

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Plugs, socket-outlets and ship couplers for high-voltage shore connection systems (HVSC-Systems) – Part 1: General requirements**

**Prises de courant et connecteurs de navire pour les systèmes haute tension de raccordement des navires à quai – Partie 1: Règles générales**



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INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

PRICE CODE  
CODE PRIX

**XA**

ICS 29.120.30

ISBN 978-2-88912-545-6

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**PLUGS, SOCKET-OUTLETS AND SHIP COUPLERS  
FOR HIGH-VOLTAGE SHORE CONNECTION SYSTEMS  
(HVSC-SYSTEMS) –**

**Part 1: General requirements**

FOREWORD

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International Standard IEC 62613-1 has been prepared by subcommittee 23H: Industrial plugs and socket-outlets, of IEC technical committee 23: Electrical accessories.

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

FDIS	Report on voting
23H/254/FDIS	23H/259/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.

In this standard, the following print types are used:

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

A list of all the parts in the IEC 62613 series, under the general title *Plugs, socket-outlets and ship couplers for high-voltage shore connection systems (hvsc-systems)*, can be found on the IEC website.

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

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## INTRODUCTION

International Standard IEC 62613-1 has been primarily written to address the needs of the IEC/PAS 60092-510 High Voltage Shore Connection Systems, in terms of plugs, socket-outlets, ship connectors and ship inlets, herein referred to as “accessories”, to deliver electrical power to ships in ports. The purpose of the IEC/PAS 60092-510 is to define requirements that allow compliant ships to connect to compliant high-voltage shore power supplies through a compatible shore-to-ship connection.

Ships that do not require connecting with standardized high-voltage shore power supplies as above may use accessories that are not covered by the standard sheets of IEC 62613-2 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 62613 is divided into several parts:

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

*Part 2: Dimensional compatibility and interchangeability requirements for accessories used for ship-to-shore connections*, comprising standard sheets for different types of accessories.

These ships are described in IEC/PAS 60092-510.



# PLUGS, SOCKET-OUTLETS AND SHIP COUPLERS FOR HIGH-VOLTAGE SHORE CONNECTION SYSTEMS (HVSC-SYSTEMS) –

## Part 1: General requirements

### 1 Scope

This part of IEC 62613 applies to accessories with

- three phases (3 poles and Earth) with up to three pilot contacts,
- one single pole (Neutral).

These accessories have rated currents not exceeding 500 A and rated operating voltages not exceeding 12 kV 50/60 Hz.

NOTE 1 In the USA, the term "Ground" is used instead of "Earth".

These accessories are primarily intended for use outdoors, in a seawater environment, for the shore supply of ships (ship-to-shore connection), in an ambient temperature within the range of -25 °C to +45 °C.

NOTE 2 In some countries, other ambient temperatures may prevail and may need to be taken into account.

These accessories are not intended for use in hazardous areas. In such locations where special conditions prevail, additional requirements may be necessary.

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 are within the scope of this standard.

### 2 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 60068-2-75, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

IEC 60092 (all parts), *Electrical installations in ships*

IEC 60092-101:1994, *Electrical installations in ships – Part 101: Definitions and general requirements*

IEC 60092-354, *Electrical installations in ships – Part 354: Single- and three-core power cables with extruded solid insulation for rated voltages 6 kV ( $U_m = 7,2$  kV) up to 30 kV ( $U_m = 36$  kV)*

IEC 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60228, *Conductors of insulated cables*

IEC 60269-1:2006, *Low-voltage fuses – Part 1: General requirements*

IEC 60269-2:2010, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application) – Examples of standardized systems of fuses A to J*

IEC 60502-4:2010, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ( $U_m = 1,2$  kV) up to 30 kV ( $U_m = 36$  kV) – Part 4: Test requirements on accessories for cables with rated voltages from 6 kV ( $U_m = 7,2$  kV) up to 30 kV ( $U_m = 36$  kV)*

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

IEC 60664-1, *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 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62271-1, *High voltage Switchgear and Controlgear – Part 1: Common specifications*

IEEE 1580, *Recommended Practice for Marine Cable for use on Shipboard and Fixed or Floating Marine Platforms*

ASTM B117-1985, *Standard practice for operating salt spray (fog) apparatus*

### **3 Terms and definitions**

For the purposes of this document, the following terms and definitions apply.

NOTE Where the terms “voltage” and “current” are used, they imply the a.c. r.m.s. values.

#### **3.1**

##### **accessory**

plugs, socket-outlets, ship connectors and ship inlets

NOTE The application of accessories is shown in Figure 1.

#### **3.2**

##### **socket-outlet**

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

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

#### **3.3**

##### **plug**

the part intended to be attached directly to one flexible cable

**3.4****ship coupler**

a means enabling the connection at will of a flexible cable to the ship. It consists of two parts, a ship connector and ship inlet

**3.5****ship connector**

the part intended to be attached to one flexible cable connected to the supply

**3.6****ship inlet**

the part incorporated in, or fixed to, the ship

**3.7****interlock**

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

NOTE In the USA, the term "Grounded" is used instead of "Earthed".

**3.8****retaining device**

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

**3.9****cap**

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

**3.10****lid**

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

**3.11****insulation voltage**

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

**3.12****rated current**

the current assigned to the accessory by the manufacturer

**3.13****rated operating voltage**

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

**3.14****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 definition 17-20 of IEC 60050-441 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.

**3.15**

**live**

a conductor or circuit is live when a difference of potential exists between it and Earth

(IEC 60092-101:1994, definition 1.3.14)

**3.16**

**clamping unit**

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

**3.17**

**terminal**

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

**3.17.1**

**pillar terminal**

〈pilot conductors〉 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 7a)

**3.17.2**

**screw terminal**

〈pilot conductors〉 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 7b and 7c)

**3.17.3**

**stud terminal**

〈pilot conductors〉 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 7d)

**3.17.4**

**saddle terminal**

〈pilot conductors〉 a terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts (see Figure 7e)

**3.17.5**

**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 7f)

**3.17.6**

**crimping terminal**

a terminal in which the conductor is crimped by means of an adequate tool

**3.17.7**

**soldering terminal**

a terminal in which the conductor is soldered

**3.17.8**

**mantle terminal**

〈Earth conductor〉 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 7g)

### 3.18

#### **non-rewireable accessory**

accessory so constructed that the cable or wiring cannot be separated from the accessory without making it permanently useless

### 3.19

#### **field-rewireable accessory**

accessory so constructed that it can be rewired by skilled personnel as qualified by the manufacturer

### 3.20

#### **non field-rewireable accessory**

accessory so constructed that it can only be rewired by the manufacturer's authorised personnel

### 3.21

#### **user-serviceable accessory**

accessory so constructed that parts can be replaced, using commonly available tools

### 3.22

#### **non user-serviceable accessory**

accessory so constructed that parts can only be replaced by the manufacturer's authorised personnel

### 3.23

#### **(electrically) skilled person**

person with technical training and knowledge to enable him or her to perform the assigned task without creating a hazard

[IEC 60050-195, Amendment 1:2001, definition 04-01 modified]

### 3.24

#### **(electrically) instructed person**

person adequately advised or supervised by electrically skilled persons to enable him or her to perceive risks and to avoid hazards which electricity can create

[IEC 60050-195, Amendment 1:2001, definition 04-02]

## 4 General

### 4.1 General requirements

Accessories shall be supplied with all the necessary instructions from the manufacturer, e.g. installation, assembling, wiring, commissioning, inspection, preventive maintenance, replacement of consumable parts, etc., including the levels of ability of the personnel to perform such operations.

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

Accessories constructed in accordance with this standard shall be suitable for the environment conditions in the space(s) where they are intended to operate. Accessories located on ships shall comply with the applicable part(s) of IEC 60092.

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

Accessories shall comply with the applicable requirements of IEC 60502-4.

Accessories shall be wired, installed, commissioned, maintained and used by electrically instructed or skilled personnel.

HVSC-systems do not allow in-line connections unless a specific piece of equipment made for that purpose is used. It shall not be possible to connect a plug into a ship connector (see 8.4).

## 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.

**4.2.2** Unless otherwise specified, the samples are tested as delivered and under normal conditions of use, at an ambient temperature of  $(20 \pm 5)$  °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. For the tests of Subclause 11.1.4, for the tests of Subclause 19.6 and 19.7, and for the tests of Clause 27, one new set of three samples can be used, if necessary.

**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.

NOTE In general, it will only be necessary to repeat the test that caused the failure, unless the sample fails in one of the tests of Clause 21 in which case the tests are repeated from that of Clause 20 onwards.

The applicant may submit, together with the first set of samples, the additional set, which may be wanted should one sample fail. The testing station will then, without further request, test the additional samples and will reject only if a further failure occurs. If the additional set of samples is not submitted at the same time, the failure of one sample will entail a rejection.

**4.2.6** When the tests are carried out with conductors, unless otherwise specified, they shall be copper and comply with IEC 60228 flexible (class 5). Accessories according to this standard are intended to be connected to cables with plain or metal coated copper conductors.

## 5 Standard ratings

Maximum voltages and currents for accessories standard ratings are

- 7,2 kV, 350 A,
- 12 kV, 350 A,
- 12 kV, 500 A,
- single-pole, 7,2 kV, 250 A,
- pilot contacts: 10 A 250 V a.c. / 1 A 300 V d.c. or  
10 A 50 V a.c. / 1 A 120 V d.c.

## 6 Classification

### 6.1 Accessories are classified according to their purpose:

- plugs,
- socket-outlets,
- ship connectors,
- ship inlets.

### 6.2 Accessories are classified according to their rewirability:

- non rewirable accessories,
- field-rewirable accessories,
- non field-rewirable accessories.

### 6.3 Accessories are classified according to their serviceability:

- user-serviceable accessories,
- non user-serviceable accessories.

### 6.4 Accessories are classified according to their conditional short-circuit current withstand capacity:

- accessories with a short-circuit withstand current of 16 kA r.m.s./1 s,
- accessories with a short-circuit withstand current of 25 kA r.m.s./1 s.

## 7 Marking

### 7.1 Accessories shall be marked with

- rated current, in amperes;
- rated operating voltage, in kilovolts;
- rated short-time withstand current ( $I_{k/s}$ );
- rated short-circuit current peak withstand capacity;
- range of conductor sizes accepted by terminals;
- the IP rating according to IEC 60529 (IP66H or IP66/IP67H);
- either the name or trademark of the manufacturer or of the responsible vendor;
- type reference, which may be a catalogue number;
- DO NOT DISCONNECT WHILE ENERGIZED.

NOTE Optionally, the insulation voltage may be marked.

The nameplates shall be legible during normal service.

*Compliance is checked by inspection.*