

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**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)**

**Installations électriques à bord des navires –
Partie 354: Câbles d'énergie unipolaires et tripolaires à isolement massif extrudé
pour des tensions assignées allant de 6 kV ($U_m = 7,2$ kV) jusqu'à 30 kV
($U_m = 36$ kV)**



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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)**

FOREWORD

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International Standard IEC 60092-354 has been prepared by subcommittee 18A: Electric cables for ships and mobile and fixed offshore units, of IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

This third edition cancels and replaces the second edition published in 2003. This edition constitutes a technical revision with respect to the previous edition.

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

- a) Modification of construction requirements in line with IEC 60092-350. There has been some redistribution of test methods between IEC 60092-350 and this new standard to remove all tests carried out on complete cables.

- b) Requirements for enhanced cold properties, oil resistance and resistance to drilling fluids have been aligned to IEC 60092-350.

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

FDIS	Report on voting
18A/377/FDIS	18A/380/RVD

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

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

The list of all the parts of the IEC 60092 series, under the general title *Electrical installations in ships*, can be found on the IEC website.

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

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- replaced by a revised edition, or
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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)

1 Scope

This part of IEC 60092 is applicable to shipboard and offshore power cables with extruded solid insulation, conductor and core screening, having a voltage rating of one of the following: 3,6/6 (7,2) kV, 6/10 (12) kV, 8,7/15 (17,5) kV, 12/20 (24) kV, 18/30 (36) kV.

NOTE 1 Subclause 4.1 gives more details.

The cables are intended for fixed installations.

The various types of power cables are given in 5.1. The constructional requirements and test methods are aligned with those indicated in IEC 60092-350, unless otherwise specified in this standard.

The object of this standard is:

- to standardize cables whose safety and reliability are ensured when they are installed in accordance with the requirements of IEC 60092-352 or IEC 61892-4;
- to lay down standard manufacturing requirements and characteristics of such cables directly or indirectly bearing on safety;
- to specify test methods for checking conformity with those requirements.

NOTE 2 Only radial field cables are covered.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60038, *IEC standard voltages*

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

IEC 60228, *Conductors of insulated cables*

IEC 60332-1-2, *Tests on electric and optical fibre cables under fire conditions – Part 1-2: Test for vertical flame propagation for a single insulated wire or cable – Procedure for 1 kW pre-mixed flame*

IEC 60332-3-22, *Tests on electric cables under fire conditions – Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables – Category A*

IEC 60684-2, *Flexible insulating sleeving – Part 2: Methods of test*

IEC 60754-1, *Test on gases evolved during combustion of materials from cables – Part 1: Determination of the halogen acid gas content*

IEC 60754-2, *Test on gases evolved during combustion of materials from cables – Part 2: Determination of acidity (by pH measurement) and conductivity*

IEC 60885-2, *Electrical test methods for electric cables – Part 2: Partial discharge tests*

IEC 61034-1, *Measurement of smoke density of cables burning under defined conditions – Part 1: Test apparatus*

IEC 61034-2, *Measurement of smoke density of cables burning under defined conditions – Part 2: Test procedure and requirements*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 60092-350 apply.

4 General requirements

4.1 Rated voltage

The standard method of designating the rated voltages of cables covered by this standard shall take the form

$U_0/U (U_m)$

where

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

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

U_m is the maximum value of the highest system voltage for which the equipment (including cable) may be used (see IEC 60038).

All voltages are given as r.m.s. values.

The standard rated voltages $U_0/U (U_m)$ of the cables considered in this standard are: 3,6/6 (7,2) kV, 6/10 (12) kV, 8,7/15 (17,5) kV, 12/20 (24) kV, and 18/30 (36) kV.

4.2 Markings

4.2.1 Indication of origin and voltage identification

Cables shall comply with 4.1.3 of IEC 60092-350:2014 with respect to:

- a) indication of origin;
- b) rated voltage and cable construction (number of cores and cross-sectional area of the construction);

- c) continuity of marking;
- d) durability/legibility.

4.2.2 Continuity of marking

The marking is deemed to be continuous if the distance between the end of any marking and the beginning of the next does not exceed:

- a) 550 mm if the marking is on the outer surface of the cable;
- b) 275 mm in all other cases.

4.2.3 Core identification for three-cores

Cores of cables shall be provided with a suitable method of identification. Each core shall be easily distinguishable from the other cores in the cable.

5 Constructional requirements

5.1 General cable description

5.1.1 Overview

Shipboard and offshore cables for fixed installations shall be single or multi-core cables generally constructed as follows.

5.1.2 Armoured single-sheathed cable with outer sheath only

The armoured single-sheathed cables having only an outer sheath are constructed as follows:

- copper conductor, see 5.2;
- conductor semi-conducting screen, see 5.4.2;
- insulation, see 5.3;
- insulation screening, see 5.4.3;
- cabling (for three-core cables), see 5.6;
- inner covering, see 5.7;
- braid armour, see 5.9;
- outer sheath applied as either one or two layer systems, see 5.10.

5.1.3 Armoured double-sheathed cable with inner and outer sheath

The armoured double-sheathed cables having both an inner and an outer sheath are constructed as follows:

- copper conductor, see 5.2;
- conductor semi-conducting screen, see 5.4.2;
- insulation, see 5.3;
- insulation screening, see 5.4.3;
- cabling (for three-core cables), see 5.6;
- inner sheath, see 5.8;
- braid armour, see 5.9;
- outer sheath applied as either one or two layer systems, see 5.10.

The use of a thermoplastic inner sheath (ST 2 or SHF 1) is not recommended if the outer sheath consists of an elastomeric cross-linked material.

5.1.4 Armoured single-sheathed cable with inner sheath only

The armoured single-sheathed cables having only an inner sheath are constructed as follows:

- copper conductor, see 5.2;
- conductor semi-conducting screen, see 5.4.2;
- insulation, see 5.3;
- insulation screening, see 5.4.3;
- inner sheath, see 5.8;
- braid armour, see 5.9.

The cables for installation in spaces where corrosion can occur, for example weather decks, wet locations, battery compartments, refrigeration rooms, etc., should have an outer sheath over the braid, if any, unless the braid itself is corrosion-resistant.

5.1.5 Unarmoured single-sheathed cable

The unarmoured single-sheathed cables are constructed as follows:

- copper conductor, see 5.2;
- conductor semi-conducting screen, see 5.4.2;
- insulation, see 5.3;
- insulation screening, see 5.4.3;
- cabling (for three-core cables), see 5.6;
- inner covering (optional), see 5.7;
- outer sheath applied as either one or two layer systems, see 5.10.

5.2 Conductors

Material, metal coating, class and form of the conductors shall be in accordance with IEC 60092-350. The form of the conductor shall be round circular stranded, non-compacted or compacted, in accordance with Class 2 of IEC 60228. To aid installation a conductor of Class 5 may be used. Cables with such Class 5 conductors should not be regarded as suitable for repeated flexing in service.

The minimum cross-sectional area shall be 10 mm² for 3,6/6 (7,2) kV cables, 16 mm² for 6/10 (12) kV cables, 25 mm² for 8,7/15 (17,5) kV cables, 35 mm² for 12/20 (24) kV cables and 50 mm² for 18/30 (36)kV cables.

5.3 Insulation

5.3.1 Material

The insulation system shall be EPR, HEPR or XLPE compounds as defined in IEC 60092-360.

5.3.2 Application

The application shall be as detailed in 4.3.2 of IEC 60092-350:2014.