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REDLINE VERSION

INTERNATIONAL STANDARD

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Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions

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Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 1: General requirements and conditions

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the 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 61892-1 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

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

a) The general requirement to harmonic distortion has been changed from IEC 61000-2-4 Class 2 to Class 1.
b) The voltage tolerance for a DC system has been changed from ±10 % to +10 %, −15 %.
c) Annex C (informative) regarding specification of surface treatment and protective painting system has been added.

The text of this standard based on the following documents:

CDV	Report on voting
18/1385/CDV	18/1449/RVC

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 parts of the IEC 61892 series can be found, under the general title *Mobile and fixed offshore units – Electrical installations*, 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 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 document using a colour printer.

INTRODUCTION

The IEC 61892 series of International Standards is intended to enable safety in the design, selection, installation, maintenance and use of electrical equipment for the generation, storage, distribution and utilization of electrical energy for all purposes in offshore units which are used for the purpose of exploration or exploitation of petroleum resources.

This part of the IEC 61892 incorporates and co-ordinates, as far as possible, existing rules and forms a code of interpretation, where applicable, of the requirements of the International Maritime Organization, a guide for future regulations which may be prepared and a statement of practice for offshore unit owners, constructors and appropriate organizations.

This standard is based on equipment and practices which are in current use, but it is not intended in any way to impede development of new or improved techniques.

The ultimate aim has been to produce a set of International Standards exclusively for the offshore petroleum industry.

MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 1: General requirements and conditions

1 Scope

This part of IEC 61892 contains provisions for electrical installations in mobile and fixed offshore units including pipeline, pumping or 'pigging' stations, compressor stations and exposed location single buoy moorings, used in the offshore petroleum industry for drilling, processing and storage purposes.

This International Standard applies to all installations, whether permanent, temporary, transportable or hand-held, to AC installations up to and including 35 000 V and DC installations up to and including 1 500 V (AC and DC voltages are nominal values).

This standard does not apply either to fixed equipment for medical purposes or to the electrical installations of tankers.

NOTE For medical rooms, IEC 60364-7-710 provides more information.

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 60034-1:2010, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60079 (all parts), *Explosive atmospheres*

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

IEC 61000-2-4:2002, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61892-2:~~2005~~ 2012, *Mobile and fixed offshore units – Electrical installations – Part 2: System design*

IEC 61892-5, *Mobile and fixed offshore units – Electrical installations – Part 5: Mobile units*

IEC 61892-6, *Mobile and fixed offshore units – Electrical installations – Part 6: Installation*

IEC 61892-7, *Mobile and fixed offshore units – Electrical installations – Part 7: Hazardous areas*

~~IMO-110E, IMO-111F and IMO-113S,~~ *International Convention for the Safety of Life at Sea (SOLAS)*~~:~~*:1974, Consolidated edition 2009*

IMO MODU Code, *Code for the construction and equipment of mobile offshore drilling units*

3 Terms and definitions

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

NOTE The terms and definitions included in this part are those having general application in the IEC 61892 series. Terms and definitions applying to particular apparatus or equipment are included in the other parts of IEC 61892.

3.1
appropriate authority
governmental body and/or classification society with whose rules a unit is required to comply

3.2
equipment
single apparatus or set of devices or apparatuses, or the set of main devices of an installation, or all devices necessary to perform a specific task

EXAMPLE Power transformer, measuring equipment.

[SOURCE IEC 60050-151:2001, 151-11-25, modified — The words "the equipment of a substation" has been removed from the example.]

3.3
apparatus
device or assembly of devices which can be used as an independent unit for specific functions

[SOURCE IEC 60050-151:2001, 151-11-22, modified — The note has been deleted.]

3.4
rooms with a controlled atmosphere
rooms where the temperature and humidity can be controlled within specified limits

3.5
degree of protection ~~**provided by enclosures (of electrical apparatus) measures**~~ **of enclosure**
IP
numerical classification according to IEC 60529 preceded by the symbol IP applied to the enclosure of electrical ~~equipment and~~ apparatus to provide :

– protection of persons against contact with, or approach to, live parts and against contact with moving parts (other than smooth rotating shafts and the like) inside the enclosure,

– protection of the electrical apparatus against ingress of solid foreign ~~bodies~~ objects, and

– where indicated by the classification, protection of the electrical apparatus ~~inside the enclosure~~ against harmful ingress of water

~~NOTE 1 For further information regarding degree of protection, see IEC 60529.~~

NOTE ~~2~~ 1 to entry Explanation of the numerals used for classification of degree of protection is given in Tables A.1 and A.2.

[SOURCE IEC 60050-426:2008, 426-04-02, modified — Note 1 to entry has been added.]

3.6
distribution board
assembly containing different types of switchgear and controlgear associated with one or more outgoing electric circuits fed from one or more incoming electric circuits, together with terminals for the neutral and protective conductors, if required

[SOURCE IEC 60050-826:2004, 826-16-08, modified — The words "if required" have been added.]

3.7
earth
ground, US, CA
general mass of the metal structure or hull of the unit

3.8
earthed
connected to the general mass of the metal structure or hull of the unit in such a manner as will ensure at all times an immediate discharge of electrical energy without danger

3.9
essential services
services essential for the navigation, steering or manoeuvring of the mobile unit, or for the safety of human life, or for special characteristics of the unit (for example special services)

3.10
frequency

3.10.1
cyclic frequency variation
periodic deviation in frequency during normal operation such as might be caused by regularly repeated loading

$$\frac{\pm(f_{max} - f_{min}) \times 100}{2\, f_{nominal}} \%$$

3.10.2
frequency tolerance
maximum departure from nominal frequency during normal operation conditions excluding transient and cyclic frequency variations

Note 1 to entry: Frequency tolerance is a steady state tolerance and includes variations caused by loads and governor characteristics. It also includes variations due to environmental conditions.

3.10.3
frequency transient
sudden change in frequency which goes outside the frequency tolerance limits and returns to and remains inside these limits within a specified recovery time after initiation of the disturbance (time range: seconds)

~~**3.11**~~
~~**insulation**~~

~~**3.11.1**~~
~~**basic insulation**~~
~~insulation of hazardous-live-parts which provides basic protection against electric shock~~

~~NOTE Basic insulation does not necessarily include insulation used exclusively for functional purposes.~~

~~[IEC 60050-195:1998, 195-06-06, modified]~~

~~**3.11.2**~~
~~**supplementary insulation**~~
~~independent insulation applied in addition to basic insulation, for fault protection in the event of a failure of basic insulation~~

~~[IEC 60050-195:1998, 195-06-07, modified]~~

3.11
live part
conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor

Note 1 to entry: This concept does not necessarily imply a risk of electric shock.

[SOURCE IEC 60050-195:1998, 195-02-19]

3.12
PEN conductor
conductor combining the functions of both a protective earthing conductor and a neutral conductor

[SOURCE IEC 60050-195:1998, 195-02-12]

3.13
PEM conductor
conductor combining the functions of both a protective earthing conductor and a mid-point conductor

[SOURCE IEC 60050-195:1998, 195-02-13]

3.14
PEL conductor
conductor combining the functions of both a protective earthing conductor and a line conductor

[SOURCE IEC 60050-195:1998, 195-02-14]

3.15
petroleum
complex mixture of hydrocarbons that occurs in the earth in liquid or gaseous forms

3.16
point <wiring>
any termination of the fixed wiring intended for the attachment of a luminaire or for connecting to the supply of a current-using appliance

~~**3.18**~~
~~**spaces**~~

~~**3.18.1**~~
~~**accommodation spaces**~~
~~spaces used for public spaces, corridors, lavatories, cabins, offices, crew quarters, hospitals, game and hobby rooms, pantries containing no cooking appliances and similar spaces~~

~~**3.18.2**~~
~~**machinery spaces**~~
~~spaces containing propelling machinery, boilers, oil fuel units, steam and internal combustion engines, hydrocarbon process equipment, water treatment and handling equipment, drilling and associated equipment, generators and major electrical machinery, oil filling stations,~~

~~refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces and trunks to such spaces~~

~~**3.18.3**~~
~~**public spaces**~~
~~portions of the accommodation used for halls, dining rooms, lounges, and similar permanently enclosed spaces~~

3.17
voltages

3.17.1
voltage tolerance
maximum departure from nominal user voltage during normal operating conditions, excluding transient and cyclic voltage variations

Note 1 to entry: Voltage tolerance is a steady state tolerance and includes voltage drop in cables and voltage regulator characteristics. It also includes variations due to environmental conditions.

3.17.2
voltage unbalance tolerance
difference between the highest and lowest phase to phase voltage

3.17.3
cyclic voltage variation
periodic voltage deviation (max. to min. r.m.s. values) of the nominal voltage, such as might be caused by regularly repeated loading

$$\frac{\pm(U_{\max} - U_{\min}) \times 100}{2\,U_{\text{nominal}}}\ \%$$

3.17.4
voltage transient
sudden change in voltage (excluding spikes) which goes outside the nominal voltage tolerance limits and returns to and remains inside these limits within a specified recovery time after the initiation of the disturbance (time range: seconds)

3.18
recovery time

3.18.1
voltage transient recovery time
time elapsed from exceeding the normal voltage tolerance until the voltage recovers and remains within the normal tolerance limits

3.18.2
frequency transient recovery time
time elapsed from exceeding the normal frequency tolerance until the frequency recovers and remains within the frequency tolerance limits

3.19
waveform

3.19.1
total harmonic distortion
THD
ratio of the r.m.s. value of the sum of all the harmonic components up to a specified order (recommended notation "H") to the r.m.s. value of the fundamental component

$$\mathrm{THD} = \sqrt{\sum_{h=2}^{h=H} \frac{(Q_h)^2}{(Q_1)^2}}$$

where

Q represents either current or voltage;

Q_1 is the r.m.s. value of the fundamental component;

h is the harmonic order;

Q_h is the r.m.s. value of the harmonic component of order h;

H is 50 for the purpose of the compatibility levels in this standard

Note 1 to entry: THD takes account of harmonics only. For the case where interharmonics are to be included, reference is made to A.3.1 of IEC 61000-2-4:2002.

Note 2 to entry: This note applies to the French language only.

[SOURCE IEC 61000-2-4:2002, 3.2.7, modified — Note 1 to entry is modified.]

3.19.2
single harmonic content
ratio of the effective r.m.s. value of the harmonic to the r.m.s. value of the fundamental expressed in per cent

4 General requirements and conditions

4.1 General

This clause contains conditions and requirements which are common to all equipment and installations in the IEC 61892 series.

Electrical installations in units shall be such that:

– essential services will be maintained under various emergency conditions;
– the safety of crew, contractors, visitors and unit will be ensured;
– the requirements with respect to safety in this standard are considered;
– the requirements of the International Convention for the Safety of Life at Sea (SOLAS) are met as far as applicable;
– the requirements of the IMO MODU Code are met as far as applicable.

For floating and mobile units, all machinery and equipment shall operate satisfactorily under the static and dynamic inclination limits according to IEC 61892-5.

The appropriate authority may have additional requirements which have to be complied with.

NOTE Emergency conditions are normally defined in the safety assessment of the installation.

~~**4.2 Workmanship and material**~~

~~Good workmanship and adequate material are essential requirements for compliance with these standards.~~

4.2 Acceptance of substitutes or alternatives

Where in the IEC 61892 series any special type of equipment, construction, or arrangement is specified, the use of any other equipment, construction or arrangement is admissible, provided it is not less effective and reliable.

4.3 Additions and alterations

An addition or alteration, temporary or permanent, shall not be made to an existing installation until it has been ascertained that the ratings and the condition of existing accessories, conductors, switchgear, etc. affected, are adequate for the new situation.

Special attention is drawn to those factors affecting the existing system design such as current-carrying capacity, short-circuit level, voltage drop, harmonics, stability and proper discrimination of the protective devices.

4.4 Environmental conditions

4.4.1 General

Electrical equipment shall operate satisfactorily under various environmental conditions.

Environmental conditions are characterised by a number of variables:

– one set including mainly climatic conditions, biological conditions, conditions dependent upon chemically and mechanically active substances and mechanical conditions;

– another set dependent mainly upon locations in unit, operational patterns and transient conditions.

NOTE For further information regarding environmental conditions in conjunction with some selected locations, operational patterns and transient conditions which are considered to be generally representative, see IEC 60721-3-6.

4.4.2 Design parameters

4.4.2.1 General

Design parameters based on environmental conditions applicable to certain types of equipment may be determined according to location. Where no data is available, Table 1 and Table 2 give recommended values.

~~NOTE~~ In certain areas, e.g. arctic areas, lower temperatures than those given in the tables have to be taken into consideration. In certain areas, also a higher temperature than given in the tables has to be taken into consideration.

4.4.2.2 Temperature

For a specific project, the project documentation may give specific information regarding ambient temperature. In absence of such information, the following may be used:

In other parts of the IEC 61892 series, where no "high air temperature" has been specified as a design parameter for equipment, a value of 45 °C shall apply.

Where equipment is designed to operate with temperatures higher or lower than those stated in Table 1, permissible temperature rises may be reduced or increased accordingly.

Table 1 – Operational design parameters – Ambient temperature

Type of equipment	Value °C
High air temperature	
Cables	45
Generators and motors	50
Switchgear	45
Transformers	45
Control and instrumentation	55
Other electrical equipment	45
Low air temperature	
Control and instrumentation	5 (general)
Control and instrumentation	−25 (open deck)
High water temperature	
Generators and motors	35

NOTE ~~1~~ The lower design temperature will normally ~~be~~ specified in the product standard.

~~NOTE 2~~ For batteries, see ~~10.1.1 and 10.7 of~~ IEC 61892-6.

Sea water temperature is max 32 °C.

4.4.2.3 Relative humidity

Design values for relative humidity are given in Table 2.

Table 2 – Design parameters – Relative humidity

Value	
%	°C
95	Up to 45
70	Above 45

4.5 Materials

In general, all electrical equipment shall be constructed of durable, flame-retardant, moisture-resistant materials, which are not subject to deterioration in the atmosphere and at the temperatures to which they are likely to be exposed.

Equipment enclosures located outdoor, in naturally ventilated and wash down areas shall be made of proven seawater resistant materials.

NOTE 1 Examples of such material ~~may be~~ are seawater resistant aluminium, stainless steel or UV resistant plastic material.

Suitable means shall be taken to prevent galvanic corrosion when securing dissimilar metals, for example aluminium to the steel structure or hull of a unit.

NOTE 2 For further information regarding environmental conditions; refer to IEC 60721-3-6.

4.6 Power supply system characteristics

4.6.1 General

Unless otherwise stated in other parts of this standard, the equipment shall function when supplied from general distribution systems with due regard to voltage and frequency variations, harmonic distortion and conducted disturbances. The characteristics of general distribution systems are given in the following subclauses.

~~NOTE 1~~ Where the power supply is obtained from the shore, due regard should be paid to the effect that the quality of the supply, if different from that specified in this clause, may have on the performance of equipment.

~~NOTE 2~~ For systems where semiconductors are connected having a total rating which is a significant portion of the total system rating, it may be feasible to suppress the harmonics. Consideration should be given to taking appropriate measures to attenuate these effects of the distribution system so that safe operation is assured. Care should be taken in selecting consumers supplied from an electric power supply system with a higher harmonic content than specified in this clause.

~~NOTE 3~~ Electrical equipment which requires a higher quality power supply may need additional provisions to be made locally. Where additional equipment is fitted to achieve this higher quality power supply, it may be required to be duplicated and segregated to the same degree as the electrical equipment it supplies.

~~NOTE 4~~ Special attention should be paid to the installation of electrical equipment which may influence the quality of power supply on a local basis or react with any harmonics present on the general distribution system.

~~NOTE 5~~ Variable frequency/voltage systems may be admissible provided safe operation of the system is assured and equipment is suitably rated for the expected variations.

4.6.2 AC distribution systems

4.6.2.1 General

The voltages referred to in 4.6.2.2 ~~and 4.7.3~~ are measured at the point where the equipment is installed.

Electric motors are normally designed for a combination of voltage and frequency variations which is less than the combined limits given in this clause. For combined voltage and frequency variations for electric motors, reference is made to IEC 60034-1.

4.6.2.2 Voltage characteristics

Requirements to voltage characteristics are given in Table 3. Tolerances are expressed in a percentage of the nominal voltage.

Table 3 – Voltage characteristics

Voltage characteristics	Value
Voltage tolerance (continuous)	$^{+6}_{-10}$ %
Voltage unbalance tolerance including phase voltage unbalance as a result of unbalance of load according to IEC 61892-2	7 %
Cyclic voltage variation (continuous).	2 %
Voltage transients: • slow transients e.g. due to load variations tolerance (deviation from nominal voltage) • voltage transients recovery time	 $^{+20}_{-20}$ % maximum 1,5 s
Voltages are root mean square (r.m.s.) unless otherwise stated.	

Where three-phase AC motors conforming to the IEC 60034 series are connected, then the system negative sequence component shall not exceed 1 % of the positive sequence component over a long period, or 1,5 % for a short period not exceeding a few minutes, and a zero sequence component not exceeding 1 % of the positive sequence component.

The transient voltage at the point where equipment is installed can be up to −20 %. The correct operating condition for a contactor is based upon a value of the control supply voltage not less than 85 % of its rated value. The contactor shall not drop at a voltage above 75 % of the rated control supply voltage.

~~NOTE~~ The sum of voltage excursions at any point on the system (tolerances and transients) from nominal voltage should not exceed $^{+20}_{-20}$ %.

4.6.2.3 Harmonic distortion (voltage waveform)

For voltage harmonic distortion, acceptance limits shall correspond to IEC 61000-2-4:2002, Class ~~2~~ 1. In addition no single harmonic shall exceed ~~5~~ 3 %.

Distorting equipment emission levels shall be such that the above limits shall not be exceeded in normal operating conditions.

For certain installations, where it is confirmed by design study that it is not possible to comply with the requirements of IEC 61000-2-4:2002, Class 1, higher values, as given in Class 2 may be accepted, provided the generation and distribution equipment and consumers are designed to operate at the higher limits.

IEC 61000-2-4:2002 (Table 2) Class 1 states that no single harmonic shall exceed 3 % and the THD shall not exceed 5 %.

~~NOTE 1~~ IEC 61000-2-4:2002 (Table 2) Class 2 ~~requires~~ states that no single harmonic shall exceed 6 % and the THD shall not exceed 8 %.

~~NOTE 2 Other values may be considered subject to approval of the appropriate authority.~~

~~NOTE 3 Some equipment may require Class 1 (5 % and 3 %). Classification societies may have other requirements, which may be more stringent.~~

4.6.2.4 Frequency characteristics

Requirements to frequency characteristics are given in Table 4. Tolerances are expressed in a percentage of the nominal frequency.

Table 4 –Frequency characteristics

Frequency characteristics	Value
Frequency tolerance (continuous)	$^{+5}_{-5}$ %
Cyclic frequency variation (continuous)	0,5 %
Frequency transient tolerance	$^{+10}_{-10}$ %
Frequency transients recovery time	maximum 5 s
~~NOTE~~ The sum of frequency excursions at any point on the system (tolerances and transients) from nominal frequency should not exceed $^{+12,5}_{-12,5}$ %.	

The frequency tolerance is based on generators operating in "island mode". In case of operation in parallel with an external grid a more stringent value has to be applied. This value has to be agreed between the network owners.

A typical value when operating in parallel with an external network is ± 2,5 %.

4.6.3 DC distribution systems

Tolerances for DC system are given in Table 5. Tolerances are expressed in a percentage of the nominal voltage, measured at the equipment terminal.

Table 5 –Tolerances for DC system

Voltage tolerance (continuous)	$^{+10}_{-15}$ %
Cyclic voltage variation	5 %
Voltage ripple (AC r.m.s. over steady DC voltage, battery in fully loaded condition)	2 %
Voltage ripple VRLA batteries	1 %

~~NOTE 1 When battery chargers/(battery combinations) are used as d.c. power supply systems, adequate measures should be taken to keep the voltage within the specified limits during charging, quick charging and discharging of the battery.~~

~~NOTE 2 For control and instrumentation systems, see IEC 61892-2.~~

Depending of the different configuration of battery charger and batteries system, voltage over 10 % of nominal value could be present in the DC system during full or boost charging. In this case adequate measures should be taken to keep the voltage on the equipment terminal within the limits specified above.

Configuration with load directly connected to battery charger and battery system without any voltage stabilizer device shall be accepted only in absence of load sensible to voltage variation over 10 %.

The transient recovery time shall not exceed 2 s maximum.

Fast transients e.g. spikes caused by switching, peak impulse voltage amplitude shall not exceed the values given in Table 6.

Table 6 – Fast transients

System voltage	Peak impulse voltage amplitude
24 V DC systems	500 V
110 V DC systems	1 500 V
220 V DC systems	2 500 V
600 V DC system	4 000 V
1 000 V DC system	6 000 V
NOTE ~~3~~ The figures are in accordance with IEC 60664-1. Values for DC systems with rated voltage above 1 000 V are not given in that standard	

4.7 Manual disconnection

It shall be possible to de-energize electrical apparatus from an appropriate location, e.g. the units central control room, if its continued energization would lead to hazards (e.g. spreading of fire). Electrical apparatus which shall continue to operate to prevent additional danger shall not be included in the emergency switch-off circuit.

For special requirements to shutdown of equipment in hazardous areas due to emergency situations such as gas leakage, reference is made to IEC 61892-7.

4.8 Electrical apparatus for explosive gas atmospheres

Electrical apparatus and cables shall, to the extent possible, be located in a non-hazardous area. Where it is not possible to do this it shall be located in the least hazardous area.

When an apparatus is required to be suitable for use in explosive gas atmospheres, it shall comply with the requirements of IEC 61892-7. Such equipment shall be constructed and tested in accordance with the requirements of the IEC 60079 series as required in IEC 61892-7 and be certified as fit for purpose for the actual ambient temperature and other environmental conditions, to the satisfaction of the appropriate authority.

NOTE In most countries, it is required that certification is done by an independent testing authority.

~~4.9 Precautions against galvanic corrosion~~

~~Suitable means shall be taken to prevent galvanic corrosion when securing dissimilar metals, for example aluminium to the structure or hull of a unit.~~

4.9 Clearance and creepage distances

The distances between live parts of different potential and between live parts and the cases of other earthed metal, whether across surfaces or in air, shall be adequate for the working voltage, having regard to the nature of the insulating material and the conditions of service.

NOTE Information regarding clearance and creepage distances are given in the specific equipment standards, referred to in IEC 61892-3.

4.10 Insulation

Insulating materials and insulated windings shall be resistant to moisture, sea air and oil vapour, unless special precautions are taken to protect insulants against such agents.

~~NOTE~~ As a consequence of this clause, insulating materials in important applications, such as busbar supports, etc., should have sufficient resistance against tracking. It is recommended that the comparative tracking index of such materials be not less than 175 ~~V~~ when determined according to IEC 60112.

4.11 Maintenance and inspection

Equipment shall be so designed and installed as to permit its being maintained and inspected as required for all its parts.

~~NOTE Equipment should, to the extent possible be designed to allow for thermographic inspection. Where this is not possible, consideration should be given to installation of equipment for temperature monitoring.~~

The design and construction of the equipment shall minimize the exposure of workers to arc-flash hazards, electric shock and explosions, during operation, inspection and maintenance activities.

It may be preferable to design the equipment to allow for thermographic inspection. This normally requires a number of portholes to be made in the switchboard in order to get access to the relevant connection parts. The type test of the switchboard will then normally have to be performed with the portholes. The necessary arrangement in order to allow for thermographic inspection is subject to discussion between the designer/owner and the switchboard manufacturer.

4.12 Cable entries

Cable glands or bushings, or fittings for screwed conduits, shall be suitable for the intended cables and shall facilitate the cable entrance into the equipment. All entries shall maintain the degree of protection provided by the enclosure of the associated equipment.

~~NOTE~~ For explosion protected equipment, it should be noted that gas or vapour leakage and propagation of flames may occur through the interstices between the strands of standard stranded conductors, or between individual cores of a cable. Construction methods as compacted strands, sealing of the individual strands, and inner sheath can be employed as means of reducing leakage and preventing propagation of flames.

4.13 Precautions against vibration and mechanical shock

Equipment shall be unaffected by vibration and shock likely to arise under normal service. Connections shall be secured against becoming loose due to vibration.

NOTE For guidance regarding shock testing, see IEC 60068-2-27.

4.14 Location of electrical equipment in units

Major electrical equipment shall, wherever possible, be installed in rooms with a controlled atmosphere. Such equipment includes

- electrical switchgears and distribution boards/panels,
- motor starters and feeders including contactors and breakers,
- power transformers,
- battery chargers,
- frequency converters.

~~NOTE~~ Regarding installations in hazardous areas, reference is made to IEC 61892-7.

4.15 Mechanical protection

Electrical equipment shall be placed so that, as far as practicable, it is not exposed to risk of mechanical damage.

~~NOTE~~ Special attention to protection of electrical equipment against mechanical damage should be given in storage, loading and other exposed areas.

4.16 Protection from heat, water, steam and oil

Electrical equipment shall be so selected and located or protected from the effects of exposure to saliferous atmosphere, water, steam, oil or oil fumes, spray, ice formation, etc., that the effects are minimised. It should be located well clear of boilers, steam, oil or water pipes, and engine exhaust pipes and manifolds, unless specifically designed for such locations. If pipes must be run adjacent to electrical equipment, there shall be no joints in the immediate vicinity of the electrical equipment.

For specific requirements to installation of electrical equipment, see IEC 61892-6.

~~NOTE~~ Where sprinkler heads or water spraying devices or water mist are fitted for fire-fighting, due consideration should be given to the siting of electrical equipment which would be seriously affected by the inadvertent operation of the extinguishing arrangement. This is particularly applicable to switchgear and switch rooms, where a suitable alternative method of extinguishing should be used.

4.17 Protection against electrical shock

All electrical equipment shall be provided with an enclosure complying with a degree of protection of at least IP2X or shall be provided with at least provisions for basic protection in accordance with IEC 61140.

~~NOTE 1~~ Where an item of equipment or enclosure contains live parts that are not capable of being isolated by a single device, a warning notice should be placed in such a position that any person gaining access to live parts will be warned of the need to use appropriate isolating devices, unless an interlocking arrangement is provided so that all the circuits are isolated.

NOTE ~~2~~ For information regarding IP codes, see Annex A.

4.18 Enclosures

Enclosures shall comply with the degrees of protection as required in Table ~~7~~ 9 of IEC 61892-2:2012. Enclosing cases for electrical equipment shall be of adequate mechanical strength and rigidity and mounted so that their enclosing arrangements and the functioning of the built-in equipment will not be affected by distortions, vibrations and movements of the unit's construction, or by risk of damage.

~~NOTE~~ For additional requirements to mobile units, see IEC 61892-5.

4.19 Environmental impact

The design, construction and maintenance shall, wherever possible, consider:

- the impact on the environment;
- the efficient use of generated power;
- ~~the actual environmental values, e.g. temperature variations, over the year and operational area;~~
- the use of high efficient motors and ~~high frequency drives~~ VSD to optimize power consumption, e.g. motors;
- the use of low-loss transformers, generators and other high power equipment;
- the re-use of waste energy in HVAC installations;
- the use of ~~low energy luminaires and efficient switching arrangements~~ high efficient with long life lamps lighting fixtures.

~~NOTE 1~~ Consideration should be given to establishing an energy management system.

~~NOTE 2~~ Energy optimization by use of ~~i.e.~~ brake energy or waste heat recovery should be evaluated.

Annex A
(informative)

Degree of protection

A.1 Definitions of numerals in the IP code

Tables A.1 and A.2 give information regarding the IP code, as found in IEC 60529.

Table A.1 – Degrees of protection against foreign objects indicated by the first characteristic numeral

First characteristic numeral	Degree of protection	
	Short description	Definition
0	Non-protected	–
1	Protected against solid objects of 50 mm Ø and greater	The object probe, sphere of 50 mm Ø, shall not fully penetrate [a]
2	Protected against solid foreign objects of 12,5 mm Ø and greater	The object probe, sphere of 12,5 mm Ø, shall not fully penetrate [a]
3	Protected against solid objects of 2,5 mm Ø and greater	The object probe, sphere of 2,5 mm Ø, shall not penetrate at all [a]
4	Protected against solid objects of 1 mm Ø and greater	The object probe, sphere of 1,0 mm Ø, shall not penetrate at all [a]
5	Dust-protected	Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus to impair safety
6	Dust-tight	No ingress of dust

Second characteristic numeral 6 will also include protection against heavy seas.

NOTE 1 For information about degrees of protection against access to hazardous parts indicated by an additional letter and/or a supplementary letter, see IEC 60529.

NOTE 2 IEC 60034-5 provides information about degrees of protection for rotating electrical machines.

[a] The full diameter of the object probe shall not pass through an opening of the enclosure.

Table A.2 – Degrees of protection against water indicated by the second characteristic numeral

Second characteristic numeral	Degree of protection	
	Short description	Definition
0	Non-protected	–
1	Protected against vertically falling water drops	Vertically falling drops shall have no harmful effects
2	Protected against vertically falling water drops when enclosure tilted up to 15°	Vertically falling drops shall have no harmful effects when the enclosure is tilted at any angle up to 15° on either side of the vertical
3	Protected against spraying water	Water sprayed at an angle up to 60° on either side of the vertical shall have no harmful effects
4	Protected against splashing water	Water splashed against the enclosure from any direction shall have no harmful effects
5	Protected against water jets	Water projected in jets against the enclosure from any direction shall have no harmful effects
6	Protected against powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects
7	Protected against the effects of temporary immersion in water	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time
8	Protected against the effects of continuous immersion in water	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for numeral 7
9	Protected against high pressure and temperature water jets	Water projected at high pressure and high temperature against the enclosure from any direction shall not have harmful effects

~~Notes common to Tables 1 and 2:~~

~~NOTE 3~~ Second characteristic numeral 6 will also include protection against heavy seas.

NOTE 1 IEC 60529 provides information about degrees of protection against access to hazardous parts indicated by an additional letter and/or a supplementary letter.

NOTE 2 For information about degrees of protection for rotating electrical machines, see IEC 60034-5.

Annex B
(informative)

Cold climate precautions

Due to the harsh climate conditions experienced in arctic areas, the environmental conditions given in 4.4 may not be relevant for units operating in arctic areas, where the minimum temperature may go down to −60 °C.

For units required to operate in arctic areas the following needs to be considered:

- the suitability of materials for cold climate. Plastic materials may not be suitable if they become brittle at the actual temperature;
- an increased use of heat tracing;
- anti-condensation heaters to be used in enclosures located in outdoor areas;
- the motors should have bearings and lubrication systems suitable for the expected low temperature. It should be noted that according to IEC 60034-1, the design ambient air temperature is not less than −15 °C for any machine and not less than 0 °C for specific machines, see 6.4 of IEC 60034-1:2010;
- an emergency light with integral battery may not be suitable due to reduced battery capacity at low temperature;
- fluorescent lighting may not be suitable as they may not start up in low temperature. Also the light output may decrease at lower temperature;
- the cable insulation and jacket material shall be suitable for these low temperatures;
- Ex ~~d~~ equipment is normally certified for a minimum temperature of −20 °C. At lower temperature, the internal explosion pressure may be higher, which means that the Ex ~~d~~ equipment needs to be certified for the actual, lower temperature;
- when necessary, cable trays are to be designed for the expected ice and snow load;
- the capacity of emergency power sources needs to be specially evaluated.

Annex C
(informative)

Specification of surface treatment and protective painting system

C.1 Objectives

This annex establishes criteria for specification of surface treatment and protective painting system to be applied on electrical equipment for use in offshore environment.

C.2 General and specification

C.2.1 General

The surface treatment and the protective painting system play a fundamental role in the integrity and maintenance aspects of electrical equipment in an offshore environment, especially for “Ex” equipment.

Considerations should be made depending of the fabrication process and material of the electrical equipment, to adequately specify the required protective painting system or surface treatment.

The classification of environment of installation or use of the electrical equipment, taking into account the specification of the protective painting system, should be made according to the requirements set forth in ISO 9223.

The types of surface and surface preparation for the protective paint system should be considered and applied in accordance to the requirements set forth in ISO 12944-4.

The protective painting system should be specified according to the requirements set forth in ISO 12944-5, taking into account the atmospheric corrosivity category and the required durability performance.

The protective painting system performance should be evaluated by laboratory performance test methods, in accordance with the requirements set forth in ISO 12944-6.

For explosion protected equipment, the protective painting system should be also in accordance with the requirements set forth in IEC 60079-0, regarding to limitation of thickness of non-metallic layer. This limitation is intended to permit dissipation of electrostatic charge through the insulation to earth. By this means the static charge is not able to build up to incendive levels.

C.2.2 Atmospheric corrosivity categories for protective painting systems

For the purposes of the protective painting system, atmospheric environments are classified into the following six atmospheric-corrosivity categories according to ISO 9223:

– **C1**: very low corrosivity;
– **C2**: low corrosivity;
– **C3**: medium corrosivity;
– **C4**: high corrosivity;
– **C5**: very high corrosivity (industrial environments);
– **CX**: extreme (marine environments).

Table C.1 shows the classification of atmospheric environments according to ISO 9223 as well as typical examples of outdoor and indoor atmospheres.

Table C.1 – Description of typical atmospheric environments related to the estimation of corrosivity categories

Corrosivity category	Environment corrosivity	Indoor atmospheres	Outdoor atmospheres
C1	Very low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices	Dry or cold zone, atmospheric environment with very low pollution and time of wetness
C2	Low	Unheated spaces with varying temperature and relative humidity. Low frequency of condensation and low pollution, e.g. storage	Temperate zone, atmospheric environment with low pollution, e.g. rural areas
C3	Medium	Spaces with moderate frequency of condensation and moderate pollution from production process, e.g. food processing plants, laundries	Temperate zone, atmospheric environment with medium pollution, e.g. urban areas, coastal areas with low deposition of chlorides
C4	High	Spaces with high frequency of condensation and high pollution from production process, e.g. industrial processing plants	Temperate zone, atmospheric environment with high pollution, e.g. polluted urban areas, industrial areas, coastal areas without spray of salt water or, exposure to strong effect of de-icing salt
C5 (industrial)	Very high	Spaces with very high frequency of condensation and/or with high pollution from production process, e.g. mines	Temperate and subtropical zone, atmospheric environment with very high pollution and/or significant effect of chlorides, e.g. industrial areas, coastal areas, sheltered positions on coastline
CX (marine / offshore)	Extreme	Spaces with almost permanent condensation or extensive periods of exposure to extreme humidity effects and/or with high pollution from production process	Subtropical and tropical zone, atmospheric environment with very high SO_2 pollution and production factors and/or strong effect of chlorides e.g. coastal and offshore areas, occasional contact with salt spray.

C.2.3 Durability performance of a protective painting system

The level of coating failure before the first major maintenance painting shall be specified in accordance with ISO 4628-1 to ISO 4628-5, unless otherwise agreed between the interested parties.

According to ISO 12944-1, the durability range does not represent a guarantee time span. Instead it is a technical consideration that can help the owner to set up a maintenance program. Painting system maintenance is often required at more frequent intervals because of fading, chalking, combination or wear and tear or for other reasons.

The evaluation of degradation of the applied protective coatings, such as blistering, rusting, cracking, and flaking shall be assessed according to the requirements set forth in ISO 4628-1 to ISO 4628-5. It has to be assumed, in accordance with tables shown in Annex A of ISO 12944-5:2007, that the first major maintenance painting would be carried out for reasons of corrosion protection once the coating has reached a degree of rusting and rusted area “Ri3” (1 % of rusted area), according to the requirement set forth in ISO 4628-3. Based on this precondition, durability of protective painting system is expressed in ISO 12944-1 in terms of the following three ranges:

– low (L): durability between 2 to 5 years;
– medium (M): durability between 5 to 15 years;
– high (H): durability more than 15 years.

General purpose “Ex” equipment should be specified, as standard, with a painting system that corresponds to corrosion category C3M specified by ISO 12944-1. Surface treatment, for general purpose applications, normally should correspond to medium (M) durability.

Other corrosion categories, e.g. C4M, C5-M and C5-I, should be specified for more aggressive environments, such as polluted, industrial onshore or offshore application installation.

The required corrosive category shall be selected by the user taking into account, for each particular application, the environment characteristics on the site installation, as well all aggressive external influences present. The required durability performance of the “Ex” equipment protective painting system shall be selected taking into consideration reliability, maintenance costs and repair availability approaches.

The maintenance requirements of a IIC non- metallic layer requires frequent and special attention when installed in Atmospheric Corrosive Category CX Extreme (Marine environment).

Annex D
(informative)

DC distribution systems

D.1 DC distribution systems

A typical configuration of DC distribution systems are shown in Figure D.1

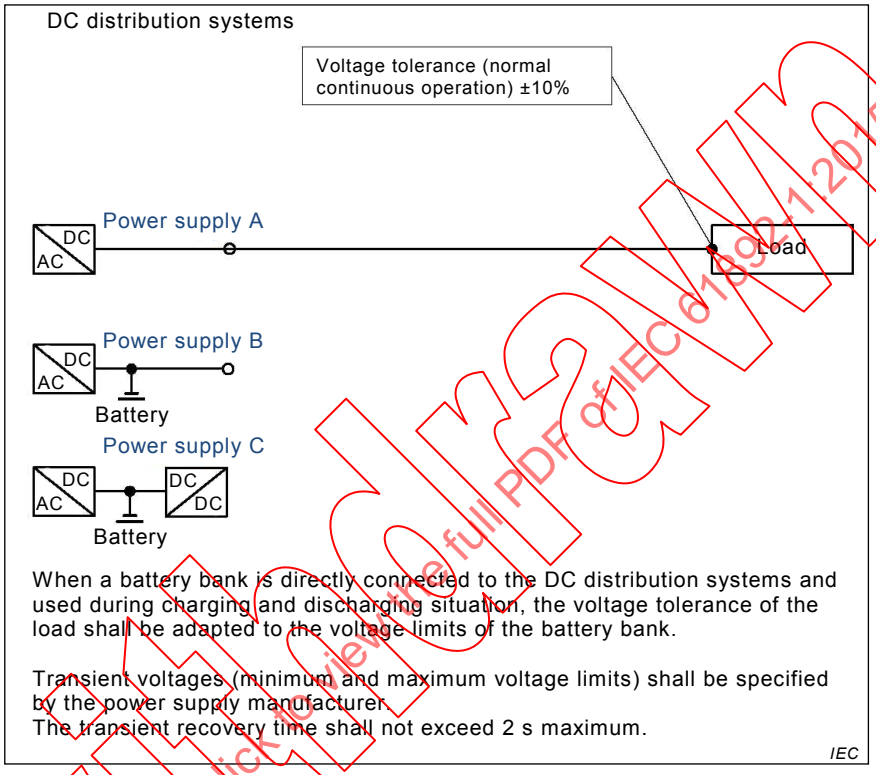

Figure D.1 – Typical configuration of DC distribution system

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

IEC 60364-7-710, *Electrical installations of buildings – Part 7-710: Requirements for special installations or locations – Medical locations*

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 60721-3-6, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Ship environment*

IEC 61892-3, *Mobile and fixed offshore units – Electrical installations – Part 3: Equipment*

~~IEC 61892-5, *Mobile and fixed offshore units – Electrical installations – Part 5: Mobile units*~~

~~IEC 61892-6:2007, *Mobile and fixed offshore units – Electrical installations – Part 6: Installation*~~

ISO 4628-1, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 1: General introduction and designation system*

ISO 4628-2, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 2: Assessment of degree of blistering*

ISO 4628-3, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting*

ISO 4628-4, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 4: Assessment of degree of cracking*

ISO 4628-5, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 5: Assessment of degree of flaking*

ISO 9223, *Corrosivity of metals and alloys – Corrosivity of atmospheres – Classification, determination and estimation*

ISO 12944-1, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 1: General introduction*

ISO 12944-4, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 4: Types of surface and surface preparation*

ISO 12944-5:2007, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 5: Protective paint systems*

ISO 12944-6, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 6: Laboratory performance test methods and associated assessment criteria*

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INTERNATIONAL STANDARD

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Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions

Unités mobiles et fixes en mer – Installations électriques – Partie 1: Exigences générales et conditions

IEC 61892-1:2015-07(en-fr)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 1: General requirements and conditions

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61892-1 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This third edition cancels and replaces the second edition published in 2010. This edition constitutes a technical revision.

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

a) The general requirement to harmonic distortion has been changed from IEC 61000-2-4 Class 2 to Class 1.
b) The voltage tolerance for a DC system has been changed from ±10 % to +10 %, −15 %.
c) Annex C (informative) regarding specification of surface treatment and protective painting system has been added.

The text of this standard based on the following documents:

CDV	Report on voting
18/1385/CDV	18/1449/RVC

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 parts of the IEC 61892 series can be found, under the general title *Mobile and fixed offshore units – Electrical installations*, 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 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 document using a colour printer.

INTRODUCTION

The IEC 61892 series of International Standards is intended to enable safety in the design, selection, installation, maintenance and use of electrical equipment for the generation, storage, distribution and utilization of electrical energy for all purposes in offshore units which are used for the purpose of exploration or exploitation of petroleum resources.

This part of the IEC 61892 incorporates and co-ordinates, as far as possible, existing rules and forms a code of interpretation, where applicable, of the requirements of the International Maritime Organization, a guide for future regulations which may be prepared and a statement of practice for offshore unit owners, constructors and appropriate organizations.

This standard is based on equipment and practices which are in current use, but it is not intended in any way to impede development of new or improved techniques.

The ultimate aim has been to produce a set of International Standards exclusively for the offshore petroleum industry.

MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 1: General requirements and conditions

1 Scope

This part of IEC 61892 contains provisions for electrical installations in mobile and fixed offshore units including pipeline, pumping or 'pigging' stations, compressor stations and exposed location single buoy moorings, used in the offshore petroleum industry for drilling, processing and storage purposes.

This International Standard applies to all installations, whether permanent, temporary, transportable or hand-held, to AC installations up to and including 35 000 V and DC installations up to and including 1 500 V (AC and DC voltages are nominal values).

This standard does not apply either to fixed equipment for medical purposes or to the electrical installations of tankers.

NOTE For medical rooms, IEC 60364-7-710 provides more information.

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 60034-1:2010, *Rotating electrical machines – Part 1: Rating and performance*

IEC 60079 (all parts), *Explosive atmospheres*

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

IEC 61000-2-4:2002, *Electromagnetic compatibility (EMC) – Part 2-4: Environment – Compatibility levels in industrial plants for low-frequency conducted disturbances*

IEC 61140, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61892-2:2012, *Mobile and fixed offshore units – Electrical installations – Part 2: System design*

IEC 61892-5, *Mobile and fixed offshore units – Electrical installations – Part 5: Mobile units*

IEC 61892-6, *Mobile and fixed offshore units – Electrical installations – Part 6: Installation*

IEC 61892-7, *Mobile and fixed offshore units – Electrical installations – Part 7: Hazardous areas*

International Convention for the Safety of Life at Sea (SOLAS):1974, Consolidated edition 2009

IMO MODU Code, *Code for the construction and equipment of mobile offshore drilling units*

3 Terms and definitions

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

NOTE The terms and definitions included in this part are those having general application in the IEC 61892 series. Terms and definitions applying to particular apparatus or equipment are included in the other parts of IEC 61892.

3.1
appropriate authority
governmental body and/or classification society with whose rules a unit is required to comply

3.2
equipment
single apparatus or set of devices or apparatuses, or the set of main devices of an installation, or all devices necessary to perform a specific task

EXAMPLE Power transformer, measuring equipment.

[SOURCE IEC 60050-151:2001, 151-11-25, modified — The words "the equipment of a substation" has been removed from the example.]

3.3
apparatus
device or assembly of devices which can be used as an independent unit for specific functions

[SOURCE IEC 60050-151:2001, 151-11-22, modified — The note has been deleted.]

3.4
rooms with a controlled atmosphere
rooms where the temperature and humidity can be controlled within specified limits

3.5
degree of protection of enclosure
IP
numerical classification according to IEC 60529 preceded by the symbol IP applied to the enclosure of electrical apparatus to provide:

– protection of persons against contact with, or approach to, live parts and against contact with moving parts (other than smooth rotating shafts and the like) inside the enclosure,

– protection of the electrical apparatus against ingress of solid foreign objects, and

– where indicated by the classification, protection of the electrical apparatus against harmful ingress of water

Note 1 to entry: Explanation of the numerals used for classification of degree of protection is given in Tables A.1 and A.2.

[SOURCE IEC 60050-426:2008, 426-04-02, modified — Note 1 to entry has been added.]

3.6
distribution board
assembly containing different types of switchgear and controlgear associated with one or more outgoing electric circuits fed from one or more incoming electric circuits, together with terminals for the neutral and protective conductors, if required

[SOURCE IEC 60050-826:2004, 826-16-08, modified — The words “if required” have been added.]

3.7
earth
ground, US, CA
general mass of the metal structure or hull of the unit

3.8
earthed
connected to the general mass of the metal structure or hull of the unit in such a manner as will ensure at all times an immediate discharge of electrical energy without danger

3.9
essential services
services essential for the navigation, steering or manoeuvring of the mobile unit, or for the safety of human life, or for special characteristics of the unit (for example special services)

3.10
frequency

3.10.1
cyclic frequency variation
periodic deviation in frequency during normal operation such as might be caused by regularly repeated loading

$$\frac{\pm(f_{max} - f_{min}) \times 100}{2\, f_{nominal}} \%$$

3.10.2
frequency tolerance
maximum departure from nominal frequency during normal operation conditions excluding transient and cyclic frequency variations

Note 1 to entry: Frequency tolerance is a steady state tolerance and includes variations caused by loads and governor characteristics. It also includes variations due to environmental conditions.

3.10.3
frequency transient
sudden change in frequency which goes outside the frequency tolerance limits and returns to and remains inside these limits within a specified recovery time after initiation of the disturbance (time range: seconds)

3.11
live part
conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor

Note 1 to entry: This concept does not necessarily imply a risk of electric shock.

[SOURCE IEC 60050-195:1998, 195-02-19]

3.12
PEN conductor
conductor combining the functions of both a protective earthing conductor and a neutral conductor

[SOURCE IEC 60050-195:1998, 195-02-12]

3.13
PEM conductor
conductor combining the functions of both a protective earthing conductor and a mid-point conductor

[SOURCE IEC 60050-195:1998, 195-02-13]

3.14
PEL conductor
conductor combining the functions of both a protective earthing conductor and a line conductor

[SOURCE IEC 60050-195:1998, 195-02-14]

3.15
petroleum
complex mixture of hydrocarbons that occurs in the earth in liquid or gaseous forms

3.16
point <wiring>
any termination of the fixed wiring intended for the attachment of a luminaire or for connecting to the supply of a current-using appliance

3.17
voltages

3.17.1
voltage tolerance
maximum departure from nominal user voltage during normal operating conditions, excluding transient and cyclic voltage variations

Note 1 to entry: Voltage tolerance is a steady-state tolerance and includes voltage drop in cables and voltage regulator characteristics. It also includes variations due to environmental conditions.

3.17.2
voltage unbalance tolerance
difference between the highest and lowest phase to phase voltage

3.17.3
cyclic voltage variation
periodic voltage deviation (max. to min. r.m.s. values) of the nominal voltage, such as might be caused by regularly repeated loading

$$\frac{\pm(U_{max} - U_{min}) \times 100}{2U_{nominal}} \%$$

3.17.4
voltage transient
sudden change in voltage (excluding spikes) which goes outside the nominal voltage tolerance limits and returns to and remains inside these limits within a specified recovery time after the initiation of the disturbance (time range: seconds)

3.18
recovery time

3.18.1
voltage transient recovery time
time elapsed from exceeding the normal voltage tolerance until the voltage recovers and remains within the normal tolerance limits

3.18.2
frequency transient recovery time
time elapsed from exceeding the normal frequency tolerance until the frequency recovers and remains within the frequency tolerance limits

3.19
waveform

3.19.1
total harmonic distortion
THD
ratio of the r.m.s. value of the sum of all the harmonic components up to a specified order (recommended notation "H") to the r.m.s. value of the fundamental component

$$\mathrm{THD} = \sqrt{\sum_{h=2}^{h=H} \frac{(Q_h)^2}{(Q_1)^2}}$$

where

Q represents either current or voltage;

Q_1 is the r.m.s. value of the fundamental component;

h is the harmonic order;

Q_h is the r.m.s. value of the harmonic component of order h;

H is 50 for the purpose of the compatibility levels in this standard

Note 1 to entry: THD takes account of harmonics only. For the case where interharmonics are to be included, reference is made to A.3.1 of IEC 61000-2-4:2002.

Note 2 to entry: This note applies to the French language only.

[SOURCE IEC 61000-2-4:2002, 3.2.7, modified — Note 1 to entry is modified.]

3.19.2
single harmonic content
ratio of the effective r.m.s. value of the harmonic to the r.m.s. value of the fundamental expressed in per cent

4 General requirements and conditions

4.1 General

This clause contains conditions and requirements which are common to all equipment and installations in the IEC 61892 series.

Electrical installations in units shall be such that:

– essential services will be maintained under various emergency conditions;
– the safety of crew, contractors, visitors and unit will be ensured;
– the requirements with respect to safety in this standard are considered;
– the requirements of the International Convention for the Safety of Life at Sea (SOLAS) are met as far as applicable;
– the requirements of the IMO MODU Code are met as far as applicable.

For floating and mobile units, all machinery and equipment shall operate satisfactorily under the static and dynamic inclination limits according to IEC 61892-5.

The appropriate authority may have additional requirements which have to be complied with.

NOTE Emergency conditions are normally defined in the safety assessment of the installation.

4.2 Acceptance of substitutes or alternatives

Where in the IEC 61892 series any special type of equipment, construction, or arrangement is specified, the use of any other equipment, construction or arrangement is admissible, provided it is not less effective and reliable.

4.3 Additions and alterations

An addition or alteration, temporary or permanent, shall not be made to an existing installation until it has been ascertained that the ratings and the condition of existing accessories, conductors, switchgear, etc. affected, are adequate for the new situation.

Special attention is drawn to those factors affecting the existing system design such as current-carrying capacity, short-circuit level, voltage drop, harmonics, stability and proper discrimination of the protective devices.

4.4 Environmental conditions

4.4.1 General

Electrical equipment shall operate satisfactorily under various environmental conditions.

Environmental conditions are characterised by a number of variables:

– one set including mainly climatic conditions, biological conditions, conditions dependent upon chemically and mechanically active substances and mechanical conditions;

– another set dependent mainly upon locations in unit, operational patterns and transient conditions.

NOTE For further information regarding environmental conditions in conjunction with some selected locations, operational patterns and transient conditions which are considered to be generally representative, see IEC 60721-3-6.

4.4.2 Design parameters

4.4.2.1 General

Design parameters based on environmental conditions applicable to certain types of equipment may be determined according to location. Where no data is available, Table 1 and Table 2 give recommended values.

In certain areas, e.g. arctic areas, lower temperatures than those given in the tables have to be taken into consideration. In certain areas, also a higher temperature than given in the tables has to be taken into consideration.

4.4.2.2 Temperature

For a specific project, the project documentation may give specific information regarding ambient temperature. In absence of such information, the following may be used:

In other parts of the IEC 61892 series, where no "high air temperature" has been specified as a design parameter for equipment, a value of 45 °C shall apply.

Where equipment is designed to operate with temperatures higher or lower than those stated in Table 1, permissible temperature rises may be reduced or increased accordingly.

Table 1 – Operational design parameters – Ambient temperature

Type of equipment	Value °C
High air temperature	
Cables	45
Generators and motors	50
Switchgear	45
Transformers	45
Control and instrumentation	55
Other electrical equipment	45
Low air temperature	
Control and instrumentation	5 (general)
Control and instrumentation	−25 (open deck)
High water temperature	
Generators and motors	35
NOTE The lower design temperature will normally be specified in the product standard.	

For batteries, see IEC 61892-6.

Sea water temperature is max 32 °C.

4.4.2.3 Relative humidity

Design values for relative humidity are given in Table 2.

Table 2 – Design parameters – Relative humidity

Value	
%	°C
95	Up to 45
70	Above 45

4.5 Materials

In general, all electrical equipment shall be constructed of durable, flame-retardant, moisture-resistant materials, which are not subject to deterioration in the atmosphere and at the temperatures to which they are likely to be exposed.

Equipment enclosures located outdoor, in naturally ventilated and wash down areas shall be made of proven seawater resistant materials.

NOTE 1 Examples of such material are seawater resistant aluminium, stainless steel or UV resistant plastic material.

Suitable means shall be taken to prevent galvanic corrosion when securing dissimilar metals, for example aluminium to the steel structure or hull of a unit.

NOTE 2 For further information regarding environmental conditions; refer to IEC 60721-3-6.

4.6 Power supply system characteristics

4.6.1 General

Unless otherwise stated in other parts of this standard, the equipment shall function when supplied from general distribution systems with due regard to voltage and frequency variations, harmonic distortion and conducted disturbances. The characteristics of general distribution systems are given in the following subclauses.

Where the power supply is obtained from the shore, due regard should be paid to the effect that the quality of the supply, if different from that specified in this clause, may have on the performance of equipment.

For systems where semiconductors are connected having a total rating which is a significant portion of the total system rating, it may be feasible to suppress the harmonics. Consideration should be given to taking appropriate measures to attenuate these effects of the distribution system so that safe operation is assured. Care should be taken in selecting consumers supplied from an electric power supply system with a higher harmonic content than specified in this clause.

Electrical equipment which requires a higher quality power supply may need additional provisions to be made locally. Where additional equipment is fitted to achieve this higher quality power supply, it may be required to be duplicated and segregated to the same degree as the electrical equipment it supplies.

Special attention should be paid to the installation of electrical equipment which may influence the quality of power supply on a local basis or react with any harmonics present on the general distribution system.

Variable frequency/voltage systems may be admissible provided safe operation of the system is assured and equipment is suitably rated for the expected variations.

4.6.2 AC distribution systems

4.6.2.1 General

The voltages referred to in 4.6.2.2 are measured at the point where the equipment is installed.

Electric motors are normally designed for a combination of voltage and frequency variations which is less than the combined limits given in this clause. For combined voltage and frequency variations for electric motors, reference is made to IEC 60034-1.

4.6.2.2 Voltage characteristics

Requirements to voltage characteristics are given in Table 3. Tolerances are expressed in a percentage of the nominal voltage.

Table 3 – Voltage characteristics

Voltage characteristics	Value
Voltage tolerance (continuous)	$^{+6}_{-10}$ %
Voltage unbalance tolerance including phase voltage unbalance as a result of unbalance of load according to IEC 61892-2	7 %
Cyclic voltage variation (continuous).	2 %
Voltage transients: • slow transients e.g. due to load variations tolerance (deviation from nominal voltage) • voltage transients recovery time	 $^{+20}_{-20}$ % maximum 1,5 s
Voltages are root mean square (r.m.s.) unless otherwise stated.	

Where three-phase AC motors conforming to the IEC 60034 series are connected, then the system negative sequence component shall not exceed 1 % of the positive sequence component over a long period, or 1,5 % for a short period not exceeding a few minutes, and a zero sequence component not exceeding 1 % of the positive sequence component.

The transient voltage at the point where equipment is installed can be up to −20 %. The correct operating condition for a contactor is based upon a value of the control supply voltage not less than 85 % of its rated value. The contactor shall not drop at a voltage above 75 % of the rated control supply voltage.

The sum of voltage excursions at any point on the system (tolerances and transients) from nominal voltage should not exceed $^{+20}_{-20}$ %.

4.6.2.3 Harmonic distortion (voltage waveform)

For voltage harmonic distortion, acceptance limits shall correspond to IEC 61000-2-4:2002, Class 1. In addition no single harmonic shall exceed 3 %.

Distorting equipment emission levels shall be such that the above limits shall not be exceeded in normal operating conditions.

For certain installations, where it is confirmed by design study that it is not possible to comply with the requirements of IEC 61000-2-4:2002, Class 1, higher values, as given in Class 2 may be accepted, provided the generation and distribution equipment and consumers are designed to operate at the higher limits.

IEC 61000-2-4:2002 (Table 2) Class 1 states that no single harmonic shall exceed 3 % and the THD shall not exceed 5 %

IEC 61000-2-4:2002 (Table 2) Class 2 states that no single harmonic shall exceed 6 % and the THD shall not exceed 8 %

4.6.2.4 Frequency characteristics

Requirements to frequency characteristics are given in Table 4. Tolerances are expressed in a percentage of the nominal frequency.

Table 4 –Frequency characteristics

Frequency characteristics	Value
Frequency tolerance (continuous)	$^{+5}_{-5}$ %
Cyclic frequency variation (continuous)	0,5 %
Frequency transient tolerance	$^{+10}_{-10}$ %
Frequency transients recovery time	maximum 5 s
The sum of frequency excursions at any point on the system (tolerances and transients) from nominal frequency should not exceed $^{+12,5}_{-12,5}$ %.	

The frequency tolerance is based on generators operating in "island mode". In case of operation in parallel with an external grid a more stringent value has to be applied. This value has to be agreed between the network owners.

A typical value when operating in parallel with an external network is ±2,5 %.

4.6.3 DC distribution systems

Tolerances for DC system are given in Table 5. Tolerances are expressed in a percentage of the nominal voltage, measured at the equipment terminal.

Table 5 –Tolerances for DC system

Voltage tolerance (continuous)	$^{+10}_{-15}$ %
Cyclic voltage variation	5 %
Voltage ripple (AC r.m.s. over steady DC voltage, battery in fully loaded condition)	2 %
Voltage ripple VRLA batteries	1 %

Depending of the different configuration of battery charger and batteries system, voltage over 10 % of nominal value could be present in the DC system during full or boost charging. In this case adequate measures should be taken to keep the voltage on the equipment terminal within the limits specified above.

Configuration with load directly connected to battery charger and battery system without any voltage stabilizer device shall be accepted only in absence of load sensible to voltage variation over 10 %.

The transient recovery time shall not exceed 2 s maximum.

Fast transients e.g. spikes caused by switching, peak impulse voltage amplitude shall not exceed the values given in Table 6.

Table 6 – Fast transients

System voltage	Peak impulse voltage amplitude
24 V DC systems	500 V
110 V DC systems	1 500 V
220 V DC systems	2 500 V
600 V DC system	4 000 V
1 000 V DC system	6 000 V
NOTE The figures are in accordance with IEC 60664-1. Values for DC systems with rated voltage above 1 000 V are not given in that standard	

4.7 Manual disconnection

It shall be possible to de-energize electrical apparatus from an appropriate location, e.g. the units central control room, if its continued energization would lead to hazards (e.g. spreading of fire). Electrical apparatus which shall continue to operate to prevent additional danger shall not be included in the emergency switch-off circuit.

For special requirements to shutdown of equipment in hazardous areas due to emergency situations such as gas leakage, reference is made to IEC 61892-7.

4.8 Electrical apparatus for explosive gas atmospheres

Electrical apparatus and cables shall, to the extent possible, be located in a non-hazardous area. Where it is not possible to do this it shall be located in the least hazardous area.

When an apparatus is required to be suitable for use in explosive gas atmospheres, it shall comply with the requirements of IEC 61892-7. Such equipment shall be constructed and tested in accordance with the requirements of the IEC 60079 series as required in IEC 61892-7 and be certified as fit for purpose for the actual ambient temperature and other environmental conditions, to the satisfaction of the appropriate authority.

NOTE In most countries, it is required that certification is done by an independent testing authority.

4.9 Clearance and creepage distances

The distances between live parts of different potential and between live parts and the cases of other earthed metal, whether across surfaces or in air, shall be adequate for the working voltage, having regard to the nature of the insulating material and the conditions of service.

NOTE Information regarding clearance and creepage distances are given in the specific equipment standards, referred to in IEC 61892-3.

4.10 Insulation

Insulating materials and insulated windings shall be resistant to moisture, sea air and oil vapour, unless special precautions are taken to protect insulants against such agents.

As a consequence of this clause, insulating materials in important applications, such as busbar supports, etc., should have sufficient resistance against tracking. It is recommended that the comparative tracking index of such materials be not less than 175 when determined according to IEC 60112.

4.11 Maintenance and inspection

Equipment shall be so designed and installed as to permit its being maintained and inspected as required for all its parts.

The design and construction of the equipment shall minimize the exposure of workers to arc-flash hazards, electric shock and explosions, during operation, inspection and maintenance activities.

It may be preferable to design the equipment to allow for thermographic inspection. This normally requires a number of portholes to be made in the switchboard in order to get access to the relevant connection parts. The type test of the switchboard will then normally have to be performed with the portholes. The necessary arrangement in order to allow for thermographic inspection is subject to discussion between the designer/owner and the switchboard manufacturer.

4.12 Cable entries

Cable glands or bushings, or fittings for screwed conduits, shall be suitable for the intended cables and shall facilitate the cable entrance into the equipment. All entries shall maintain the degree of protection provided by the enclosure of the associated equipment.

For explosion protected equipment, it should be noted that gas or vapour leakage and propagation of flames may occur through the interstices between the strands of standard stranded conductors, or between individual cores of a cable. Construction methods as compacted strands, sealing of the individual strands, and inner sheath can be employed as means of reducing leakage and preventing propagation of flames.

4.13 Precautions against vibration and mechanical shock

Equipment shall be unaffected by vibration and shock likely to arise under normal service. Connections shall be secured against becoming loose due to vibration.

NOTE For guidance regarding shock testing, see IEC 60068-2-27.

4.14 Location of electrical equipment in units

Major electrical equipment shall, wherever possible, be installed in rooms with a controlled atmosphere. Such equipment includes

- electrical switchgears and distribution boards/panels,
- motor starters and feeders including contactors and breakers,
- power transformers,
- battery chargers,
- frequency converters.

Regarding installations in hazardous areas, reference is made to IEC 61892-7.

4.15 Mechanical protection

Electrical equipment shall be placed so that, as far as practicable, it is not exposed to risk of mechanical damage.

Special attention to protection of electrical equipment against mechanical damage should be given in storage, loading and other exposed areas.

4.16 Protection from heat, water, steam and oil

Electrical equipment shall be so selected and located or protected from the effects of exposure to saliferous atmosphere, water, steam, oil or oil fumes, spray, ice formation, etc., that the effects are minimised. It should be located well clear of boilers, steam, oil or water pipes, and engine exhaust pipes and manifolds, unless specifically designed for such locations. If pipes must be run adjacent to electrical equipment, there shall be no joints in the immediate vicinity of the electrical equipment.

For specific requirements to installation of electrical equipment, see IEC 61892-6.

Where sprinkler heads or water spraying devices or water mist are fitted for fire-fighting, due consideration should be given to the siting of electrical equipment which would be seriously affected by the inadvertent operation of the extinguishing arrangement. This is particularly applicable to switchgear and switch rooms, where a suitable alternative method of extinguishing should be used.

4.17 Protection against electrical shock

All electrical equipment shall be provided with an enclosure complying with a degree of protection of at least IP2X or shall be provided with at least provisions for basic protection in accordance with IEC 61140.

Where an item of equipment or enclosure contains live parts that are not capable of being isolated by a single device, a warning notice should be placed in such a position that any person gaining access to live parts will be warned of the need to use appropriate isolating devices, unless an interlocking arrangement is provided so that all the circuits are isolated.

NOTE For information regarding IP codes, see Annex A.

4.18 Enclosures

Enclosures shall comply with the degrees of protection as required in Table 9 of IEC 61892-2:2012. Enclosing cases for electrical equipment shall be of adequate mechanical strength and rigidity and mounted so that their enclosing arrangements and the functioning of the built-in equipment will not be affected by distortions, vibrations and movements of the unit's construction, or by risk of damage.

For additional requirements to mobile units, see IEC 61892-5.

4.19 Environmental impact

The design, construction and maintenance shall, wherever possible, consider:

- the impact on the environment;
- the efficient use of generated power;
- the use of high efficient motors and VSD to optimize power consumption, e.g. motors;
- the use of low-loss transformers, generators and other high power equipment;
- the re-use of waste energy in HVAC installations;
- the use of high efficient with long life lamps lighting fixtures.

Consideration should be given to establishing an energy management system.

Energy optimization by use of brake energy or waste heat recovery should be evaluated.

Annex A
(informative)

Degree of protection

A.1 Definitions of numerals in the IP code

Tables A.1 and A.2 give information regarding the IP code, as found in IEC 60529.

Table A.1 – Degrees of protection against foreign objects indicated by the first characteristic numeral

First characteristic numeral	Degree of protection	
	Short description	Definition
0	Non-protected	–
1	Protected against solid objects of 50 mm Ø and greater	The object probe, sphere of 50 mm Ø, shall not fully penetrate [a]
2	Protected against solid foreign objects of 12,5 mm Ø and greater	The object probe, sphere of 12,5 mm Ø, shall not fully penetrate [a]
3	Protected against solid objects of 2,5 mm Ø and greater	The object probe, sphere of 2,5 mm Ø, shall not penetrate at all [a]
4	Protected against solid objects of 1 mm Ø and greater	The object probe, sphere of 1,0 mm Ø, shall not penetrate at all [a]
5	Dust-protected	Ingress of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the apparatus to impair safety
6	Dust-tight	No ingress of dust
Second characteristic numeral 6 will also include protection against heavy seas. NOTE 1 For information about degrees of protection against access to hazardous parts indicated by an additional letter and/or a supplementary letter, see IEC 60529. NOTE 2 IEC 60034-5 provides information about degrees of protection for rotating electrical machines.		
[a] The full diameter of the object probe shall not pass through an opening of the enclosure.		

Table A.2 – Degrees of protection against water indicated by the second characteristic numeral

Second characteristic numeral	Degree of protection	
	Short description	Definition
0	Non-protected	–
1	Protected against vertically falling water drops	Vertically falling drops shall have no harmful effects
2	Protected against vertically falling water drops when enclosure tilted up to 15°	Vertically falling drops shall have no harmful effects when the enclosure is tilted at any angle up to 15° on either side of the vertical
3	Protected against spraying water	Water sprayed at an angle up to 60° on either side of the vertical shall have no harmful effects
4	Protected against splashing water	Water splashed against the enclosure from any direction shall have no harmful effects
5	Protected against water jets	Water projected in jets against the enclosure from any direction shall have no harmful effects
6	Protected against powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects
7	Protected against the effects of temporary immersion in water	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water under standardized conditions of pressure and time
8	Protected against the effects of continuous immersion in water	Ingress of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for numeral 7
9	Protected against high pressure and temperature water jets	Water projected at high pressure and high temperature against the enclosure from any direction shall not have harmful effects
Second characteristic numeral 6 will also include protection against heavy seas. NOTE 1 IEC 60529 provides information about degrees of protection against access to hazardous parts indicated by an additional letter and/or a supplementary letter. NOTE 2 For information about degrees of protection for rotating electrical machines, see IEC 60034-5.		

Annex B
(informative)

Cold climate precautions

Due to the harsh climate conditions experienced in arctic areas, the environmental conditions given in 4.4 may not be relevant for units operating in arctic areas, where the minimum temperature may go down to −60 °C.

For units required to operate in arctic areas the following needs to be considered:

- the suitability of materials for cold climate. Plastic materials may not be suitable if they become brittle at the actual temperature;
- an increased use of heat tracing;
- anti-condensation heaters to be used in enclosures located in outdoor areas;
- the motors should have bearings and lubrication systems suitable for the expected low temperature. It should be noted that according to IEC 60034-1, the design ambient air temperature is not less than −15 °C for any machine and not less than 0 °C for specific machines, see 6.4 of IEC 60034-1:2010;
- an emergency light with integral battery may not be suitable due to reduced battery capacity at low temperature;
- fluorescent lighting may not be suitable as they may not start up in low temperature. Also the light output may decrease at lower temperature;
- the cable insulation and jacket material shall be suitable for these low temperatures;
- Ex equipment is normally certified for a minimum temperature of −20 °C. At lower temperature, the internal explosion pressure may be higher, which means that the Ex equipment needs to be certified for the actual, lower temperature;
- when necessary, cable trays are to be designed for the expected ice and snow load;
- the capacity of emergency power sources needs to be specially evaluated.

Annex C
(informative)

Specification of surface treatment and protective painting system

C.1 Objectives

This annex establishes criteria for specification of surface treatment and protective painting system to be applied on electrical equipment for use in offshore environment.

C.2 General and specification

C.2.1 General

The surface treatment and the protective painting system play a fundamental role in the integrity and maintenance aspects of electrical equipment in an offshore environment, especially for “Ex” equipment.

Considerations should be made depending of the fabrication process and material of the electrical equipment, to adequately specify the required protective painting system or surface treatment.

The classification of environment of installation or use of the electrical equipment, taking into account the specification of the protective painting system, should be made according to the requirements set forth in ISO 9223.

The types of surface and surface preparation for the protective paint system should be considered and applied in accordance to the requirements set forth in ISO 12944-4.

The protective painting system should be specified according to the requirements set forth in ISO 12944-5, taking into account the atmospheric corrosivity category and the required durability performance.

The protective painting system performance should be evaluated by laboratory performance test methods, in accordance with the requirements set forth in ISO 12944-6.

For explosion protected equipment, the protective painting system should be also in accordance with the requirements set forth in IEC 60079-0, regarding to limitation of thickness of non-metallic layer. This limitation is intended to permit dissipation of electrostatic charge through the insulation to earth. By this means the static charge is not able to build up to incendive levels.

C.2.2 Atmospheric corrosivity categories for protective painting systems

For the purposes of the protective painting system, atmospheric environments are classified into the following six atmospheric-corrosivity categories according to ISO 9223:

– **C1**: very low corrosivity;
– **C2**: low corrosivity;
– **C3**: medium corrosivity;
– **C4**: high corrosivity;
– **C5**: very high corrosivity (industrial environments);
– **CX**: extreme (marine environments).

Table C.1 shows the classification of atmospheric environments according to ISO 9223 as well as typical examples of outdoor and indoor atmospheres.

Table C.1 – Description of typical atmospheric environments related to the estimation of corrosivity categories

Corrosivity category	Environment corrosivity	Indoor atmospheres	Outdoor atmospheres
C1	Very low	Heated spaces with low relative humidity and insignificant pollution, e.g. offices	Dry or cold zone, atmospheric environment with very low pollution and time of wetness
C2	Low	Unheated spaces with varying temperature and relative humidity. Low frequency of condensation and low pollution, e.g. storage	Temperate zone, atmospheric environment with low pollution, e.g. rural areas
C3	Medium	Spaces with moderate frequency of condensation and moderate pollution from production process, e.g. food processing plants, laundries	Temperate zone, atmospheric environment with medium pollution, e.g. urban areas, coastal areas with low deposition of chlorides
C4	High	Spaces with high frequency of condensation and high pollution from production process, e.g. industrial processing plants	Temperate zone, atmospheric environment with high pollution, e.g. polluted urban areas, industrial areas, coastal areas without spray of salt water or, exposure to strong effect of de-icing salt
C5 (industrial)	Very high	Spaces with very high frequency of condensation and/or with high pollution from production process, e.g. mines	Temperate and subtropical zone, atmospheric environment with very high pollution and/or significant effect of chlorides, e.g. industrial areas, coastal areas, sheltered positions on coastline
CX (marine / offshore)	Extreme	Spaces with almost permanent condensation or extensive periods of exposure to extreme humidity effects and/or with high pollution from production process	Subtropical and tropical zone, atmospheric environment with very high SO_2 pollution and production factors and/or strong effect of chlorides e.g. coastal and offshore areas, occasional contact with salt spray.

C.2.3 Durability performance of a protective painting system

The level of coating failure before the first major maintenance painting shall be specified in accordance with ISO 4628-1 to ISO 4628-5, unless otherwise agreed between the interested parties.

According to ISO 12944-1, the durability range does not represent a guarantee time span. Instead it is a technical consideration that can help the owner to set up a maintenance program. Painting system maintenance is often required at more frequent intervals because of fading, chalking, combination or wear and tear or for other reasons.

The evaluation of degradation of the applied protective coatings, such as blistering, rusting, cracking, and flaking shall be assessed according to the requirements set forth in ISO 4628-1 to ISO 4628-5. It has to be assumed, in accordance with tables shown in Annex A of ISO 12944-5:2007, that the first major maintenance painting would be carried out for reasons of corrosion protection once the coating has reached a degree of rusting and rusted area “Ri3” (1 % of rusted area), according to the requirement set forth in ISO 4628-3. Based on this precondition, durability of protective painting system is expressed in ISO 12944-1 in terms of the following three ranges:

– low (L): durability between 2 to 5 years;
– medium (M): durability between 5 to 15 years;
– high (H): durability more than 15 years.

General purpose “Ex” equipment should be specified, as standard, with a painting system that corresponds to corrosion category C3M specified by ISO 12944-1. Surface treatment, for general purpose applications, normally should correspond to medium (M) durability.

Other corrosion categories, e.g. C4M, C5-M and C5-I, should be specified for more aggressive environments, such as polluted, industrial onshore or offshore application installation.

The required corrosive category shall be selected by the user taking into account, for each particular application, the environment characteristics on the site installation, as well all aggressive external influences present. The required durability performance of the “Ex” equipment protective painting system shall be selected taking into consideration reliability, maintenance costs and repair availability approaches.

The maintenance requirements of a IIC non- metallic layer requires frequent and special attention when installed in Atmospheric Corrosive Category CX Extreme (Marine environment).

Annex D
(informative)

DC distribution systems

D.1 DC distribution systems

A typical configuration of DC distribution systems are shown in Figure D.1

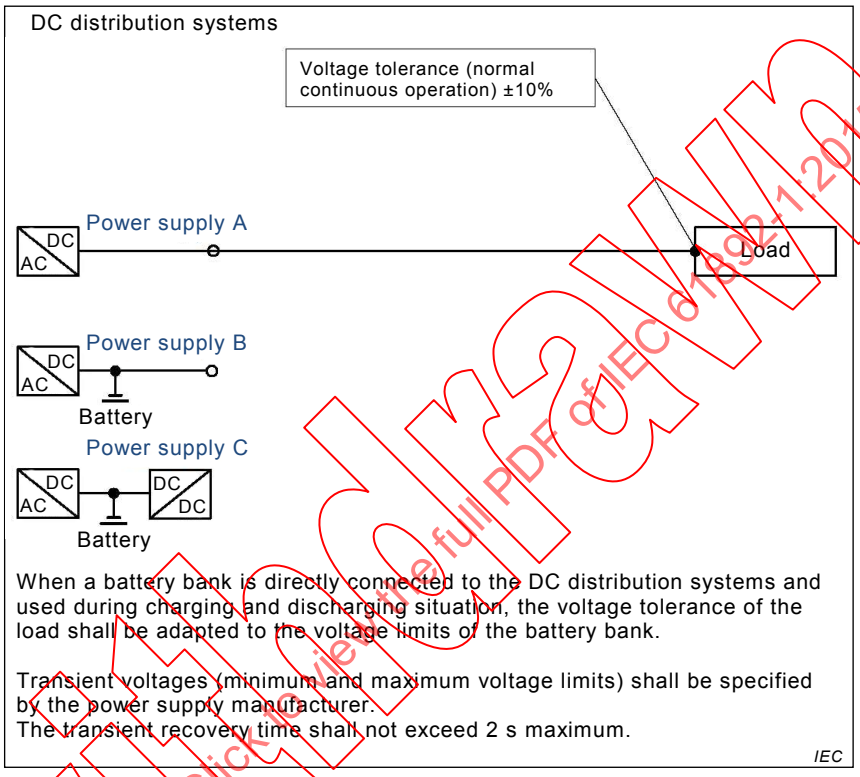

Figure D.1 – Typical configuration of DC distribution system

Bibliography

IEC 60050 (all parts), *International electrotechnical vocabulary* (available at <http://www.electropedia.org>)

IEC 60068-2-27, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

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

IEC 60364-7-710, *Electrical installations of buildings – Part 7-710: Requirements for special installations or locations – Medical locations*

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 60721-3-6, *Classification of environmental conditions – Part 3: Classification of groups of environmental parameters and their severities – Ship environment*

IEC 61892-3, *Mobile and fixed offshore units – Electrical installations – Part 3: Equipment*

ISO 4628-1, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 1: General introduction and designation system*

ISO 4628-2, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 2: Assessment of degree of blistering*

ISO 4628-3, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting*

ISO 4628-4, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 4: Assessment of degree of cracking*

ISO 4628-5, *Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 5: Assessment of degree of flaking*

ISO 9223, *Corrosivity of metals and alloys – Corrosivity of atmospheres – Classification, determination and estimation*

ISO 12944-1, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 1: General introduction*

ISO 12944-4, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 4: Types of surface and surface preparation*

ISO 12944-5:2007, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 5: Protective paint systems*

ISO 12944-6, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 6: Laboratory performance test methods and associated assessment criteria*

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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UNITÉS MOBILES ET FIXES EN MER – INSTALLATIONS ÉLECTRIQUES –

Partie 1: Exigences générales et conditions

AVANT-PROPOS

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Cette troisième édition annule et remplace la deuxième édition parue en 2010. Cette édition constitue une révision technique.

Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) L'exigence générale relative à la distorsion harmonique est passée de la Classe 2 à la Classe 1 (voir IEC 61000-2-4).
b) La tolérance de tension d'un système à courant continu est passée de ±10 % à +10 %, -15 %.

c) L'Annexe C (informative) concernant la spécification du traitement de surface et du système de peinture protectrice a été ajoutée.

Le texte de cette norme est issu des documents suivants:

CDV	Rapport de vote
18/1385/CDV	18/1449/RVC

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à l'approbation de cette norme.

Cette publication a été rédigée selon les Directives ISO/IEC, Partie 2.

Une liste de toutes les parties de la série IEC 61892, publiées sous le titre général *Unités mobiles et fixes en mer – Installations électriques,* peut être consultée sur le site web de l'IEC.

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INTRODUCTION

La série IEC 61892 de Normes internationales est conçue pour assurer la sécurité de la conception, de la sélection, de l'installation, de la maintenance et de l'utilisation des équipements électriques destinés à la production, au stockage, à la distribution et à l'utilisation de l'énergie électrique, et ce à toutes fins, dans les unités en mer employées pour l'exploration ou l'exploitation des ressources pétrolières.

La présente partie de l'IEC 61892 comprend et coordonne autant que faire se peut, les règles existantes et constitue un code d'interprétation, le cas échéant, des exigences de l'Organisation Maritime Internationale (OMI), un guide pour les règlements qui peuvent être préparés à l'avenir et un guide pratique pour les propriétaires et les constructeurs d'unités en mer, ainsi que pour les organismes concernés.

La présente norme s'appuie sur les équipements et les pratiques qui sont utilisés actuellement, mais elle n'a pas pour objet de freiner le développement de nouvelles techniques ou l'amélioration de techniques existantes.

Le but final est de produire un ensemble de Normes internationales destinées exclusivement à l'industrie pétrolière en mer.

UNITÉS MOBILES ET FIXES EN MER – INSTALLATIONS ÉLECTRIQUES –

Partie 1: Exigences générales et conditions

1 Domaine d'application

La présente partie de l'IEC 61892 contient des dispositions concernant les installations électriques des unités mobiles et fixes en mer, y compris les canalisations, les stations de pompage ou de raclage, les stations de compression et les systèmes d'amarrage à point unique en zone exposée, qui sont utilisées dans l'industrie pétrolière en mer (offshore) pour le forage, le traitement et le stockage.

La présente Norme internationale s'applique à toutes les installations, qu'elles soient permanentes ou provisoires, transportables ou portatives, aux installations en courant alternatif jusqu'à 35 000 V inclus et aux installations en courant continu jusqu'à 1 500 V inclus (les tensions alternatives et continues sont des valeurs nominales).

La présente norme ne s'applique pas aux équipements fixes destinés aux applications médicales ni aux installations électriques destinées aux navires pétroliers.

NOTE Pour les locaux médicaux, l'IEC 60364-7-710 fournit des informations supplémentaires.

2 Références normatives

Les documents suivants sont cités en référence de manière normative, en intégralité ou en partie, dans le présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60034 (toutes les parties), *Machines électriques tournantes*

IEC 60034-1:2010, *Machines électriques tournantes – Partie 1: Caractéristiques assignées et caractéristiques de fonctionnement*

IEC 60079 (toutes les parties), *Atmosphères explosives*

IEC 60529, *Degrés de protection procurés par les enveloppes (Code IP)*

IEC 61000-2-4:2002, *Compatibilité électromagnétique (CEM) – Partie 2-4: Environnement – Niveaux de compatibilité dans les installations industrielles pour les perturbations conduites à basse fréquence*

IEC 61140, *Protection contre les chocs électriques – Aspects communs aux installations et aux matériels*

IEC 61892-2:2012, *Mobile and fixed offshore units – Electrical installations – Part 2: System design* (disponible en anglais seulement)

IEC 61892-5, *Unités mobiles et fixes en mer – Installations électriques – Partie 5: Unités mobiles*

IEC 61892-6, *Unités mobiles et fixes en mer – Installations électriques – Partie 6: Installation*

IEC 61892-7, *Unités mobiles et fixes en mer – Installations électriques – Partie 7: Emplacements dangereux*

Convention internationale pour la sauvegarde de la vie humaine en mer (SOLAS):1974, édition consolidée 2009

IMO MODU Code, *Code for the construction and equipment of mobile offshore drilling units* (disponible en anglais seulement)

3 Termes et définitions

Pour les besoins du présent document, les termes et définitions suivants s'appliquent.

NOTE Les termes et définitions inclus dans la présente partie correspondent à ceux qui ont une application générale dans la série IEC 61892. Les termes et définitions s'appliquant à des matériels ou équipements particuliers sont inclus dans d'autres parties de l'IEC 61892.

3.1
autorité compétente
organe gouvernemental et/ou société de classification comportant des règles auxquelles une unité doit satisfaire

3.2
équipement
matériel
appareil unique ou ensemble de dispositifs ou appareils, ou ensemble des dispositifs principaux d'une installation, ou ensemble des dispositifs nécessaires à l'accomplissement d'une tâche particulière

EXEMPLE Transformateur de puissance, équipement de mesure.

[SOURCE IEC 60050-151:2001, 151-11-25, modifiée – L'expression "équipement d'une sous-station" a été supprimée de l'exemple.]

3.3
appareil
dispositif ou assemblage de dispositifs qui peut être utilisé comme unité indépendante pour remplir des fonctions particulières

[SOURCE IEC 60050-151:2001, 151-11-22, modifiée – La note a été supprimée.]

3.4
locaux à atmosphère contrôlée
locaux où la température et l'humidité peuvent être contrôlées dans des limites spécifiées

3.5
degré de protection procuré par une enveloppe
IP
classification numérique selon l'IEC 60529, précédée du symbole IP, appliquée à une enveloppe de matériel électrique pour apporter:

– une protection des personnes contre tout contact ou proximité avec des parties actives et contre tout contact avec une pièce mobile (autre que les roulements en faible rotation) à l'intérieure d'une enveloppe,

– une protection du matériel électrique contre la pénétration de corps solides étrangers, et

– selon l'indication donnée par la classification, une protection du matériel électrique contre la pénétration dangereuse de l'eau

Note 1 à l'article: L'explication des chiffres utilisés pour la classification du degré de protection est donnée dans les Tableaux A.1 et A.2.

[SOURCE IEC 60050-426:2008, 426-04-02, modifiée – La note 1 à l'article a été ajoutée.]

3.6
tableau de répartition
ensemble comportant différents types d'appareillages associés à un ou plusieurs circuits électriques de départ alimentés par un ou plusieurs circuits électriques d'arrivée, ainsi que des bornes pour les conducteurs neutre et de protection (si cela est exigé)

[SOURCE IEC 60050-826:2004, 826-16-08, modifiée – L'expression "si cela est exigé" a été ajoutée]

3.7
terre
masse, US, CA
masse générale de la structure ou coque métallique de l'unité

3.8
mis à la terre
connecté à la masse générale de la structure ou coque métallique de l'unité de façon à réaliser à tout moment une décharge immédiate et non dangereuse de l'énergie électrique

3.9
services essentiels
services critiques pour la navigation, la manœuvre ou la conduite de l'unité mobile ou pour la sauvegarde de la vie humaine ou pour des fonctions spéciales du navire (par exemple, services spécialisés)

3.10
fréquence

3.10.1
variation cyclique de fréquence
écart périodique de la fréquence en exploitation normale, tel qu'il pourrait être causé par une charge appliquée régulièrement

$$\frac{\pm(f_{max} - f_{min}) \times 100}{2 f_{nominal}} \%$$

3.10.2
tolérance de fréquence
excursion maximale de la fréquence nominale dans des conditions normales d'exploitation, à l'exclusion des variations transitoires et cycliques de fréquence

Note 1 à l'article: La tolérance de fréquence est une tolérance d'état stable qui inclut les variations dues à des charges et aux caractéristiques des générateurs. Elle inclut aussi les variations dues aux conditions d'environnement.

3.10.3
fréquence transitoire
variation brusque de la fréquence qui dépasse les limites de tolérance de fréquence, revient dans ces limites et s'y maintient en un temps de recouvrement spécifié après l'apparition de la perturbation (en secondes)

3.11
partie active
conducteur ou partie conductrice destiné(e) à être sous tension en service normal, y compris le conducteur de neutre, mais par convention, excepté le conducteur PEN, le conducteur PEM ou le conducteur PEL

Note 1 à l'article: La notion n'implique pas nécessairement un risque de choc électrique.

[SOURCE: IEC 60050-195:1998, 195-02-19]

3.12
conducteur PEN
conducteur assurant à la fois les fonctions de conducteur de mise à la terre de protection et de conducteur de neutre

[SOURCE: IEC 60050-195:1998, 195-02-12]

3.13
conducteur PEM
conducteur assurant les fonctions de conducteur de mise à la terre de protection et de conducteur de point milieu

[SOURCE: IEC 60050-195:1998, 195-02-13]

3.14
conducteur PEL
conducteur assurant à la fois les fonctions de conducteur de mise à la terre de protection et de conducteur de ligne

[SOURCE: IEC 60050-195:1998, 195-02-14]

3.15
pétrole brut
mélange complet d'hydrocarbures se trouvant sous terre sous forme liquide ou gazeuse

3.16
point d'utilisation < câblage>
tout point d'un câblage fixe prévu pour la connexion d'un luminaire ou le raccordement à l'alimentation d'un appareil d'utilisation

3.17
tensions

3.17.1
tolérance de tension
excursion maximale de la tension utilisateur nominale dans des conditions normales d'exploitation, à l'exclusion des variations transitoires et cycliques de tension

Note 1 à l'article: La tolérance de tension est une tolérance d'état stable qui inclut la chute de tension dans les câbles et les caractéristiques de la régulation de tension. Elle inclut aussi les variations dues aux conditions d'environnement.

3.17.2
tolérance de déséquilibre de tension
différence entre la tension la plus élevée et la tension la plus faible entre phases

3.17.3
variation cyclique de tension
écart périodique (valeurs efficaces maximales à minimales) de la tension nominale, tel qu'il pourrait être causé par une charge appliquée régulièrement

$$\frac{\pm(U_{max} - U_{min}) \times 100}{2\,U_{nominal}} \%$$

3.17.4
tension transitoire
variation brusque de la tension (à l'exclusion des pics) qui dépasse les limites de tolérance de tension nominale, revient dans ces limites et s'y maintient en un temps de recouvrement spécifié après l'apparition de la perturbation (en secondes)

3.18
temps de recouvrement

3.18.1
temps de recouvrement de tension transitoire
temps s'écoulant entre le dépassement de la tolérance de tension normale et le retour et le maintien de la tension dans les limites de tolérance normales

3.18.2
temps de recouvrement de fréquence transitoire
temps s'écoulant entre le dépassement de la tolérance de fréquence normale et le retour et le maintien de la fréquence dans les limites de tolérance de fréquence

3.19
forme d'onde

3.19.1
taux de distorsion harmonique total
THD
rapport de la valeur efficace de la somme des composantes harmoniques jusqu'à un rang spécifié (notation recommandée "H") à la valeur efficace de la composante fondamentale

$$\mathrm{THD} = \sqrt{\sum_{h=2}^{h=H} \frac{(Q_h)^2}{(Q_1)^2}}$$

où

Q représente soit le courant soit la tension;

Q_1 est la valeur efficace de la composante fondamentale;

h est le rang harmonique;

Q_h est la valeur efficace de la composante harmonique de rang h;

H est égal à 50 pour les niveaux de compatibilité définis dans cette norme.

Note 1 à l'article: THD prend en compte uniquement les harmoniques. Pour les cas dans lesquels les interharmoniques sont à exclure, il est fait référence à A.3.1 de l'IEC 61000-2-4:2002.

Note 2 à l'article: L'abréviation «THD» est dérivée du terme anglais développé correspondant «total harmonic distortion».

[SOURCE IEC 61000-2-4:2002, 3.2.7, modifiée – La Note 1 à l'article est modifiée.]

3.19.2
taux d'harmonique individuel
rapport de la valeur efficace réelle de l'harmonique à la valeur efficace du fondamental, exprimé en pourcentage

4 Exigences générales et conditions

4.1 Généralités

Le présent article décrit les conditions et exigences qui sont communes à l'ensemble des équipements et installations de la série IEC 61892.

Les installations électriques dans les unités doivent être telles que:

– les services essentiels sont maintenus en présence de conditions d'urgence variées;
– la sécurité de l'équipage, des prestataires, des visiteurs et de l'unité est garantie;
– les exigences relatives à la sécurité indiquées dans la présente norme sont prises en compte;
– les exigences de la Convention internationale pour la sauvegarde de la vie humaine en mer (SOLAS, *International Convention for the Safety of Life at Sea*) sont satisfaites lorsqu'elles sont applicables;
– les exigences du Code de l'OMI relatif aux unités mobiles de forage au large (MODU, *Mobile Offshore Drilling Unit*) sont satisfaites lorsqu'elles sont applicables.

Pour les unités flottantes et mobiles, l'ensemble des machines et équipements doit fonctionner de manière satisfaisante dans les limites d'inclinaison statique et dynamique selon l'IEC 61892-5.

L'autorité compétente peut avoir des exigences complémentaires qui sont à satisfaire.

NOTE Les conditions d'urgence sont habituellement définies lors de l'évaluation de sécurité de l'installation.

4.2 Acceptation des méthodes de substitution ou alternatives

Lorsqu'un type particulier d'équipement, de construction ou de disposition est spécifié dans la série IEC 61892, l'utilisation d'autres équipements, constructions ou dispositions est permise, sous réserve de ne pas être moins performants et fiables.

4.3 Ajouts et modifications

Aucun ajout ni modification, de nature provisoire ou permanente, ne doit être apporté à une installation existante tant qu'il n'a pas été établi que les caractéristiques assignées et l'état des accessoires, des conducteurs, de l'appareillage de connexion, etc. existants affectés sont adéquats pour la nouvelle situation.

Une attention particulière est portée sur ces facteurs qui affectent la conception de système existante telle que le courant admissible, le niveau de court-circuit, la chute de tension, les harmoniques, la stabilité et la discrimination adéquate des dispositifs de protection.

4.4 Conditions d'environnement

4.4.1 Généralités

Les équipements électriques doivent fonctionner de façon satisfaisante dans des conditions d'environnement variées.

Les conditions d'environnement sont caractérisées par un certain nombre de variables:

– un ensemble incluant essentiellement les conditions climatiques, les conditions biologiques, les conditions relatives aux substances chimiques et mécaniques actives, ainsi que les conditions mécaniques;
– un autre ensemble dépendant essentiellement des localisations dans l'unité, des schémas opérationnels et des conditions transitoires.

NOTE Pour plus d'informations sur les conditions d'environnement associées à des localisations, schémas opérationnels et conditions transitoires particuliers qui sont considérés comme étant généralement représentatifs, voir l'IEC 60721-3-6.

4.4.2 Paramètres de conception

4.4.2.1 Généralités

Les paramètres de conception basés sur les conditions d'environnement applicables à certains types d'équipements peuvent être déterminés en fonction de la localisation. Lorsqu'aucune donnée n'est disponible, le Tableau 1 et le Tableau 2 fournissent des valeurs recommandées.

Dans certaines régions (par exemple, régions arctiques), des températures inférieures à celles données dans les tableaux sont à prendre en compte. Dans certaines régions, une température supérieure à celles données dans les tableaux est également à prendre en compte.

4.4.2.2 Température

Pour un projet spécifique, la documentation du projet peut fournir des informations spécifiques concernant la température ambiante. En l'absence de telles informations, il est permis d'utiliser ce qui suit:

Dans d'autres parties de la série IEC 61892 où aucune "température de l'air élevée" n'a été spécifiée comme paramètre de conception de l'équipement, une valeur de 45 °C doit s'appliquer.

Lorsque l'équipement est conçu pour fonctionner sous des températures supérieures ou inférieures à celles données dans le Tableau 1, il est permis d'augmenter ou de réduire les échauffements admissibles en conséquence.

Tableau 1 – Paramètres de conception d'exploitation – Température ambiante

Type d'équipement	Valeur °C
Température de l'air élevée	
Câbles	45
Générateurs et moteurs	50
Appareillage de connexion	45
Appareillage de connexion	45
Transformateurs	45
Commande et instrumentation	55
Autres équipements électriques	45
Température de l'air faible	
Commande et instrumentation	5 (général)
Commande et instrumentation	−25 (pont découvert)
Température de l'eau élevée	
Générateurs et moteurs	35
NOTE La température de conception inférieure est normalement spécifiée dans la norme de produit	

Pour les batteries, voir l'IEC 61892-6.

La température de l'eau de mer est de 32 °C maximum.