

# PUBLICLY AVAILABLE SPECIFICATION

## PRE-STANDARD



Utility connections in port –  
Part 3: Low Voltage Shore Connection (LVSC) Systems – General requirements

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## UTILITY CONNECTIONS IN PORT –

**Part 3: Low Voltage Shore Connection (LVSC) Systems –  
General requirements**

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This Publicly Available Specification (PAS) IEC/ISO 80005-3 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units, in cooperation with IEC subcommittee 23H: Plugs, socket-outlets and couplers for industrial and similar applications, and for electric vehicles, of IEC technical committee 23: Electrical accessories and IEC technical committee 20: Electric cables, ISO technical committee 8: Ships and marine technology, subcommittee 3: Piping and machinery, and IEEE IAS Petroleum and Chemical Industry Committee (PCIC) of the Industry Applications Society of the IEEE.

This PAS will eventually be replaced with an IEC/IEEE prefix and IEC/ISO/IEEE triple logo standard.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

| Draft PAS   | Report on voting |
|-------------|------------------|
| 18/1377/PAS | 18/1390/RVD      |

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

A list of all the parts in the IEC 80005 series, published under the general title *Utility Connections In Port*, can be found on the IEC website.

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## INTRODUCTION

This Publicly Available Specification (PAS) was developed jointly by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units in cooperation with IEC subcommittee 23H: Plugs, socket-outlets and couplers for industrial and similar applications, and for electric vehicles, of IEC technical committee 23: Electrical accessories and IEC technical committee 20: Electric cables, ISO technical committee 8: Ships and marine technology, subcommittee 3: Piping and Machinery, and IEEE IAS PCIC Marine Industry subcommittee.

For a variety of reasons, including environmental considerations, it is becoming an increasingly common requirement for ships to shut down ship generators and to connect to shore power for as long as practicable during stays in port.

The intention of this PAS is to define requirements that support, with the application of suitable operating practices, efficiency and safety of connections by compliant ships to compliant low-voltage shore power supplies through a compatible shore-to-ship connection.

With the support of sufficient planning, cooperation between ship and terminal facilities, and appropriate operating procedures and assessment, compliance with the requirements of this PAS is intended to allow different ships to connect to low-voltage shore connection (LVSC) systems at different berths. This provides the benefits of standard, straightforward connection without the need for adaptation and adjustment at different locations that can satisfy the requirement to connect for as long as practicable during stays in port.

Ships that do not apply this PAS may find it impossible to connect to compliant shore supplies.

Where deviations from the requirements and recommendations in this PAS may be considered for certain designs, the potential effects on compatibility are highlighted.

Where the requirements and recommendations of this PAS are complied with, low-voltage shore supplies arrangements are likely to be compatible for visiting ships for connection.

Clauses 1 to 12 are intended for application to all LVSC systems. They are intended to address mainly the safety and effectiveness of LVSC systems with a minimum level of requirements that would standardise on one solution. This PAS includes the requirement to complete a detailed compatibility assessment for each combination of ship and shore supply prior to a given ship arriving to connect to a given shore supply for the first time.

The other annexes in this PAS are ship-specific annexes which include additional requirements related to agreed standardisation of solutions to achieve compatibility for compliant ships at different compliant berths and to address safety issues that are considered to be particular to that ship type. These annexes use the same numbering as Clauses 1 to 12 with an annex letter prefix. Hence, the numbering is not necessarily continuous. Where no additional requirements are identified, the clause is not shown.

## UTILITY CONNECTIONS IN PORT –

### Part 3: Low Voltage Shore Connection (LVSC) Systems – General requirements

#### 1 Scope

This PAS describes low voltage shore connection (LVSC) systems, on board the ship and on shore, to supply the ship with electrical power from shore.

This PAS is applicable to the design, installation and testing of LVSC systems and addresses:

- LV shore distribution systems;
- shore-to-ship connection and interface equipment;
- transformers/reactors;
- semiconductor/rotating convertors;
- ship distribution systems; and
- control, monitoring, interlocking and power management systems.

NOTE It does not apply to the electrical power supply during docking periods, e.g. dry docking and other out-of-service maintenance and repair.

Additional and/or alternative requirements may be imposed by national administrations or the authorities within whose jurisdiction the ship is intended to operate and/or by the owners or authorities responsible for a shore supply or distribution system.

It is expected that LVSC systems will have practicable applications for ships requiring up to 1 MVA. Low-voltage shore connection systems not exceeding 250 A, with a maximum of 125 A per cable and not exceeding 300 V to earth are not covered by this PAS. High-voltage shore connection systems are covered by IEC/ISO/IEEE 80005-1.

#### 2 Normative references

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

IEC 60034 (all parts), *Rotating electrical machines*

IEC 60076 (all parts), *Power transformers*

IEC 60079 (all parts), *Explosive atmospheres*

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

IEC 60092-201:1994, *Electrical installations in ships – Part 201: System design – General*

IEC 60092-301:1980, *Electrical installations in ships – Part 301: Equipment – Generators and motors*

IEC 60092-401:1980, *Electrical installations in ships – Part 401: Installation and test of completed installation*

IEC 60092-502:1999, *Electrical installations in ships – Part 502: Tankers – Special features*

IEC 60092-504:2001, *Electrical installations in ships – Part 504: Special features – Control and instrumentation*

IEC 60146-1 (all parts), *Semiconductor convertors – General requirements and line commutated convertors*

IEC 60204-1:2005, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60228:2004, *Conductors of insulated cables*

IEC 60309-1:2012, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

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

IEC 60947-2:2006, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-5-1:2003, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and switching elements – Electromechanical control circuit devices*

IEC 61363-1, *Electrical installations of ships and mobile and fixed offshore units – Part 1: Procedures for calculating short-circuit currents in three-phase a.c.*

IEC 61439 (all parts), *Low-voltage switchgear and controlgear assemblies*

International Convention for the Safety of Life at Sea (SOLAS):1974, *Consolidated edition 2009, Ch. II-1/D, Regulations 42, 43 and 45*

### 3 Terms and definitions

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

#### 3.1

##### **cable management system**

all equipment designed to control, monitor and handle the LV-flexible and control cables and their connection devices

#### 3.2

##### **plug and socket-outlet**

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

Note 1 to entry: "plug and socket-outlet" corresponds to the French "prise de courant" that has no equivalent in English. It is anyhow required for the French version of this PAS.

[SOURCE: IEC 60309-1:2012, 2.1, modified (Note 1 to entry added)]

**3.2.1****socket-outlet**

the part intended to be installed with the fixed wiring (shore side) or incorporated in equipment

Note 1 to entry: A socket-outlet may also be incorporated in the output circuit of an isolating transformer.

Note 2 to entry: For the use of plugs, socket-outlets, and ship couplers, see Figure 5 – Diagram showing the use of accessories.

[SOURCE: IEC 62613-1:2011, 3.2 modified ("shore side" and Note 2 to entry added)]

**3.2.2****plug**

the part intended to be attached directly to one flexible cable, and to be connected to the shore socket-outlet

[SOURCE: IEC 62613-1:2011, 3.3 modified ("and to be connected to the shore socket-outlet" added)]

**3.3****ship coupler**

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

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

**3.3.1****ship connector**

the 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 ("and to be connected to the ship inlet" added)]

**3.3.2****ship inlet**

the part incorporated in, or fixed to, the ship

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

**3.4****equipotential bonding**

provision of electric connections between conductive parts, intended to achieve equipotentiality

[SOURCE: IEC 60050-195:1998, 195-01-10]

**3.5****low voltage****LV**

a set of voltage levels used for the distribution of electricity and whose upper limit is generally accepted to be 1 000 V AC

[SOURCE: IEC 60050-601, 601-01-26]

**3.6****person in charge****PIC**

individual responsible for LVSC systems operations

### **3.7**

#### **pilot contact**

a contact of the plug, ship inlet, socket-outlet and ship connector which signals correct connection and which is a safety-related component

### **3.8**

#### **receiving point**

connection point of the flexible cable on the ship

### **3.9**

#### **safe**

condition in which safety risks are minimized to an acceptable level

### **3.10**

#### **supply point**

the connection point of the flexible cable on shore

### **3.11**

#### **fail safe**

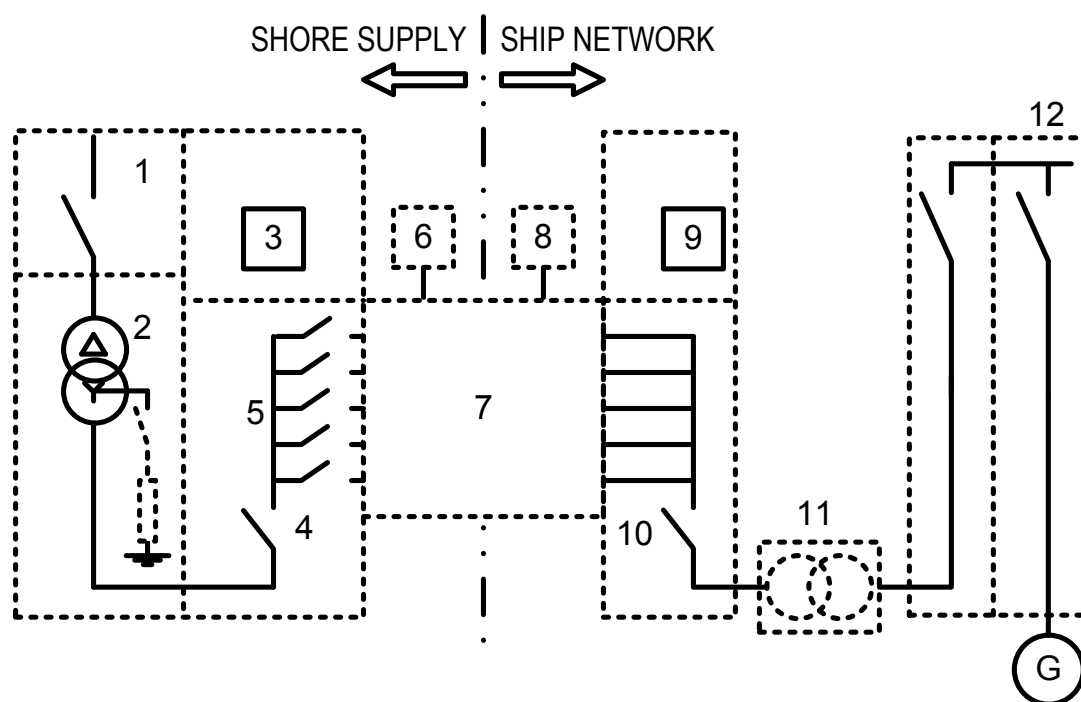
a design property of an item which prevents its failures from resulting in critical faults

[SOURCE: IEC 60050-195:1998, 191-15-04]

## **4 General requirements**

### **4.1 System description**

A typical LVSC system described in this PAS consists of hardware components as shown in Figure 1.

**Key**

- |                                                                           |                                               |
|---------------------------------------------------------------------------|-----------------------------------------------|
| 1. SHORE SUPPLY SYSTEM                                                    | 8. CONTROL SHIP                               |
| 2. SHORE-SIDE TRANSFORMER AND NEUTRAL GROUNDING RESISTOR OR/AND IT SYSTEM | 9. SHIP PROTECTION RELAYING                   |
| 3. SHORE-SIDE PROTECTION RELAYING                                         | 10. ON-BOARD SHORE CONNECTION SWITCHBOARD     |
| 4. SHORE-SIDE CIRCUIT-BREAKER                                             | 11. ON – BOARD TRANSFORMER (WHERE APPLICABLE) |
| 5. SHORE-SIDE FEEDERS CIRCUIT-BREAKERS                                    | 12. ON-BOARD RECEIVING SWITCHBOARD            |
| 6. CONTROL SHORE                                                          |                                               |
| 7. SHORE-TO-SHIP CONNECTION AND INTERFACE EQUIPMENT                       |                                               |

**Figure 1 – Block diagram of a typical LVSC system****4.2 Distribution system****4.2.1 General**

Typical distribution systems requirements used on shore are given in IEC 60364. Typical ship distribution systems requirements are given in IEC 60092-101.

NOTE IEEE 45 provides additional information on typical ship distribution systems.

**4.2.2 Equipotential bonding**

An equipotential bonding between the ship's hull and shore earthing electrode shall be established by the earth contacts of the plug, socket-outlet, ship connector and ship inlet.

Equipotential bonding shall be periodically checked (see 11.2.2).

NOTE The terms earth(ing) and ground(ing) are used throughout this PAS and have the same meaning. See IEC 60050-195:1998, 195-01-08.