

Maritime navigation and radiocommunication equipment and systems — Integrated bridge systems (IBS) — Operational and performance requirements, methods of testing and required test results

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 48 and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Amendments issued since publication

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English version

Maritime navigation and radiocommunication
equipment and systems
Integrated bridge systems (IBS)
Operational and performance requirements,
methods of testing and required test results

(IEC 61209:1999)

Matériels et systèmes de navigation et de
radiocommunication maritimes
Systèmes intégrés de passerelle
Exigences d'exploitation et de fonctionnement,
méthodes d'essai et résultats d'essai exigés
(CEI 61209:1999)

Navigations- und
Funkkommunikations- geräte und -systeme für
die Seeschifffahrt Integrierte Brückensysteme
(IBS) Betriebs- und Leistungsanforderungen,
Prüfverfahren und geforderte Prüfergebnisse
(IEC 61209:1999)

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

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CENELEC

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

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Foreword

The text of document 80/199/FDIS, future edition 1 of IEC 61209, prepared by IEC TC 80, Maritime navigation and radiocommunication equipment and systems, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 61209 on 1999-08-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2000-05-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2002-08-01

Annexes designated “normative” are part of the body of the standard.

Annexes designated “informative” are given for information only.

In this standard, Annex A, Annex D and Annex ZA are normative and Annex B, Annex C and Annex E are informative.

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 61209:1999 was approved by CENELEC as a European Standard without any modification.

In the official version, for Annex A, Additional IMO requirements, the following notes have to be added for the standards indicated:

IEC 60872-1	NOTE Harmonized as EN 60872-1:1998 (not modified).
IEC 60936	NOTE Harmonized as EN 60936:1993 (not modified).
IEC 60936-2	NOTE Harmonized as EN 60936-2:1999 (not modified).
IEC 61023	NOTE Harmonized as EN 61023:1993 (not modified).
IEC 61075	NOTE Harmonized as EN 61075:1993 (modified).
IEC 61097-1	NOTE Harmonized as EN 61097-1:1993 (not modified).

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

IEC 60417	NOTE Harmonized as EN 60417:1999 (series; not modified).
IEC 60447	NOTE Harmonized as EN 60447:1993 (not modified).
IEC 60529	NOTE Harmonized as EN 60529:1991 (not modified).
IEC 60651	NOTE Harmonized as EN 60651:1994 (not modified).
IEC 60812	NOTE Harmonized as HD 485 S1:1987 (not modified).

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Introduction

In 1991, the International Electrotechnical Commission (IEC) technical committee 80 (TC 80) observed that, while considerable work was progressing to develop standards for the individual systems or subsystems of a modern ship's bridge, no international organization had yet assigned the task of integrating these individual systems or co-ordinating the individual standards.

The normal progression would be the development of an International Maritime Organization (IMO) safety-related circular or assembly resolution, to be followed by assignment for the development of the IEC standard to a TC working group (WG).

IEC TC 80 felt that the development of an integrated bridge system was so important that they should not wait any longer before embarking on the development of this International Standard. They therefore assigned the task to TC 80, WG 9, Integrated bridge systems (IBS) for ships, and informed IMO of this work programme.

WG 9 co-ordinated their work closely with similar activity within the IMO subcommittees on Safety of Navigation (NAV), Design and Equipment, Radiocommunications, Search and Rescue, and other working groups of TC 80, the activities of the International Association of Classification Societies (IACS), as well as individual classification societies, and national initiatives. Many of the working group members actively participated in one or more of these other groups.

IEC TC 80 submitted the material contained in the requirements section of this standard to IMO with a proposal that it could provide the basis for an international agreement on the subject of integrated bridges. The IMO Maritime Safety Committee (MSC), at its 67th session, agreed to the essence of this proposal and adopted resolution MSC.64(67), Annex 1, performance standards for integrated bridge systems (IBS).

The aims of this standard are to provide recommendations for the design, manufacture, integration and testing of:

- stand-alone equipment;
- networks;
- integration units; and
- multifunction displays

in connection with the aspect of interaction (integration) within a bridge.

1 Scope

This International Standard specifies the minimum requirements for the design, manufacture, integration and testing of integrated bridge systems (IBS) to comply with IMO resolution MSC.64(67), Annex 1, of the International Maritime Organization (IMO), and other relevant IMO performance standards, in order to meet the functional requirements contained in applicable IMO instruments, not precluding multiple usage of equipment and modules or the need for duplication. Reference is made, where appropriate, to IMO resolution MSC.64(67) Annex 1, and text in this standard, the meaning of which is identical to that in the IMO resolution, is printed in *italics* and identified by the resolution paragraph numbers in brackets.

This standard aims to increase safe and efficient ship management by suitably qualified personnel taking care of, *inter alia*, uninterrupted functional availability of systems, and of human factors.

Operation of the IBS may conflict with the requirements for individual equipment. Such conflicts may imply modification to, or deviation from, individual equipment standards or the carriage of additional equipment. This standard highlights those deviations as well as their justification. Existing standards for individual equipment are not addressed.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, these publications do not apply. However parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative documents referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60945:1996, *Maritime navigation and radiocommunication equipment and systems — General requirements — Methods of testing and required test results*.

IEC 61162 (all parts), *Maritime navigation and radiocommunication equipment and systems — Digital interfaces*.

ISO 8468:1990, *Ship's bridge layout and associated equipment — Requirements and guidelines*.

ISO 9000 (all parts), *Quality management and quality assurance standards*.

ISO 9001:1994, *Quality systems — Model for quality assurance in design, development, production, installation and servicing*.

ISO 9002:1994, *Quality systems — Model for quality assurance in production, installation and servicing*.

IMO International Convention for the Safety of Life at Sea (SOLAS):1997, Consolidated edition.

IMO A.686:1991, *Code on alarms and indicators*.

IMO A.823:1995, *Performance standards for automatic radar plotting aids (ARPAs)*.

IMO A.830:1995, *Code on alarms and indicators* (amendments to IMO 686:1991).

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

IMO MSC.64(67):1996, Annex 1 — *Performance standards for integrated bridge systems (IBS)*.

IMO MSC.64(67):1996, Annex 4 — Amendments to A.477:1981, *Performance standards for radar equipment*.

IMO MSC/Circular 566:1991, *Provisional guidelines on the conduct of trials in which the officer of the navigational watch acts as the sole look-out in periods of darkness*.

IACS UR N1:1992, *Unified requirements for one man bridge operated (OMBO) ships*.

NOTE Additional IMO requirements which may be applicable to IBS are listed in Annex A.

3 Definitions and abbreviations

3.1 Definitions

For the purpose of this standard, the following definitions apply.

3.1.1 configuration of complete system

all operational functions of the IBS as installed

3.1.2 configuration available

operation(s) allocated to and available at each workstation

3.1.3 configuration in use

operation(s) and task(s) currently in use at each workstation

3.1.4 connectivity

a complete data link and the presence of valid data

3.1.5 essential functions

functions related to determination, execution and maintenance of safe course, speed and position of the ship in relation to the waters, traffic and weather conditions (passage execution)

such functions normally include, but are not limited to,

- route planning;
- navigation;
- collision avoidance;
- manoeuvring;
- docking;
- monitoring of internal safety systems;
- external and internal communication related to safety in bridge operation and distress situations;
- ship stability

3.1.6 essential information

that information which is necessary for the monitoring and control of essential functions

3.1.7 functionality

ability to perform an intended function. The performance of a function normally involves a system of displays, controls and instrumentation

3.1.8 IMO requirements

IMO conventions, regulations, resolutions, codes, recommendations, guidelines, circulars and related ISO and IEC standards

3.1.9 (1.1, 2) integrated bridge system (IBS)

any combination of systems which are interconnected in order to allow centralized access to sensor information or command/control from workstations to perform two or more of the following operations:

- *passage execution;*
- *communications;*
- *machinery control;*
- *loading, discharging and cargo control;*
- *safety and security.*

management operations may also be performed within the ibs (see Annex C)

3.1.10 integrity

ability of a system to provide users with accurate, timely, complete and unambiguous information and warnings within a specified time when the system shall not be used

3.1.11 latency

time interval between an event and the resulting information, including time for processing, transmission and reception

3.1.12 multifunction display

a single visual display unit which can present, either simultaneously or through a series of selectable pages, information from more than one operation of an IBS

3.1.13 part

an individual subsystem, equipment or module

3.1.14 performance check

a representative selection of short qualitative tests, to confirm correct operation of essential functions of the IBS

3.1.15 sensor

a device which provides information to or is controlled or monitored by the IBS

a compilation of definitions of integration related terms is contained in Annex E

3.2 Abbreviations

Abbreviations used in this standard:

ARPA	Automatic radar plotting aid
GMDSS	Global maritime distress and safety system
IACS	International Association of Classification Societies
IBS	Integrated bridge system
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
ISO	International Organization for Standardization
MMI	Man-machine-interface
MSC	IMO Maritime Safety Committee
NAV	IMO Subcommittee on Safety of Navigation
SOLAS	(International Convention for the) Safety of Life at Sea

SSD System specification document

VDU Visual display unit

Additional relevant abbreviations are found in Annex B.

4 General requirements

4.1 (3.1) General

4.1.1 (3.1.1) *The IBS shall comply with all applicable IMO requirements as contained in clause 2 and Annex A of this standard. Parts executing multiple operations shall meet the requirements specified for each individual function they can control, monitor or perform.* By complying with the provisions of this standard, all essential functions remain available in the event of a single failure. Therefore, means for operation independent of the IBS shall not be required.

4.1.2 (3.1.2) *Each part of an IBS shall meet the relevant requirements of IMO resolution A.694(17) as detailed in IEC 60945. In consequence the IBS is in compliance with these requirements without further environmental testing to IEC 60945.*

4.1.3 Where implemented, passage execution shall not be interfered with by other operations.

4.1.4 (3.1.3) *A failure of one part shall not affect the functionality of other parts except for those functions directly dependent upon the information from the defective part.*

4.2 (3.2) Integration

The IBS shall provide functional integration meeting the following requirements.

4.2.1 (3.2.1) *The functionality of the IBS shall ensure that operations are at least as effective as with stand-alone equipment.*

4.2.2 (3.2.2) *Continuously displayed information shall be reduced to the minimum necessary for safe operation of the ship. Supplementary information shall be readily accessible.*

4.2.3 Integrated display and control functions shall adopt a consistent man-machine-interface (MMI) philosophy and implementation. Particular consideration shall be paid to

- symbols;
- colours;
- controls;
- information priorities;
- layout.

4.2.4 (3.2.3) *Where multifunction displays and controls are used to perform functions necessary for safe operation of the ship they shall be duplicated and interchangeable.*

4.2.5 (3.2.4) *It shall be possible to display the complete system configuration, the available configuration and the configuration in use.*

4.2.6 Any unintentional change of a configuration shall be brought to the immediate attention of the user. An unintentional change of the configuration in use shall, in addition, activate an audible and visual alarm.

4.2.7 (3.2.5) *Each part to be integrated shall provide details of its operational status and the latency and validity of essential information. Means shall be provided within the IBS to make use of this information.*

4.2.8 (3.2.6) *An alternative means of operation shall be provided for essential functions.*

4.2.9 For integrated machinery control, it shall be possible for all machinery essential for the safe operation of the ship to be controlled from a local position.

4.2.10 (3.2.7) *An alternative source of essential information shall be provided. The IBS shall identify loss of either source.*

4.2.11 (3.2.8) *The source of information (sensor, result of calculation or manual input) shall be displayed continuously or on request.*

4.3 (3.3) Data exchange

4.3.1 (3.3.1) *Interfacing within the IBS and to an IBS shall comply with IEC 61162, as applicable.*

4.3.2 (3.3.2) *Data exchange shall be consistent with safe operation of the ship.* The manufacturer shall specify in the system specification document (SSD) the maximum permissible latency for each function, considering the use of fast control loop, normal control loop, essential information and other information.

4.3.3 Corrupted data shall not be accepted by the IBS. Corrupted or missing data shall not affect functions which are not dependent on this data.

4.3.4 (3.3.3) *The integrity of data flowing on the network shall be ensured.*

4.3.5 The network shall be such that in the event of a single fault between nodes there shall be an indication, and the sensors and displays on the network shall continue to operate and data transmission between them shall be maintained.

4.3.6 (3.3.4) *A failure in the connectivity shall not affect independent functionality.*

4.4 (3.4) Failure analysis

(3.4.1) A failure analysis shall be performed, documented and be acceptable.

4.4.1 Parts, functions and connectivity shall be identified.

4.4.2 Possible failures of parts and connectivity associated with essential functions and information shall be identified.

4.4.3 Consequences of failures with respect to operation, function or status of the IBS shall be identified.

4.4.4 Each failure shall be classified with respect to its impact on the IBS taking into account relevant characteristics, such as detectability, diagnosability, testability, replaceability and compensating and operating provisions.

4.4.5 The results of the failure analysis shall confirm the possibility for continued safe operation of the ship.

4.5 Quality assurance

The IBS shall be designed, developed, produced, installed and serviced by companies certified to ISO 9001 or ISO 9002, as applicable.

5 (4) Operational requirements

5.1 (4.1) Human factors

5.1.1 (4.1.1) *The IBS shall be capable of being operated by personnel holding appropriate certificates.*

5.1.2 (4.1.2) *The MMI shall be designed to be easily understood and in a consistent style for all integrated functions.*

5.1.3 Operational information shall be presented in a format readily understandable without need to transpose, compute or translate.

5.1.4 Indications, which may be accompanied by a short low-intensity audible signal, shall occur when

- an attempt is made to execute an invalid function;

- an attempt is made to use invalid information.

5.1.5 If an input error is detected by the system, it shall require the operator to correct the error immediately. Messages actuated by an input error shall guide the correct responses, for example

do not use: Invalid entry

but use: Invalid entry: re-enter set point between 0 and 10.

5.1.6 Layered menus shall be presented in a way which minimizes the added workload to find and return from the desired functions.

5.1.7 An overview shall be easily available to assist the operator in the use of a multiple page system. Each page shall have a unique identifier.

5.1.8 (4.1.3) *Where multifunction displays are used, they shall be in colour. Continuously displayed information and functional areas, for example menus, shall be presented in a consistent manner.*

5.1.9 (4.1.4) *For actions which may cause unintended results, the IBS shall request confirmation from the operator.¹⁾*

5.1.10 Functions requested by the operator shall be acknowledged or clearly indicated by the IBS on completion.

5.1.11 Default values, where applicable, shall be indicated by the IBS when requesting operator input.

5.1.12 For bridge operation by one person, special consideration shall be given to the technical requirements in IMO MSC/Circular 566, paragraphs 10 to 32.

5.2 (4.2) Functionality

5.2.1 (4.2.1) *It shall always be clear from where essential functions may be performed.*

5.2.2 (4.2.2) *The system management shall ensure, that one user only has the control of an input or function at the same time. If so, all other users shall be informed about that by the IBS.*

5.3 Training

5.3.1 Manufacturers of integrated bridge systems shall provide training possibilities for the ship's crew. This training shall take place ashore or on board and shall be carried out by means of suitable material and methods to cover the following topics.

5.3.2 General understanding and operation of the system:

- knowledge and understanding of the system's configuration and application;
- reading and understanding of the operating manual;
- usage and understanding of brief descriptions and instructions provided on the bridge;
- usage and understanding of electronic "HELP" functions, if provided in the system;
- familiarization with the system using safe trial modes.

5.3.3 Mastering of uncommon conditions in the system:

- detecting and locating of failures;
- resetting the system to safe default values and modes;

— operating safely without certain sensor data or parts;

— possibilities for on-board repair;

— identifying the potential for unintended results.

5.3.4 Methods and support for providing the above-mentioned training may be, for example

- printed material;
- training courses;
- video films;
- computer-based learning programmes;
- simulation of different situations or data, respectively;
- recorded speech.

6 (5) Technical requirements

6.1 (5.1) Sensors

In order to ensure an adequate system functionality, the sensors employed shall meet the following requirements, as applicable:

6.1.1 *ensure communication compatibility in accordance with the relevant international marine interface standard, IEC 61162; and provide information about their operational status and about the latency and validity of essential information;*

6.1.2 respond to a command with minimal latency, and indicate receipt of invalid commands, when remote control is employed;

6.1.3 have the capability to silence and re-establish the audible portion of the local alarm;

6.1.4 have information documented about deterministic and stochastic errors and how they are handled, insofar as signals are pre-processed locally, for example plausibility check.

6.2 (5.2) Alarm management

6.2.1 (5.2.1) *The IBS alarm management as a minimum shall comply with the requirements of the Code on Alarms and Indicators, 1995 [IMO Resolution A.830(19)] (see also IMO A.686).*

6.2.2 (5.2.2) *Appropriate alarm management on priority levels (see 6.2.5) and grouping of alarms²⁾ based on operations and tasks (see Annex C) shall be provided within the IBS.*

¹⁾ Examples of such actions are

- attempting to change position of next waypoint while in track mode steering;
- attempting to switch on bow thruster when insufficient electrical power is available.

²⁾ The purpose of grouping alarms is to achieve the following:

- to reduce the variety in type and number of audible and visual alarms and indicators so as to provide quick and unambiguous information to the personnel responsible for the safe operation of the ship;
- to readily identify any abnormal situation requiring action to maintain the safe operation of the ship;
- to avoid distraction by alarms which require attention but do not require immediate action to restore or maintain the safe operation of the ship.

6.2.3 (5.2.3) *The number of alarms shall be kept as low as possible by providing indications for information of lower importance.*

6.2.4 (5.2.4) *Alarms shall be displayed so that the alarm reason and the resulting functional restrictions can be easily understood. Indications shall be self-explanatory.*

6.2.5 Alarms shall be prioritized as follows:

a) Emergency alarms

Alarms which indicate that immediate danger to human life or to the ship and its machinery exists, and that immediate action shall be taken.

b) Distress, urgency and safety alarms

Alarms which indicate that a mobile unit or a person is in distress, or the calling station has a very urgent message concerning the safety of a mobile unit or a person, or has an important warning to transmit.

c) Primary alarms

Alarms which indicate a condition that requires prompt attention to prevent an emergency condition as specified in statutory and classification rules and regulations.

d) Secondary alarms

Alarms which are not included above.

6.3 Human factors

6.3.1 A multifunction display, if used, shall be a colour display.

6.3.2 The size, colour and density of text and graphic information presented on a display shall be such that it may be easily read from the normal operator position under all operational lighting conditions³⁾.

6.3.3 Symbols used in mimic diagrams shall be standardized throughout the system displays.

6.3.4 All information shall be presented on a background providing high contrast and emit as little light as possible by night.

6.4 (5.3) Power interruptions and shut-down

6.4.1 (5.3.1) *If subjected to an orderly shut-down, the IBS shall, upon turn-on come to an initial default state.*

6.4.2 (5.3.2) *After a power interruption full functionality of the IBS shall be available after recovery of all subsystems. The IBS shall not increase the recovery time of individual subsystem functions after power restoration.*

6.4.3 (5.3.3) *If subjected to a power interruption the IBS shall upon restoration of power maintain the configuration in use and continue automated operation as far as practicable. Safety related automatic functions, for example automated steering control shall only be restored upon confirmation by the operator.*

6.5 (5.4) Power supply

6.5.1 General power supply requirements are summarized in Annex D.

6.5.2 (5.4.1) *Power supply requirements applying to parts of the IBS as a result of other IMO requirements shall remain applicable.*

6.5.3 (5.4.2) *The IBS shall be supplied*

— *from the main and emergency source of power with automated changeover through a local distribution board with provision to preclude inadvertent shut-down;*

— *from a transitional source of power for a duration of not less than 1 min; and*

— *where required in Annex D, parts of the IBS shall also be supplied from a reserve source of power.*

7 Methods of testing and required results

7.1 Introduction

7.1.1 The testing proposed as part of this standard is intended to supplement, and not replace, testing of parts that is required to meet the relevant IMO performance standards. The intention is to ensure that when parts are integrated there is no degradation of their individual functionality and the overall system meets the requirements contained in clauses 4 to 6.

7.1.2 In all instances, the performance standards for parts will form the minimum test requirement for an integrated system. Parts previously type-approved will not require re-testing. Bridge-mounted parts for which no IMO performance standard exists shall be tested to the requirements of IEC 60945. Integration aspects of the IBS shall require testing to ensure compliance with requirements contained in clauses 4 to 6.

7.1.3 The test strategy shall demonstrate that the IBS, when operated by suitably trained personnel, shall increase safe and efficient management of the ship (clause 1).

7.2 General requirements (clause 4)

7.2.1 The manufacturer shall state the operations intended to be performed by the IBS.

³⁾ (See 6.2.3 of ISO 8468.)

7.2.2 Since each IBS may integrate an individual set of operations and parts, it is not possible to define in advance which IMO requirements apply. Therefore, the following steps shall be taken with each individual IBS being considered.

7.2.2.1 Produce a matrix of the applicable IMO requirements from Annex A:

- collect IMO requirements referring generally to IBS (for example SOLAS Chapter V and Code on Alarms and Indicators (A.686 and A.830);
- collect IMO requirements applicable to the operations stated in **7.2.1** (for example if a radar/ARPA is integrated, collect IMO MSC.64(67), annex 4 and A.823);
- identify the individual parts of the IBS and their interfaces;
- identify parts executing multiple operations;
- identify functions necessary to perform the operations stated in **7.2.1**;
- identify power supply requirements for the individual parts of the IBS from Annex D.

7.2.2.2 Verify the validity of the appropriate type-approval certificates (**4.1.1**).

7.2.2.3 Verify that all functions identified in **7.2.2.1** are performed (**4.1.1**).

7.2.3 Confirm compliance with IEC 60945 by one of the following:

- a valid type-approval certificate;
- a test certificate issued by an appropriate body;
- successful completion of appropriate tests (**4.1.2**).

7.2.4 Confirm by examination of the SSD that operational functions in addition to passage execution are implemented on a non-interference basis (**4.1.3**).

7.2.5 Independently disable each part identified in **7.2.2.1** and determine by a test that only those functions dependent on the disabled part are affected (**4.1.4**).

7.2.6 Confirm by examination that only minimum information necessary for the safe operation of the ship and as applicable to the configuration in use is continuously displayed, and that supplementary information is readily accessible (**4.2.2**).

7.2.7 Where IMO requirements governing the symbols, colours, controls, information priorities and layout of the integrated display and control functions exist, confirm compliance by examination. Where no such requirements exist, confirm by examination that the use of symbols, colours, controls, information priorities and layout is consistent (**4.2.3**).

7.2.8 Where used, confirm by examination that there are at least two identical and interchangeable multifunction displays and controls (**4.2.4**).

7.2.9 Confirm by examination that it is possible to display the configuration of the complete system, the configuration available and the configuration in use (**4.2.5**).

7.2.10 Disable a part of the configuration in use and confirm that an audible and visual alarm is activated immediately (**4.2.6**).

7.2.11 Confirm by examination of relevant certificates and documentation that each part integrated in the IBS provides details of its operational status, latency and validity of essential information. Confirm by a performance check that changes in status of the parts and of the latency and validity of information is used by the IBS in a safe and unambiguous manner (**4.2.8**).

7.2.12 Confirm by examination of the SSD that there is an alternative means of performing each applicable essential function (**4.2.8**).

7.2.13 Confirm by examination of the SSD that, for integrated machinery control, it is possible for all machinery essential for the safe operation of the ship to be controlled from a local position (**4.2.9**).

7.2.14 Confirm by examination that there is an alternative source of essential information. Confirm by a performance check that loss of essential information is recognized by the IBS (**4.2.10**).

7.2.15 Confirm by examination that the source of information is displayed continuously or on request (**4.2.11**).

7.2.16 Confirm by examination of relevant certificates and documentation that interfacing complies with IEC 61162, as applicable (**4.3.1**).

7.2.17 Confirm by examination of the SSD that the stated latencies are appropriate to all intended operations. Confirm by examination of the manufacturer's SSD that the stated latencies are achieved while the network is loaded to its maximum expected loading (**4.3.2**).

7.2.18 Confirm by a performance check that corrupted data is not accepted by the IBS and that corrupted and missing data does not affect functions which are not dependent on this data (**4.3.3**).

7.2.19 Confirm by examination of the manufacturer's SSD that, as a minimum, data includes a checksum in accordance with IEC 61162, and that, in addition, limits checking is applied to essential data (**4.3.4**).

7.2.20 Create a representative number of single faults between network nodes and confirm that there is an indication of the fault and the displays and sensors continue to operate and data transmission is maintained (4.3.5).

7.2.21 Identify the system connectivity by examination of the SSD. Independently interrupt each connection and determine by a performance check that only those functions dependent on the connection are affected and that all essential functions can still be performed (4.3.6).

7.2.22 Confirm by examination of the SSD that a failure analysis has been performed and documented. The results of the failure analysis and the possibility for continued safe operation of the ship shall be verified by testing a representative selection of failures (4.4).

7.2.23 Confirm by examination of the relevant certificate(s) that the manufacturer complies with ISO 9000 series standards (4.5).

7.3 Operational requirements (clause 5)

7.3.1 Confirm by examination that the IBS includes displays, controls and instrumentation necessary to perform the functions identified in 7.2.2.1.

7.3.2 Confirm by a performance check, performed by suitably qualified personnel, that information presented is understandable without the need to transpose, compute or translate, and that operation of integrated functions of the IBS identified in 7.2.1.1 is as effective as for equivalent stand-alone equipment (4.2.1, 5.1.1, 5.1.2).

7.3.3 Confirm by examination of the manufacturer's SSD that the specific requirements in MSC/Circular 566, paragraphs 10 to 32, are met, if applicable (5.1.3).

7.3.4 Confirm by a performance check that normal execution of functions and use of information are not accompanied by acoustic signals. If provided, ensure that acoustic signals accompanying attempts to execute an invalid function or use invalid information are short, of low intensity and are clearly distinguishable from alarms (5.1.4).

7.3.5 Create an input error and ensure that immediate correction is required and that relevant guidance is given (5.1.5).

7.3.6 Confirm by a performance check, performed by suitably qualified personnel, that layered menus, if provided, are presented such as to minimize workload (5.1.6).

7.3.7 If provided, ensure that multiple pages are uniquely identified and that an overview is available (5.1.7).

7.3.8 Ensure that continuously displayed information and functional areas, for example menus, are presented in a consistent manner in multifunction displays (5.1.2, 5.1.8).

7.3.9 Initiate a situation causing a potentially unintended result and ensure that the result is identified and that confirmation of the action is requested from the operator (5.1.9).

7.3.10 Confirm by a performance check that completion of functions is acknowledged or clearly indicated (5.1.10).

7.3.11 No test is required for 5.1.11.

7.3.12 Confirm that there is an indication of configurations available at each workstation (5.2.1).

7.3.13 Confirm that essential functions cannot be performed simultaneously at more than one workstation and that there is an indication of the configuration in use at each workstation (5.2.2).

7.3.14 The manufacturer shall produce a written statement that training possibilities are provided. Confirm by examination of the training material that it covers general understanding and operation and mastering of uncommon conditions (5.3).

7.4 Technical requirements (clause 6)

7.4.1 As applicable, confirm by examination of the SSD that sensors employed:

- communicate in accordance with IEC 61162 (6.1.1);
- provide details of operational status, latency and validity of essential information (6.1.1);
- respond to a command with minimal latency and indicate receipt of invalid commands when remote control is employed (6.1.2);
- have the capability to silence and re-establish the audible portion of the local alarm (6.1.3);
- have information documented about deterministic and stochastic errors and how they are handled (6.1.4).

7.4.2 Initiate a situation identified in the SSD as requiring immediate reaction by an operator and confirm that the resultant alarm complies with IMO A.686 and A.830 (6.2.1).

7.4.3 Create conditions necessary to generate all types of alarms and indications listed in the matrix prepared in 7.2.2.1.

7.4.3.1 Confirm that appropriate alarm management on priority levels and functional groups is provided and that the number of alarm types and their release is kept as low as possible by providing indications for information of lower importance (6.2.2, 6.2.3).

7.4.3.2 Confirm that alarms are displayed so that the alarm reason and the resulting functional restrictions can be easily understood and that indications are self-explanatory (6.2.4).

7.4.3.3 Confirm that alarms are prioritized as emergency alarms, distress, urgency and safety alarms, primary alarms and secondary alarms (6.2.5).

7.4.4 Confirm by examination, performed by suitably qualified personnel, that:

- a multifunction display is a colour display (6.3.1);
- the size, colour and density of text and graphic information displayed on a VDU is such that it can be easily read from the normal operator position under all operational lighting conditions (6.3.2);
- symbols used in mimic diagrams are standardized throughout the system displays (6.3.3); and
- all information is presented on a background providing high contrast and emitting as little light as possible by night (6.3.4).

7.4.5 Perform an orderly shut-down of the IBS and confirm that when power is turned on again, the default state specified in the SSD is reached (6.4.1).

7.4.6 Record the configuration in use and the recovery times of all subsystems. Disconnect all external sources of power and wait for expiration of the IBS transitional source of power. Restore power and wait for recovery of all subsystems. The recovery times of all subsystems shall be as recorded (6.4.2).

7.4.7 The IBS shall come to the configuration in use and continue automated operation as far as practicable. Verify that safety related automatic functions are continued only after confirmation (6.4.3).

7.4.8 Confirm by examination of the SSD that provisions are made to comply with the power supply requirements listed in Annex D and in the matrix prepared in 7.2.2.1 (6.5).

Annex A (normative)

Additional IMO requirements

IEC 60533:1977, *Electromagnetic compatibility of electrical and electronic installations in ships.*

IEC 60872-1:1998, *Maritime navigation and radiocommunication equipment and systems — Radar plotting aids — Part 1: Automatic radar plotting aids (ARPA) — Methods of testing and required test results.*

IEC 60936:1988, *Shipborne radar — Operational and performance requirements — Methods of test and required test results.*

IEC 60936-2:1998, *Maritime navigation and radiocommunication equipment and systems — Radar — Part 2: Shipborne radar for high-speed craft — Methods of testing and required test results.*

IEC 61023:1990, *Marine speed and distance measuring equipment — Operational and performance requirements — Methods of testing and required test results.*

IEC 61075:1991, *Loran-C receivers for ships — Minimum performance standards — Methods of testing and required test results.*

IEC 61097-1:1992, *Global maritime distress and safety system (GMDSS) — Part 1: Radar transponder — Marine search and rescue (SART) — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-2:1994, *Global maritime distress and safety system (GMDSS) — Part 2: COSPAS-SARSAT EPIRB — Satellite emergency position indicating radio beacon operating on 406 MHz — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-3:1994, *Global maritime distress and safety system (GMDSS) — Part 3: Digital selective calling (DSC) equipment — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-4:1994, *Global maritime distress and safety system (GMDSS) — Part 4: INMARSAT-C ship earth station and INMARSAT enhanced group call (EGC) equipment — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-5:1997, *Global maritime distress and safety system (GMDSS) — Part 5: INMARSAT-E — Emergency position indicating radio beacon (EPIRB) operating through the INMARSAT system — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-6:1995, *Global maritime distress and safety system (GMDSS) — Part 6: Narrow-band direct-printing telegraph equipment for reception of navigational and meteorological warnings and urgent information to ships (NAVTEX) — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-7:1996, *Global maritime distress and safety system (GMDSS) — Part 7: Shipborne VHF radiotelephone transmitter and receiver — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-8:1998, *Global maritime distress and safety system (GMDSS) — Part 8: Shipborne watchkeeping receivers for the reception of digital selective calling (DSC) in the maritime MF, MF/HF and VHF bands — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-9:1997, *Global maritime distress and safety system (GMDSS) — Part 9: Shipborne transmitters and receivers for use in the MF and HF bands suitable for telephony, digital selective calling (DSC) and narrowband direct printing (NBDP) — Operational and performance requirements, methods of testing and required test results.*

IEC 61097-12:1996, *Global maritime distress and safety system (GMDSS) — Part 12: Survival craft portable two-way VHF radiotelephone apparatus — Operational and performance requirements, methods of testing and required test results.*

IEC 61108-1:1996, *Maritime navigation and radiocommunication equipment and systems — Global navigation satellite systems (GNSS) — Part 1: Global positioning system (GPS) — Receiver equipment — Performance standards, methods of testing and required test results.*

IEC 61108-2:1998, *Maritime navigation and radiocommunication equipment and systems — Global navigation satellite systems (GNSS) — Part 2: Global navigation satellite system (GLONASS) — Receiver equipment — Performance standards, methods of testing and required test results.*

- IEC 61110:1992, *System Omega and differential Omega receivers for ships — Operational and performance requirements — Methods of testing and required test results.*
- IEC 61135:1992, *Decca Navigator system: Receivers for ships — Minimum performance standards — Methods of testing and required test results.*
- IEC 61174:1998, *Maritime navigation and radiocommunication equipment and systems — Electronic chart display and information system (ECDIS) — Operational and performance requirements — Methods of testing and required test results.*
- ISO 449:1997, *Ships and marine technology — Magnetic compasses and binnacles and azimuth reading devices — Class A.*
- ISO 613:1982, *Shipbuilding — Magnetic compasses, binnacles and azimuth reading devices — Class B.*
- ISO 8468:1990, *Ship's bridge layout and associated equipment — Requirements and guidelines.*
- ISO 8728:1997, *Ships and marine technology — Marine gyro-compasses.*
- ISO 9875:1996, *Ships and marine technology — Marine echo-sounding equipment.*
- ISO 9876:1997, *Ships and marine technology — Marine facsimile receivers for meteorological charts.*
- ISO 11606:1997, *Ships and marine technology — Marine electromagnetic compasses.*
- IMO A.221:1971, *Radio equipment for homing.*
- IMO A.224:1971, *Performance standards for echo-sounding equipment [see also IMO MSC.74(69):1998 — Annex 4].*
- IMO A.334:1975, *Recommendation on operational standards for radiotelephone transmitters and receivers.*
- IMO A.342:1975, *Recommendation on performance standards for automatic pilots [see also IMO MSC.64(67)].*
- IMO A.382:1977, *Magnetic compasses: carriage and performance standards.*
- IMO A.383:1977, *Operational standards for radiotelephone watch receivers.*
- IMO A.385:1977, *Operational standards for VHF radiotelephone installations.*
- IMO A.421:1979, *Operational standards for radiotelephone alarms signal generators.*
- IMO A.422:1979, *Performance standards for automatic plotting aids (ARPA) (see also IMO A.823).*
- IMO A.424:1979, *Performance standards for gyro-compasses.*
- IMO A.477:1981, *Performance standards for radar equipment [see also IMO Resolution MSC.64(67) — Annex 4].*
- IMO A.478:1981, *Performance standards for devices to indicate speed and distance [see also IMO A.824(19)].*
- IMO A.479:1981, *Performance standards for shipborne receivers for use with differential Omega.*
- IMO A.524:1983, *Performance standards for VHF multiple watch facilities.*
- IMO A.525:1983, *Performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships.*
- IMO A.526:1983, *Performance standards for rate-of-turn indicators.*
- IMO A.570:1985, *Type approval of ship earth stations.*
- IMO A.662:1989, *Performance standards for float-free release and activation arrangements for emergency radio equipment.*
- IMO A.664:1989, *Performance standards for enhanced group call equipment.*
- IMO A.665:1989, *Performance standards for radio direction-finding systems.*
- IMO A.696:1991, *Type approval of satellite emergency position-indicating radio beacons (EPIRBs) operating in the COSPAS-SARSAT system.*
- IMO A.700:1991, *Performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ship (MSI) by HF.*
- IMO A.702:1991, *Radio maintenance guidelines for the global maritime distress and safety system (GMDSS) related to sea areas A3 and A4.*
- IMO A.708:1991, *Navigation bridge visibility and functions.*