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**Utility connections in port –
Part 1: High voltage shore connection (HVSC) systems – General requirements**

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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	10
1 Scope.....	12
2 Normative references	12
3 Terms and definitions	14
4 General requirements	16
4.1 System description.....	16
4.2 Distribution system	16
4.2.1 General	16
4.2.2 Equipotential bonding	16
4.3 Compatibility assessment before connection.....	17
4.4 HVSC system design and operation	17
4.4.1 System design.....	17
4.4.2 System operation.....	18
4.5 Personnel safety	18
4.6 Design requirements	18
4.6.1 General	18
4.6.2 Protection against moisture and condensation	18
4.6.3 Location and construction.....	18
4.6.4 Electrical equipment in areas where flammable gas or vapour and/or combustible dust may can be present	19
4.7 Electrical requirements	19
4.8 System study and calculations	19
4.9 Emergency shutdown including emergency-stop facilities	20
5 HV shore supply system requirements	22
5.1 Voltages and frequencies.....	22
5.2 Quality of HV shore supply.....	23
6 Shore side installation	24
6.1 General.....	24
6.2 System component requirements	25
6.2.1 Circuit-breaker, disconnector and earthing switch	25
6.2.2 Transformer.....	25
6.2.3 Neutral earthing resistor	26
6.2.4 Equipment-earthing conductor bonding.....	26
6.3 Shore-to-ship electrical protection system.....	26
6.4 HV interlocking	27
6.4.1 General	27
6.4.2 Operating of the high-voltage (HV) circuit breakers, disconnectors and earthing switches.....	27
6.5 Shore connection convertor equipment	28
6.5.1 General	28
6.5.2 Degree of protection	28
6.5.3 Cooling.....	28
6.5.4 Protection.....	29
7 Ship-to-shore connection and interface equipment	29
7.1 General.....	29

7.2	Cable management system	30
7.2.1	General	30
7.2.2	Monitoring of cable mechanical tension	30
7.2.3	Monitoring of the cable length	30
7.2.4	Connection-conductor current unbalance Connectors protection	31
7.2.5	Equipotential bond monitoring	31
7.2.6	Slip ring units	31
7.3	Plugs and socket-outlets Connectors	31
7.3.1	General	31
7.3.2	Pilot contacts	32
7.3.3	Earth contact	32
7.3.4	Fibre optical plug/socket connection	32
7.4	Interlocking of earthing switches	34
7.5	Ship-to-shore connection cable	34
7.6	Independent Control and monitoring cable	35
7.7	Storage	35
7.8	Data communication	35
8	Ship requirements	35
8.1	General	35
8.2	Ship electrical distribution system protection	36
8.2.1	Short-circuit protection	36
8.2.2	Earth fault protection, monitoring and alarm	36
8.3	Shore connection switchboard	36
8.3.1	General	36
8.3.2	Circuit-breaker, disconnecter and earthing switch	36
8.3.3	Instrumentation and protection	37
8.4	Onboard transformer	37
8.5	Onboard receiving switchboard connection point	37
8.5.1	General	37
8.5.2	Circuit-breaker and earthing switch	38
8.5.3	Instrumentation	38
8.5.4	Protection	38
8.5.5	Operation of the circuit-breaker	39
8.6	Ship power restoration	40
9	HVSC system control and monitoring	40
9.1	General requirements	40
9.2	Load transfer via blackout	40
9.3	Load transfer via automatic synchronization	41
9.3.1	General	41
9.3.2	Protection requirements	41
10	Verification and testing	41
10.1	General	41
10.2	Initial tests of shore side installation	42
10.2.1	General	42
10.2.2	Tests	42
10.3	Initial tests of ship-side installation	42
10.3.1	General	42
10.3.2	Tests	42
10.4	Tests at the first call at a shore supply point	43

10.4.1	General	43
10.4.2	Tests	43
11	Periodic tests and maintenance	43
11.1	General.....	43
11.2	Tests at repeated calls of a shore supply point	43
11.2.1	General	43
11.2.2	Verification	44
11.3	Earthing bonding connections	44
12	Documentation	44
12.1	General.....	44
12.2	System description.....	44
Annex A	(informative) Ship-to-shore connection cable	45
A.1	Rated voltage	45
A.2	General design	45
A.2.1	General	45
A.2.2	Conductors	45
A.2.3	Insulation of power cores and neutral core.....	45
A.2.4	Screening	46
A.2.5	Earth conductors	46
A.2.6	Pilot element with rated voltage $U_0/U (U_m) = 150/250 (300) V$	46
A.2.7	Optical fibres	47
A.2.8	Cabling	47
A.2.9	Separator tape.....	47
A.2.10	Outer sheath.....	47
A.2.11	Markings.....	47
A.3	Tests on complete cables	48
Annex B	(normative) Additional requirements for Roll-on Roll-off (Ro-Ro) cargo ships and Ro-Ro passenger ships	50
B.1	General.....	50
Annex C	(normative) Additional requirements for cruise ships	56
C.1	General.....	56
C.6	Shore side installation.....	64
Annex D	(normative) Additional requirements of container ships	67
D.1	General.....	67
Annex E	(normative informative) Additional requirements of liquefied natural gas carriers (LNGC)	74
E.1	General.....	74
Annex F	(normative informative) Additional requirements for tankers	80
F.1	General.....	80
Bibliography	85
Figure 1	– Block diagram of a typical described HVSC system arrangement	16
Figure 2	– Phase sequences.....	23
Figure 3	– Single harmonic distortion limits.....	24
Figure 4	– Fibre-optic socket outlet.....	33
Figure 5	– Fibre-optic plug	34
Figure A.1	– Bending test arrangement.....	48

Figure B.1 – Example for General system layout diagram	51
Figure B.2 – Safety circuits	53
Figure B.3 – Three-phase plug and socket-outlet contact assignment	54
Figure C.1 – General system layout diagram.....	57
Figure C.2 – Cruise ship HVSC system single line functional diagram.....	59
Figure C.3 – Safety and control circuits	63
Figure C.4 – Three-phase ship connector and ship inlet contact assignment.....	65
Figure C.5 – The power Three-phase ship inlet fitted with fail-safe limit switch	66
Figure D.1 – General system layout diagram.....	68
Figure D.2 – Safety circuits.....	71
Figure D.3 – Power plug and socket pin assignment Three-phase plug and socket-outlet contact assignment	72
Figure E.1 – General system layout diagram.....	75
Figure E.2 – Three-phase ship connector and ship inlet contact assignment	78
Figure F.1 – General system layout diagram	81
Figure F.2 – Three-phase shore plug and ship socket-outlet contact assignment	84
Table E.1 – LNGC 140 000 m ³ to 225 000 m ³	76
Table E.2 – LNGC > 225 000 m ³	76

UTILITY CONNECTIONS IN PORT –

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

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This Redline version is not an official Standard and is intended to provide the user with an indication of what changes have been made to the previous version. Only the IEC International Standard provided in this package is to be considered the official Standard.

This Redline version provides you with a quick and easy way to compare all the changes between this standard and its previous edition. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

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.

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:
 - 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
18/1643/FDIS	18/1657/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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

INTRODUCTION

~~The following standard was developed jointly between IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units, 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 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 ~~may~~ can find it impossible to connect to compliant shore supplies.

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

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. ~~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.~~

~~It should be noted that~~ 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 ~~may~~ 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-MW~~ 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), ~~Electrical apparatus for explosive gas~~ *Explosive atmospheres*

IEC 60092-101:~~2002~~, *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:~~1995~~, *Electrical installations in ships – Part 301: Equipment – Generators and motors*

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

IEC 60092-503:~~2007~~, *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:~~2004~~ 2016, *Electrical installations in ships – Part 504: ~~Special features~~ 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:~~2004~~, *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:~~2005~~, *Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m = \del{7,2} 1,2$ 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 60502-4:2005, *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 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 61936-1:~~2002~~, *Power installations exceeding 1 kV a.c. – Part 1: Common rules*

IEC 62271-200:~~2003~~, *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:~~2014~~, *Plugs, socket-outlets and ship couplers for high-voltage shore connection systems (HVSC-Systems) – Part 1: General requirements*

IEC 62613-2:~~2014~~ 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*

~~SOLAS 2009, Chapter II-1/D, Regulations 42, 43 and 45~~

~~MIL-DTL-38999K, General specification for connectors, electrical, circular, miniature, high density, quick disconnect (bayonet, threaded, and breech coupling), environment resistant, removable crimp and hermetic solder contacts~~

~~MIL-STD-1560A, Interface standard: Insert arrangements for MIL-C-38999 and MIL-C-27599 electrical, circular connectors~~

~~MIL-PRF-29504/5C, Performance specification sheet. Termini, fiber optic, connector, removable, environment resisting, socket terminus, size 16, rear release, MIL-DTL-38999, SERIES III~~



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INTERNATIONAL STANDARD



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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references	10
3 Terms and definitions	11
4 General requirements	13
4.1 System description.....	13
4.2 Distribution system	14
4.2.1 General	14
4.2.2 Equipotential bonding	14
4.3 Compatibility assessment before connection.....	15
4.4 HVSC system design and operation	15
4.4.1 System design.....	15
4.4.2 System operation.....	15
4.5 Personnel safety	16
4.6 Design requirements.....	16
4.6.1 General	16
4.6.2 Protection against moisture and condensation	16
4.6.3 Location and construction.....	16
4.6.4 Electrical equipment in areas where flammable gas or vapour and/or combustible dust can be present.....	17
4.7 Electrical requirements	17
4.8 System study and calculations	17
4.9 Emergency shutdown including emergency-stop facilities	18
5 HV shore supply system requirements	19
5.1 Voltages and frequencies.....	19
5.2 Quality of HV shore supply.....	20
6 Shore side installation	22
6.1 General.....	22
6.2 System component requirements	22
6.2.1 Circuit-breaker, disconnector and earthing switch	22
6.2.2 Transformer.....	22
6.2.3 Neutral earthing resistor	23
6.2.4 Equipment-earthing conductor bonding.....	23
6.3 Shore-to-ship electrical protection system.....	23
6.4 HV interlocking	24
6.4.1 General	24
6.4.2 Operating of the high-voltage (HV) circuit breakers, disconnectors and earthing switches.....	24
6.5 Shore connection convertor equipment	25
6.5.1 General	25
6.5.2 Degree of protection	25
6.5.3 Cooling.....	25
6.5.4 Protection.....	26
7 Ship-to-shore connection and interface equipment	26
7.1 General.....	26

7.2	Cable management system	26
7.2.1	General	26
7.2.2	Monitoring of cable mechanical tension	27
7.2.3	Monitoring of the cable length	27
7.2.4	Connectors protection	27
7.2.5	Equipotential bond monitoring	27
7.2.6	Slip ring units	27
7.3	Connectors	28
7.3.1	General	28
7.3.2	Pilot contacts	28
7.3.3	Earth contact	28
7.3.4	Fibre-optic connection	29
7.4	Interlocking of earthing switches	30
7.5	Ship-to-shore connection cable	30
7.6	Control and monitoring cable	31
7.7	Storage	31
7.8	Data communication	31
8	Ship requirements	31
8.1	General	31
8.2	Ship electrical distribution system protection	32
8.2.1	Short-circuit protection	32
8.2.2	Earth fault protection, monitoring and alarm	32
8.3	Shore connection switchboard	32
8.3.1	General	32
8.3.2	Circuit-breaker, disconnecter and earthing switch	32
8.3.3	Instrumentation and protection	33
8.4	Onboard transformer	33
8.5	Onboard receiving switchboard connection point	33
8.5.1	General	33
8.5.2	Circuit-breaker and earthing switch	33
8.5.3	Instrumentation	34
8.5.4	Protection	34
8.5.5	Operation of the circuit-breaker	35
8.6	Ship power restoration	35
9	HVSC system control and monitoring	36
9.1	General	36
9.2	Load transfer via blackout	36
9.3	Load transfer via automatic synchronization	36
9.3.1	General	36
9.3.2	Protection	37
10	Verification and testing	37
10.1	General	37
10.2	Initial tests of shore side installation	37
10.2.1	General	37
10.2.2	Tests	37
10.3	Initial tests of ship-side installation	38
10.3.1	General	38
10.3.2	Tests	38
10.4	Tests at the first call at a shore supply point	38

10.4.1	General	38
10.4.2	Tests	38
11	Periodic tests and maintenance	39
11.1	General.....	39
11.2	Tests at repeated calls of a shore supply point	39
11.2.1	General	39
11.2.2	Verification	39
11.3	Earthing bonding connections	39
12	Documentation	40
12.1	General.....	40
12.2	System description.....	40
Annex A	(informative) Ship-to-shore connection cable	41
A.1	Rated voltage	41
A.2	General design	41
A.2.1	General	41
A.2.2	Conductors	41
A.2.3	Insulation of power cores and neutral core.....	41
A.2.4	Screening	42
A.2.5	Earth conductors	42
A.2.6	Pilot element with rated voltage $U_0/U (U_m) = 150/250 (300) V$	42
A.2.7	Optical fibres	43
A.2.8	Cabling	43
A.2.9	Separator tape.....	43
A.2.10	Outer sheath.....	43
A.2.11	Markings.....	43
A.3	Tests on complete cables	44
Annex B	(normative) Additional requirements for Roll-on Roll-off (Ro-Ro) cargo ships and Ro-Ro passenger ships	47
B.1	General.....	47
Annex C	(normative) Additional requirements for cruise ships	52
C.1	General.....	52
C.6	Shore side installation.....	57
Annex D	(normative) Additional requirements of container ships	60
D.1	General.....	60
Annex E	(informative) Additional requirements of liquefied natural gas carriers (LNGC).....	64
E.1	General.....	64
Annex F	(informative) Additional requirements for tankers	70
F.1	General.....	70
Bibliography	73
Figure 1	– Block diagram of a typical described HVSC system arrangement	14
Figure 2	– Phase sequences.....	20
Figure 3	– Single harmonic distortion limits.....	21
Figure 4	– Fibre-optic socket outlet.....	29
Figure 5	– Fibre-optic plug.....	30
Figure A.1	– Bending test arrangement.....	45
Figure B.1	– General system diagram	48

Figure B.2 – Safety circuits	50
Figure B.3 – Three-phase plug and socket-outlet contact assignment	51
Figure C.1 – General system diagram	52
Figure C.2 – Cruise ship HVSC system functional diagram	53
Figure C.3 – Safety and control circuits	56
Figure C.4 – Three-phase ship connector and ship inlet contact assignment.....	58
Figure C.5 – Three-phase ship inlet fitted with fail-safe limit switch.....	59
Figure D.1 – General system diagram	60
Figure D.2 – Safety circuits.....	62
Figure D.3 – Three-phase plug and socket-outlet contact assignment.....	63
Figure E.1 – General system diagram	65
Figure E.2 – Three-phase ship connector and ship inlet contact assignment.....	68
Figure F.1 – General system diagram	70
Figure F.2 – Three-phase shore plug and ship socket-outlet contact assignment	72
Table E.1 – LNGC 140 000 m ³ to 225 000 m ³	66
Table E.2 – LNGC > 225 000 m ³	66

UTILITY CONNECTIONS IN PORT –**Part 1: High voltage shore connection (HVSC) systems –
General requirements****FOREWORD**

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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.

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:
 - 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
18/1643/FDIS	18/1657/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.

IMPORTANT – The “colour inside” logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this publication using a colour printer.

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*