

ELEKTRIPAIGALDISED LAEVADEL. OSA 507:
VÄIKELAEVAD

Electrical installations in ships - Part 507 - Small vessels

EESTI STANDARDI EESSÕNA

NATIONAL FOREWORD

See Eesti standard EVS-EN 60092-507:2015 sisaldab Euroopa standardi EN 60092-507:2015 ingliskeelset teksti.	This Estonian standard EVS-EN 60092-507:2015 consists of the English text of the European standard EN 60092-507:2015.
Standard on jõustunud sellekohase teate avaldamisega EVS Teatajas	This standard has been endorsed with a notification published in the official bulletin of the Estonian Centre for Standardisation.
Euroopa standardimisorganisatsioonid on teinud Euroopa standardi rahvuslikele liikmetele kättesaadavaks 09.01.2015.	Date of Availability of the European standard is 09.01.2015.
Standard on kättesaadav Eesti Standardikeskusest.	The standard is available from the Estonian Centre for Standardisation.

Tagasisidet standardi sisu kohta on võimalik edastada, kasutades EVS-i veebilehel asuvat tagasiside vormi või saates e-kirja meiliaadressile standardiosakond@evs.ee.

ICS 47.020.60

Standardite reprodutseerimise ja levitamise õigus kuulub Eesti Standardikeskusele

Andmete paljundamine, taastekitamine, kopeerimine, salvestamine elektroonsesse süsteemi või edastamine ükskõik millises vormis või millisel teel ilma Eesti Standardikeskuse kirjaliku loata on keelatud.

Kui Teil on küsimusi standardite autorikaitse kohta, võtke palun ühendust Eesti Standardikeskusega:

Aru 10, 10317 Tallinn, Eesti; koduleht www.evs.ee; telefon 605 5050; e-post info@evs.ee

The right to reproduce and distribute standards belongs to the Estonian Centre for Standardisation

No part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, without a written permission from the Estonian Centre for Standardisation.

If you have any questions about copyright, please contact Estonian Centre for Standardisation:

Aru 10, 10317 Tallinn, Estonia; homepage www.evs.ee; phone +372 605 5050; e-mail info@evs.ee

EUROPEAN STANDARD

EN 60092-507

NORME EUROPÉENNE

EUROPÄISCHE NORM

January 2015

ICS 47.020.60

Supersedes EN 60092-507:2000

English Version

**Electrical installations in ships - Part 507 - Small vessels
(IEC 60092-507:2014)**

Installations électriques à bord des navires - Partie 507:
Petits navires
(IEC 60092-507:2014)

Elektrische Anlagen auf Schiffen - Teil 507: Kleine
Wasserfahrzeuge
(IEC 60092-507:2014)

This European Standard was approved by CENELEC on 2014-12-30. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.



European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

The text of document 18/1426/FDIS, future edition 3 of IEC 60092-507, prepared by IEC/TC 18 "Electrical installations of ships and of mobile and fixed offshore units" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 60092-507:2015.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-09-30
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2017-12-30

This document supersedes EN 60092-507:2000.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 60092-507:2014 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

ISO 10133	NOTE	Harmonised as	EN ISO 10133 (not modified).
ISO 10240	NOTE	Harmonised as	EN ISO 10240 (not modified).
ISO 13297	NOTE	Harmonised as	EN ISO 13297 (not modified).

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60034	series	Rotating electrical machines	EN 60034	series
IEC 60079	series	Explosive atmospheres	EN 60079	series
IEC 60092-101	1994	Electrical installations in ships - Part 101: Definitions and general requirements	-	-
IEC 60092-202	1994	Electrical installations in ships - Part 202: System design - Protection	-	-
IEC 60092-301	1980	Electrical installations in ships - Part 301: Equipment - Generators and motors	-	-
IEC 60092-302	-	Electrical installations in ships - Part 302: Low-voltage switchgear and controlgear assemblies	-	-
IEC 60092-303	-	Electrical installations in ships - Part 303: Equipment - Transformers for power and lighting	-	-
IEC 60092-304	-	Electrical installations in ships. Part 304: Equipment - Semiconductor convertors	-	-
IEC 60092-306	-	Electrical installations in ships - Part 306: Equipment - Luminaires and accessories	-	-
IEC 60092-307	-	Electrical installations in ships - Part 307: Equipment - Heating and cooking appliances	-	-
IEC 60092-350	-	Electrical installations in ships - Part 350: Shipboard power cables - General construction and test requirements	-	-
IEC 60092-352	-	Electrical installations in ships - Part 352: Choice and installation of electrical cables	-	-
IEC 60092-401	1980	Electrical installations in ships.- Part 401: Installation and test of completed installation	-	-
IEC 60092-501	2013	Electrical installations in ships - Part 501: Special features - Electric propulsion plant	-	-
IEC 60146	series	General requirements and line commutated convertors	EN 60146	series
IEC 60245-4	-	Rubber insulated cables - Rated voltages up to and including 450/750 V - Part 4: Cords and flexible cables	-	-

IEC 60309-1	-	Plugs, socket-outlets and couplers for industrial purposes - Part 1: General requirements	EN 60309-1	-
IEC 60309-2	-	Plugs, socket-outlets and couplers for industrial purposes - Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories	EN 60309-2	-
IEC 60332-1	series	Tests on electric cables under fire conditions; Part 1: test on a single vertical insulated wire or cable	EN 60332-1	series
IEC 60332-3-22	-	Tests on electric and optical fibre cables under fire conditions - Part 3-22: Test for vertical flame spread of vertically-mounted bunched wires or cables - Category A	-	-
IEC 60364-7-709	-	Low-voltage electrical installations - Part 7-709: Requirements for special installations or locations - Marinas and similar locations	HD 60364-7-709	-
IEC 60445	2010	Basic and safety principles for man-machine interface, marking and identification - Identification of equipment terminals, conductor terminations and conductors	EN 60445	2010
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	-
IEC 60533	-	Electrical and electronic installations in ships - Electromagnetic compatibility	-	-
IEC 60898-1	-	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation	EN 60898-1	-
IEC 60945	-	Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results	EN 60945	-
IEC 60947-2	-	Low voltage switchgear and controlgear – Part 2: Circuit-breakers	EN 60947-2	-
IEC 60947-7-1	-	Low-voltage switchgear and controlgear - Part 7-1: Ancillary equipment - Terminal blocks for copper conductors	EN 60947-7-1	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-
IEC 61558	series	Safety of power transformers, power supplies, reactors and similar products	EN 61558	series
IEC 61558-2-4	2009	Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V - Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers	EN 61558-2-4	2009
ISO 8846	-	Small craft - Electrical devices - Protection against ignition of surrounding flammable gases	EN 28846:1993/A1	-
ISO 9094-1	-	Small craft - Fire protection - Part 1: Craft with a hull length of up to and including 15 m	EN ISO 9094-1	-
ISO 9094-2	-	Small craft - Fire protection - Part 2: Craft with a hull length of over 15 m	EN ISO 9094-2	-

ISO 10239	-	Small craft - Liquefied petroleum gas (LPG) systems	EN ISO 10239	-
IMO 904E	-	Convention on the International Regulations for Preventing Collisions at Sea, International Maritime Organization (COLREG)	-	-
SOLAS	1974	International Convention for the Safety of Life at Sea	-	-

This document is a preview generated by EVS

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
1.1 General.....	10
1.2 Electrical systems.....	10
2 Normative references.....	11
3 Terms and definitions.....	13
3.1 General terms.....	13
3.2 Terms and definitions related to DC systems of distribution.....	14
3.3 Terms and definitions related to AC systems of distribution.....	14
3.4 Terms and definitions related to protection.....	15
3.5 Terms and definitions related to equipment.....	16
3.6 Terms and definitions related to batteries.....	18
3.7 Terms and definitions related to galvanic isolation from shore supplies.....	19
4 General requirements.....	19
4.1 Ratings.....	19
4.2 Ambient air and cooling water temperature.....	19
4.3 Inclination of vessel.....	20
4.4 Voltage and frequency variations.....	20
4.4.1 General.....	20
4.4.2 DC systems.....	20
4.4.3 AC systems.....	21
4.5 Electrical power sources.....	21
4.5.1 General.....	21
4.5.2 DC systems supplied from batteries.....	22
4.5.3 DC generator.....	22
4.5.4 AC systems.....	23
4.5.5 AC generator.....	23
4.5.6 Measuring instruments.....	24
4.5.7 Emergency source of electrical power.....	24
4.6 Equipment.....	25
4.6.1 Transformers.....	25
4.6.2 Converters.....	25
4.6.3 Motors.....	25
4.7 Electrical equipment and enclosures.....	25
4.7.1 General requirements.....	25
4.7.2 General degree of protection of equipment and enclosures.....	25
4.7.3 Protection from dripping water.....	26
4.7.4 Cable entry.....	26
4.7.5 Identification.....	26
4.7.6 Segregation of DC and AC systems.....	27
4.7.7 Electromagnetic compatibility.....	27
4.7.8 Busbars.....	27
4.7.9 Switches and controls.....	27
4.7.10 Final circuits.....	27
4.8 Plugs and socket-outlets.....	28

4.8.1	AC system	28
4.8.2	DC systems	28
4.8.3	Installation in special locations	28
4.9	Battery installation	28
4.9.1	General arrangements	28
4.9.2	Isolation of battery banks	28
4.9.3	Operational switching of battery banks	29
4.9.4	Permanently energised circuits	29
4.9.5	Ventilation	29
4.10	Electrical apparatus for explosive gas atmospheres	30
4.11	Battery chargers	30
4.11.1	Protection against overcharging and reversal of charging current	30
4.11.2	Wind generator and photovoltaic devices	31
4.12	Electric propulsion systems	31
4.12.1	General	31
4.12.2	Component parts of electric propulsion systems suitable for small vessels	31
4.12.3	Operator controls, instruments, system and trip alarms	33
4.13	Electrical fittings and cables attached to structures of another metal	34
4.14	Internal communication circuits	34
4.15	Navigation lights supply	34
4.16	Luminaires	34
4.17	Electrical heating and cooking appliances	35
4.18	Magnetic compasses	35
5	Distribution systems	35
5.1	DC distribution systems	35
5.2	Standard AC distribution systems	35
5.2.1	Types of AC distribution system	35
5.2.2	Earthing the neutral conductor in type TN AC systems	35
5.2.3	Earthing of non-current-carrying parts	36
5.2.4	Protective conductor in AC systems	36
5.3	Earth bonding conductors	36
5.4	Balance of loads in three-phase AC systems	36
5.5	Shore connection arrangements	37
5.5.1	General	37
5.5.2	Vessel connections	37
5.5.3	Information and connection instructions	37
5.5.4	Galvanic isolation provided by an isolation transformer	37
5.5.5	Galvanic isolation provided by a diode type galvanic isolator	38
6	Protection against electric shock in AC and DC systems with voltage exceeding safety voltage	39
6.1	Protection against direct contact	39
6.2	Automatic disconnection of supply to final circuit or equipment	39
6.3	Earthed neutral AC system (TN system)	39
6.4	Non-neutral earthed AC system (IT-type system)	39
6.5	Use of class II equipment	40
7	Protection against over-current and fault-current in AC and DC systems	40
7.1	General	40
7.2	Characteristics of protective devices	40

7.3	DC battery source	40
7.3.1	Overcurrent protection of main circuit from batteries	40
7.3.2	Batteries without output overcurrent protection	41
7.4	AC system	41
7.4.1	Protective devices	41
7.4.2	Final circuits	41
7.5	Generators	42
7.5.1	Small generators in DC systems	42
7.5.2	Use of fuses	42
7.5.3	Generator circuit-breaker	42
7.6	Transformers	42
7.7	Motor protection	42
7.8	Electronic power converters	42
8	Diversity (demand) factor	42
8.1	Circuits other than final circuits	42
8.2	Application of diversity (demand) factors	43
8.3	Final circuits	43
8.4	Motor power circuits	43
9	Cables	43
9.1	Selection of cables	43
9.1.1	Cables for DC systems	43
9.1.2	Cables for AC systems	43
9.1.3	Conductors	43
9.1.4	Protective coverings	43
9.2	Determination of the cross-sectional areas of conductors	44
9.2.1	General requirement	44
9.2.2	DC system	44
9.2.3	AC system	44
9.2.4	Protective conductor in AC systems	44
9.2.5	Current ratings for continuous service (AC and DC)	45
9.2.6	Correction factors for different ambient air temperatures	46
9.2.7	Correction factors for cable bunching	47
9.2.8	Correction factors for non-continuous service	47
9.2.9	Parallel connection of cables	47
10	Cable installation, conductor terminations and identification	48
10.1	Cable routes	48
10.2	Cable support and protection	48
10.3	Segregation of circuits	48
10.4	DC and AC cabling segregation	49
10.5	Instrument, control, navigation aids, data, and communications cables	49
10.6	Conductor terminations	50
10.7	Conductor identification	50
10.7.1	General	50
10.7.2	Bonding conductors	51
10.7.3	Conductor insulation colours in DC systems	51
11	Earthing	51
11.1	Earthing arrangements on small vessels with non-metallic hull	51
11.2	Earthing arrangements on small vessels with metallic hull	51

11.3	Earthing plate for the main earth connection in a small vessel with non-metallic hull	51
11.4	Insulation from earth of control systems for internal combustion engine on metallic hulled vessels	51
11.5	Earthing of electrical equipment enclosures	52
12	Lightning protection	52
12.1	Lightning protection conductors	52
12.2	Installation	52
12.3	Earthing of lightning conductors	52
13	Testing	52
13.1	General	52
13.2	Earthing	53
13.3	Insulation resistance	53
13.3.1	General	53
13.3.2	Switchboards, panel boards and distribution boards	53
13.3.3	Lighting and power circuits	53
13.3.4	Generators and motors	53
13.3.5	Transformers	53
13.4	Switchgear and controlgear	54
13.5	Voltage drop	54
13.6	Internal communication circuits	54
13.7	Lighting, heating and galley equipment	54
14	Vessels over 24 m in length up to 50 m/500 GT	54
14.1	General	54
14.2	Essential services	54
14.3	Capacity of the batteries	54
14.4	Segregation of supplies for essential circuits	55
14.5	SOLAS battery charger protection	55
14.6	Protection against over current and fault current – safety equipment	55
14.7	Earth faults in essential circuits	55
14.7.1	Earthed neutral systems (TN-type systems)	55
14.7.2	Non-earthed system (IT-type system)	55
14.8	Navigation light supply	55
14.9	Radio and navigation equipment	55
14.10	Navigation, control, instrumentation and communication systems	56
14.11	Electric and electrohydraulic steering gear	56
Annex A (informative)	Shore-side power supply arrangements	57
A.1	Connection to a shore power supply	57
A.1.1	General	57
A.1.2	Instructions included in a vessel owner's manual (ISO 10240)	57
A.1.3	Information and instructions for connecting an electrical shore supply to a vessel	57
A.2	Examples of general arrangements for an electrical supply to a vessel	58
A.2.1	Direct connection to a single phase mains supply	58
A.2.2	Direct connection to a single phase mains supply with an isolating transformer on the vessel	59
A.2.3	Direct connection to a three phase mains supply	59
A.2.4	Direct connection to a three phase mains supply with an isolating transformer on the vessel	60

A.2.5	Connection to a single phase supply through a shore-mounted isolating transformer	61
A.2.6	Direct connection to a single phase mains supply with a diode type galvanic isolator in the PE circuit to shore.	61
A.2.7	Direct connection to a three phase mains supply with a diode type galvanic isolator in the PE circuit to shore.	62
Annex B (informative)	Diode type galvanic isolator	63
B.1	General.....	63
B.2	Testing	64
Annex ZZ (informative)	Relationship between this standard and the essential requirements of EU directive 94/25/EC as amended by directive 2003/44/EC	65
Bibliography.....		66
Figure 1 – Diagram showing the use of shore power supply accessories.....		18
Figure A.1 – Direct connection to a single phase mains supply		59
Figure A.2 – Direct connection to a single phase mains supply with an isolating transformer on the vessel		59
Figure A.3 – Direct connection to a three phase mains supply		60
Figure A.4 – Direct connection to a three phase mains supply with an isolating transformer on the vessel		60
Figure A.5 – Connection to a single phase supply through a shore-mounted isolating transformer		61
Figure A.6 – Direct connection to a single phase mains supply with a diode type galvanic isolator in the protective earth circuit to shore		62
Figure A.7 – Direct connection to a three phase mains supply with a diode type galvanic isolator in the protective earth circuit to shore		62
Table 1 – Design parameters – Temperature		20
Table 2 – Angular deviation and motion		20
Table 3 – AC voltages and frequencies for vessel's service systems of supply.....		21
Table 4 – Required technical data for owner's manual		22
Table 5 – Degree of protection in accordance with IEC 60529.....		26
Table 6 – Minimum clearances and creepage distances for bare busbars		27
Table 7 – Reference currents for calculation of minimum ventilation		30
Table 8 – Table of main component parts of an electric propulsion system and associated clauses and sections in this standard		32
Table 9 – Recommended maximum breaking times for protective devices.....		41
Table 10 – Values of α used in the calculation of current ratings.....		45
Table 11 – Recommended current ratings for single core cables in continuous service (ambient temperature 45 °C).....		46
Table 12 – Correction factors for various ambient air temperatures.....		47
Table 13 – Correction factors for half-hour and one-hour service		47
Table ZZ.1 – Correspondence between this standard and directive 94/25/EC as amended by directive 2003/44/EC.....		65

INTRODUCTION

This International Standard incorporates and coordinates, as far as possible, the existing requirements for electrical installations relevant to small vessels as published in other parts of the IEC 60092 series and the IEC 60364 series.

This document is a preview generated by EVS