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Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a non-metallic hull

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ELECTRICAL AND ELECTRONIC INSTALLATIONS IN SHIPS – ELECTROMAGNETIC COMPATIBILITY (EMC) – SHIPS WITH A NON-METALLIC HULL

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International Standard IEC 62742 has been prepared by Technical committee 18: Electrical installations of ships and of mobile and fixed offshore units.

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

FDIS	Report on voting
18/1725/FDIS	18/1733/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/standardsdev/publications.

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- withdrawn,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

INTRODUCTION

It is important that electrical installations of ships with electric and/or electronic systems operate under a wide range of environmental conditions. The control of undesired electromagnetic emission ensures that no other device on board will be unduly influenced by the equipment under consideration. On the other hand, the equipment is expected to function without degradation in the normal electromagnetic environment. It is also important to take into account special risks, for instance lightning strikes, transients from the operation of circuit breakers and electromagnetic radiation from radio transmitters.

Experience related to the EMC of non-metallic ships can be expected in the area of defence technology. But most of this information including the documents is classified and therefore not publicly available. This document was derived from the NATO document ANEP 45 (unclassified), MIL-STD-1310H (NAVY) and VG 95375 (all parts) due to lack of information from other sources, for example from yards which had already built such kind of ships.

This document can assist to achieve electromagnetic compatibility of all electrical and electronic installations in ships with non-metallic hull, for example manufactured from wood or composite.

Composite structures typically comprise of resin and fibre laminate layers combined with a core material (colloquially referred to as a "sandwich"). The most widely used being glass fibre reinforced plastic (GRP or FRP). Many composites are non-conductive and offer no inherent electromagnetic shielding. Carbon fibre technology has the important characteristic of a conductive material that can provide electromagnetic shielding.

This document should be used during the ship design process and not as a problem solving procedure. The intent is to decrease the number of special EMI/EMC problems which could occur as a consequence of the use of non-metallic constructions.

Originally, this document had been designed as a "stand-alone-document" which covers the complete field of EMC similar to IEC 60533. But with progressing work, it became more and more clear that many repetitions of requirements already contained in IEC 60533 would have been necessary to fulfil the stand-alone demand: most of the requirements are identical, no matter whether composite or metal is used.

Finally, the project team came to the conclusion that it would be better to avoid repetitions. Therefore, this document was further prepared to align with, and refer to IEC 60533.

ELECTRICAL AND ELECTRONIC INSTALLATIONS IN SHIPS – ELECTROMAGNETIC COMPATIBILITY (EMC) – SHIPS WITH A NON-METALLIC HULL

1 Scope

This document specifies minimum requirements for emission, immunity and performance criteria regarding electromagnetic compatibility (EMC) of electrical and electronic equipment for ships with non-metallic hull.

NOTE Requirements for metallic hull are given by IEC 60533. This document acts an extension of IEC 60533 to cater for EMC effects on non-metallic hull.

This document further gives guidance on how to achieve electromagnetic compatibility (EMC) on ships whose hull (surface) is made from non-metallic material and can also be useful for ships with hull comprising of a metallic hull, but with non-metallic superstructure or components.

This document assists in meeting the requirements of IMO resolution A.813(19).

It does not specify basic safety requirements such as protection against electric shock and dielectric tests for equipment. Electromagnetic effects on human beings are not the subject of this document.

NOTE More information on 'Basic safety' can be found in IEC guide 104.

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 60092-101, *Electrical installations in ships – Part 101: Definitions and general requirements*

IEC 60092-401, *Electrical installations in ships – Part 401: Installation and test of completed installation*

IEC 60092-507, *Electrical installations in ships – Part 507: Small vessels*

IEC 60533:2015, *Electrical and electronic installations in ships – Electromagnetic compatibility (EMC) – Ships with a metallic hull*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60533 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
hull
watertight main part or body of a ship

3.2
compartment
subdivision of the hull formed by bulkheads

3.3
room
subdivision of a compartment or deck space

3.4
non-metallic
material which is non-conductive or has a high-impedance

EXAMPLE Carbon fibre, epoxy-glass resin, wood.

Note 1 to entry: The property under consideration is strictly seen not "metallic", but "conductive". "Conductive" is technically more correct, but because of the title of IEC 60533 and the fact that "metallic" is a synonym for "conductive", the term "metallic" has been applied. This also avoids the difficulty of having to specify measurement values for "conductive" and/or "non-conductive".

3.5
composite
composition of several materials, usually consisting of a core with several layers

EXAMPLE Glass reinforced plastic (GRP).

3.6
shield
<EMC> electrically conductive or magnetic material barrier or enclosure

EXAMPLE Metal plate, wire mesh, metal foil.

Note 1 to entry: Conductive ship structures can act as a shield.

3.7
shielding
<EMC> construction method to protect against disturbing electromagnetic emissions and/or to prevent unintended electromagnetic emissions

EXAMPLE Use of a conductive layer or enclosure.

3.8
screen
screening
<EMC> property of conductive or magnetic material to reduce (damp, filter) electromagnetic emissions

EXAMPLE A braided shield can be used for screening a cable from EMI.

Note 1 to entry: Shielding can be carried out by use of screening materials.

3.9
bond
electrically conductive path between two or more conductors

Note 1 to entry: A bond can be established by welding, bolting/clamping or with a special strap.

3.10
equipotential bonding
provision of electric connections between conductive parts, intended to achieve equipotentiality

[SOURCE: IEC 60050-195:1998, 195-01-10]

3.11
reference earth
reference earth potential
ground, US, CA
point, plane, or surface designated as the zero potential (nominally) common reference point for electrical or electronic equipment

3.12
reference earthing
reference grounding, US, CA
method of establishing an electrical connection between a metallic item to earth potential

3.13
protective earthing
protective grounding, US, CA
earthing a point or points in a system or in an installation or in equipment, for purposes of electrical safety

[SOURCE: IEC 60050-195:2001, 195-01-11]

3.14
earth plate
ground plate, US, CA
earth electrode consisting of a metal plate below water level for common use as protective earth and reference earth

3.15
antenna ground plane
flat conductive surface that is at the same electric potential as reference earth

4 General

Installations shall comply with relevant requirements of IEC 60533, except those that are only relevant for metallic hull.

NOTE 1 The requirements of IEC 60533 are not fully applicable for non-metallic hull.

NOTE 2 Basic requirements on the design of a ship's electrical system are specified in IEC 60092-201 and IEC 60092-202. The ship specific climatic and mechanic environment is reflected by the condition limits and design parameters given in IEC 60092-101.

Two detailed comparative tables about the connection of this document with IEC 60533:2015 are given in Annex A and Annex B.

5 Electromagnetic environment (EME)

5.1 General

The specified electromagnetic environment needed in the early design phase should be based on prediction and experiences.

NOTE The electromagnetic environment describes those interferences which act on a system or equipment from outside. Because there is generally a lack of information in the early design phase, it is difficult to accurately define the real electromagnetic environment. Scale-modelling or test mock-ups or numerical simulation can help to build up the design information base. The field strengths are mainly influenced by the topside design and the maximum transmitting power combined with the antenna type.

5.2 Susceptibility study

A study shall be made, on the susceptibility of the equipment to be placed in a certain room compared with the expected electromagnetic environment, to decide if additional room-shielding is required.

NOTE 1 The result of a study can be:

a) no susceptibility problem expected; additional room shielding is not needed;

b) susceptibility problem expected; change arrangement of equipment, additional room-shielding is not needed;

c) susceptibility problem expected; decrease equipment susceptibility, additional room-shielding is not needed;

d) susceptibility problem expected; replace the equipment by less susceptible ones, additional room-shielding is not needed;

e) susceptibility problem expected; specify an overall shielded room if decreasing of equipment susceptibility is more burdensome than creating an additional room-shielding;

f) susceptibility problem expected; the problem can be controlled by operational regulations.

Which rooms to be shielded shall be identified during the design phase.

NOTE 2 Required equipment, relevant standards, specifications and rules normally influence the decisions on which rooms to be shielded, for example for the radiocommunication room.

NOTE 3 See the information about EMC plan in IEC 60533.

5.3 Unintentional radiators installed near VHF antennas

Lighting systems using light emitting diode (LED) technology (navigation lights, deck lighting, rigging lighting) and other electronic devices capable of unintentional radiated emission can cause interference to VHF marine radio and shipboard automatic identification system (AIS) equipment when installed near antennas. LED lighting certified to IEC 60945 should be separated from antennas by a distance greater than 15 m. If 15 m separation is not possible, devices should be separated by as much as possible, placed above or below the antenna plane, and should be tested after installation to verify the absence of interference.

NOTE Requirements to unintentional radiators are under consideration for IEC 60533.

6 Shielding

6.1 General

A significant reduction or elimination of radiated fields from the outside electromagnetic environment can be achieved by shielding of sensitive equipment. This also applies vice-versa against unintended radiation of electronic equipment which is mounted inside the shield.

A ship mainly constructed with non-metallic materials has a low hull conductivity. This is synonymous with decreased or absence of shielding, normally provided by the metallic structure of a conventional ship. Therefore, additional problems can be expected for electric and electronic equipment operated on board.