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# Utility connections in port —

## Part 1:
## High Voltage Shore Connection (HVSC) Systems — General requirements

*Alimentation des navires à quai —*

*Partie 1: Systèmes de connexion à quai à haute tension — Exigences générales*

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This draft is submitted to a parallel vote in ISO and in IEC.

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# UTILITY CONNECTIONS IN PORT –

# Part 1: High voltage shore connection (HVSC) systems – General requirements

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International Standard IEC/IEEE 80005-1 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;
- 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.[1]

This document is published as a triple logo (IEC, ISO and IEEE) standard.

This second edition cancels and replaces the first edition published in 2012. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) modification of 4.1, Figure 1:
   – transformer on ship is optional, earthing switches on ship removed;
b) modification of 4.2.2 and new item 11.3:
   – alternative procedure of periodic testing added;
c) modification of 4.9:
   – minimum current value in the safety circuits shall be 50 mA;
   – opening of safety loop shall cause the automatic opening of ship and shore HVSC circuit breakers in a maximum time of 200 ms;
d) modification of 5.2:
   – added Figure on harmonic contents;
e) modification of 6.2.3:
   – earthing transformer with resistor can be used also on the secondary side;
   – neutral earthing resistor rating in amperes shall be minimum 25 A, 5 s;
f) modification of all annexes:
   – the safety circuits shall be mandatory;
g) modification of A.2.1:
   – a metallic shield shall be installed at least on the power cores or common on pilot wires;
h) modification of B.7.2.1:
   – new safety circuit introduced: single line diagram and description;
i) modification of C.4.1:

_____

1 A list of IEEE participants can be found at the following URL:

https://standards.ieee.org/project/80005-1.html

  - SLD for cruise ships was updated, also the safety circuits to be coherent with main body, IEC symbols and introduced more details about the control socket-outlets and plugs manufacturer type;

j) modification of C.7.3.1:
  - shore power connector pin assignment is updated;
  - all cruise ships shall use 4 cables in all cases;

k) added D.6.1:
  - the supply point on shore can be fixed or movable;

l) modification of D.7.3.2:
  - the voltage used in the pilot circuit for container ships shall be less than 60 V DC or 25 V AC.

m) added D.8.6 and D.9.3.1:
  - automatic restart and synchronization alternatives;

n) Annex E set to informative;

o) Annex F set to informative.

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.

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

| FDIS | Report on voting |
|---|---|
| 18/XX/FDIS | 18/XX/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.

International standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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.

The IEC Technical Committee and IEEE Technical Committee have decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

A bilingual version of this publication may be issued at a later date.

# INTRODUCTION

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 scenario of receiving electrical power and other utilities from shore is historically known as "cold ironing".

The intention of this part of IEC/IEEE 80005 is to define requirements that support, with the application of suitable operating practices, efficiency and safety of connections by compliant ships to compliant high-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 document is intended to allow different ships to connect to high-voltage shore connections (HVSC) 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 document can find it impossible to connect to compliant shore supplies.

Where deviations from this document are considered, it is useful to note the effects of such deviations in the compatibility study.

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

Clauses 1 to 12 are intended for application to all HVSC systems. They intend to address mainly the safety and effectiveness of HVSC systems with a minimum level of requirements that would standardise on one solution. This document 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. This does not preclude the use of this document e.g. for safety purposes, such as for proprietary connection systems where a ship operates on dedicated routes.

Annex A includes cabling recommendations that should be used in HVSC systems.

The other annexes in this document are ship-specific annexes that 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.

Annex A is considered informative for the purposes of this document. Annex A contains performance-based requirements for shore connection cables and was developed by technical experts from a number of countries. IEC technical committee 18, subcommittee 18A and IEC technical committee 20 were consulted regarding cable requirements. It was determined that existing standards for cable can be used at this time and there is presently no need to develop a separate standard for shore connection cables.

# UTILITY CONNECTIONS IN PORT –

# Part 1: High voltage shore connection (HVSC) systems – General requirements

## 1 Scope

This part of IEC/IEEE 80005 describes high-voltage shore connection (HVSC) systems, onboard the ship and on shore, to supply the ship with electrical power from shore.

This document is applicable to the design, installation and testing of HVSC systems and addresses

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

It does not apply to the electrical power supply during docking periods, for example dry docking and other out of service maintenance and repair.

Additional and/or alternative requirements can 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 HVSC systems will have practicable applications for ships requiring 1 MVA or more or ships with HV main supply.

Low-voltage shore connection systems are not covered by this document.

## 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.

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

IEC 60050-151:2001, *International Electrotechnical Vocabulary – Part 151: Electrical and magnetic devices*

IEC 60076 (all parts), *Power transformers*

IEC 60079 (all parts), *Explosive atmospheres*

IEC 60092-101, *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, *Electrical installations in ships – Part 301: Equipment – Generators and motors*

IEC 60092-503, *Electrical installations in ships – Part 503: Special features – AC supply systems with voltages in the range of above 1 kV up to and including 15 kV*

IEC 60092-504:2016, *Electrical installations in ships – Part 504: Automation, control and instrumentation*

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

IEC 60204-11:2000, *Safety of machinery – Electrical equipment of machines – Part 11: Requirements for HV equipment for voltages above 1 000 V a.c. or 1 500 V d.c. and not exceeding 36 kV*

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 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

IEC 60502-2, *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 2: Cables for rated voltages from 6 kV ($U_m$ = 7,2 kV) up to 30 kV ($U_m$ = 36 kV)*

IEC 60947-5-1, *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 61936-1, *Power installations exceeding 1 kV a.c. – Part 1: Common rules*

IEC 62271-200, *High-voltage switchgear and controlgear – Part 200: AC metal-enclosed switchgear and controlgear for rated voltages above 1 kV and up to and including 52 kV*

IEC 62613-1, *Plugs, socket-outlets and ship couplers for high-voltage shore connection systems (HVSC-Systems) – Part 1: General requirements*

IEC 62613-2:2016, *Plugs, socket-outlets and ship couplers for high-voltage shore connection systems (HVSC-Systems) – Part 2: Dimensional compatibility and interchangeability requirements for accessories to be used by various types of ships*

IEC/IEEE 80005-2, *Utility connections in port – Part 2: High and low voltage shore connection systems – Data communication for monitoring and control*

IMO, *International Convention for the Safety of Life at Sea (SOLAS)*:1974, *Consolidated edition 2014*

## 3 Terms and definitions

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

ISO, IEC and IEEE 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
- IEEE Standards Dictionary Online: available at http://dictionary.ieee.org

**3.1**
**cable management system**
all equipment designed to control, monitor and handle the HV-flexible and control cables and their connection devices

**3.2**
**equipotential bonding**
provision of electric connections between conductive parts, intended to achieve equipotentiality

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

**3.3**
**equipotential bond monitoring device**
device that monitors the equipotential bonding between two points

**3.4**
**ESD-1**
**emergency shutdown-1**
shutdown initiated when the ship moves past the warning range of allowable motion forward, aft or outward from the berth, and which initiates an LNG-ESD signal from shore to ship

**3.5**
**ESD-2**
**emergency shutdown-2**
shutdown initiated when the ship moves past the maximum range of allowable motion forward, aft or outward from the berth, and which initiates loading arm disconnection on shore

**3.6**
**high voltage**
**HV**
nominal voltage in range above 1 000 V AC and up to and including 15 kV AC

**3.7**
**LNG-ESD**
**liquefied natural gas-emergency shutdown**
type of emergency shutdown defined at LNG terminals

**3.8**
**low voltage**
**LV**
nominal voltage up to and including 1 000 V AC

**3.9**
**PIC**
**person in charge**
individual responsible for HVSC systems operations

**3.10**
**pilot contact**
contact of the plug and socket-outlet, which signals correct plug connection and is a safety-related component

**3.11**
**receiving point**
connection point of the flexible cable on the ship

**3.12**
**safe**
condition in which safety risks are minimized to an acceptable level

**3.13**
**supply point**
connection point of the flexible cable on shore

**3.14**
**fail-safe**, adj
able to enter or remain in a safe state in the event of a failure

[SOURCE: IEC 60050-821:2017, 821-01-10]

**3.15**
**safety circuit**
normally closed interlocking circuit with pilot contacts and safety devices that shuts down the HVSC system in response to specific initiating events

**3.16**
**connector**
coupling device employed to connect conductors of one circuit element with those of another circuit element

## 4 General requirements

### 4.1 System description

A typical HVSC system described in this document consists of hardware components as shown in Figure 1.