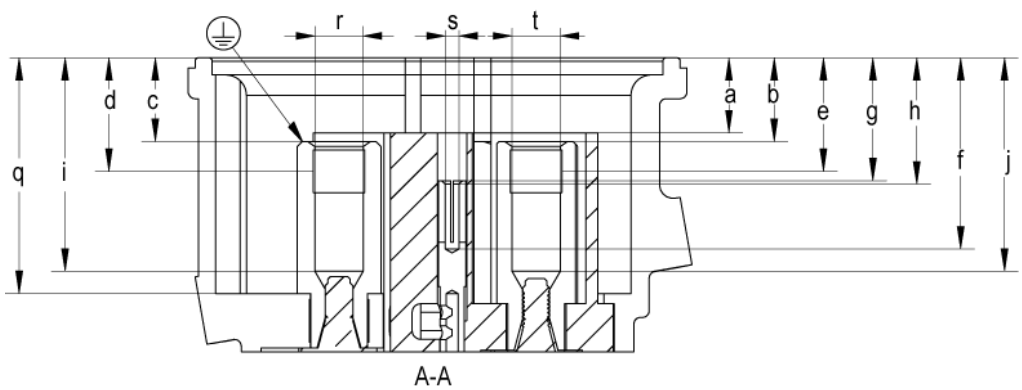
Clause 30 of IEC 60309-1:1999 + A1:2005 + A2:2012 applies.

STANDARD SHEETS

STANDARD SHEET 5-I
SOCKET-OUTLET







Key	Description	Dimension mm	
a	Top, insulator	22,0	±0,25
b	Top, phase contact	24,5	±0,25
c	Top, earth contact	25,5	±0,25
d	Earth contact	34,2	±0,25
e	Phase contact	33,2	±0,25
f	Bottom, pilot contact	55,7	±0,25
g	Top, pilot contact	35,7	±0,25
h	Pilot contact	36,7	±0,25
i	Bottom, earth contact	63,5	±0,25
j	Bottom, phase contact	62,5	±0,25
k	Pitch, phase contacts	47,7	±0,25
l	Pitch, inner pilot contacts	13,5	±0,25
m	Pitch, earth contact	48,0	±0,25
n	Insulator width	84,0	±0,10
o	Socket-outlet inner dia. + nose	111,6	±0,25
p	Socket-outlet inner dia.	103,3	+0,20 0
q	Tongue depth	69,0	±0,25
r	Earth-contact inner dia.	14,0	+0,10 0
s	Pilot-contact inner diameter	4,0	+0,10 0
t	Phase-contact inner dia.	14,0	+0,10 0
u	Pitch, outer pilot contacts	52,8	±0,25

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