

# INTERNATIONAL STANDARD

# IEC 60945

Fourth edition  
2002-08

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

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Commission Electrotechnique Internationale  
International Electrotechnical Commission  
Международная Электротехническая Комиссия

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## INTERNATIONAL ELECTROTECHNICAL COMMISSION

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**MARITIME NAVIGATION AND RADIOCOMMUNICATION  
EQUIPMENT AND SYSTEMS –**
**General requirements –  
Methods of testing and required test results**

## FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the 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, the IEC publishes International Standards. 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. The 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 60945 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This fourth edition cancels and replaces the third edition published in 1996 and constitutes a technical revision.

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

FDIS	Report on voting
80/345/FDIS	80/349/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 3.

Annex A forms an integral part of this standard.

Annexes B, C, D, E, F, and G are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2007. At this date, the publication will be

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- withdrawn;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

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## INTRODUCTION

IEC 945 was originally produced to give test methods and, where appropriate, limit values to the IMO Resolution A.574(14) which was a recommendation on general requirements for electronic navigational aids. (It has subsequently been replaced, see below.) The tests dealing with electromagnetic immunity could not be produced in time for the publication of the original standard, and these were added later in 1992 as amendment 1.

In 1991 the IMO, when discussing the changes that would arise with the introduction of the global maritime distress and safety system (GMDSS), noted that in future, radio equipment would be installed on the bridge of a vessel alongside the navigation equipment instead of in a special radio room as hitherto. The IMO consequently withdrew Resolution A.574(14), and a corresponding Resolution A.569(14) dealing with the general requirements of radio equipment, and replaced them with IMO Resolution A.694(17). A second edition of IEC 945 was rapidly prepared to reflect this change.

The third edition of IEC 945 in 1996 was a complete revision which aligned the test methods with appropriate other IEC standards and introduced, wherever possible, the requirements of the classification societies. The scope was extended to make the standard applicable additionally to other equipment installed on and around the bridge of a ship with regard to EMC. A new class of equipment – “portable” – was added, together with better definitions of operational tests which involve subjective judgement and descriptions of operational and durability aspects of software.

This fourth edition (now IEC 60945) extends the detail of operational tests particularly for equipment which is operated through software menus. This has been derived from an exhaustive investigation of appropriate references as described in the Bibliography. The layout of clause 4 (Minimum performance requirements) has been changed to give a better grouping of ergonomics, hardware and software requirements.

The EMC tests have been revised with the frequency range having been extended from 1 GHz to 2 GHz.

Clarifications to the text of the third edition have been added where experience has shown a need and the references have been updated.

A comparison of the test requirements in the third and fourth editions is given in annex G to assist manufacturers and test houses in the use of the new edition.

## MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

### General requirements – Methods of testing and required test results

#### 1 Scope

This International Standard assists in meeting a requirement of the International Convention for Safety of Life at Sea (SOLAS), adopted by the International Maritime Organization (IMO), that the radio equipment defined in chapters III and IV, and the navigation equipment defined in chapter V of the Convention, be type-approved by administrations to conform with performance standards not inferior to those adopted by the IMO. (Administrations are defined by the IMO as governments of the states whose flags the ships are entitled to fly.)

The performance standard for general requirements for shipborne radio equipment and electronic navigation aids that has been adopted by the IMO is given in IMO Resolution A.694 and is reproduced in this standard as annex A, which forms the basis for this standard. Reference is made, where appropriate, to IMO Resolutions A.694 and A.813 and all subclauses whose wording is identical to that in the resolutions are printed in italics.

This standard specifies minimum performance requirements, methods of testing and required test results for general requirements which can be applied to those characteristics common to all equipment described hereunder:

- a) shipborne radio equipment forming part of the global maritime distress and safety system required by the International Convention for Safety of Life at Sea (SOLAS) as amended, and by the Torremolinos International Convention for the Safety of Fishing Vessels as amended;
- b) shipborne navigational equipment required by the International Convention for Safety of Life at Sea (SOLAS) as amended, and by the Torremolinos International Convention for the Safety of Fishing Vessels as amended, and to other navigational aids, where appropriate; and
- c) for EMC only, all other bridge-mounted equipment, equipment in close proximity to receiving antennas, and equipment capable of interfering with safe navigation of the ship and with radio-communications (see IMO Resolution A.813).

NOTE For EMC, this standard is in the IEC category “product family”.

The requirements of this standard are not intended to prevent the use of new techniques in equipment and systems, provided the facilities offered are not inferior to those stated.

## 2 Normative references

The following referenced documents are indispensable for the application 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 60050-161:1990, *International Electrotechnical Vocabulary (IEV) – Chapter 161: Electromagnetic compatibility*  
Amendment 1 (1997)  
Amendment 2 (1998)

IEC 60068-2-1:1990, *Environmental testing – Part 2: Tests – Tests A: Cold*  
Amendment 1 (1993)  
Amendment 2 (1994)

IEC 60068-2-2:1974, *Environmental testing – Part 2: Tests – Tests B: Dry heat*  
Amendment 1 (1993)  
Amendment 2 (1994)

IEC 60068-2-5:1975, *Environmental testing – Part 2: Test Sa: Simulated solar radiation at ground level*

IEC 60068-2-6:1995, *Environmental testing – Part 2: Test Fc: Vibration (sinusoidal)*  
Corrigendum 1 (1995)

IEC 60068-2-9:1975, *Environmental testing – Part 2: Guidance for solar radiation testing*  
Amendment 1 (1984) Corrigendum 1 (1989)

IEC 60068-2-30:1980, *Environmental testing – Part 2: Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*  
Amendment 1 (1985)

IEC 60068-2-48:1982, *Environmental testing – Part 2: Guidance on the application of the tests of IEC 60068 to simulate the effects of storage*

IEC 60068-2-52:1996, *Environmental testing – Part 2: Test Kb: Salt mist, cyclic (sodium chloride solution)*  
Corrigendum 1 (1996)

IEC 60071-2:1996, *Insulation co-ordination – Part 2: Application guide*

IEC 60092-101:1994, *Electrical installations in ships – Part 101: Definitions and general requirements*  
Amendment 1 (1995)  
Corrigendum 1 (1996)

IEC 60417(all parts), *Graphical symbols for use on equipment*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*  
Amendment 1 (1999)

IEC 60533:1999, *Electrical and electronic installations in ships – Electromagnetic compatibility*

IEC 60651:1979, *Sound level meters*  
Amendment 1 (1993)

IEC 61000-4-2:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 2: Electrostatic discharge immunity test* – Basic EMC publication

IEC 61000-4-3:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 3: Radiated, radio frequency, electromagnetic field immunity test*

IEC 61000-4-4:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 4: Electrical fast transient/burst immunity test* – Basic EMC publication

IEC 61000-4-5:1995, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 5: Surge immunity test*

IEC 61000-4-6:1996, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 6: Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8:1993, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 8: Power frequency magnetic field immunity test* – Basic EMC publication

IEC 61000-4-11:1994, *Electromagnetic compatibility (EMC) – Part 4: Testing and measurement techniques – Section 11: Voltage dips, short interruptions and voltage variations immunity tests*

CISPR 16-1:1999, *Specification for radio disturbance and immunity measuring apparatus and methods – Part 1: Radio disturbance and immunity measuring apparatus*

ISO 694:2000, *Ships and marine technology – Positioning of magnetic compasses in ships*

ISO 3791:1976, *Office machines and data processing equipment – Keyboard layouts for numeric applications*

*IMO Convention for Safety of Life at Sea (SOLAS):1997*

*IMO Torremolinos Convention for the Safety of Fishing Vessels, 1977, as modified by the Torremolinos Protocol of 1993*

*IMO MSC/Circ.794 IMO Standard Marine Communication Phrases (SMCPs):1997*

IMO Resolution A.694:1991, *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system and for electronic navigational aids*

IMO Resolution A.803:1995, *Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling*

IMO Resolution A.813:1995, *General requirements for electromagnetic compatibility (EMC) for all electrical and electronic ship's equipment*

ITU-T Recommendation E.161:1993, *Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network*

NOTE A bibliography of informative references is given at the end of this standard.

### 3 Definitions and abbreviations

#### 3.1 Definitions

For the purposes of this International Standard, the following definitions apply:

##### 3.1.1

###### **electronic navigational aid**

an electronic item, for example instrument, device or chart, carried on board and intended to assist the navigation of a craft

##### 3.1.2

###### **maintenance**

repair or replacement of defective parts or corresponding corrections to software. Minor changes and improvements to existing functionality are considered to be maintenance but not the addition of new functionality

##### 3.1.3

###### **operational check**

a check by a suitably qualified person to confirm that the equipment complies with the operational requirements in this standard or in the equipment standard

##### 3.1.4

###### **performance check**

a short functional test carried out during or after a technical test to confirm that the equipment operates

##### 3.1.5

###### **performance check (EMC)**

a short functional test carried out during or after an EMC test to confirm that the equipment complies with the required immunity performance criteria

##### 3.1.6

###### **performance test**

a measurement or a group of measurements carried out during or after a technical test to confirm that the equipment complies with selected parameters as defined in the equipment standard

##### 3.1.7

###### **pre-conditioning**

the treatment of a specimen with the object of removing or partly counteracting the effects of its previous history

NOTE 1 Where pre-conditioning is called for, it is the first process in the test procedure.

NOTE 2 It may be effected by subjecting the specimen to climatic, electrical, or any other conditions required by the relevant specification in order that the properties of the specimen may be stabilised before measurements and test.

##### 3.1.8

###### **product family EMC standard**

definition of specific EM requirements and test procedures dedicated to particular product families. It applies the IEC basic standards, is co-ordinated with IEC generic standards, and has precedence over IEC generic standards.

##### 3.1.9

###### **technical test**

each test for which a repeatable method of measurement is defined in this standard or in the equipment standard

### 3.2 Abbreviations used in this standard

a.c.	Alternating current
AE	Auxiliary equipment
ASTM	American Society for Testing and Materials
CDN	Coupling and decoupling network
CISPR	International special committee on radio interference
d.c.	Direct current
EFT/B	Electrical fast transients/bursts
EMC	Electromagnetic compatibility
e.m.f.	Electromotive force
ESD	Electrostatic discharge
EUT	Equipment under test
HMI	Human machine interface
IMO	International Maritime Organization
ISO	International Organization for Standardization
ITU	International Telecommunications Union
PC	Performance check
PT	Performance test
r.m.s.	Root mean square
SOLAS	International Convention for Safety of Life at Sea
SMCPs	Standard Marine Communication Phrases
VCP	Vertical coupling plane
VDU	Visual display unit

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### 3.3 IMO performance standards

For the purpose of interpreting IMO performance standards the following definitions apply:

#### 3.3.1

##### **accessible; readily; easily**

affording unrestricted access appropriate to the function served. Access for the operation shall not require the use of tools, and shall be gained comfortably from the operator's assigned work station. Access for maintenance is not subject to these restrictions, but should not require the removal of other fixtures or the use of special aids to reach the point of access

#### 3.3.2

##### **adjustments; normal**

adjustments made by an operator in the course of equipment usage to maintain its operational efficiency

#### 3.3.3

##### **atmosphere; satisfactory**

an atmosphere suitable for the preservation, safety and comfort of occupying material and/or personnel