IEC 61892-4

Edition 2.0 2019-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Mobile and fixed offshore units – Electrical installations –
Part 4: Cables

Unités mobiles et fixes en mer – Installations électriques –
Partie 4: Câbles

IEC 61892-4:2019-04(en-fr)

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Mobile and fixed offshore units – Electrical installations – Part 4: Cables

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MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 4: Cables

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 61892-4 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This second edition cancels and replaces the first edition published in 2007. This edition constitutes a technical revision.

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

a) construction requirements for cables have been removed; reference is made to relevant standards from Subcommittee (SC) 18A;
b) reference is made to standards from IEC TC 20 for cables with rated voltage above 30 kV;
c) tables for current-carrying capacities for defined installations have been removed; reference is made to relevant standards from IEC TC 64;

d) requirements as to the sizes of earth continuity conductors not contained in a cable have been moved to IEC 61892-6;

e) requirements as to fire stops have been deleted;

f) requirements as to tests for cables exposed to drilling fluids have been removed; reference is made to relevant standards from IEC SC 18A;

g) the procedure for tests of jet fire resistant cables has been updated;

h) requirements as to the design of cable systems have been moved to IEC 61892-2;

i) requirements in relation to the installation of cables have been moved to IEC 61892-6.

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

FDIS	Report on voting
18/1652/FDIS	18/1662/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 in 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 document using a colour printer.

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.

MOBILE AND FIXED OFFSHORE UNITS – ELECTRICAL INSTALLATIONS –

Part 4: Cables

1 Scope

This part of IEC 61892 is applicable to the selection of electrical cables intended for fixed electrical systems 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.

This document specifies requirements such as those concerning

– types of cables,
– voltage rating of cables,
– cables and wiring for interconnection of equipment,
– current-carrying capacities for continuous service,
– correction factors for different ambient temperature and for short time duty, and
– short-circuit withstand capacity.

This document also gives information on the jet fire test for hydrocarbon (HCF) fire resistant cables.

The reference to fixed electrical systems includes those subjected to vibration due to the movement of the unit, for example, cables installed on a drag chain, and not those intended for repeated flexing. This document does not cover flexible cables, for example, those used on drilling decks for top-drive, or cables for portable equipment.

This document is applicable for cables with a rated voltage up to and including 18/30 kV AC and makes reference to cable standards developed by SC 18A.

For higher voltages, relevant standards developed by TC 20 are applicable.

This document does not apply to

– optical fibre cables,
– sub-sea and umbilical cables;,
– cables supplying downhole pumps, and
– data, telecommunication and radio frequency cables.

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 60092-350:2014, *Electrical installations in ships – Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications*

IEC 60092-353, *Electrical installations in ships – Part 353: Power cables for rated voltages 1 kV and 3 kV*

IEC 60092-354:2014, *Electrical installations in ships – Part 354: Single and three-core power cables with extruded solid insulation for rated voltages 6 kV (U_m = 7,2 kV) up to 30 kV (U_m = 36 kV)*

IEC 60092-360:2014, *Electrical installations in ships – Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication cables*

IEC 60092-376, *Electrical installations in ships – Part 376: Cables for control and instrumentation circuits 150/250 V (300 V)*

IEC 61892-1, *Mobile and fixed offshore units – Electrical installations – Part 1: General requirements and conditions*

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

EN 1363-2:1999, *Fire resistance tests – Part 2: Alternative and additional procedures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61892-1 and the following 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

3.1
braid armour
covering formed from braided metal wires used to protect a cable from external mechanical effects

[SOURCE: IEC 60092-350:2014, 3.3, modified – The notes to entry have been deleted.]

3.2
armour
covering consisting of metal tape(s) or wires, generally used to protect the cable from external mechanical effects

[SOURCE: IEC 60050-461:2008, 461-05-06]

3.3
screen
conducting layer or assembly of conducting layers having the function of control of the electric field within the insulation

Note 1 to entry: It may also provide smooth surfaces at the boundaries of the insulation and assist in the elimination of spaces at these boundaries

[SOURCE: IEC 60050-461:2008, 461-03-01]

4 Types and operating conditions of cables

4.1 Types of cables

Cables constructed in accordance with IEC 60092-353, IEC 60092-354, and IEC 60092-376 shall be used on mobile and fixed offshore units. All cables shall be low smoke and halogen free, using materials according to IEC 60092-360. For voltages higher than 30 kV (nominal), standards from IEC TC 20 shall be used.

NOTE 1 Relevant standard from TC 20 is IEC 60840.

When cables according to standards from TC 20 are used, the cables shall meet the minimum requirements in IEC 60092-354:2014, Table 3 "Flame spread tests" and Table 4.

In the case of single-core cables for AC systems or cables for circuits with a high content of harmonics, such as SCR circuits, non-magnetic braid armour or armour shall be used.

Test requirements for cables exposed to drilling fluid are given in IEC 60092-360:2014, Annex D.

NOTE 2 IEC 60092-350, IEC 60092-353, IEC 60092-354 and IEC 60092-376 specify braid armour only. However, in some countries, cables with armour are also used for offshore applications.

4.2 Voltage rating – Power frequency cables

The maximum rated voltage (U) considered in this document for power frequency cables is 30 kV.

In the voltage designation of cables U_0 / U / (U_m):

– U_0 is the rated power frequency voltage between conductor and earth or the metallic screen for which the cable is designed;

– U is the rated power frequency voltage between conductors for which the cable is designed;

– U_m is the maximum value of the highest system voltage which may be sustained under normal operating conditions at any time and at any point in the system. It excludes transient voltage conditions and rapid disconnection of loads.

U_m is chosen to be equal to or greater than the highest voltage of the three-phase system. Where cables are permitted for use on circuits where the nominal system voltage exceeds the rated voltage of the cables, the nominal system voltage shall not exceed the highest system voltage (U_m) of the cable.

Careful consideration shall be given to cables subjected to voltage surges associated with highly inductive circuits to ensure that they are of a suitable voltage rating.

The choice of standard cables of appropriate voltage designations for particular systems depends upon the system voltage and the system earthing arrangements.

The rated voltage of any cable shall not be lower than the nominal voltage of the circuit for which it is used. To facilitate the choice of the cable, the values of U recommended for cables to be used in three-phase systems are listed in Table 1 in which systems are divided into the following three categories.

- Category A

This category comprises those systems in which any phase conductor that comes into contact with earth or an earth conductor is automatically disconnected from the system.

- Category B

This category comprises those systems that, under fault conditions, are operated for a short time, not exceeding 8 h on any occasion, with one phase earthed.

For example, for a 13,8 kV system of Category A or B, the cable should have a rated voltage not less than 8,7/15 kV.

In a system where an earth fault is not automatically and promptly eliminated, the increased stresses on the insulation of cables during the earth fault are likely to affect the life of the cables to a certain degree. If the system is expected to be operated fairly often with a sustained earth fault, it may be preferable to use cables suitable for Category C. In any case, for classification as Category B, the expected total duration of earth faults in any year should not exceed 125 h.

- Category C

This category comprises all systems that do not fall into Categories A and B.

The nominal system voltages from 3,3 kV to 30 kV shown in Table 1 are generally in accordance with IEC 60038:2009, series I. For nominal system voltages intermediate between these standard voltages and also between 0,6/1 kV and 1,8/3,3 kV, the cables should be selected with a rated voltage not less than the next higher standard value. For example: a first earth fault with one phase earthed causes a $\sqrt{3}$ higher voltage between the phases and earth during the fault. If the duration of this earth fault exceeds the times given for Category B, then according to Table 1, for a 17,5 kV system, the cable is to have a rated voltage not less than 12/20 kV.

A DC voltage to earth of up to a maximum of 1,5 times the AC U_0 voltage may be used. However, consideration should be given to the peak value when determining the voltage of DC systems derived from rectifiers, bearing in mind that smoothing does not modify the peak value when the semiconductors are operating on an open circuit.

Table 1 – Choice of cables for AC systems

System voltage		System category	Minimum rated voltage of cable U_0/U	
Nominal voltage U kV	Maximum sustained voltage U_m kV		Unscreened kV	Single-core or screened kV
up to 0,25	0,30	A, B or C	0,15 / 0,25	–
1	1,2	A, B or C	0,6 / 1,0	0,6 / 1,0
3	3,6	A or B	1,8 / 3,0	1,8 / 3,0
3	3,6	C		3,6 / 6,0
6	7,2	A or B		3,6 / 6,0
6	7,2	C		6,0 / 10
10	12	A or B		6,0 / 10
10	12	C		8,7 / 15
15	17,5	A or B		8,7 / 15
15	17,5	C		12 /20
20	24	A or B		12 / 20
20	24	C		18 / 30
30	36	A or B		18 / 30

4.3 Cables and wiring for interconnection of equipment

Cables external to an enclosure shall comply with the requirements of this document.

The minimum size for conductors in IEC 60092-350:2014, Table 1, shall be used. Smaller cable sizes may be considered; however, the mechanical strength and insulation qualities of such cables and wiring shall not affect the reliability and safety of the system of which they form a part.

4.4 Cross-sectional areas of conductors and current-carrying capacities

4.4.1 Earth conductors

The cross-sectional area of an earth conductor contained in a cable is given in Table 2.

Table 2 – Sizes of earth continuity conductors and equipment earthing connections

Arrangement of earth conductor	Cross-section Q of associated current-carrying conductor (one phase or pole) mm^2	Minimum cross-section of earth conductor
Insulated earth conductor in cable for fixed installation.	$Q \leq 16$	Q
Copper braid armour of cable for fixed installation according to IEC 60092-350:2014, 4.8.1.	$Q > 16$	50 % of the current-carrying conductor, but not less than 16 mm^2

For earth conductors not incorporated in a cable, see IEC 61892-6:2019, Table 5.

4.4.2 Current-carrying capacities

The procedure for cable selection employs rating factors to adjust the current-carrying capacities for different ambient temperatures, short time duty, the mutual heating effects of grouping with other cables, and methods of installation. Guidance on the use of these factors is given in 4.4.3 to 4.4.5.

4.4.3 Current-carrying capacities for continuous service

Continuous service for a cable shall be considered, for the purpose of this document, as a current-carrying service with constant load having a duration longer than three times the thermal time constant of the cable, i.e., longer than the critical duration (see Figure 1).

The current to be carried by any conductor for sustained periods during normal operation shall be such that the maximum permissible conductor temperature limit is not exceeded.

Current ratings for use generally for continuous service shown in Table 4 and Table 5 are recommended as being applicable to both cables with and without braid armour or armour, laid in free air as a group of six bunched together.

These ratings may be considered applicable, without correction factors, for cables bunched together on cable trays, in cable conduits, pipes or trunking, unless more than six cables, which may be expected to operate simultaneously at their full rated capacity, are laid close together in a cable bunch in such a way that there is an absence of free air circulation around them. In this case, a correction factor of 0,85 should be applied.

NOTE 1 Cables are said to be bunched when two or more are contained within a single conduit, trunking or duct, or if not enclosed, are not separated from each other.

These ratings have been calculated using the basis given below for an ambient temperature of 45 °C and a conductor temperature that is assumed to be equal to the maximum rated temperature of the insulation and continuously maintained.

The basis for the calculation of the ratings in Table 4 and Table 5 is as follows.

The current ratings I, in amperes, have been calculated for each nominal cross-sectional area A, in square millimetres, with the formula:

$$I = \alpha A^{0,625}$$

where

α is a coefficient related to the maximum permissible service temperature of the conductor, as given in Table 3.

Table 3 – Coefficient related to maximum permissible temperature of the conductor

Maximum permissible temperature of the conductor			90 °C	95 °C
Values of α for nominal cross-sectional area	≥ 2,5 mm^2		17	18
	< 2,5 mm^2		18	20

For two-, three- and four-conductor cables, the current ratings derived from Table 3 should be multiplied by the following (approximate) correction factors:

- 0,85 for two-core cables;
- 0,70 for three- and four-core cables.