IEC 60092-504

Edition 5.0 2026-04

INTERNATIONAL STANDARD

REDLINE VERSION

Electrical installations in ships -
Part 504: Automation, control and instrumentation

ICS 47.020.60

ISBN 978-2-8327-1222-1

IEC 60092-504:2026-04 RLV(en)

THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2026 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD 6
INTRODUCTION 8
1 Scope 9
2 Normative references 9
3 Terms and definitions 11
4 General requirements 18
~~4.1 Dependability ..... 18~~
4.1 Safety 18
4.2 Segregation 18
4.3 Performance 18
4.4 Usability 19
4.5 Integration 19
4.6 Development activities 19
4.7 Cyber security 19
4.7.1 General 19
4.7.2 Internet of Things (IoT) 19
4.8 Generic requirements for raising and presenting alerts, including both individual equipment and the (central) alert (management) system 19
4.8.1 Introduction 19
4.8.2 Characterization of alerts 20
4.8.3 Presentation of alerts 20
4.8.4 Circuits 21
4.9 General emergency alarm system 21
4.9.1 General requirements 21
4.9.2 System arrangement 21
4.9.3 Sound requirements 23
4.9.4 Interface for external devices 24
4.9.5 Cabling 24
4.9.6 Unauthorized modification of software configuration 25
4.9.7 General emergency alarm systems on passenger ships (additional requirements) 25
5 ~~Environmental type testing parameters~~ Tests 25
~~5.1 General ..... 25~~
~~5.2 Performance ..... 25~~
6 Design 32
6.1 Environmental and supply conditions 32
6.2 Circuit design 32
6.3 Mutual effects 32
6.4 Electrical subdivision 32
6.5 Signal level 33
6.6 Power supply 33
6.6.1 Independent supplies 33
6.6.2 Capacity 33
6.6.3 Protection 33
7 Construction and materials 33
7.1 Adjustments 33
7.2 Accessibility 33

7.3 Replacement 33
7.4 Non-interchangeability 34
7.5 Cooling 34
7.6 Mechanical load on connectors 34
7.7 Mechanical features of cabinets 34
7.8 Shock and vibration absorbers 34
7.9 Internal wiring 34
7.10 Cable connections 35
8 Installation and ergonomics 35
8.1 General 35
8.1.1 Layout 35
8.1.2 Compatibility 35
8.1.3 Labelling 35
8.1.4 Labels 35
8.1.5 Display colours 35
8.1.6 Illumination 35
8.1.7 Protection against fluid leakage 36
8.1.8 Protection from condensation 36
8.1.9 External cables and wiring 36
8.2 Sensors 36
8.2.1 Location of sensors 36
8.2.2 Temperature sensors 36
8.2.3 Pressure sensors 36
8.2.4 Water level detectors ~~on bulk carriers~~ 36
8.2.5 Enclosure 37
8.2.6 Testing and calibration 37
8.2.7 Presentation of information 37
8.3 Controls 37
8.3.1 Remote controls 37
8.3.2 Man-machine interface 38
~~8.4 Alert systems~~ .....
9 Specific installations 38
9.1 General 38
9.2 Fire safety systems 38
9.3 Bilge systems 39
9.4 ~~Machinery alert installations~~ Alert system 39
~~9.3.1 General~~ .....
9.4.1 Alert requirements 39
9.4.2 Display of information 40
9.4.3 Supply arrangements 41
9.4.4 Design 42
9.5 Power management system 42
9.5.1 General 42
9.5.2 Automatic starting and stopping of main power supply equipment 44
9.5.3 Heavy load request and power reserve calculation 45
9.5.4 Black-out recovery 45
9.5.5 Load sharing and frequency control 45
9.5.6 Shut-down of diesel engine 45
9.5.7 Automatic disconnection of non-essential consumers 46

9.5.8 Design requirements of power management system (PMS) 46
9.6 Energy management system 47
9.6.1 General 47
9.6.2 Functional requirements 47
9.7 Automatic starting installations for electrical motor-driven auxiliaries 49
9.7.1 General 49
9.7.2 Automatic sequence starting 50
9.7.3 Starting installations for stand-by auxiliaries 50
9.7.4 Control voltages 50
9.7.5 Manual control 50
9.7.6 Mechanically driven auxiliaries in low-speed range 50
9.7.7 Mechanically driven auxiliaries 50
9.7.8 Sensors 51
9.8 Machinery control installations 51
9.8.1 General 51
9.8.2 General requirements 51
9.8.3 Transfer of control 51
9.8.4 Remote control of propulsion machinery from the bridge 51
9.8.5 Indicators for remote control of machinery 52
9.8.6 Manual override 53
9.9 Machinery protection and safety systems 53
9.9.1 General 53
9.9.2 General requirements 53
9.10 Bow, inner, side shell and stern doors 54
9.10.1 Application 54
9.10.2 Remote control 54
9.10.3 Indicator system 54
9.10.4 Mode selection 54
9.10.5 Failsafe 54
9.10.6 Testing 55
9.10.7 Independence 55
9.10.8 Display 55
9.10.9 Sensors 55
9.10.10 Television surveillance 55
9.10.11 Water leakage detection 55
9.10.12 Drainage ~~alarm~~ alert 56
9.10.13 Control location 56
9.11 Power-operated watertight doors 56
9.11.1 General 56
9.11.2 Indications 56
9.11.3 Emergency alarm 56
9.11.4 Closure rate 56
9.11.5 Power supply 56
9.11.6 Dedicated circuits 57
9.11.7 Location of equipment 57
9.11.8 Enclosures 57
9.11.9 Leakage 57
9.11.10 Independent circuits 58
9.11.11 Failure of ~~alarm~~ alert circuits 58

9.11.12 Failure of control circuits 58
9.11.13 Power supply monitoring 58
9.11.14 Mode selection 58
9.11.15 Indication on navigation bridge 58
9.11.16 Remote opening 58
9.12 Public address systems (PA) ~~on passenger ships~~ 58
9.12.1 General 58
9.12.2 System arrangement 59
9.12.3 Emergency broadcast 60
9.12.4 Sound requirements 61
9.12.5 Interference 61
9.12.6 Fault tolerance 61
9.12.7 Protection 62
9.12.8 Fire zones 62
9.12.9 Segregation 62
9.12.10 Power supplies 62
9.12.11 Cabling 62
9.12.12 Ships operating in polar waters 62
9.12.13 Public address system (PA) on passenger ships (additional requirements) 63
9.13 Use of public address system (PA) for general emergency alarm (GA) and fire alarm 63
9.13.1 General 63
9.13.2 Power supply 64
10 Computer-based systems 64
10.1 General 64
10.2 General requirements 64
10.3 System categories 65
10.4 System configuration 66
10.4.1 General 66
10.4.2 Power supply 66
10.4.3 Hardware 66
10.4.4 Software 67
10.4.5 Data communication links 67
10.4.6 Wireless data communication 67
10.4.7 Network integration of systems 68
10.4.8 User interface 68
10.4.9 Input devices 68
10.4.10 Output devices 69
10.4.11 Graphical user interface 69
10.5 Protection against modification and loss of data 69
10.6 Software maintenance 70
10.7 Remote access 70
10.7.1 General 70
10.7.2 Remote software maintenance 70
10.8 Documentation 70
10.8.1 General 70
10.8.2 Hardware 71
10.8.3 System functional description 71

10.8.4 Software 71
10.8.5 User interface 72
10.8.6 Test and evidence 72
11 Additional requirements for periodically unattended machinery spaces or for reduced attendance 73
11.1 General 73
11.2 Fire precautions 74
11.3 Protection against flooding 74
11.4 Control of propulsion machinery 74
11.5 ~~Alarm~~Alert system and engineers' ~~alarm~~alert 74
11.6 Protection (safety) systems 74
11.7 Machinery, boiler and electrical installations 74
12 Commissioning and testing 74
12.1 Tests of completed installation on board 74
12.2 Operational tests 74
13 Documentation 75
Annex A (informative) Characterization of alerts 76
Bibliography 77

Figure 1 – Relationship between different alarm processing and handling concepts 20
Figure 2 – Block diagram showing general emergency alarm system interfaces 24
Figure 3 – Typical designs of power management systems 43
Figure A.1 – Characterization of alerts 76

Table 1 – Operating conditions of equipment in respect to power demand 15
Table 2 – Type tests, test procedures and severities 26
Table 3 – Electrical grid control overview 49
Table 4 – Minimum water ingress protection 57
Table 5 – System categories 65
Table 6 – Examples of assignment to system categories 65
Table 7 – Tests and evidence according to the system category 72

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Electrical installations in ships - Part 504: Automation, control and instrumentation

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.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 60092-504:2016. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 60092-504 has been prepared by IEC technical committee 18: Electrical installations of ships and of mobile and fixed offshore units. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2016. This edition constitutes a technical revision.

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

a) aligned bridge and machinery alert references throughout the document;
b) transfer of EMC items to IEC 60533 throughout the document;
c) update of power management and energy management (9.5 and 9.6).

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

Draft	Report on voting
18/2024/FDIS	18/2034/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 60092 series, published under the general title *Electrical installations in ships*, 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 webstore.iec.ch in the data related to the specific document. At this date, the document will be

– reconfirmed,
– withdrawn, or
– revised.

INTRODUCTION

IEC 60092 forms a series of International Standards for electrical installations in sea-going ships, incorporating good practice and coordinating, as far as possible, existing rules.

These standards form a code of practical interpretation and amplification of the requirements of the International Convention for the Safety of Life at Sea (SOLAS), a guide for future regulations which ~~may~~ can be prepared and a statement of practice for use by ship owners, shipbuilders and appropriate organizations.

1 Scope

This part of IEC 60092 specifies requirements for electrical, electronic and programmable equipment supporting essential services intended for automation, control, monitoring, alert, ~~and~~ safety and protection systems ~~for in ships~~

This document is not applicable for:

– maritime navigation and radiocommunication equipment and systems making use of electrotechnical, electronic, electroacoustic, electro-optical and data processing techniques.

NOTE It is important that equipment in the scope of IEC TC 80 (Maritime navigation and radiocommunication equipment and systems) complies with IEC 60945 which already covers the requirements stated in this document.

– internal communication systems, except PA/GA (Public Adress/General Alarm).

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 60050 (all parts), *International Electrotechnical Vocabulary (IEV)* (available at www.electropedia.org)~~

IEC 60068-2-1, *Environmental testing - Part 2: Tests - Test A: Cold*

IEC 60068-2-2, *Environmental testing - Part 2: Tests - Test B: Dry heat*

IEC 60068-2-6, *Environmental testing - Part 2: Tests - Test Fc: Vibration (sinusoidal)*

IEC 60068-2-30, *Environmental testing - Part 2: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 60068-2-52, *Environmental testing - Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)*

IEC 60079-14:2024, *Explosive atmospheres - Part 14: Electrical installation design, selection and installation of equipment, including initial inspection*

IEC 60092-101:~~1994~~2018, *Electrical installations in ships - Part 101: Definitions and general requirements*
~~IEC 60092-101:1994/AMD1:1995~~

IEC 60092-201:1994, *Electrical installations in ships - Part 201: System design - General*

IEC 60092-202, *Electrical installations in ships - Part 202: System design - Protection*

~~IEC 60092-302, *Electrical installations in ships – Part 302: Low -voltage switchgear and controlgear assemblies*~~

IEC 60092-302-2, *Electrical installations in ships - Part 302-2: Low voltage switchgear and controlgear assemblies - Marine power*

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

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

IEC 60092-501, *Electrical installations in ships - Part 501: Special features - Electric propulsion plant*

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

IEC 60331 (all parts), *Tests for electric cables under fire conditions*

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 60447, *Basic and safety principles for man-machine interface, marking and identification - Actuating principles*

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

IEC 60533, *Electrical and electronic installations in ships - Electromagnetic compatibility (EMC) - Ships with a metallic hull*

~~IEC 60945, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*~~

~~IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measuring techniques – Electrostatic discharge immunity test*~~

~~IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*~~

~~IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*~~

~~IEC 61000-4-5:2014, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*~~

~~IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*~~

IEC 61000-4-11, *Electromagnetic compatibility (EMC) - Part 4-11: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current up to 16 A per phase*

IEC 61000-4-17, *Electromagnetic compatibility (EMC) - Part 4-17: Testing and measurement techniques - Ripple on d.c. input power port immunity test*

IEC 61000-4-29, *Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests*

~~IEC 61355-1, *Classification and designation of documents for plants, systems and equipment – Part 1: rules and classification tables*~~

~~IEC 62443 (all parts), *Industrial communication networks – Network and system security*~~

IEC 62923-1:2018, *Maritime navigation and radiocommunication equipment and systems - Bridge alert management - Part 1: Operational and performance requirements, methods of testing and required test results*

IEC 81355-1, *Industrial systems, installations and equipment and industrial products - Classification and designation of information - Part 1: Basic rules and classification of information*

~~ABS publication, *Guidance notes on the application of ergonomics to marine systems (2014-02)*~~

~~CISPR 16-1-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1-1: Radio disturbance and immunity measuring apparatus – Measuring apparatus*~~

~~CISPR 16-2-1, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements*~~

ISO 3740, *Acoustics - Determination of sound power levels of noise sources - Guidelines for the use of basic standards*

EN 54 (all parts), *Fire detection and fire alarm systems*

~~IMO Resolution A.1021(26):2009, *Code on alerts and Indicators*~~

SOLAS, *International Convention for the Safety of Life at Sea*:1974, consolidated edition, 2024

MSC-FAL.1/Circ.3/Rev.2, *Guidelines on maritime cyber risk management,* 2022

IMO Resolution MSC.302(87)~~:2010,~~ *Adoption of Performance Standards for Bridge Alert Management* ~~*(BAM)*~~

~~IMO Resolution A.813(19):1995, *General Requirements for Electromagnetic Compatibility (EMC) for all Electrical and Electronic Ship's Equipment*~~

~~IMO Resolution MSC.98(73):2000, *Adoption of the international code for fire safety systems (FSS Code)*~~

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

3 Terms and definitions

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

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

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.1
accuracy
quality which characterizes the closeness of a measured value to the corresponding true value