

INTERNATIONAL STANDARD



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

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INTERNATIONAL STANDARD



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

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 General requirements and conditions	14
4.1 General.....	14
4.2 Acceptance of substitutes or alternatives	14
4.3 Additions and alterations.....	14
4.4 Environmental conditions	14
4.4.1 General	14
Design parameters	14
4.4.2 Ambient temperature	16
Materials.....	16
4.5 Power supply system characteristics.....	16
4.5.1 General	16
4.5.2 AC distribution systems	17
4.5.3 DC distribution systems	20
Manual disconnection	20
Electrical apparatus for explosive gas atmospheres	20
4.6 Clearance and creepage distances	21
4.7 Insulation	22
Maintenance and inspection.....	22
Cable entries	22
4.8 Precautions against vibration and mechanical shock.....	22
4.9 Location of electrical equipment in units.....	22
4.10 Mechanical protection.....	23
4.11 Protection from against heat, water, steam and oil.....	24
4.12 Protection against electrical shock.....	24
4.13 Enclosures.....	24
4.14 Ignition source control.....	24
4.14.1 General	24
4.14.2 Emergency shutdown (ESD) – General.....	25
4.14.3 Emergency conditions due to drilling operations – Mobile drilling units	26
4.14.4 Manual electrical shutdown.....	26
4.15 Degree of protection of equipment by enclosures.....	26
4.16 Environmental impact.....	29
Annex A (informative) Degree of protection.....	30
Annex B (informative) Cold climate precautions	32
B.1 General.....	32
B.2 Emergency power source.....	32
B.3 Equipment – General	32
B.4 Cables and cable installations.....	33
B.5 Electrical trace heating systems.....	33
B.6 Lighting systems	33
B.6.1 General	33

B.6.2	Emergency lights	33
B.7	Electrical rotating machines	33
B.8	Explosion protected equipment	33
Annex C (informative)	Specification of surface treatment and protective painting system	34
C.1	Objectives	34
C.2	General and specification	34
C.2.1	General	34
C.2.2	Atmospheric corrosivity categories for protective painting systems	34
C.2.3	Durability performance of a protective painting system	35
Annex D (informative)	DC distribution systems	38
 D.1	DC distribution systems	38
Bibliography	38
Figure D.1	Typical configuration of DC distribution system	38
Table	Operational design parameters – Ambient temperature	38
Table	Design parameters – Relative humidity	38
Table 1	– Voltage characteristics	17
Table 2	– Frequency characteristics	19
Table 3	– Tolerances for DC system	20
Table 4	– Fast transients	21
Table 5	– Minimum requirements for the degree of protection for mobile and fixed offshore units	27
Table A.1	– Degrees of protection against foreign objects indicated by the first characteristic numeral	30
Table A.2	– Degrees of protection against water indicated by the second characteristic numeral	31
Table C.1	– Description of typical atmospheric environments related to the estimation of corrosivity categories	35

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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 fourth edition cancels and replaces the third edition published in 2015. This edition constitutes a technical revision.

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

- a) voltage limitations have been removed;
- b) definitions for fixed offshore units and mobile offshore units have been included;
- c) tables for ambient air temperature and relative humidity have been removed, as this information will normally be given in owner's/operator's documentation for specific projects;
- d) the requirement as to ignition source control has been moved from IEC 61892-7 to this document;
- e) tables for voltage characteristics have been updated;
- f) requirements for a minimum degree of protection for equipment have been moved from IEC 61892-2 to this document.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
18/1649/FDIS	18/1664/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61892 series, published under the general title *Mobile and fixed offshore units – Electrical installations*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

INTRODUCTION

IEC 61892 forms a series of International Standards ~~is intended to enable~~ for safety in the design, selection, installation, maintenance and use of electrical equipment for the generation, transmission, 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 IEC 61892 incorporates and coordinates, as far as possible, existing rules and forms a code of interpretation, where applicable, of the requirements of the International Maritime Organization (IMO), and constitutes a guide for future regulations which may be prepared and a statement of practice for offshore unit owners, ~~constructors~~ designers, installers and appropriate organizations.

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

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

In this revision, voltage limitations have been removed. However, voltage limitations may be given in the referenced equipment standards. The removal of voltage limitations is considered necessary due to the interconnection of, and supply from shore to offshore units. In such cases, transmission voltages up to 132 kV AC and 150 kV DC are used and higher voltages are being planned.

The IEC 61892 series aims to constitute a set of International Standards for the offshore petroleum industry, but it is not intended to prevent their use beyond petroleum installations.

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MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 1: General requirements and conditions

1 Scope

This part of IEC 61892 ~~contains provisions for~~ is applicable to electrical installations and equipment 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, production, accommodation, processing, storage and offloading purposes.

It 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) without any voltage level limitation. Referenced equipment standards may give voltage level limitations.

This document specifies requirements such as those concerning

- environmental conditions,
- power supply characteristics,
- location of electrical equipment in units,
- protection against external influences,
- protection against electrical shock, and
- ignition source control.

This document gives information and guidance on topics such as

- cold climate protection, and
- surface treatment and protective painting system.

This document does not apply ~~either~~ to

- fixed equipment for medical purposes ~~or to the~~,
- electrical installations of tankers, and
- control of ignition sources other than those created by electrical equipment.

NOTE 1 For medical rooms, IEC 60364-7-710 provides ~~more information~~ specific requirements. Requirements for tankers are given in IEC 60092-502.

NOTE 2 Guidance on protection of non-electrical equipment can be found in ISO 80079-36, ISO 80079-37 and IMO 2009 MODU Code, 6.7.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

~~IEC 60079 (all parts), Explosive atmospheres~~

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

~~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 2019, *Mobile and fixed offshore units – Electrical installations – Part 2: System design*

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 61892-6:2019, *Mobile and fixed offshore units – Electrical installations – Part 6: Installation*

IEC 61892-7:2019, *Mobile and fixed offshore units – Electrical installations – Part 7: Hazardous areas*

ISO 8468, *Ships and marine technology – Ship's bridge layout and associated equipment – Requirements and guidelines*

ISO 11064 (all parts), *Ergonomic design of control centres*

IMO, *International Convention for the Safety of Life at Sea (SOLAS):1974, Consolidated edition-2009 2014*

IMO, *2009 MODU Code, Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009, 2010 Edition*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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

3.1 offshore unit

construction, buoyant or non-buoyant, designed and built for installation or operation at an offshore location

Note 1 to entry: Topside interface of subsea installed equipment which is an integral part of production and transport systems assigned to fixed and floating offshore units, as well as a temporary interface to mobile offshore units, are also considered as part of the offshore unit.

3.2 unmanned offshore unit

offshore unit normally unmanned, remote controlled without need of human presence for operability and without living quarter facilities

Note 1 to entry: An unmanned offshore unit may also contain a survival shelter to support occasional site maintenance.

3.3 fixed offshore unit

buoyant or non-buoyant construction engaged in offshore operations including drilling, production, storage or support functions, and which is designed and built for installation at a particular offshore location

Note 1 to entry: LNG production units and LNG storage and regasification unit terminals are also considered to be fixed offshore units. FPSO/FSO on location is also considered as a fixed offshore unit. Floating LNG terminals and FPSOs with detachable arrangements are also considered to be fixed offshore units.

3.4 mobile offshore unit

buoyant construction engaged in offshore operations including drilling, production, storage, accommodation or support functions, not intended for service at one particular offshore site and which can be relocated without major dismantling or modification, for example barges, semisubmersible or jack-up unit and drill-ships

3.5 manned unit

offshore unit with need of human presence for operation and maintenance, and provided with living quarter facility

3.6 satellite unit

small offshore unit, normally unmanned, connected to a larger unit by means of a pipeline, power cable and/or umbilical

3.7 appropriate authority

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

3.8 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" have been removed from the example.]

3.9 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~~

3.10

IP

degree of protection of enclosure

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.]

3.11

primary distribution system

system which is galvanically connected to the generator or, in offshore units with power supply from another unit or shore via cable, connected to the switchboard where the voltage regulation takes place

3.12

secondary distribution system

system without galvanic connection to the generator or to the switchboard where the voltage regulation takes place

3.13

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.]

3.14

earth

ground, US, CA

general mass of the metal structure or hull of the unit

3.15

earthed

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

3.16

emergency service

services required to allow safe shutdown of the unit and provide safety oriented services for the personnel on the unit during an emergency situation for a defined time

EXAMPLE Emergency shutdown system, emergency lighting, firefighting, alarm and telecommunication systems are examples of emergency services.

3.17

essential service

~~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)~~ services required to maintain the unit in a defined state of readiness and habitation for a period defined by the user for situations other than normal operation and without recourse to the emergency source of power except than in an emergency situation

EXAMPLE Services required to maintain the unit in a minimum comfortable condition of habitability, maintaining heading control thrusters for turret moored floating units and fuel transfer/bunkering operations are examples of essential services.

3.18

frequency

3.18.1

cyclic frequency variation

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

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

3.18.2

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.~~

3.18.3

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)

3.19

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]

3.20

PEN conductor

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

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

3.21

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]

3.22

PEL conductor

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

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

3.23

petroleum

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

3.24

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

3.25

voltages

3.25.1

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.

3.25.2

voltage unbalance tolerance

~~difference~~ maximum permissible unbalance, expressed in percent of nominal voltage, between the highest and lowest ~~phase to phase~~ voltage

3.25.3

cyclic voltage variation

periodic voltage deviation (max. to min. RMS values) of the nominal voltage, such as might be caused by regularly repeated loading

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

3.25.4

voltage transient

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

3.26

recovery time

3.26.1

voltage transient recovery time

time elapsed from exceeding the ~~normal~~ steady state voltage tolerance until the voltage recovers and remains within the ~~normal~~ steady state tolerance limits

3.26.2**frequency transient recovery time**

time elapsed from exceeding the ~~normal~~ steady state frequency tolerance until the frequency recovers and remains within the ~~frequency~~ steady state tolerance limits

3.27**waveform****3.27.1****THD****total harmonic distortion**

ratio of the RMS value of the sum of all the harmonic components up to a specified order (recommended notation "H") to the RMS value of the fundamental component

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

where

Q represents either current or voltage;

Q_1 is the RMS value of the fundamental component;

h is the harmonic order;

Q_h is the RMS value of the harmonic component of order h ;

H is 50 for the purpose of the compatibility levels in this document.

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

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~~ has been rephrased, and Note 2 to entry has been added.]

3.27.2**single harmonic content**

ratio of the effective RMS value of the harmonic to the RMS value of the fundamental, expressed as a percentage

3.28**umbilical**

group of functional components, such as electrical cables, optical fibre cables, hoses and tubes, laid up or bundled together or in combination with each other, that generally provides hydraulics, fluid injection, power and/or communication services

[SOURCE: ISO 13628-5:2009, 3.1.47, modified – Note 1 to entry has been omitted.]

3.29**equipment protection level****EPL**

level of protection assigned to equipment based on its likelihood of becoming a source of ignition and distinguishing the differences between explosive gas atmospheres, explosive dust atmospheres, and the explosive atmospheres in mines susceptible to firedamp

Note 1 to entry: This note applies to the French language only.

[SOURCE: IEC 60079-0:2017, 3.33, modified – The note to entry has been added in English.]

4 General requirements and conditions

4.1 General

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

Electrical installations ~~in units~~ shall be such that:

~~a) essential services will be maintained under various emergency conditions;~~

a) the safety of ~~crew, contractors, visitors and unit will be~~ the unit and any people present onboard is ensured;

b) the requirements with respect to safety in this document are ~~considered~~ followed;

c) the requirements of the International Convention for the Safety of Life at Sea (SOLAS) are met as far as applicable;

d) the requirements of the IMO MODU Code are met as far as applicable.

For ~~floating and mobile~~ buoyant 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

In the IEC 61892 series, where 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~~ at least of equal safety, effectiveness, and reliability.

4.3 Additions and alterations

An addition or alteration, temporary or permanent, shall not be made to an existing electrical 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 in the location for which the unit is designed.

Environmental conditions are characterised by a number of variables:

a) one set including mainly climatic conditions, ~~biological conditions~~, as well as conditions dependent upon chemically and mechanically active substances and mechanical conditions;

b) another set dependent mainly upon locations within 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.~~

NOTE 1 Environmental conditions will normally be specified in the overall design documentation for each project, based on the place of operation.

NOTE 2 Guidance on of surface treatment and protective painting system is given in Annex C.

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.~~

4.4.2 Ambient temperature

For a specific project, the project documentation may give specific information regarding ambient temperature. In the absence of such information, the following shall apply.

In other parts of the IEC 61892 series, where no maximum ambient air temperature has been specified as a design parameter for equipment, a value of 40 °C shall apply.

Mobile offshore units shall comply with IEC 61892-5.

NOTE 1 The Classification societies normally require an ambient air temperature of 45 °C. Other values of ambient air temperature can be considered according to specific local conditions.

For a fixed unit, design temperature shall be based on the environmental condition of the place of operation.

NOTE 2 For cold climate precautions, see Annex B.

4.5 Power supply system characteristics

4.5.1 General

Unless otherwise stated in other parts of this document, when supplied from general distribution systems the equipment shall function 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 of 4.5.

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 4.5, may have on the performance of equipment.

For systems where semiconductors are connected and have 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 that specified in 4.5.2.3.

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.

~~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.~~

4.5.2 AC distribution systems

4.5.2.1 General

The voltages referred to in 4.5.2.2 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.~~

4.5.2.2 Voltage characteristics

Requirements for voltage characteristics are given in Table 1. Tolerances are expressed as a percentage of the nominal voltage.

Table 1 – 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: <ul style="list-style-type: none"> • 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.	

System withstand requirements		
Voltage characteristics	Value	Comments
Voltage tolerance	+6 % -10 %	Steady state voltage tolerance on switchboards and distribution panels which electrical system and consumers in general shall withstand.
Voltage transient variation	+15 % -15 %	Transient voltage tolerance on switchboards and distribution panels which consumers in general shall withstand.
Max. voltage variation	+20 % -20 %	Voltage excursions (sum of transient and steady state deviation) on switchboards and distribution panels which electrical system and consumers in general shall withstand.
System operational requirements		
Voltage characteristics	Value	Comments
Voltage tolerance in primary distribution system	+2,5 % -2,5 %	Steady state voltage tolerance on generator switchboards. For offshore units with power supply from other unit or shore via cable, this applies to the switchboard where the voltage regulation takes place.
Voltage tolerance in secondary distribution system	+5 % -5 %	Steady state voltage tolerance on switchboards and distribution panels in secondary distribution system.
Voltage transients: slow transients e.g. due to load variation tolerance (deviation from nominal voltage) voltage transients recovery time ^a	+20 % -15 % Maximum 1,5 s	
Voltage unbalance	7 %	Including phase voltage unbalance as a result of unbalance of load.
Voltages are root mean square (RMS) unless otherwise stated.		
^a After a transient condition has been initiated, the voltage in a main distribution system shall not differ from the voltage before the transient was initiated by more than ±3 % within 1,5 s. In an emergency system the limit is ±4% within 5 s.		

~~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 drop 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 $\begin{matrix} +20 \\ -20 \end{matrix}$ %.

The requirements for voltage tolerances are valid for local generation (voltage controlled by generator AVR). When power is supplied from sources external to the unit (voltage controlled by transformer OLTC, on-load tap changer), it may not be possible to obtain these values.

4.5.2.3 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.

When operating with split sections (i.e. an open bus-tie breaker or an out-of-service component such as a filter), the limits of IEC 61000-2-4:2002, Class 2 may be accepted.

For certain electrical installations, where it is confirmed by design study that it is not ~~possible~~ practical 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 as well as consumers are designed to operate at ~~the~~ such higher limits.

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

IEC 61000-2-4:2002 (Table 2 and Table 5) Class 2, states that no single harmonic shall exceed 6 % and the THD shall not exceed 8 %.

4.5.2.4 Frequency characteristics

Requirements for frequency characteristics are given in Table 2. Tolerances are expressed as a percentage of the nominal frequency.

Table 2 – Frequency characteristics

System withstand requirements		
Frequency characteristics	Value	Comments
Frequency tolerance (continuous)	+5 % –5 %	Steady state frequency tolerance which consumers in general shall withstand.
Cyclic frequency variation (continuous)	0,5 %	
Frequency transient tolerance	+10 % –10 %	Transient frequency tolerance which consumers in general shall withstand.
Frequency transients recovery time	maximum 5 s	Minimum period of time which consumers in general shall withstand the transient frequency deviation.
The sum of frequency excursions at any point on the system (tolerances and transients) from in relation to nominal frequency should not exceed $\pm 12,5$ %.		

NOTE 1 Some combinations of frequency and voltage variations can cause rotating machines to operate outside the zones as specified in IEC 60034-1:2017, 7.3. Such operation can cause increased temperature rise in the motor.

NOTE 2 For some types of explosion protected equipment the testing is based on nominal values of voltages.

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.

NOTE 3 A typical frequency tolerance (continuous) value when operating in parallel with an external network is $\pm 2,5$ %.

4.5.2.5 Voltage drop

The voltage profile of the system shall be confirmed by studies according to IEC 61892-2:2019, 10.3 Load flow calculations.

Requirement for voltage drop:

- a) lighting circuits and heat tracing: Voltage drop on cable from distribution panel to end consumer (for heat tracing, this is "end junction box") shall not exceed 10 %;
- b) socket circuit: Voltage drop on cable from distribution panel to end socket should not exceed 6 % when socket is loaded with 80 % of rated current (power factor 1,0);
- c) motor circuit: Total voltage drop, including all upstream network impedance, at motor terminals during start shall be maximum 20 % (typical power factor 0,3);
- d) switchboard and distribution board: Total voltage drop, including all upstream network impedance, during motor start (or any other transient conditions) shall be maximum 15%. (see Table 1);
- e) other AC circuits and consumers: Voltage drop on cable from switchboard/distribution panel to consumer should not exceed 6 % (consumer rated current);
- f) other DC circuits and consumers: Voltage drop on cable from switchboard/distribution panel to consumer should not exceed 10 % (consumer rated current). The tolerances listed in Table 3 for the DC system also have to be taken into account.

If the biggest motor on the switchboard causes 15 % voltage drop on switchboard busbar during start, accepted maximum voltage drop in motor cable is 5 %.

If motor start current causes less voltage drop on the switchboard, a higher drop is accepted on the motor cable (sum is maximum 20 %).

Where specific loads require other tolerances for voltages in order to maintain functionality or performance, then specific calculations should be made to confirm values of voltage drop, particularly in cables.

4.5.3 DC distribution systems

Tolerances for DC systems are given in Table 3. Tolerances are expressed as a percentage of the nominal voltage, measured at the equipment terminal.

Table 3 – Tolerances for DC system

Voltage characteristics	Value
Voltage tolerance (continuous), measured at the distribution board	+15 -15 %
Cyclic voltage variation	5 %
Voltage ripple (AC RMS over steady DC voltage, battery in fully loaded condition)	2 %
Voltage ripple VRLA batteries	1 %
The transient recovery time shall not exceed 2 s.	

Specific requirements for different battery types have to be taken into account.

Depending on the different configurations of battery charger and battery system, voltage over ~~10~~ 15 % 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.~~

Load directly connected to the battery charger and battery system should be selected to accept the voltage variations specified in Table 3.

If voltage-sensitive loads are to be connected, or if voltage exceeds the values in Table 3, for example during boost charging, a stabilizer device shall be used to keep voltage within acceptable limits unless consumers are documented to tolerate the voltage to which they are exposed.

Fast transients, for example spikes caused by switching, peak impulse voltage amplitude shall not exceed the values given in Table 4.

Table 4 – 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 60664-1:2007, Table F1. 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.~~

4.6 Clearance and creepage distances

The distances between live parts of different potential and between live parts and ~~the cases of~~ enclosures or 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. When the specific equipment standards referred to in IEC 61892-3 contain specific requirements in relation to clearance and creepage distances, the requirements of the equipment standards apply.

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

4.7 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 4.7, 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.~~

4.8 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.

4.9 Location of electrical equipment in units

The layout planning of the electrical system shall take into account:

- a) separation of the generation plant, transformers and major electrical rooms from areas with explosion hazard, i.e. the drilling and process area;
- b) access to major electrical equipment, for example generators, motors, transformers and switchgear for easy handling and repair/replacement;

c) UPS configurations (centralized vs decentralized).

Equipment in a control room shall meet the requirements of ISO 11064 (all parts) or ISO 8468 as applicable.

Major electrical equipment shall, wherever possible, be installed in rooms with a controlled atmosphere, i.e. a room where the temperature and humidity can be controlled within specified limits.

Such equipment includes:

- 1) electrical switchgears and distribution boards/panels;
- 2) motor starters ~~and feeders including contactors and breakers~~;
- 3) dry power transformers;
- 4) battery chargers;
- 5) batteries;
- 6) frequency converters;
- 7) energy control, monitoring and alarm systems;
- 8) communication systems;
- 9) entertainment system;
- 10) information technology equipment.

For self-propelled mobile units, equipment in the bridge control room shall meet the requirements of ISO 8468.

Control positions shall be ergonomically arranged for the convenience of the operator and hence the accuracy and safety of the operation.

Area or group identification shall be considered, especially in complex layouts, for example adequate spacing between display and control groups.

The design of the control equipment shall be such that a failure in the control equipment will lead to the least dangerous condition, and furthermore, such failure shall not render inoperative either of any reserve automatic controls or manual controls.

Requirements in relation to the location of:

- i) emergency generator shall comply with IEC 61892-2:2019, 4.4.3;
- ii) transformers shall comply with IEC 61892-6:2019, Clause 6;
- iii) switchgears shall comply with IEC 61892-6:2019, 7.1;
- iv) batteries shall comply with IEC 61892-6:2019, 9.2.

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

4.10 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 the protection of electrical equipment against mechanical damage should be given in storage, loading and other exposed areas.

4.11 Protection ~~from~~ against heat, water, steam and oil

Electrical equipment shall be so selected and located or protected from the effects of exposure to a 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. Only piping and integrated heat exchangers needed for operation of the electrical equipment should be installed in the switchgear room. If pipes must be run adjacent to electrical equipment, there shall be no joints in the immediate vicinity of the electrical equipment. The piping shall be arranged so as to minimise the risk of leakage, which may have a detrimental effect on other equipment in the room.

~~For specific requirements to~~ Installation of electrical equipment, ~~see~~ shall comply with IEC 61892-6.

Where sprinkler heads or water spraying devices or water mist system are fitted for firefighting, 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 switchgear rooms, where a suitable alternative method of extinguishing should be used.

NOTE Information regarding the degree of protection (IP-codes) for electrical equipment is given in Annex A.

4.12 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, at the minimum, be provided with ~~at least~~ provisions for basic protection in accordance with ~~IEC 61140~~ IEC 60364-4-41.

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.

4.13 Enclosures

Enclosures shall as a minimum comply with the degrees of protection as required in ~~Table 9 of IEC 61892-2:2012~~ 4.15. 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.~~

4.14 Ignition source control

4.14.1 General

In order to prevent and protect against the ignition of combustible liquids and explosive gases, a systematic mapping of all potential ignition sources in the electric system design shall be performed. In addition, the necessary technical, operational and organizational measures shall be implemented so as to reduce the risk of ignition.

All electrical equipment that is required to remain operational in abnormal situations, where an explosive atmosphere can exist outside hazardous area zones defined by the area classification (see IEC 61892-7:2019, Clause 4), shall as a minimum fulfil requirements in relation to zone 2 (EPL Gc), or be placed in protective rooms. This can be accomplished by having:

- a) rooms which normally have overpressure; or

- b) rooms that are located beyond hazardous areas and where the ventilation arrangement is such that gas cannot penetrate into the room.

Air intake into, and exhaust from the relevant rooms shall be closed by airtight fire/gas dampers on HVAC shutdown.

NOTE 1 Information on testing of dampers can be found in EN 1751.

The following are examples of equipment located inside rooms as described in a) and b) above that may be accepted without complying at the minimum with EPL Gc for zone 2 areas:

- c) emergency generator and transitional source of emergency power;
- d) UPS, for emergency supplies only;
- e) emergency switchgear;
- f) equipment in central control room required for control of the situation;
- g) equipment necessary during such emergency situations for internal/external communication;
- h) BOP remote control panel.

Other non-critical equipment that represents an ignition source shall deactivate automatically on gas detection, but manual deactivation shall also be possible when it is practical to do so from a central or strategic location, in accordance with the unit's specific strategy for fire and explosion safety.

Manual disconnection or shutdown shall be possible from at least two strategic locations, one of which shall be outside hazardous areas.

NOTE 2 Equipment and systems required to be in operation after emergency shutdown are listed in IEC 61892-2:2019, 4.7.2.

The appropriate authority may require equipment to comply with requirement to Zone 1 (EPL Gb).

On offshore units, irrespective of size, there could be numerous sources of ignition apart from those associated with electrical equipment. Precautions could be necessary to ensure safety from other possible ignition sources, but guidance on this aspect is outside the scope of this document.

NOTE 3 Information regarding RF (radio frequency) ignition hazard is given in CLC/TR 50427.

NOTE 4 Guidance on protection of non-electrical equipment can be found in ISO 80079-36, ISO 80079-37 and MODU Code 2009, 6.7. Further standards dealing with this subject will be issued by IEC TC 31/SC 31M, Non-electrical equipment and protective systems for explosive atmospheres.

4.14.2 Emergency shutdown (ESD) – General

In the event of an emergency situation such as a gas leakage, the hazardous areas can under certain conditions extend beyond those described in IEC 61892-7:2019, 4.6 and 4.7. Apparatus which needs to be operated during such conditions shall be explosion protected in accordance with requirements of 4.14.1.

Arrangements are to be provided to ensure selective shutdown of:

- a) ventilation systems, except:
 - 1) fans necessary for supplying combustion air to prime movers for the production of electrical power;
 - 2) supply and extract fans from mechanically ventilated hazardous areas containing a source of release;
- b) main generator prime movers, including the ventilation systems for these;

- c) emergency apparatus including the emergency generator with prime mover and transitional source of emergency power;
- d) emergency switchgear;
- e) equipment in central control room required for control of the situation;
- f) equipment necessary during such emergency situations for internal/external communication;
- g) non-essential electrical apparatus, essential electrical apparatus.

In the case of units using a dynamic positioning system as the sole means of position keeping, special consideration may be given to the selective disconnection or shutdown of machinery and equipment associated with maintaining the operability of the dynamic positioning system in order to preserve the integrity of the well.

Apparatus located in spaces other than enclosed pressurized rooms and which is capable of operation after shutdown as given in 4.14 shall be suitable for installation in zone 2 locations and shall, at the minimum, fulfil EPL Gc. Such apparatus that is located in enclosed spaces shall be suitable for its intended application to the satisfaction of the relevant authority.

Shutdown systems shall be so designed that the risk of unintentional stoppages caused by malfunction in a shutdown system and the risk of inadvertent operation of a shutdown are minimized.

4.14.3 Emergency conditions due to drilling operations – Mobile drilling units

The requirements of 4.14.2 are applicable both to fixed and mobile offshore units. However, a manual shut down is acceptable on mobile drilling units.

4.14.4 Manual electrical shutdown

In addition to the requirements of 4.14.2 and 4.14.3, it shall be possible to shut down electrical apparatus from an appropriate location, for example, the unit's 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 shutdown circuit.

Arrangement for the manual shutdown of rooms containing transformers and large switchboards should also be considered.

4.15 Degree of protection of equipment by enclosures

Depending on its location, electrical equipment shall as a minimum have the degree of protection as given in Table 5.

(1) Example of location	(2) Condition in location	(3) Design according to degree of protection	(4) Equipment X complies with column (3) – not recommended							
			Switch-boards Controlgear Motor starters	Generators	Motors	Transformers Semi-conductor converters	Luminaires	Heating appliances	Cooking appliances	Accessories (e.g. switches, branch boxes)
Ballast pump rooms ^a	Increased danger of liquid and mechanical damage	IP44	X	-	X	X	IP55	X	-	IP55
Pontoons		IP44	X	-	X	X	IP55	-	-	-
Refrigerated rooms		IP44	-	-	X	-	IP55	X	-	IP55
Galleys and laundries		IP22	X	-	X	-	IP44	X	X	IP44
Shaft or pipe tunnels ^a	Danger of liquid spraying	IP55	X	-	X	X	X	X	-	IP56
Process areas	Danger of explosion	IP55	-	X	-	-	-	X	-	X
Battery rooms	Risk of dust and danger of aggressive fumes	See NOTE	-	-	-	-	X	-	-	-
Paint stores	Increased danger of liquid and serious mechanical damage	-	-	-	-	-	X	-	-	X
Stores for welding-gas bottles		-	-	-	-	-	-	-	-	-
Holds classified as hazardous	Danger of green water (sea waves boarding on deck)	IP55	-	-	-	-	X	-	-	X
Drilling modules		IP55	-	-	X	-	X	X	-	X
Open decks	-	IP56	X	-	X	-	-	-	-	X
Additional requirements for equipment located in hazardous areas are given in IEC 61892-7.										
Special consideration should be given to equipment installed near to deluge or sprinkler systems and areas where hosing down is likely to occur. Particular attention should be given to equipment associated with emergency systems.										
NOTE For installations in battery rooms, see IEC 61892-6:2019, Clause 9.										
^a Applicable to mobile units only.										

4.16 Environmental impact

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

- a) ~~the~~ any negative impact on the environment;
- b) the efficient use of generated power;
- c) the use of high-~~efficient~~ efficiency motors and VSD to optimize power consumption, for example, motors;
- d) the use of low-loss transformers, generators and other high-power equipment;
- e) the re-use of waste energy in HVAC installations;
- f) the use of ~~high-efficient with long life lamps~~ lighting fixtures with high efficiency, long life lamps;
- g) energy optimization through use of brake energy or waste heat recovery;
- h) establishing an energy management system.

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

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

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Annex A
(informative)

Degree of protection

A.1 — Definitions of numerals in the IP code

Table A.1 and Table A.2 give information regarding the IP codes, 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 foreign 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
<p>Second characteristic numeral 6 will also include protection against heavy seas.</p> <p>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.</p> <p>NOTE 2 IEC 60034-5 provides information about degrees of protection for rotating electrical machines.</p> <p>^a The full diameter of the object probe shall not pass through an opening of the enclosure.</p>		

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 $-60\text{ }^{\circ}\text{C}$.~~

~~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 $-15\text{ }^{\circ}\text{C}$ for any machine and not less than $0\text{ }^{\circ}\text{C}$ 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 $-20\text{ }^{\circ}\text{C}$. 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.~~

B.1 General

The objective of Annex B is to provide guidance on the proper design, selection and erection of equipment used in low ambient temperatures.

Special precaution should be applied when selecting equipment for use in an arctic climate, due to extremely low temperatures.

Because of the harsh climate conditions experienced in arctic areas, with extreme cold, special considerations need to be taken with regard to environmental conditions.

B.2 Emergency power source

In particular, the functionality and reliability of emergency power sources need to be evaluated.

B.3 Equipment – General

The suitability of materials for cold climates needs to be considered. Plastic materials may not be suitable if they become brittle at the minimum ambient air temperature.

Increased use of anti-condensation heaters to be used in enclosures located in outdoor areas should be considered.

B.4 Cables and cable installations

In the selection of cables, care should be taken with regard to the characteristics of the insulation material at extremely low temperatures. Special precaution should be taken for the service temperature and minimum bending radius of the cable at such low temperatures.

Flexible cables should be designed for operation in the required ambient temperature.

The installation of cables should be carried out at an appropriate ambient temperature range.

When necessary, cable trays are to be designed for the expected ice and snow load.

B.5 Electrical trace heating systems

Special precaution should be taken for the inrush current, the service temperature, the minimum bending radius and the thermal insulation properties of electrical resistance trace heaters at such low temperatures.

B.6 Lighting systems

B.6.1 General

Selection of luminaires should take into account that not all types of lamps will work under such low temperatures. Fluorescent lighting may not be suitable as it may not start up in low temperatures. Also, the light output may decrease at lower temperatures.

B.6.2 Emergency lights

Selection of emergency lights should take into account that some batteries cannot be charged at such low temperatures.

B.7 Electrical rotating machines

Selection of electrical rotating machines should take into account the appropriate type for these low temperatures.

The motors should have bearings and lubrication systems suitable for the expected low temperatures. It should be noted that, according to IEC 60034-1, the design ambient air temperature is not less than -15 °C for all machines except machines with certain specific characteristics as set out in IEC 60034-1:2017, 6.4, for which the ambient temperature is not less than 0 °C .

B.8 Explosion protected equipment

For special considerations for explosion protected equipment, see IEC 61892-7:2019, Annex F.

Annex C (informative)

Specification of surface treatment and protective painting system

C.1 Objectives

Annex C establishes criteria for specification of the surface treatment and protective painting system to be applied on electrical equipment for use in an 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” explosion protected equipment.

It is important to consider the difference in the environment between outdoor installations, naturally ventilated areas and air-conditioned areas. The different areas of the world have considerable differences in temperature and weather impact on the units.

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

Classification of the operating environment of installation the unit or use of the electrical equipment, taking into account the specification of the protective painting system, should be made according to the requirements set out in ISO 9223.

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

The protective painting system should be specified according to the requirements set out 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 out in ISO 12944-6.

For explosion protected equipment, the protective painting system should also be in accordance with the requirements set out in IEC 60079-0, regarding the limitation of thickness of the non-metallic layer. This limitation is intended to permit the 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.

Attention should be given to the atmospheres shown in Table C.1 where indoor areas with a well-designed HVAC system can be as low as C1 and where outdoor installations can, based on the environment, vary from C3 to CX, where temperature has a significant impact.

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~~ should 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 guaranteed time span. Instead, it is a technical consideration that can help the owner to set up a maintenance programme. Painting system maintenance is often required at more frequent intervals because of fading, chalking, a combination ~~or~~ of wear and tear, or for other reasons.

The evaluation of degradation of the applied protective coatings, such as blistering, rusting, cracking, and flaking ~~shall~~ should be assessed according to the requirements set out in ISO 4628-1 to ISO 4628-5. It has to be assumed, in accordance with the tables shown in ~~Annex A of ISO 12944-5:2007~~ ISO 12944-5:2018, Annexes C, D and E, 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 out 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.~~

C3 for indoor locations, or CX in outdoor areas, specified by ISO 12944-2. For indoor locations, other corrosion categories, for example C4 or C5, can be specified for more aggressive environments.

The required corrosive category ~~shall~~ should be selected by the user taking into account, for each particular application, the environmental characteristics ~~on~~ at the site ~~installation~~, as well as all aggressive external influences, as for example corrosive fluids present. The required durability performance of the ~~"Ex"~~ equipment protective painting system ~~shall~~ should 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

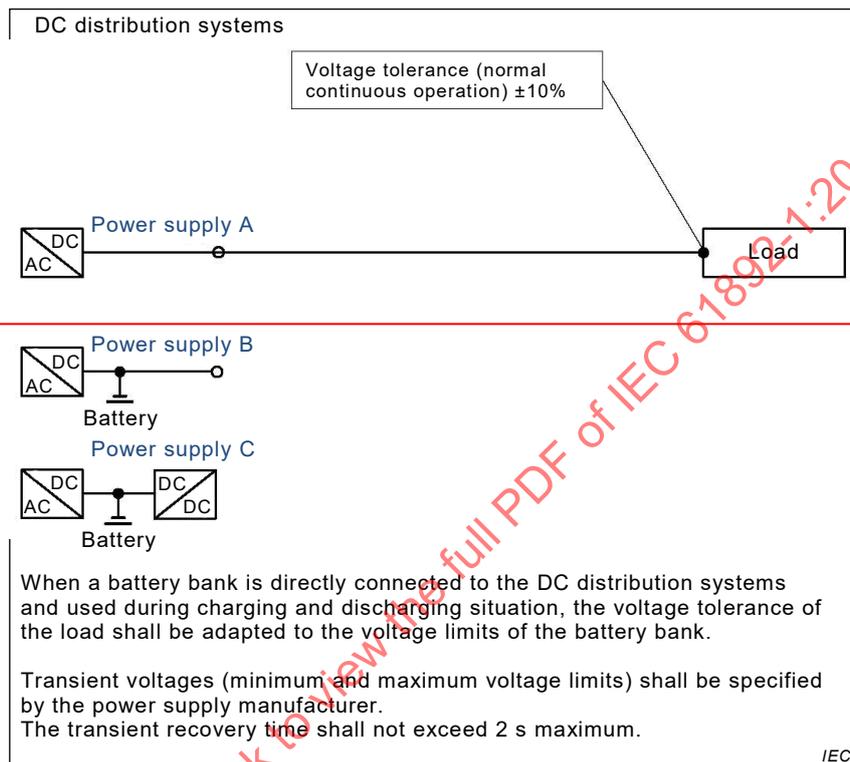


Figure D.1 – Typical configuration of DC distribution system

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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*

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INTERNATIONAL STANDARD

NORME INTERNATIONALE

**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**

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CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	7
3 Terms and definitions	8
4 General requirements and conditions	13
4.1 General.....	13
4.2 Acceptance of substitutes or alternatives	14
4.3 Additions and alterations.....	14
4.4 Environmental conditions	14
4.4.1 General	14
4.4.2 Ambient temperature	14
4.5 Power supply system characteristics.....	14
4.5.1 General	14
4.5.2 AC distribution systems	15
4.5.3 DC distribution systems	18
4.6 Clearance and creepage distances	19
4.7 Insulation	19
4.8 Precautions against vibration and mechanical shock.....	19
4.9 Location of electrical equipment in units.....	19
4.10 Mechanical protection	20
4.11 Protection against heat, water, steam and oil.....	20
4.12 Protection against electrical shock.....	21
4.13 Enclosures.....	21
4.14 Ignition source control.....	21
4.14.1 General	21
4.14.2 Emergency shutdown (ESD) – General.....	22
4.14.3 Emergency conditions due to drilling operations – Mobile drilling units	23
4.14.4 Manual electrical shutdown.....	23
4.15 Degree of protection of equipment by enclosures.....	23
4.16 Environmental impact.....	26
Annex A (informative) Degree of protection.....	27
Annex B (informative) Cold climate precautions	29
B.1 General.....	29
B.2 Emergency power source.....	29
B.3 Equipment – General	29
B.4 Cables and cable installations.....	29
B.5 Electrical trace heating systems.....	29
B.6 Lighting systems	30
B.6.1 General	30
B.6.2 Emergency lights	30
B.7 Electrical rotating machines	30
B.8 Explosion protected equipment	30
Annex C (informative) Specification of surface treatment and protective painting system.....	31
C.1 Objectives.....	31

C.2	General and specification.....	31
C.2.1	General	31
C.2.2	Atmospheric corrosivity categories for protective painting systems	31
C.2.3	Durability performance of a protective painting system	32
	Bibliography.....	34
	Table 1 – Voltage characteristics	16
	Table 2 – Frequency characteristics.....	17
	Table 3 – Tolerances for DC system	18
	Table 4 – Fast transients	19
	Table 5 – Minimum requirements for the degree of protection for mobile and fixed offshore units.....	24
	Table A.1 – Degrees of protection against foreign objects indicated by the first characteristic numeral.....	27
	Table A.2 – Degrees of protection against water indicated by the second characteristic numeral	28
	Table C.1 – Description of typical atmospheric environments related to the estimation of corrosivity categories	32

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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 fourth edition cancels and replaces the third edition published in 2015. This edition constitutes a technical revision.

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

- a) voltage limitations have been removed;
- b) definitions for fixed offshore units and mobile offshore units have been included;
- c) tables for ambient air temperature and relative humidity have been removed, as this information will normally be given in owner's/operator's documentation for specific projects;

- d) the requirement as to ignition source control has been moved from IEC 61892-7 to this document;
- e) tables for voltage characteristics have been updated;
- f) requirements for a minimum degree of protection for equipment have been moved from IEC 61892-2 to this document.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
18/1649/FDIS	18/1664/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of the IEC 61892 series, published under the general title *Mobile and fixed offshore units – Electrical installations*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

IEC 61892 forms a series of International Standards for safety in the design, selection, installation, maintenance and use of electrical equipment for the generation, transmission, 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 IEC 61892 incorporates and coordinates, as far as possible, existing rules and forms a code of interpretation, where applicable, of the requirements of the International Maritime Organization (IMO), and constitutes a guide for future regulations which may be prepared and a statement of practice for offshore unit owners, designers, installers and appropriate organizations.

This document is based on solutions and methods which are in current use, but it is not intended to impede the development of new or improved techniques.

In this revision, voltage limitations have been removed. However, voltage limitations may be given in the referenced equipment standards. The removal of voltage limitations is considered necessary due to the interconnection of, and supply from shore to offshore units. In such cases, transmission voltages up to 132 kV AC and 150 kV DC are used and higher voltages are being planned.

The IEC 61892 series aims to constitute a set of International Standards for the offshore petroleum industry, but it is not intended to prevent their use beyond petroleum installations.

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MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 1: General requirements and conditions

1 Scope

This part of IEC 61892 is applicable to electrical installations and equipment in mobile and fixed offshore units, including pipeline, pumping or "pigging" stations, compressor stations and single buoy moorings, used in the offshore petroleum industry for drilling, production, accommodation, processing, storage and offloading purposes.

It applies to all installations, whether permanent, temporary, transportable or hand-held, to AC installations and DC installations without any voltage level limitation. Referenced equipment standards may give voltage level limitations.

This document specifies requirements such as those concerning

- environmental conditions,
- power supply characteristics,
- location of electrical equipment in units,
- protection against external influences,
- protection against electrical shock, and
- ignition source control.

This document gives information and guidance on topics such as

- cold climate protection, and
- surface treatment and protective painting system.

This document does not apply to

- fixed equipment for medical purposes,
- electrical installations of tankers, and
- control of ignition sources other than those created by electrical equipment.

NOTE 1 For medical rooms, IEC 60364-7-710 provides specific requirements. Requirements for tankers are given in IEC 60092-502.

NOTE 2 Guidance on protection of non-electrical equipment can be found in ISO 80079-36, ISO 80079-37 and IMO 2009 MODU Code, 6.7.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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

IEC 61892-2:2019, *Mobile and fixed offshore units – Electrical installations – Part 2: System design*

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 61892-6:2019, *Mobile and fixed offshore units – Electrical installations – Part 6: Installation*

IEC 61892-7:2019, *Mobile and fixed offshore units – Electrical installations – Part 7: Hazardous areas*

ISO 8468, *Ships and marine technology – Ship's bridge layout and associated equipment – Requirements and guidelines*

ISO 11064 (all parts), *Ergonomic design of control centres*

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

IMO, *2009 MODU Code, Code for the Construction and Equipment of Mobile Offshore Drilling Units*, 2009, 2010 Edition

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

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

3.1 offshore unit

construction, buoyant or non-buoyant, designed and built for installation or operation at an offshore location

Note 1 to entry: Topside interface of subsea installed equipment which is an integral part of production and transport systems assigned to fixed and floating offshore units, as well as a temporary interface to mobile offshore units, are also considered as part of the offshore unit.

3.2 unmanned offshore unit

offshore unit normally unmanned, remote controlled without need of human presence for operability and without living quarter facilities

Note 1 to entry: An unmanned offshore unit may also contain a survival shelter to support occasional site maintenance.

3.3

fixed offshore unit

buoyant or non-buoyant construction engaged in offshore operations including drilling, production, storage or support functions, and which is designed and built for installation at a particular offshore location

Note 1 to entry: LNG production units and LNG storage and regasification unit terminals are also considered to be fixed offshore units. FPSO/FSO on location is also considered as a fixed offshore unit. Floating LNG terminals and FPSOs with detachable arrangements are also considered to be fixed offshore units.

3.4

mobile offshore unit

buoyant construction engaged in offshore operations including drilling, production, storage, accommodation or support functions, not intended for service at one particular offshore site and which can be relocated without major dismantling or modification, for example barges, semisubmersible or jack-up unit and drill-ships

3.5

manned unit

offshore unit with need of human presence for operation and maintenance, and provided with living quarter facility

3.6

satellite unit

small offshore unit, normally unmanned, connected to a larger unit by means of a pipeline, power cable and/or umbilical

3.7

appropriate authority

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

3.8

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" have been removed from the example.]

3.9

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.]

3.10

IP

degree of protection of enclosure

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.]

3.11

primary distribution system

system which is galvanically connected to the generator or, in offshore units with power supply from another unit or shore via cable, connected to the switchboard where the voltage regulation takes place

3.12

secondary distribution system

system without galvanic connection to the generator or to the switchboard where the voltage regulation takes place

3.13

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.]

3.14

earth

ground, US, CA

general mass of the metal structure or hull of the unit

3.15

earthed

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

3.16

emergency service

services required to allow safe shutdown of the unit and provide safety oriented services for the personnel on the unit during an emergency situation for a defined time

EXAMPLE Emergency shutdown system, emergency lighting, firefighting, alarm and telecommunication systems are examples of emergency services.

3.17

essential service

services required to maintain the unit in a defined state of readiness and habitation for a period defined by the user for situations other than normal operation and without recourse to the emergency source of power except than in an emergency situation

EXAMPLE Services required to maintain the unit in a minimum comfortable condition of habitability, maintaining heading control thrusters for turret moored floating units and fuel transfer/bunkering operations are examples of essential services.

3.18

frequency

3.18.1

cyclic frequency variation

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

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

3.18.2

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.

3.18.3

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)

3.19

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]

3.20

PEN conductor

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

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

3.21

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]

3.22

PEL conductor

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

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

3.23

petroleum

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

3.24

point

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

**3.25
voltages**

3.25.1

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.

3.25.2

voltage unbalance tolerance

maximum permissible unbalance, expressed in percent of nominal voltage, between the highest and lowest phase voltage

3.25.3

cyclic voltage variation

periodic voltage deviation (max. to min. RMS values) of the nominal voltage, such as might be caused by regularly repeated loading

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

3.25.4

voltage transient

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

3.26

recovery time

3.26.1

voltage transient recovery time

time elapsed from exceeding the steady state voltage tolerance until the voltage recovers and remains within the steady state tolerance limits

3.26.2

frequency transient recovery time

time elapsed from exceeding the steady state frequency tolerance until the frequency recovers and remains within the steady state tolerance limits

3.27

waveform

3.27.1

THD

total harmonic distortion

ratio of the RMS value of the sum of all the harmonic components up to a specified order (recommended notation "H") to the RMS value of the fundamental component

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

where

Q represents either current or voltage;

Q_1 is the RMS value of the fundamental component;

h is the harmonic order;

Q_h is the RMS value of the harmonic component of order h ;

H is 50 for the purpose of the compatibility levels in this document.

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

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 has been rephrased, and Note 2 to entry has been added.]

3.27.2

single harmonic content

ratio of the effective RMS value of the harmonic to the RMS value of the fundamental, expressed as a percentage

3.28

umbilical

group of functional components, such as electrical cables, optical fibre cables, hoses and tubes, laid up or bundled together or in combination with each other, that generally provides hydraulics, fluid injection, power and/or communication services

[SOURCE: ISO 13628-5:2009, 3.1.47, modified – Note 1 to entry has been omitted.]

3.29

equipment protection level

EPL

level of protection assigned to equipment based on its likelihood of becoming a source of ignition and distinguishing the differences between explosive gas atmospheres, explosive dust atmospheres, and the explosive atmospheres in mines susceptible to firedamp

Note 1 to entry: This note applies to the French language only.

[SOURCE: IEC 60079-0:2017, 3.33, modified – The note to entry has been added in English.]

4 General requirements and conditions

4.1 General

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

Electrical installations shall be such that:

- a) the safety of the unit and any people present onboard is ensured;
- b) the requirements with respect to safety in this document are followed;
- c) the requirements of the International Convention for the Safety of Life at Sea (SOLAS) are met as far as applicable;
- d) the requirements of the IMO MODU Code are met as far as applicable.

For buoyant 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.

4.2 Acceptance of substitutes or alternatives

In the IEC 61892 series, where any special type of equipment, construction, or arrangement is specified, the use of any other equipment, construction or arrangement is admissible, provided it is at least of equal safety, effectiveness, and reliability.

4.3 Additions and alterations

An addition or alteration, temporary or permanent, shall not be made to an existing electrical 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 in the location for which the unit is designed.

Environmental conditions are characterised by a number of variables:

- a) one set including mainly climatic conditions, as well as conditions dependent upon chemically and mechanically active substances and mechanical conditions;
- b) another set dependent mainly upon locations within unit, operational patterns and transient conditions.

NOTE 1 Environmental conditions will normally be specified in the overall design documentation for each project, based on the place of operation.

NOTE 2 Guidance on of surface treatment and protective painting system is given in Annex C.

4.4.2 Ambient temperature

For a specific project, the project documentation may give specific information regarding ambient temperature. In the absence of such information, the following shall apply.

In other parts of the IEC 61892 series, where no maximum ambient air temperature has been specified as a design parameter for equipment, a value of 40 °C shall apply.

Mobile offshore units shall comply with IEC 61892-5.

NOTE 1 The Classification societies normally require an ambient air temperature of 45 °C. Other values of ambient air temperature can be considered according to specific local conditions.

For a fixed unit, design temperature shall be based on the environmental condition of the place of operation.

NOTE 2 For cold climate precautions, see Annex B.

4.5 Power supply system characteristics

4.5.1 General

Unless otherwise stated in other parts of this document, when supplied from general distribution systems the equipment shall function 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 of 4.5.

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 4.5, may have on the performance of equipment.

For systems where semiconductors are connected and have 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 that specified in 4.5.2.3.

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.

4.5.2 AC distribution systems

4.5.2.1 General

The voltages referred to in 4.5.2.2 are measured at the point where the equipment is installed.

4.5.2.2 Voltage characteristics

Requirements for voltage characteristics are given in Table 1. Tolerances are expressed as a percentage of the nominal voltage.

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Table 1 – Voltage characteristics

System withstand requirements		
Voltage characteristics	Value	Comments
Voltage tolerance	+6 % -10 %	Steady state voltage tolerance on switchboards and distribution panels which electrical system and consumers in general shall withstand.
Voltage transient variation	+15 % -15 %	Transient voltage tolerance on switchboards and distribution panels which consumers in general shall withstand.
Max. voltage variation	+20 % -20 %	Voltage excursions (sum of transient and steady state deviation) on switchboards and distribution panels which electrical system and consumers in general shall withstand.
System operational requirements		
Voltage characteristics	Value	Comments
Voltage tolerance in primary distribution system	+2,5 % -2,5 %	Steady state voltage tolerance on generator switchboards. For offshore units with power supply from other unit or shore via cable, this applies to the switchboard were the voltage regulation takes place.
Voltage tolerance in secondary distribution system	+5 % -5 %	Steady state voltage tolerance on switchboards and distribution panels in secondary distribution system.
Voltage transients: slow transients e.g. due to load variation tolerance (deviation from nominal voltage) voltage transients recovery time ^a	+20 % -15 % Maximum 1,5 s	
Voltage unbalance	>1 %	Including phase voltage unbalance as a result of unbalance of load.
Voltages are root mean square (RMS) unless otherwise stated.		
^a After a transient condition has been initiated, the voltage in a main distribution system shall not differ from the voltage before the transient was initiated by more than ±3 % within 1,5 s. In an emergency system the limit is ±4% within 5 s.		

The transient voltage drop 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 $\begin{matrix} +20 \\ -20 \end{matrix}$ %.

The requirements for voltage tolerances are valid for local generation (voltage controlled by generator AVR). When power is supplied from sources external to the unit (voltage controlled by transformer OLTC, on-load tap changer), it may not be possible to obtain these values.

4.5.2.3 Harmonic distortion (voltage waveform)

For voltage harmonic distortion, acceptance limits shall correspond to IEC 61000-2-4:2002, Class 1.

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

When operating with split sections (i.e. an open bus-tie breaker or an out-of-service component such as a filter), the limits of IEC 61000-2-4:2002, Class 2 may be accepted.

For certain electrical installations, where it is confirmed by design study that it is not practical 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 as well as consumers are designed to operate at such higher limits.

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

IEC 61000-2-4:2002 (Table 2 and Table 5) Class 2, states that no single harmonic shall exceed 6 % and the THD shall not exceed 8 %.

4.5.2.4 Frequency characteristics

Requirements for frequency characteristics are given in Table 2. Tolerances are expressed as a percentage of the nominal frequency.

Table 2 – Frequency characteristics

System withstand requirements		
Frequency characteristics	Value	Comments
Frequency tolerance (continuous)	+5 % –5 %	Steady state frequency tolerance which consumers in general shall withstand.
Cyclic frequency variation (continuous)	0,5 %	
Frequency transient tolerance	+10 % –10 %	Transient frequency tolerance which consumers in general shall withstand.
Frequency transient recovery time	maximum 5 s	Minimum period of time which consumers in general shall withstand the transient frequency deviation.
The sum of frequency excursions at any point on the system (tolerances and transients) in relation to nominal frequency should not exceed $\pm 12,5$ %.		

NOTE 1 Some combinations of frequency and voltage variations can cause rotating machines to operate outside the zones as specified in IEC 60034-1:2017, 7.3. Such operation can cause increased temperature rise in the motor.

NOTE 2 For some types of explosion protected equipment the testing is based on nominal values of voltages.

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.

NOTE 3 A typical frequency tolerance (continuous) value when operating in parallel with an external network is $\pm 2,5$ %.

4.5.2.5 Voltage drop

The voltage profile of the system shall be confirmed by studies according to IEC 61892-2:2019, 10.3 Load flow calculations.

Requirement for voltage drop:

- a) lighting circuits and heat tracing: Voltage drop on cable from distribution panel to end consumer (for heat tracing, this is "end junction box") shall not exceed 10 %;

- b) socket circuit: Voltage drop on cable from distribution panel to end socket should not exceed 6 % when socket is loaded with 80 % of rated current (power factor 1,0);
- c) motor circuit: Total voltage drop, including all upstream network impedance, at motor terminals during start shall be maximum 20 % (typical power factor 0,3);
- d) switchboard and distribution board: Total voltage drop, including all upstream network impedance, during motor start (or any other transient conditions) shall be maximum 15%. (see Table 1);
- e) other AC circuits and consumers: Voltage drop on cable from switchboard/distribution panel to consumer should not exceed 6 % (consumer rated current);
- f) other DC circuits and consumers: Voltage drop on cable from switchboard/distribution panel to consumer should not exceed 10 % (consumer rated current). The tolerances listed in Table 3 for the DC system also have to be taken into account.

If the biggest motor on the switchboard causes 15 % voltage drop on switchboard busbar during start, accepted maximum voltage drop in motor cable is 5 %.

If motor start current causes less voltage drop on the switchboard, a higher drop is accepted on the motor cable (sum is maximum 20 %).

Where specific loads require other tolerances for voltages in order to maintain functionality or performance, then specific calculations should be made to confirm values of voltage drop, particularly in cables.

4.5.3 DC distribution systems

Tolerances for DC systems are given in Table 3. Tolerances are expressed as a percentage of the nominal voltage, measured at the equipment terminal.

Table 3 – Tolerances for DC system

Voltage characteristics	Value
Voltage tolerance (continuous), measured at the distribution board	+15 % -15 %
Cyclic voltage variation	5 %
Voltage ripple (AC RMS over steady DC voltage, battery in fully loaded condition)	2 %
The transient recovery time shall not exceed 2 s.	

Specific requirements for different battery types have to be taken into account.

Depending on the different configurations of battery charger and battery system, voltage over 15 % 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.

Load directly connected to the battery charger and battery system should be selected to accept the voltage variations specified in Table 3.

If voltage-sensitive loads are to be connected, or if voltage exceeds the values in Table 3, for example during boost charging, a stabilizer device shall be used to keep voltage within acceptable limits unless consumers are documented to tolerate the voltage to which they are exposed.

Fast transients, for example spikes caused by switching, peak impulse voltage amplitude shall not exceed the values given in Table 4.

Table 4 – 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 60664-1:2007, Table F1. Values for DC systems with rated voltage above 1 000 V are not given in that standard.

4.6 Clearance and creepage distances

The distances between live parts of different potential and between live parts and enclosures or 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. When the specific equipment standards referred to in IEC 61892-3 contain specific requirements in relation to clearance and creepage distances, the requirements of the equipment standards apply.

4.7 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 4.7, insulating materials in important applications, such as busbar supports, 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.

4.8 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.

4.9 Location of electrical equipment in units

The layout planning of the electrical system shall take into account:

- separation of the generation plant, transformers and major electrical rooms from areas with explosion hazard, i.e. the drilling and process area;
- access to major electrical equipment, for example generators, motors, transformers and switchgear for easy handling and repair/replacement;
- UPS configurations (centralized vs decentralized).

Equipment in a control room shall meet the requirements of ISO 11064 (all parts) or ISO 8468 as applicable.

Major electrical equipment shall, wherever possible, be installed in rooms with a controlled atmosphere, i.e. a room where the temperature and humidity can be controlled within specified limits.

Such equipment includes:

- 1) electrical switchgear and distribution boards/panels;
- 2) motor starters;
- 3) dry power transformers;
- 4) battery chargers;
- 5) batteries;
- 6) frequency converters;
- 7) energy control, monitoring and alarm systems;
- 8) communication systems;
- 9) entertainment system;
- 10) information technology equipment.

For self-propelled mobile units, equipment in the bridge control room shall meet the requirements of ISO 8468.

Control positions shall be ergonomically arranged for the convenience of the operator and hence the accuracy and safety of the operation.

Area or group identification shall be considered, especially in complex layouts, for example adequate spacing between display and control groups.

The design of the control equipment shall be such that a failure in the control equipment will lead to the least dangerous condition, and furthermore, such failure shall not render inoperative either of any reserve automatic controls or manual controls.

Requirements in relation to the location of:

- i) emergency generator shall comply with IEC 61892-2:2019, 4.4.3;
- ii) transformers shall comply with IEC 61892-6:2019, Clause 6;
- iii) switchgears shall comply with IEC 61892-6:2019, 7.1;
- iv) batteries shall comply with IEC 61892-6:2019, 9.2.

4.10 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 the protection of electrical equipment against mechanical damage should be given in storage, loading and other exposed areas.

4.11 Protection against heat, water, steam and oil

Electrical equipment shall be so selected and located or protected from the effects of exposure to a 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. Only piping and integrated heat exchangers needed for operation of the electrical equipment should be installed in the switchgear room. If pipes must be run adjacent to electrical equipment, there shall be no joints in the immediate vicinity of the electrical equipment. The piping shall be arranged so as to minimise the risk of leakage, which may have a detrimental effect on other equipment in the room.

Installation of electrical equipment shall comply with IEC 61892-6.

Where sprinkler heads or water spraying devices or water mist system are fitted for firefighting, 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 switchgear rooms, where a suitable alternative method of extinguishing should be used.

NOTE Information regarding the degree of protection (IP) for electrical equipment is given in Annex A.

4.12 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, at the minimum, be provided with provisions for basic protection in accordance with IEC 60364-4-41.

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.

4.13 Enclosures

Enclosures shall as a minimum comply with the degrees of protection as required in 4.15. 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.

4.14 Ignition source control

4.14.1 General

In order to prevent and protect against the ignition of combustible liquids and explosive gases, a systematic mapping of all potential ignition sources in the electric system design shall be performed. In addition, the necessary technical, operational and organizational measures shall be implemented so as to reduce the risk of ignition.

All electrical equipment that is required to remain operational in abnormal situations, where an explosive atmosphere can exist outside hazardous area zones defined by the area classification (see IEC 61892-7:2019, Clause 4), shall as a minimum fulfil requirements in relation to zone 2 (EPL Gc), or be placed in protective rooms. This can be accomplished by having:

- a) rooms which normally have overpressure; or
- b) rooms that are located beyond hazardous areas and where the ventilation arrangement is such that gas cannot penetrate into the room.

Air intake into, and exhaust from the relevant rooms shall be closed by airtight fire/gas dampers on HVAC shutdown.

NOTE 1 Information on testing of dampers can be found in EN 1751.

The following are examples of equipment located inside rooms as described in a) and b) above that may be accepted without complying at the minimum with EPL Gc for zone 2 areas:

- c) emergency generator and transitional source of emergency power;
- d) UPS, for emergency supplies only;
- e) emergency switchgear;
- f) equipment in central control room required for control of the situation;

- g) equipment necessary during such emergency situations for internal/external communication;
- h) BOP remote control panel.

Other non-critical equipment that represents an ignition source shall deactivate automatically on gas detection, but manual deactivation shall also be possible when it is practical to do so from a central or strategic location, in accordance with the unit's specific strategy for fire and explosion safety.

Manual disconnection or shutdown shall be possible from at least two strategic locations, one of which shall be outside hazardous areas.

NOTE 2 Equipment and systems required to be in operation after emergency shutdown are listed in IEC 61892-2:2019, 4.7.2.

The appropriate authority may require equipment to comply with requirement to Zone 1 (EPL Gb).

On offshore units, irrespective of size, there could be numerous sources of ignition apart from those associated with electrical equipment. Precautions could be necessary to ensure safety from other possible ignition sources, but guidance on this aspect is outside the scope of this document.

NOTE 3 Information regarding RF (radio frequency) ignition hazard is given in CLC/TR 50427.

NOTE 4 Guidance on protection of non-electrical equipment can be found in ISO 80079-36, ISO 80079-37 and MODU Code 2009, 6.7. Further standards dealing with this subject will be issued by IEC TC 31/SC 31M, Non-electrical equipment and protective systems for explosive atmospheres.

4.14.2 Emergency shutdown (ESD) – General

In the event of an emergency situation such as a gas leakage, the hazardous areas can under certain conditions extend beyond those described in IEC 61892-7:2019, 4.6 and 4.7. Apparatus which needs to be operated during such conditions shall be explosion protected in accordance with requirements of 4.14.1.

Arrangements are to be provided to ensure selective shutdown of:

- a) ventilation systems, except:
 - 1) fans necessary for supplying combustion air to prime movers for the production of electrical power;
 - 2) supply and extract fans from mechanically ventilated hazardous areas containing a source of release;
- b) main generator prime movers, including the ventilation systems for these;
- c) emergency apparatus including the emergency generator with prime mover and transitional source of emergency power;
- d) emergency switchgear;
- e) equipment in central control room required for control of the situation;
- f) equipment necessary during such emergency situations for internal/external communication;
- g) non-essential electrical apparatus, essential electrical apparatus.

In the case of units using a dynamic positioning system as the sole means of position keeping, special consideration may be given to the selective disconnection or shutdown of machinery and equipment associated with maintaining the operability of the dynamic positioning system in order to preserve the integrity of the well.

Apparatus located in spaces other than enclosed pressurized rooms and which is capable of operation after shutdown as given in 4.14 shall be suitable for installation in zone 2 locations and shall, at the minimum, fulfil EPL Gc. Such apparatus that is located in enclosed spaces shall be suitable for its intended application to the satisfaction of the relevant authority.

Shutdown systems shall be so designed that the risk of unintentional stoppages caused by malfunction in a shutdown system and the risk of inadvertent operation of a shutdown are minimized.

4.14.3 Emergency conditions due to drilling operations – Mobile drilling units

The requirements of 4.14.2 are applicable both to fixed and mobile offshore units. However, a manual shut down is acceptable on mobile drilling units.

4.14.4 Manual electrical shutdown

In addition to the requirements of 4.14.2 and 4.14.3, it shall be possible to shut down electrical apparatus from an appropriate location, for example, the unit's 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 shutdown circuit.

Arrangement for the manual shutdown of rooms containing transformers and large switchboards should also be considered.

4.15 Degree of protection of equipment by enclosures

Depending on its location, electrical equipment shall as a minimum have the degree of protection as given in Table 5.

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(1) Example of location	(2) Condition in location	(3) Design according to degree of protection	(4) Equipment X complies with column (3) – not recommended							
			Switch-boards Controlgear Motor starters	Generators	Motors	Transformers Semi-conductor converters	Luminaires	Heating appliances	Cooking appliances	Accessories (e.g. switches, branch boxes)
Ballast pump rooms ^a	Increased danger of liquid and mechanical damage	IP44	X	-	X	X	IP55	X	-	IP55
Pontoons		IP44	X	-	X	X	IP55	-	-	-
Refrigerated rooms		IP44	-	-	X	-	IP55	X	-	IP55
Galleys and laundries		IP22	X	-	X	-	IP44	X	X	IP44
Shaft or pipe tunnels ^a		IP55	X	-	X	X	X	X	-	IP56
Process areas	Danger of explosion	IP55	-	X	-	X	X	X	-	X
Battery rooms	Risk of dust and danger of aggressive fumes	See NOTE	-	-	-	-	X	-	-	-
Paint stores	Increased danger of liquid and serious mechanical damage	-	-	-	-	X	-	-	-	X
Stores for welding-gas bottles		-	-	-	-	X	-	-	-	X
Holds classified as hazardous		-	-	-	-	X	-	-	-	X
Drilling modules	Danger of green water (sea waves boarding on deck)	IP55	-	X	-	X	X	X	-	X
Open decks		IP56	X	-	X	-	IP55	-	-	X
Additional requirements for equipment located in hazardous areas are given in IEC 61892-7.										
Special consideration should be given to equipment installed near to deluge or sprinkler systems and areas where hosing down is likely to occur. Particular attention should be given to equipment associated with emergency systems.										
NOTE For installations in battery rooms, see IEC 61892-6:2019, Clause 9.										
^a Applicable to mobile units only.										

4.16 Environmental impact

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

- a) any negative impact on the environment;
- b) the efficient use of generated power;
- c) the use of high efficiency motors and VSD to optimize power consumption, for example, motors;
- d) the use of low-loss transformers, generators and other high-power equipment;
- e) the re-use of waste energy in HVAC installations;
- f) the use of lighting fixtures with high efficiency, long life lamps;
- g) energy optimization through use of brake energy or waste heat recovery;
- h) establishing an energy management system.

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Annex A (informative)

Degree of protection

Table A.1 and Table A.2 give information regarding the IP codes, 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 foreign 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
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
<p>Second characteristic numeral 6 will also include protection against heavy seas.</p> <p>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.</p> <p>NOTE 2 For information about degrees of protection for rotating electrical machines, see IEC 60034-5.</p>		

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Annex B (informative)

Cold climate precautions

B.1 General

The objective of Annex B is to provide guidance on the proper design, selection and erection of equipment used in low ambient temperatures.

Special precaution should be applied when selecting equipment for use in an arctic climate, due to extremely low temperatures.

Because of the harsh climate conditions experienced in arctic areas, with extreme cold, special considerations need to be taken with regard to environmental conditions.

B.2 Emergency power source

In particular, the functionality and reliability of emergency power sources need to be evaluated.

B.3 Equipment – General

The suitability of materials for cold climates needs to be considered. Plastic materials may not be suitable if they become brittle at the minimum ambient air temperature.

Increased use of anti-condensation heaters to be used in enclosures located in outdoor areas should be considered.

B.4 Cables and cable installations

In the selection of cables, care should be taken with regard to the characteristics of the insulation material at extremely low temperatures. Special precaution should be taken for the service temperature and minimum bending radius of the cable at such low temperatures.

Flexible cables should be designed for operation in the required ambient temperature.

The installation of cables should be carried out at an appropriate ambient temperature range.

When necessary, cable trays are to be designed for the expected ice and snow load.

B.5 Electrical trace heating systems

Special precaution should be taken for the inrush current, the service temperature, the minimum bending radius and the thermal insulation properties of electrical resistance trace heaters at such low temperatures.

B.6 Lighting systems

B.6.1 General

Selection of luminaires should take into account that not all types of lamps will work under such low temperatures. Fluorescent lighting may not be suitable as it may not start up in low temperatures. Also, the light output may decrease at lower temperatures.

B.6.2 Emergency lights

Selection of emergency lights should take into account that some batteries cannot be charged at such low temperatures.

B.7 Electrical rotating machines

Selection of electrical rotating machines should take into account the appropriate type for these low temperatures.

The motors should have bearings and lubrication systems suitable for the expected low temperatures. It should be noted that, according to IEC 60034-1, the design ambient air temperature is not less than -15 °C for all machines except machines with certain specific characteristics as set out in IEC 60034-1:2017, 6.4, for which the ambient temperature is not less than 0 °C .

B.8 Explosion protected equipment

For special considerations for explosion protected equipment, see IEC 61892-7:2019, Annex F.

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Annex C (informative)

Specification of surface treatment and protective painting system

C.1 Objectives

Annex C establishes criteria for specification of the surface treatment and protective painting system to be applied on electrical equipment for use in an 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 explosion protected equipment.

It is important to consider the difference in the environment between outdoor installations, naturally ventilated areas and air-conditioned areas. The different areas of the world have considerable differences in temperature and weather impact on the units.

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

Classification of the operating environment of the unit or use of the electrical equipment, taking into account the specification of the protective painting system, should be made according to the requirements set out in ISO 9223.

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

The protective painting system should be specified according to the requirements set out 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 out in ISO 12944-6.

For explosion protected equipment, the protective painting system should also be in accordance with the requirements set out in IEC 60079-0, regarding the limitation of thickness of the non-metallic layer. This limitation is intended to permit the 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.

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

Attention should be given to the atmospheres shown in Table C.1 where indoor areas with a well-designed HVAC system can be as low as C1 and where outdoor installations can, based on the environment, vary from C3 to CX, where temperature has a significant impact.

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 should 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 guaranteed time span. Instead, it is a technical consideration that can help the owner to set up a maintenance programme. Painting system maintenance is often required at more frequent intervals because of fading, chalking, a combination of wear and tear, or for other reasons.

The evaluation of degradation of the applied protective coatings, such as blistering, rusting, cracking, and flaking should be assessed according to the requirements set out in ISO 4628-1 to ISO 4628-5. It has to be assumed, in accordance with the tables shown in ISO 12944-5:2018, Annexes C, D and E, 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 out in ISO 4628-3.

General purpose equipment should be specified, as standard, with a painting system that corresponds to corrosion category C3 for indoor locations, or CX in outdoor areas, specified by ISO 12944-2. For indoor locations, other corrosion categories, for example C4 or C5, can be specified for more aggressive environments.

The required corrosive category should be selected by the user taking into account, for each particular application, the environmental characteristics at the site, as well as all aggressive external influences, as for example corrosive fluids present. The required durability performance of the equipment protective painting system should be selected taking into consideration reliability, maintenance costs and repair availability approaches.

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

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 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

ISO 13628-5:2009, *Petroleum and natural gas industries – Design and operation of subsea production systems – Part 5: Subsea umbilicals*

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, *Corrosion 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 12944-2, *Paints and varnishes – Corrosion protection of steel structures by protective paint systems – Part 2: Classification of environments*

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

ISO 12944-5:2018, *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*

ISO 80079-36, *Explosive atmospheres – Part 36: Non-electrical equipment for explosive atmospheres – Basic method and requirements*

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CLC/TR 50427, *Assessment of inadvertent ignition of flammable atmospheres by radio-frequency radiation – Guide*

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C.1	Objectifs	67
C.2	Généralités et spécification	67
C.2.1	Généralités	67
C.2.2	Catégories de corrosivité atmosphérique pour les systèmes de peinture protectrice	67
C.2.3	Aptitude de durabilité d'un système de peinture protectrice.....	68
	Bibliographie.....	70
	Tableau 1 – Caractéristiques de tension	50
	Tableau 2 – Caractéristiques de fréquence	51
	Tableau 3 – Tolérances pour systèmes à courant continu	52
	Tableau 4 – Transitoires rapides.....	53
	Tableau 5 – Exigences minimales pour le degré de protection des unités mobiles et fixes en mer.....	59
	Tableau A.1 – Degrés de protection contre l'intrusion d'objets étrangers indiqués par le premier chiffre caractéristique.....	63
	Tableau A.2 – Degrés de protection contre la pénétration d'eau indiqués par le deuxième chiffre caractéristique	64
	Tableau C.1 – Description des environnements atmosphériques types relatifs à l'estimation des catégories de corrosivité.....	68

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

UNITÉS MOBILES ET FIXES EN MER – INSTALLATIONS ÉLECTRIQUES –

Partie 1: Exigences générales et conditions

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La Norme internationale IEC 61892-1 a été établie par le comité d'études 18 de l'IEC: Installations électriques des navires et des unités mobiles et fixes en mer.

Cette quatrième édition annule et remplace la troisième édition parue en 2015. Cette édition constitue une révision technique.

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

- a) les limites de tension ont été supprimées;
- b) les définitions pour les unités fixes et mobiles en mer ont été incluses;

- c) les tableaux pour la température ambiante de l'air et l'humidité relative ont été supprimés, étant donné que ces informations seront normalement indiquées dans les documents du propriétaire/de l'opérateur pour des projets spécifiques;
- d) l'exigence relative à la gestion des sources d'incendie a été déplacée de l'IEC 61892-7 au présent document;
- e) les tableaux pour les caractéristiques de tension ont été mis à jour;
- f) les exigences pour un degré minimal de protection des équipements ont été déplacées de l'IEC 61892-2 au présent document.

Le texte de cette Norme internationale est issu des documents suivants:

FDIS	Rapport de vote
18/1649/FDIS	18/1664/RVD

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

Ce document a été rédigé 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

L'IEC 61892 définit une série de Normes internationales destinées à garantir la sécurité de la conception, du choix, de l'installation, de la maintenance et de l'utilisation des matériels électriques destinés à la génération, à la transmission, au stockage, à la distribution et à l'utilisation d'énergie électrique, quelle qu'en soit la finalité, dans les unités en mer utilisées pour l'exploration ou l'exploitation de ressources pétrolières.

La présente partie de l'IEC 61892 comprend et coordonne, dans toute la mesure du possible, 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, les concepteurs et les installateurs d'unités en mer, ainsi que pour les organismes concernés.

Le présent document s'appuie sur des solutions et méthodes qui sont actuellement en vigueur, mais elle n'a pas pour objet de freiner le développement de nouvelles techniques ou l'amélioration des techniques existantes.

Dans cette révision, les limites de tension ont été supprimées. Elles peuvent toutefois figurer dans les normes d'équipements visées. La suppression des limites de tension a été jugée nécessaire en raison de l'interconnexion des unités en mer et de l'alimentation de ces dernières depuis le quai. Dans de tels cas, des tensions de transmission jusqu'à 132 kV en courant alternatif et 150 kV en courant continu sont utilisées et des tensions plus élevées sont prévues.

La série IEC 61892 a pour objectif de constituer un ensemble de Normes internationales destinées à l'industrie pétrolière en mer, mais elle n'a pas pour objet d'empêcher leur utilisation pour des installations autres que les installations pétrolières.

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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 s'applique aux installations et équipements 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, qui sont utilisés dans l'industrie pétrolière en mer (offshore) pour le forage, la production, les lieux d'habitation, le traitement, le stockage et le déchargement.

Elle s'applique à toutes les installations, qu'elles soient permanentes ou provisoires, transportables ou portatives, aux installations en courant alternatif et aux installations en courant continu sans aucune limitation du niveau de tension. Les normes des équipements référencés peuvent fournir des limites de niveau de tension.

Le présent document spécifie des exigences pour

- les conditions d'environnement,
- les caractéristiques du système d'alimentation,
- la localisation des équipements électriques dans les unités,
- la protection contre les influences externes,
- la protection contre les chocs électriques, et
- la gestion des sources d'incendie.

Le présent document fournit des informations et des recommandations à propos de sujets tels que

- la protection contre le climat froid, et
- le traitement de surface et le système de peinture protectrice.

Le présent document ne s'applique pas

- aux équipements fixes destinés aux applications médicales,
- aux installations électriques des navires-citernes, et
- au contrôle des sources d'incendie autres que celles générées par l'équipement électrique.

NOTE 1 Pour les locaux médicaux, l'IEC 60364-7-710 fournit des exigences spécifiques. Les exigences relatives aux navires-citernes sont données dans l'IEC 60092-502.

NOTE 2 Les recommandations relatives à la protection des équipements non électriques peuvent être consultées dans l'ISO 80079-36, l'ISO 80079-37 et le Code MODU de l'OMI (de 2009), 6.7.

2 Références normatives

Les documents suivants cités dans le texte constituent, pour tout ou partie de leur contenu, des exigences du présent document. 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 60364-4-41, *Installations électriques à basse tension – Partie 4-41: Protection pour assurer la sécurité – Protection contre les chocs électriques*

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 61892-2:2019, *Unités mobiles et fixes en mer – Installations électriques – Partie 2: conception du système*

IEC 61892-3, *Unités mobiles et fixes en mer – Installations électriques – Partie 3: Equipements*

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

IEC 61892-6:2019, *Unités mobiles et fixes en mer – Installations électriques – Partie 6: Installation*

IEC 61892-7:2019, *Unités mobiles et fixes en mer – Installations électriques – Partie 7: Zones dangereuses*

ISO 8468, *Navires et technologie maritime – Aménagement de la passerelle d'un navire et disposition de ses équipements connexes – Exigences et directives*

ISO 11064 (toutes les parties), *Conception ergonomique des centres de commande*

OMI, *International Convention for the Safety of Life at Sea (SOLAS)*, édition consolidée de 2014 (disponible en anglais seulement)

OMI, *Code MODU de 2009, Code for the Construction and Equipment of Mobile Offshore Drilling Units, 2009*, édition de 2010 (disponible en anglais seulement)

3 Termes et définitions

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

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse <http://www.electropedia.org/>
- ISO Online browsing platform: disponible à l'adresse <http://www.iso.org/obp>

NOTE Les termes et définitions inclus dans le présent document correspondent à ceux qui ont une application générale dans la série IEC 61892. Les termes et définitions qui s'appliquent à des appareils ou équipements particuliers sont inclus dans les autres parties de la série IEC 61892.

3.1

unité en mer

construction, flottante ou non flottante, conçue et érigée pour l'installation ou l'exploitation sur un site en mer

Note 1 à l'article: L'interface de surface de l'équipement sous-marin qui fait partie intégrante des systèmes de production et de transport affectés aux unités fixes et mobiles en mer et une interface temporaire pour les unités mobiles en mer sont également vues comme faisant partie de l'unité en mer.

3.2

unité en mer inhabitée

unité en mer habituellement inhabitée, contrôlée à distance sans avoir recours à la présence humaine pour son fonctionnement et sans quartier d'habitation

Note 1 à l'article: Une unité en mer inhabitée peut également comprendre un abri de survie destiné à appuyer la maintenance occasionnelle du site.

3.3

unité fixe en mer

construction flottante ou non flottante qui effectue des opérations en mer, y compris le forage, la production, le stockage ou les fonctions de support, et qui a été conçue et érigée pour être installée à un endroit spécifique en mer

Note 1 à l'article: Les unités de production de GNL ainsi que les unités de stockage et de regazéification du GNL sont également vues comme des unités fixes en mer. Un FPSO/FSO sur site est également vu comme une unité fixe en mer. Les terminaux flottants de GNL et les FPSO avec configurations amovibles sont également vus comme des unités fixes en mer.

3.4

unité mobile en mer

construction flottante ou non flottante qui effectue des opérations en mer, y compris les fonctions de forage, de production, de stockage, d'hébergement ou de support, qui n'a pas été prévue pour servir sur un site en mer spécifique et qui peut être déplacée sans démantèlement ou modification notable (barges, unité semi-submersible ou autoélévatrice et navires de forage, par exemple)

3.5

unité habitée

unité en mer nécessitant une présence humaine pour l'exploitation et la maintenance, et fournie avec des quartiers d'habitation

3.6

unité satellite

petite unité en mer, habituellement habitée, connectée à une unité plus importante au moyen de canalisations, d'un câble d'alimentation et/ou d'un ombilical

3.7

autorité compétente

organisme gouvernemental et/ou société de classification aux règles desquels il est exigé que l'unité satisfasse

3.8

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, modifié – L'expression "équipement d'une sous-station" a été supprimée de l'exemple.]

3.9

appareil

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

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

3.10

IP

degré de protection procuré par une enveloppe

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, modifié – La Note 1 à l'article a été ajoutée.]

3.11

système de distribution primaire

système relié galvaniquement au générateur ou, dans les unités en mer avec alimentation électrique à partir d'une autre unité ou depuis le quai via un câble, connecté au tableau de commutation où a lieu la régulation de la tension

3.12

système de distribution secondaire

système sans connexion galvanique au générateur ou au tableau de commutation où a lieu la régulation de la tension

3.13

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 neutres et de protection (si exigé)

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

3.14

terre

masse, US, CA

masse générale de la structure ou coque métallique de l'unité

3.15

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

3.16

services d'urgence

services exigés pour permettre l'arrêt sécurisé de l'unité et fournir des services axés sur la sécurité au personnel de l'unité en cas d'urgence pour une durée définie

EXEMPLE Le système d'arrêt d'urgence, l'éclairage de secours, la lutte contre les incendies, les systèmes d'alarme et de télécommunications sont des exemples de services d'urgence.

3.17

services essentiels

services exigés pour maintenir l'unité dans un état défini de préparation et d'habitabilité pour une période définie par l'utilisateur dans le cas de situations différentes de l'exploitation normale et sans avoir recours à la source d'alimentation de secours, excepté en cas d'urgence

EXEMPLE Les services exigés pour le maintien de l'unité dans des conditions d'habitabilité et de confort minimal, le maintien des propulseurs de commande de direction pour les unités mobiles amarrées par tourelle et les opérations de transfert de carburant/d'avitaillement en carburant sont des exemples de services essentiels.

3.18 **fréquence**

3.18.1

variation cyclique de fréquence

écart périodique de la fréquence en exploitation normale, qui pourrait être causé par une charge appliquée régulièrement

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

3.18.2

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 en régime établi qui inclut les variations dues à des charges et aux caractéristiques des générateurs.

3.18.3

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)

3.19

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]

3.20

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]

3.21

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]

3.22

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]

3.23

pétrole brut

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

3.24

point

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

3.25

tensions

3.25.1

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 en régime établi 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.

3.25.2

tolérance de déséquilibre de tension

déséquilibre maximal admissible entre la tension la plus élevée et la tension la plus faible entre phases, exprimé en pourcentage de la tension nominale

3.25.3

variation cyclique de tension

écart périodique (valeurs efficaces maximales à minimales) de la tension nominale, qui pourrait être causé par une charge appliquée régulièrement

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

3.25.4

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)

3.26

temps de recouvrement

3.26.1

temps de recouvrement de tension transitoire

temps s'écoulant entre le dépassement de la tolérance de tension établie et le retour et le maintien de la tension dans les limites de tolérance établies

3.26.2

temps de recouvrement de fréquence transitoire

temps s'écoulant entre le dépassement de la tolérance de fréquence établie et le retour et le maintien de la fréquence dans les limites de tolérance établies

3.27

forme d'onde

3.27.1

THD

taux de distorsion harmonique total

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

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

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 le présent document.

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

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, modifié – La Note 1 à l'article a été reformulée et la Note 2 à l'article a été ajoutée.]

3.27.2

taux d'harmonique individuel

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

3.28

ombilical

groupe de composants fonctionnels, comme les câbles électriques, les câbles à fibres optiques, les tuyaux et tubes, posés ou regroupés ou en combinaison les uns avec les autres, qui fournit généralement des services hydrauliques, d'injection de fluide, d'alimentation et/ou de communication

[SOURCE: ISO 13628-5:2009, 3.1.47, modifié – En français, la définition a été reformulée et la Note 1 à l'article a été omise.]

3.29

niveau de protection du matériel

EPL

niveau de protection assigné à un matériel, basé sur sa probabilité de devenir une source d'inflammation et distinguant les différences entre les atmosphères explosives gazeuses, les atmosphères explosives poussiéreuses et les atmosphères explosives dans les mines exposées au grisou

Note 1 à l'article: L'abréviation "EPL" est dérivée du terme anglais développé correspondant "equipment protection level".

[SOURCE: IEC 60079-0:2017, 3.33, modifié – En français, le mot "appareil" a été remplacé par "matériel" dans le terme, et la définition a été reformulée.]

4 Exigences générales et conditions

4.1 Généralités

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

Les installations électriques doivent être telles que:

- a) la sécurité de l'unité et des personnes présentes à bord est assurée;
- b) les exigences relatives à la sécurité indiquées dans le présent document sont respectées;

- c) 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;
- d) les exigences du Code de l'OMI relatif aux unités mobiles de forage au large (MODU, mobile offshore drilling unit) sont respectées lorsqu'elles sont applicables.

Pour les unités flottantes, 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 respecter.

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 admise, sous réserve qu'ils ne soient pas moins sûrs, efficaces et fiables.

4.3 Ajouts et modifications

Aucun ajout ni modification, de nature provisoire ou permanente, ne doit être apporté à une installation électrique 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 aux facteurs qui affectent la conception de système existante, tels 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 être exploités de façon correcte dans des conditions d'environnement variées sur le site pour lequel l'unité a été conçue.

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

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

NOTE 1 Les conditions d'environnement sont normalement spécifiées dans les documents de conception générale pour chaque projet, en fonction du lieu d'exploitation.

NOTE 2 Les recommandations relatives au traitement de surface et au système de peinture protectrice sont données à l'Annexe C.

4.4.2 Température ambiante

Pour un projet spécifique, la documentation du projet peut fournir des informations spécifiques concernant la température ambiante. En l'absence de telles informations, les dispositions suivantes doivent s'appliquer.

Dans d'autres parties de la série IEC 61892 où aucune température de l'air ambiant maximale n'a été spécifiée comme paramètre de conception de l'équipement, une valeur de 40 °C doit s'appliquer.

Les unités mobiles en mer doivent être conformes à l'IEC 61892-5.

NOTE 1 Les sociétés de classification exigent généralement une température d'air ambiant de 45 °C. D'autres valeurs de température de l'air ambiant peuvent être prises en compte en fonction des conditions locales spécifiques.

Dans le cas d'une unité fixe, la température doit être basée sur les conditions d'environnement du lieu de l'exploitation.

NOTE 2 Pour les précautions contre le climat froid, voir Annexe B.

4.5 Caractéristiques du système d'alimentation

4.5.1 Généralités

Sauf indication contraire dans d'autres parties du présent document et lorsqu'il est alimenté à partir de systèmes de distribution généraux, l'équipement doit fonctionner en tenant compte des variations de tension et de fréquence, de la distorsion harmonique et des perturbations conduites. Les caractéristiques des systèmes de distribution généraux sont données dans les paragraphes suivants du 4.5.

Lorsque l'alimentation est fournie par le quai, il convient de tenir compte de l'effet que la qualité de l'alimentation, si différente de celle indiquée en 4.5, peut avoir sur l'aptitude de l'équipement.

Pour les systèmes où des semiconducteurs sont connectés et possèdent des caractéristiques assignées correspondant à une grande partie des caractéristiques assignées totales du système, la suppression des harmoniques peut être réalisable. Il convient de veiller à prendre des mesures adéquates pour atténuer ces effets du système de distribution de manière à assurer une exploitation sûre. Il convient d'accorder une attention particulière au choix de consommateurs alimentés par un système d'alimentation électrique possédant un taux d'harmonique supérieur à celui indiqué en 4.5.2.3.

Les équipements électriques exigeant une alimentation de qualité supérieure peuvent nécessiter la réalisation en local de dispositions complémentaires. Lorsque des équipements supplémentaires sont installés pour obtenir cette alimentation de qualité supérieure, il peut être nécessaire de les dupliquer et de les séparer au même degré que l'équipement électrique qu'ils alimentent.

4.5.2 Systèmes de distribution en courant alternatif

4.5.2.1 Généralités

Les tensions citées en 4.5.2.2 sont mesurées au point d'installation de l'équipement.

4.5.2.2 Caractéristiques de tension

Les exigences relatives aux caractéristiques de tension sont indiquées dans le Tableau 1. Les tolérances sont exprimées sous la forme d'un pourcentage de la tension nominale.

Tableau 1 – Caractéristiques de tension

Exigences relatives à la résistance du système		
Caractéristiques de tension	Valeur	Commentaires
Tolérance de tension	+6 % -10 %	Tolérance de tension en régime établi sur les tableaux et panneaux de distribution que le système électrique et les appareils électriques en général doivent supporter.
Variation de la tension transitoire	+15 % -15 %	Tolérance de tension transitoire sur les tableaux et les panneaux de distribution que les appareils en général doivent supporter.
Variation de tension max.	+20 % -20 %	Excursions de tension (somme de la déviation transitoire et de la déviation en régime établi) sur les tableaux et les panneaux de distribution que le système électrique et les appareils électriques en général doivent supporter.
Exigences opérationnelles du système		
Caractéristiques de tension	Valeur	Commentaires
Tolérance de tension dans le système de distribution primaire	+2,5 % -2,5 %	Tolérance de tension en régime établi sur les tableaux des générateurs. Pour les unités en mer avec alimentation électrique depuis une autre unité ou depuis le quai via un câble, cela s'applique au tableau sur lequel a lieu la régulation de tension.
Tolérance de tension dans le système de distribution secondaire	+5 % -5 %	Tolérance de tension en régime établi sur les tableaux et panneaux de distribution dans le système de distribution secondaire.
Tensions transitoires: transitoires lentes dues par exemple à une tolérance de variation de charge (écart par rapport à la tension nominale) temps de recouvrement des tensions transitoires ^a	+20 % -15 % 1,5 s maximum	
Déséquilibre de tension	7 %	Y compris le déséquilibre de la tension de phase résultant d'un déséquilibre de la charge.
Sauf indication contraire, les tensions correspondent à des valeurs efficaces.		
^a Après l'initialisation d'une condition transitoire, la tension dans un système de distribution principal ne doit pas différer de la tension avant le début de la condition transitoire de plus de ±3 % en 1,5 s. Dans un système d'urgence, la limite est de ±4 % en 5 s.		

La baisse de la tension transitoire au point d'installation de l'équipement peut aller jusqu'à -20 %. La condition d'exploitation correcte pour un contacteur est basée sur une valeur de la tension d'alimentation de commande d'au moins 85 % de sa valeur assignée. Le contacteur ne doit pas chuter à une tension au-delà de 75 % de la tension assignée d'alimentation de commande.

Il convient que la somme des excursions de tension en un point du système (tolérances et transitoires) par rapport à la tension nominale ne dépasse pas $\begin{matrix} +20 \\ -20 \end{matrix}$ %.

Les exigences relatives aux tolérances de tension sont valides pour la génération locale (tension contrôlée par le générateur AVR). Si l'alimentation électrique se fait à partir de sources extérieures à l'unité (tension contrôlée par le changeur de prise en charge OLTC du transformateur), ces valeurs peuvent ne pas être obtenues.