IEC 61996-1

Edition 2.0 2013-05

INTERNATIONAL STANDARD

Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR) – Part 1: Performance requirements, methods of testing and required test results

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

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

Useful links:

IEC publications search - www.iec.ch/searchpub

The advanced search enables you 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It also gives information on projects, replaced and withdrawn publications.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 on-line and also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in additional languages. Also known as the International Electrotechnical Vocabulary (IEV) on-line.

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: csc@iec.ch.

IEC 61996-1

Edition 2.0 2013-05

INTERNATIONAL STANDARD

Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR) – Part 1: Performance requirements, methods of testing and required test results

INTERNATIONAL ELECTROTECHNICAL COMMISSION

PRICE CODE XC

ICS 47.020.70

ISBN 978-2-83220-799-4

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – SHIPBORNE VOYAGE DATA RECORDER (VDR) –

Part 1: Performance requirements, methods of testing and required test results

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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 61996-1 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This second edition cancels and replaces the first edition published in 2007 and constitutes a technical revision.

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

a) The description of the protective capsule in 4.3.4 has been changed in line with the requirements of the new IMO performance standards given in Resolution MSC.333(90) which now require a final recording medium comprising three parts; fixed, float-free and long-term.
b) A new requirement for a performance test has been added in 4.3.6.

c) Further data items to be recorded have been added to 4.6 for ECDIS, AIS, rolling motion and electronic logbooks.

d) Clause 5 contains new technical requirements for configuration data, operational performance test and bridge alert management system. In addition, further technical requirements have been added to 5.6 for bridge audio and to 5.8 for radar and ECDIS images.

e) References to “alarm” requirements in the previous edition have been substituted by references to “cautions” in line with current IMO recommendations. The test methods in Clause 6 have been updated to reflect the new requirements.

f) New Annexes E, F and G concerning protocols for interfacing images using a Local Area Network have been added.

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

FDIS	Report on voting
80/690/FDIS	80/699/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 2.

A list of all parts of the IEC 61996 series, under the general title *Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR)*, can be found on the IEC website.

NOTE All text of this standard, whose wording is identical to that of IMO Resolution MSC.333(90), is printed in *italics,* and the Resolution and associated performance standard paragraph numbers are indicated in brackets.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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

A bilingual version of this publication may be issued at a later date.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – SHIPBORNE VOYAGE DATA RECORDER (VDR) –

Part 1: Performance requirements, methods of testing and required test results

1 Scope

This part of IEC 61996 specifies the minimum performance requirements, technical characteristics, methods of testing and required test results, for shipborne voyage data recorder (VDR) installations as required by Chapter V of the International Convention for Safety of Life at Sea (SOLAS), as amended. It takes account of IMO resolution A.694(17) and is associated with IEC 60945. When a requirement in this standard is different from IEC 60945, the requirement in this standard takes precedence.

This standard incorporates the applicable parts of the performance standards included in IMO Resolution MSC.333(90).

NOTE All text of this standard, whose wording is identical to that of IMO Resolution MSC.333(90), is printed in *italics,* and the Resolution and associated performance standard paragraph numbers are indicated in brackets.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60068-2-27:2008, *Environmental testing – Part 2-27: Tests – Test Ea and guidance: Shock*

IEC 60268-16, *Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission* index

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

IEC 61097-2, *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 61097-7:1996, *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 61162 (all parts), *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*

IEC 61162-450:2011, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection*

IEC 61174, *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*

IEC 61260:1995, *Electroacoustics – Octave-band and fractional-octave-band filters*
Amendment 1:2001

IEC 61672-1:2002, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 62388:2007, *Maritime navigation and radiocommunication equipment and systems – Shipborne radar – Performance requirements, methods of testing and required test results*

IMO A.658(16), *Use and fitting of retro-reflective materials on life-saving appliances*

IMO A.662(16), *Performance standards for float-free release and activation arrangements for emergency radio equipment*

IMO A.694(17), *General requirements for shipborne radio equipment forming part of the Global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO A.810(19), *Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz*

IMO A.1021(26), *Code on alerts and indicators*

IMO MSC.333(90):2012, *Performance standards for shipborne Voyage Data Recorders (VDRs)*

EUROCAE ED-112:2003, *Minimum operational performance specification (MOPS) for crash protected airborne recorder systems*

VESA:2007, *Video electronics standards association – VESA and industry standards and guidelines for computer display monitor timing (DMT), Version 1.0, Revision 0.11*

SAE AS8045A:2011, *Engineering Society for advancing mobility land sea air and space – Minimum performance standard for underwater locating devices – Acoustic, self-powered*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

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

3.1.1
alert
announcement of abnormal situations and conditions requiring attention. Alerts are divided in four priorities: emergency alarms, alarms, warnings and cautions.

Note 1 to entry: See (A.1021(26)/3).

3.1.2
alarm
high priority of an alert. A condition requiring immediate attention and action, to maintain the safe navigation and operation of the ship.

Note 1 to entry: See (A.1021(26)/3).

3.1.3
bridge work station
position at which a person is expected to be when performing one of the normal bridge duties at, for example, the following work stations:

- centre line conning;
- bridge wing(s);
- main radar;
- chart table;
- helmsman;
- communication

3.1.4
caution
lowest priority of an alert. A condition which does not warrant an alarm or warning condition, but still requires attention and out of the ordinary consideration of the situation or of given information

Note 1 to entry: A caution is indicated by a steady visual indication with a message of sufficient detail to enable the bridge team to identify and address the caution condition. No acknowledgement is required and the caution should be automatically removed after the condition is rectified.

Note 2 to entry: See (A.1021(26)/3).

3.1.5
combined EPIRB/VDR capsule
single unit which meets all the requirements of a satellite EPIRB (as required by the carriage requirements of SOLAS IV) and all the requirements of a VDR (as required by the carriage requirements of SOLAS V)

Note 1 to entry: Combined EPIRB/VDR capsule was defined by IMO COMSAR 8.

3.1.6
configuration data
describes the vessel's equipment, its installation on the vessel and its relation to the VDR. The storage and playback software uses this data to store the data record and to convert the data record into information that assists casualty investigation during playback

Note 1 to entry: See (MSC.333(90)/4.10).

3.1.7
data
any item of information received by the VDR for recording, including numerical values, text and audio or radar signals and including all configuration data, except where specifically stated or where the context dictates otherwise

3.1.8
dedicated reserve power source
a battery, with suitable automatic charging arrangements, dedicated solely to the VDR, of sufficient capacity to operate it as required by 5.4.2.

Note 1 to entry: See (MSC.333(90)/4.9).

3.1.9
final recording medium
the items of hardware on which the data is recorded such that access to any one of them would enable the data to be recovered and played back by use of suitable equipment. The combination of a fixed recording medium and float-free recording medium and long-term recording medium, together, is recognized as the final recording medium.

Note 1 to entry: See (MSC.333(90)/4.3).

3.1.10
fixed recording medium
part of the Final Recording Medium which is protected against fire, shock, penetration and a prolonged period on the ocean floor. It is expected to be recovered from the deck of the vessel that has sunk. It has a means of indicating location.

Note 1 to entry: See (MSC.333(90)/4.4).

3.1.11
float-free recording medium
part of the Final Recording Medium which should float-free after a sinking. It has a means of indicating location.

Note 1 to entry: See (MSC.333(90)/4.5).

3.1.12
long-term recording medium
permanently installed part of the Final Recording Medium. It provides the longest record duration and has a readily accessible interface for downloading the stored data.

Note 1 to entry: See (MSC.333(90)/4.6).

3.1.13
playback equipment
any data medium with the playback software, the operational instructions and any special parts required for connecting a commercial-off-the-shelf laptop computer to the VDR

Note 1 to entry: See (MSC.333(90)/4.7).

3.1.14
playback software
copy of the software program to provide the capability to download the stored data and play back the information. The software should be compatible with an operating system available with commercial-off-the-shelf laptop computers and where non-standard or proprietary formats are used for storing the data in the VDR, the software should convert the stored data into open industry standard formats.

Note 1 to entry: See (MSC.333(90)/4.8).

3.1.15 playback system
system including the playback equipment that is capable of downloading and playing back the recorded data

3.1.16
recorder
VDR
complete system, including any items required to interface with the sources of input signals, their processing and encoding, the final recording medium, the playback equipment, the power supply and dedicated reserve power source

Note 1 to entry: See (MSC.333(90)/4.1).

3.1.17
resolution
smallest detectable increment between two values

3.1.18
signal source
any sensor or device external to the VDR, to which the VDR is connected and from which it obtains signals and data to be recorded

Note 1 to entry: See (MSC.333(90)/4.2*)*.

3.2 Abbreviations

EPFS	Electronic position-fixing system
EUT	Equipment under test
FFT	Fast Fourier Transform
GMDSS	Global maritime distress and safety system
IMO	International Maritime Organization
INS	Integrated navigation system
ITU	International Telecommunication Union
LAN	Local area network
ROV	Remotely operated vehicle
SAR	Search and rescue
SINAD	Signal to noise and distortion
SPL	Sound pressure level
STI	Speech transmission index
STIPA	Speech transmission index for public address systems
UTC	Coordinated universal time
VHF	Very high frequency

4 Performance requirements

4.1 General

Performance requirements described in this clause are specified by reference to the numbered paragraphs of IMO Resolution MSC.333(90).

4.2 Purpose

(MSC.333(90)/1) *The purpose of a Voyage Data Recorder (VDR) is to maintain a store, in a secure and retrievable form, of information concerning the position, movement, physical status, command and control of a vessel over the period leading up to, and following, an incident having an impact thereon. Information contained in a VDR* shall *be made available to both the Administration and the shipowner. This information is for use during any subsequent safety investigation to identify the cause(s) of the incident.*

4.3 Operational requirements

4.3.1 Design and construction

(See 6.1.5)

(MSC.333(90)/5.1.4) *The design and construction, which* shall *be in accordance with the requirements of resolution A.694(17) and international standards acceptable to the*

International Maritime Organization (IMO), shall *take special account of the requirements for data security and continuity of operation as detailed in* 4.4 and 4.5.

4.3.2 Maintenance of sequential records

(See 6.1.11)

(MSC.333(90)/5.1.1) *The VDR* shall *continuously maintain sequential records of pre-selected data items relating to the status and output of the ship's equipment, and command and control of the ship, referred to in* 4.6.

4.3.3 Co-relation in date and time

(See 6.1.12)

(MSC.333(90)/5.1.2, 5.5.1) *To permit subsequent analysis of factors surrounding an incident, the method of recording* shall *ensure that the various data items can be co-related in date and time during playback on suitable equipment.*

The recording method shall *be such that the timing of all recorded data items can be derived on playback with a resolution sufficient to reconstruct the history of an incident in detail* (see 4.6.1).

4.3.4 Final recording medium

4.3.4.1 Items of final recording medium

4.3.4.1.1 General

(MSC.333(90)/5.2) *The final recording medium* shall *consist of the following items:*

1) Fixed recording medium;

2) Float-free recording medium; and

3) Long-term recording medium.

4.3.4.1.2 Fixed recording medium

(See 6.1.13)

(MSC.333(90)/5.2.1) *The fixed recording medium* shall *be installed in a fixed protective capsule which* shall *meet all of the following requirements:*

1) be capable of being accessed following an incident but secure against a physical or electronically manipulated change or deletion of recorded data;

2) maintain the recorded data for a period of at least 2 years following termination of recording;

3) maximize the probability of survival against fire, shock, penetration and deep-sea-pressure and recovery of the final recorded data after any incident;

4) be of a highly visible colour and marked with retro-reflective materials; and

5) be fitted with an appropriate device to aid location under water.

4.3.4.1.3 Float-free recording medium

(See 6.1.14)

(MSC.333(90)/5.2.2) *The float-free recording medium* shall *be installed in a float-free capsule which* shall *meet all of the following requirements:*

1) be fitted with means to facilitate grappling and recovery;

2) maintain the recorded data for a period of at least 6 months following termination of recording;

3) be so constructed as to comply with the requirements specified in resolution IMO *A.810(19) and to minimize risk of damage during recovery operations;*

4) be capable of transmitting an initial locating signal and further locating homing signal for at least 48 hours over a period of not less than 7 days/168 hours; and

5) be capable of being accessed following an incident but secure against a physical or electronically manipulated change or deletion of recorded data.

4.3.4.1.4 Long-term recording medium

(See 6.1.4)

(MSC.333(90)/5.2.3) *The long-term recording medium* shall*:*

1) be capable of being accessed from an internal, easily accessible area of the vessel; and

2) provide access to the data held on it but be secured against a physical or electronically manipulated change or deletion of recorded data.

4.3.4.2 Assessment of fixed recording medium

(See 6.1.4)

Where the storage medium cannot be readily and reliably inspected after an incident, means shall be provided to enable an accident investigator to determine, prior to an attempted replay, whether the storage medium has been subjected to an excessive level of heat, where the survival of the stored data may be in doubt.

4.3.4.3 Access to data in capsule

(See 6.1.4)

A capsule is used to enclose the fixed and float-free final recording medium (4.3.4.1.2 and 4.3.4.1.3).

A means shall be provided to retrieve stored information from the capsule via an external device without opening the capsule.

4.3.4.4 Capsule visibility and marking

(See 6.1.4)

The capsule, together with any outermost shell, shall be of a highly visible fluorescent orange colour, marked with retro-reflective materials that comply with the relevant requirements of IMO A.658(16) and marked with the legend:

"VOYAGE DATA RECORDER – DO NOT OPEN –
REPORT TO AUTHORITIES"

4.3.4.5 Capsule location aid

The fixed recording medium capsule shall include an acoustic underwater beacon (see 5.3).

The float-free recording medium capsule shall include a suitable radio transmitter and a light (see 5.2 and 6.1.4).

4.3.5 Interfaces

(See 6.3)

4.3.5.1 Compliance with IEC 61162

(MSC.333(90)/8) *Interfacing to the various signal sources required* shall *be in accordance with the relevant international interface standard,* IEC 61162 series*, where possible. Any connection to any item of the ship's equipment* shall *be such that the operation of that equipment suffers no deterioration, even if the VDR system develops faults.*

As a minimum, the equipment shall support the sentences given in Annex A.

The interfaces for bridge audio, communications audio and screen image capture are defined in 5.6.1*,* 5.7.1 *and* 5.8.1 *respectively.*

Any interface units which may be required to convert non-IEC 61162 signals, shall conform to the requirements of IEC 60945.

In all cases, any connection to any item of the ship's equipment shall be such that the operation of that equipment suffers no deterioration, even if the VDR system develops faults.

4.3.5.2 Data interface

The VDR shall provide an interface for downloading the stored data to an external computer (see Annex C).

4.3.6 Performance test

(See 6.1.4)

(MSC.333(90)/5.1.3) *The system* shall *include functions to perform a performance test at any time, e.g., annually or following repair or maintenance work to the VDR or any signal source providing data to the VDR. This test may be conducted using the playback equipment and should ensure that all the required data items are being correctly recorded.*

Any equipment used to perform these functions shall be permanent part of the VDR installation.

Where the playback equipment is used it shall be in addition to the equipment required in Annex C.

The VDR shall record date, time and test results of at least the last 10 tests on the final recording medium.

NOTE The correct reading of the required data items check is performed in the recording integrity test (see 4.4.4). The receipt of these required data items is tested in the operational performance test (see 5.12).

4.4 Data selection and security

4.4.1 Selection of data items

(See 6.1.4)

(MSC.333(90)/5.3.1) *The minimum amount of* operational *data items to be recorded by the VDR is specified in* 4.6*. Optionally, additional items may be recorded provided that the requirements for the recording and storage of the specified selections are not compromised.*

4.4.2 Configuration data

(See 6.1.2.2)

In addition to the operational data referred to in 4.4.1, a data block defining the configuration of the VDR and the sensors to which it is connected shall be written into the final recording

medium during commissioning of the VDR. This configuration data shall be permanently retained in the final recording medium and protected from modification other than by a duly authorised person following any change to the configuration. Any change to the configuration of this data block shall not adversely affect the recording of the mandatory items. (See 4.6.19)

The following system configuration information and data source identity shall be included in this data block:

a) type approval authority and reference;

b) IMO vessel identification number;

c) software version(s) used and date and time of installation;

d) automatic insertion of date and time of last configuration data amendment;

e) microphone locations, recording channel allocation, and ID (two character identification for example M1, M2, etc.);

f) VHF communications – Location of connected VHF installation(s) and recording port allocation, and ID (two character identification, for example V1, V2, etc.);

g) for each sensor – the manufacturer, type and version number of the sensor and the interpretation of the sensor data;

h) screen display output(s) location and ID (two character identification, for example R1, R2, etc. for Radar, E1, E2 for ECDIS, D1, D2 for non-dedicated displays). For dedicated displays the function of the display, for example radar X-Band, S Band, navigational ECDIS;

i) date and time – from which source obtained;

j) ship's position – from the INS if fitted and from which EPFS obtained and relative positions on the vessel according to the method defined for the IEC 61162 POS sentence;

k) other data inputs, at the minimum for all data required by 4.6:

   1) identification of which equipment is supplying the data;

   2) identification of the sentence (IEC 61162) which is carrying the information (see Annex A);

   3) if received as proprietary sentences according to IEC 61162 (for example containing converted analogue or discrete signals), information to include the location of the information within the sentence and the specification of the relations between sensor values (RPM, rudder angles, state of alert or indicator, etc.) and received values.

4.4.3 Resistance to tampering

(See 6.1.4)

(MSC.333(90)/5.3.2) *The equipment* shall *be so designed that, as far as is practical, it is not possible to manipulate the amount of data being recorded by the VDR, the data itself nor the data which has already been recorded. Any attempt to interfere with the integrity of the data or the recording* shall *be recorded.*

4.4.4 Recording integrity

(See 6.1.10)

(MSC.333(90)/5.3.3) *The recording method* shall *be such that each item of the recorded data is checked for integrity,* i.e. it is identical to the data being received, *and an* alert according to IMO A.1021(26) *given if a non-correctable error is detected.*

The VDR shall automatically continuously monitor the following:

- power supply;
- record function;
- microphone functionality.

Malfunction of any of the above shall generate a caution (see 3.1.4). The caution shall remain until the equipment is serviceable. It shall also indicate its caution status by means of contacts of a relay (or equivalent) which is held energized in the no-alert condition.

The VDR shall also continuously monitor the period of data stored on each element of the final recording medium. If the period of any of the elements falls below the minimum compliant period defined in 4.5.4 a caution shall be generated and remain while the condition is true.

4.5 Operation

4.5.1 Recording and saving of data

(See 6.1.2.1)

(MSC.333(90)/6) *The unit* shall *be entirely automatic in normal operation.*

4.5.2 Power source

(See 6.1.4/6.1.9/6.1.16)

(MSC.333(90)/5.4.1) *The VDR* shall *be capable of operating from the ship's main and emergency source of electrical power.*

4.5.3 Dedicated reserve power source

(See 6.1.7/6.1.8)

(MSC.333(90)/5.4.2) *If the ship's source of electrical power supply to the VDR fails, the VDR* shall *continue to record Bridge Audio (see 4.6.5) from the dedicated reserve power source for a period of 2 hours. At the end of this 2 hour period all recording* shall *cease automatically.*

It shall be possible to recharge the dedicated reserve power source within a period of 10 h.

4.5.4 Recording period and duration

(See 6.1.6)

(MSC.333(90)/5.4.3) *Recording* shall *be continuous unless terminated in accordance with* 4.5.3. *The time for which all stored data items are retained* shall *be at least 30 days/720 hours on the long-term recording medium and at least 48 hours on the fixed and float-free recording media. Data items which are older than this may be overwritten with new data.*

Recording may also be terminated, by means of a key or other secure method.

NOTE This may occur under the following circumstances:

a) during essential maintenance whilst the vessel is in port;

b) when the vessel is laid-up;

c) upon request by an investigation authority, for example after the vessel had been involved in a marine incident.

4.6 Data items to be recorded

4.6.1 Date and time

(See 6.2.1)

(MSC.333(90)/5.5.1) *Date and time, referenced to UTC,* shall *be obtained from a source external to the ship and an internal clock* shall *be synchronized with valid date and time data. During times of a loss of the external source, the internal clock* shall *be used. The recording* shall *indicate which source is in use. The recording method* shall *be such that the timing of all other recorded data items can be derived on playback with a resolution and continuity sufficient to reconstruct the history of the incident in detail.*

4.6.2 Ship's position

(See 6.2.1)

(MSC.333(90)/5.5.2) *Latitude and longitude, and the datum used,* shall *be derived from a* designated EPFS or INS if available*. The recording* shall *ensure that the identity and status of the* source *can always be determined on playback.* The ship's position shall be recorded, as available on the ship, up to a resolution of 0,000 1 min of arc*.*

4.6.3 Speed

(See 6.2.1)

(MSC.333(90)/5.5.3) *Speed through the water, and speed over the ground* (transverse and longitudinal), *including an indication of which it is, derived from the ship's* designated *speed and distance measuring equipment,* shall be recorded, as available on the ship, up to a resolution of 0,1 kn.

4.6.4 Heading

(See 6.2.1)

(MSC.333(90)/5.5.4) *As indicated by a designated ship's heading source.* The ship's heading shall be recorded, as available on the ship, up to a resolution of 0,1°.

4.6.5 Bridge audio

(See 6.2.2)

(MSC.333(90)/5.5.5) *Microphones* shall *be positioned on the bridge covering all work stations as described in MSC/Circ.982 so that conversation is recorded. The recording* shall *be such that, on playback, a normal speaking voice should provide adequate intelligibility while the ship is performing its normal operations. This performance* shall *be maintained at all work stations while there is a single audio alarm anywhere on the bridge or any noise, including noise from faulty equipment or mounting, or wind. This* shall *be achieved through the use of at least two channels of audio recording. Microphones positioned outside on bridge wings,* shall *be recorded on at least one additional separate channel.*

The equipment shall be capable of recording workstations with no more than 2 microphones per channel.

4.6.6 Communications audio

(See 6.2.3)

(MSC.333(90)/5.5.6) *VHF communications relating to ship operations* shall *be recorded on an additional separate channel to those referred to in* 4.6.5, independently of the bridge audio. The recording shall include both transmitted and received audio signals and shall be continuous from a directly connected fixed VHF set to be designated at installation (see 5.7 for technical characteristics).

4.6.7 Radar data – post-display selection

(See 6.2.4)

(MSC.333(90)/5.5.7) *The electronic signals of the main displays of both ship's radar installations as required by SOLAS regulations. The recording method* shall *be such that, on playback, it is possible to present a faithful replica of the entire radar display that was on view at the time of recording, albeit within the limitations of any bandwidth compression techniques that are essential to the working of the VDR.*

NOTE In the case of a ship fitted with an INS, 'radar display' signifies 'collision avoidance task and functions display'.

4.6.8 ECDIS

(See 6.2.4)

(MSC.333(90)5.5.8) *Where a vessel is fitted with an ECDIS installation, the VDR* shall *record the electronic signals of the ECDIS display in use at the time as the primary means of navigation. The recording method* shall *be such that, on playback, it is possible to present a faithful replica of the entire ECDIS display that was on view at the time of recording, albeit within the limitations of any bandwidth compression techniques that are essential to the working of the VDR and in addition the source of the chart data and the version used.*

NOTE In the case of a ship fitted with an INS, 'ECDIS display' signifies 'route monitoring task and functions display'.

4.6.9 Echo sounder

(See 6.2.4)

(MSC.333(90)/5.5.9) *This* shall *include depth under keel,* up to a resolution of 0,1 m as available on the ship*. The depth scale currently being displayed and other status information* shall be recorded *where available.*

4.6.10 Main alarms

(See 6.2.4)

(MSC.333(90)/5.5.10) *This* shall *include the status of all* IMO *mandatory alarms on the bridge as given in Resolution A.1021(26) Table 10.1.1* (see Annex B) *or as received from the Bridge Alert Management System, if installed, recorded as individually identified alarms.*

4.6.11 Rudder order and response

(See 6.2.4)

(MSC.333(90)/5.5.11) *This* shall *include status and settings of heading or track controller, if fitted and indicate the control station, mode, and power unit(s) in use.*

Both rudder order and response angles shall be recorded up to a resolution of 1° as available and permitted on the ship.

4.6.12 Engine and thruster order and response

(See 6.2.4)

(MSC.333(90)/5.5.12) *This* shall *include the positions of any engine telegraphs or direct engine/propeller controls,* including shaft(s) rpm (or equivalent), *and feedback indications on the bridge, if fitted, including ahead/astern indicators and indicate the control station in use. This* shall *also include status of bow* and stern *thrusters if fitted and indicate the control station in use.* RPM shall be recorded up to a resolution of 1 rpm and pitch shall be recorded up to a resolution of 1°.

4.6.13 Hull openings (doors) status

(See 6.2.4)

(MSC.333(90)/5.5.13) *This* shall *include all IMO mandatory status information required to be displayed on the bridge.*

4.6.14 Watertight and fire door status

(See 6.2.4)

(MSC.333(90)/5.5.14) *This* shall *include all* IMO *mandatory status information required to be displayed on the bridge.*

4.6.15 Accelerations and hull stresses

(See 6.2.4)

(MSC.333(90)/5.5.15) *Where a ship is fitted with* IMO mandated *hull stress and response monitoring equipment, all the data items that have been pre-selected within that equipment* and are available shall *be recorded.*

4.6.16 Wind speed and direction

(See 6.2.4)

(MSC.333(90)/5.5.16) *Where a ship is fitted with a suitable sensor, wind speed and direction* shall *be recorded, including its true or relative status.*

The wind speed shall have a resolution of 1 unit (kn, m/s, etc.) and the wind direction shall have a resolution of 1°.

4.6.17 AIS

(See 6.2.4)

(MSC.333(90)/5.5,17) *All AIS data* shall *be recorded.*

4.6.18 Rolling motion

(See 6.2.4)

(MSC.333(90)/5.5.18) *The VDR* shall *be connected to an electronic inclinometer if installed. The recording method* shall *be such that the rolling motion can be reconstructed during playback.*

4.6.19 Configuration data

(See 6.1.2.2)

(MSC.333(90)/5.5.19) *In addition to the data items specified in* 4.6.1 to 4.6.18*, a data block defining the configuration of the VDR and the sensors to which it is connected* shall *be written into the final recording medium during commissioning of the VDR. The data block* shall *be maintained up to date with respect to the vessel installation. It* shall *include details on the manufacturer, type and version number of a sensor, the identification and location of the sensor and the interpretation of the sensor data. This configuration data* shall *be permanently retained in the final recording media and protected from modification other than by a duly authorized person following any change to the configuration.* (See 4.4.2).

4.6.20 Electronic logbook

(See 6.2.6)

(MSC.333(90)/5.5.20) *Where a ship is fitted with an electronic logbook in accordance with the standards of the* IMO *the information from this* shall *be recorded.*

NOTE At the time of writing the IMO has not published any standards for this purpose.

5 Technical characteristics

5.1 Co-relation in date and time

(See 6.1.12)

To ensure that relative timings can be determined within a resolution of 0,1 s, all data items shall, when sampled by the VDR, be recorded with a time index derived from a VDR system clock with an resolution of 0,05 s. The drift of this system clock shall be not more than 1 s in 1 h.

5.2 Particular design requirements for the final recording medium

5.2.1 Fixed protective capsule

(See 6.1.13)

The fixed design shall have a release mechanism to facilitate recovery under water both by a diver and a remotely operated vehicle (ROV).

To ensure that the capsule may be retrieved safely after release, suitable large pad eyes or handles should be incorporated.

NOTE Manipulator jaws of typical underwater recovery machines have a maximum opening of only 300 mm, a gripping force limit of about 1 kN, and a pulling force limit of about 500 N.

5.2.2 Float-free capsule

(See 6.1.14)

5.2.2.1 Release

The float-free release mechanism shall comply with the relevant requirements of IMO Resolution A.662(16). To ensure that the capsule may be retrieved safely after release, suitable large pad eyes or handles should be incorporated.

5.2.2.2 Light

The float-free capsule shall have a light conforming to the relevant requirements of IEC 61097-2. In addition, this light shall remain activated during daylight hours.

5.2.2.3 Locating transmitter

The float-free capsule shall be capable of resolving and transmitting its last received position or its current position with a minimum accuracy of 4 s of arc and conform to the relevant requirements of IEC 61097-2.

5.2.2.4 Combined EPIRB/VDR capsule

In case of a combined EPIRB/VDR capsule (see 3.1.5), this shall, in addition to the requirements of this standard, meet the requirements of IEC 61097-2.

5.2.3 Long-term recording medium

(See 6.1.14)

The long term recording medium shall be permanently installed and not readily removable.

5.3 Location beacons

5.3.1 Fixed protective capsule

(See 6.1.13.9)

The fixed protective capsule shall include an acoustic underwater beacon operating in the frequency band centered on 37,5 kHz with a battery life of 90 days, which shall meet SAE AS 8045A.

5.3.2 Float-free capsule

(See 6.1.14.6)

The float-free capsule shall include a homing transmitter operating on 121,5 MHz, complying with Annex D of IEC 61097-2:2008, except that a Morse letter "V" (. . . –) shall be inserted with a repetition period varying between 47,5 s and 52,5 s, with a dot length (one unit) equal to 115 ms ± 5 %, see Figure 1.

NOTE The transmission of the Morse letter "V" is made after the transmission of the 406 MHz signal. Each dot is a transmission of 1 unit followed by a space of 1 unit. The dash is 3 units followed by a space of 3 units. The total length of the letter is therefore 12 units. During the dot and dash intervals the signal is modulated at 1 000 Hz ± 50 Hz with type of emission A3X and minimum modulation depth of 85 %. The 121,5 MHz carrier is continuous except for an interruption of up to 2 s during the 406 MHz signal transmissions.

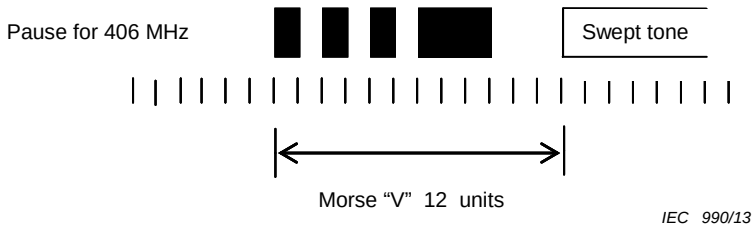


Figure 1 – Insertion of Morse letter "V" in homing transmission

5.4 Survivability of recorded data

5.4.1 Long-term retention

(See 6.1.4)

The final recording medium shall retain the recorded data for a minimum period, following termination of recording, under operational and storage conditions specified by the equipment manufacturer. For the

- fixed recording medium the period is 2 years,
- float-free recording medium the period is 6 months,
- long-term recording medium the period is 2 years.

5.4.2 Physical protection

5.4.2.1 Fixed recording medium

(See 6.1.13)

The capsule shall be designed to ensure that the data held in the fixed recording medium, shall be retrieved without loss after it has been subjected to the following conditions:

a) Shock

A half sine-wave pulse of 50 g, with a duration of 11 ms, as specified in Clause 11 of IEC 60068-2-27:2008.

b) Penetration

A mass of 250 kg with a pin of 100 mm diameter, dropped from a height of 3 m, as specified in EUROCAE 2-4.2.2 of ED-112.

c) Fire

A low temperature fire of 260 °C nominal for 10 h, as specified in 2-4.2.5 of ED-112.

A high temperature fire of 1 100 °C nominal for 1 h, as specified in 2-4.2.4 of ED-112.

d) Deep-sea pressure and immersion

Immersion in sea water at a pressure of 60 MPa (equivalent to a depth of 6 000 m), as specified in EUROCAE 2-4.2.6 of ED-112.

5.4.2.2 Float-free recording medium

(See 6.1.14)

The capsule shall be designed to ensure that the data held in the final recording medium, can be retrieved without loss after it has been deployed and subjected to salt water exposure for at least 7 days.

5.5 Information to be included in the manufacturer's documentation

(See 6.1.4)

5.5.1 Installation guidelines

The following installation guidelines shall be included.

a) Siting of the fixed recording medium and float-free recording medium.

The protective capsule shall be sited in the vicinity of the bridge on the external deck area of the vessel so as to maximise the probability of its survival and recovery following an incident. The capsule shall be positioned clear of rigging and other potential obstructions and as near to the centreline of the ship as practically possible.

Criteria to be considered when assessing the optimum position shall include but not be limited to the following:

1) separation from fuel or other potential fire sources;
2) separation from probable sources of mechanical damage;
3) operational environment for continued serviceability;
4) accessibility for routine maintenance;
5) facilitation of underwater removal and retrieval by both divers and ROVs. There should be a clear unobstructed space in the vicinity of the capsule to allow an ROV or diver to work;
6) in the case of float-free recording medium, minimisation of the risk of obstruction after release.

b) Siting of microphones to achieve the requirements of 4.6.5.

c) Siting of the data interface (4.3.5.2).

d) Siting of the playback equipment (Annex C).

e) Siting of all other components of the VDR system.

f) Entering and updating the configuration data of 4.4.2.

g) The requirement for interface units to comply with 4.3.5.

h) The requirement to record ship specific interface information to be recorded and the record to be left onboard.

5.5.2 Operation and maintenance manual

(MSC.333(90)/7) *Information describing the location of the long-term recording medium interface* (see 4.3.5.2) *and instructions describing the means of interfacing with it as referred to in* Annex C shall *be provided in at least the English language. The equipment documentation* shall *include guidance for the placement of the information and instructions at a prominent position as close to the long-term recording medium interface as practicable.*

The manual shall include the following:

a) instructions on normal operation of the VDR;

b) instructions on how to copy data from the equipment (see Annex C);

c) instructions on the action to be taken following the activation of any VDR alert;

d) instructions for downloading and verification of the data from each part of the final recording medium;

e) instructions for verification of each recorded sensor data through playback;

f) instructions on maintenance tasks required to ensure the serviceability and continued seaworthiness of the VDR including analysis to identify those sensors or transducers where the serviceability or accuracy could be degraded and remain undetected;

g) instructions to update the records of ship specific-interface information as necessary.

5.5.3 Information for use by an investigation authority

The following shall be available:

a) instructions to enable an investigation authority to manufacture any special tools or interface equipment required for retrieval of recorded data from the recorder;

b) details of the necessary actions to be followed for data retrieval from an undamaged final recording medium;

c) details of the necessary actions to be followed for data retrieval from a final recording medium that has been damaged in an incident;

d) details of the necessary actions to be followed to determine, prior to an attempted replay, whether the storage medium has been subjected to an excessive level of heat, where the survival of the stored data may be in doubt;

e) playback equipment required to enable the download and playback of recorded data (see Annex C).

5.6 Bridge audio specifications

5.6.1 Input interface

The microphones forming the bridge audio data source are to be considered to be parts of the VDR. The form of the connections, signal levels and impedances, are at the option of the manufacturer. However, for the purposes of testing, each microphone shall be connected via a plug/socket combination, which is referred to hereafter as a microphone input port.

5.6.2 Reference signal

The manufacturer shall declare a reference signal for the microphone input ports. This shall be defined as a 1 kHz sinusoid with amplitude corresponding to the nominal output from the microphone at a reference level of 85 dB SPL and 1 kHz.

The reference level is defined with respect to a free field. If the microphone is designed to be mounted in a console or wall, +6 dB should be added to the 85 dB SPL for the equivalent wall-mounted reference level.

5.6.3 Audio frequency response

(See 6.2.2.1)

Signal levels of both 6 dB and 45 dB below the reference signal level, shall be applied to every bridge area microphone input port in turn, with the frequency swept continuously at a rate not exceeding 0,1 octaves per second, over the range of 150 Hz to 6 000 Hz, the level of signal recovered from the VDR shall not vary by more than a total range of 6 dB, on playback. Any other microphone input ports shall have no signals applied at this time.

5.6.4 Quality index

5.6.4.1 Input channel with a single signal

(See 6.2.2.2.1)

The quality of the recording for each of the bridge area microphone input ports shall be established at the electrical equivalent level of 75 dBA. This shall not be less than that corresponding to the quality value for the speech transmission index of 0,85 (see IEC 60268-16 STIPA method), with no signal being simultaneously applied to other microphone ports.

5.6.4.2 Input channel with multiple signals

(See 6.2.2.2.2)

The quality of the recording for each of the bridge area microphone ports shall be established at the electrical equivalent level of 75 dBA. This shall not be less than that corresponding to the quality value for the speech transmission index of 0,60 (see IEC 60268-16 STIPA method) with all of the other microphone input ports having inputs at the electrically equivalent level of 65 dBA.

5.6.4.3 Signal noise level – Signal to no signal

(See 6.2.2.3)

With no signal applied to any bridge area microphone input port, the reproduced signal at any replay output shall be at least 48 dB below the output level, which would be produced by an input level equal to the reference signal level. This requirement shall be met across the frequency band as defined in 5.6.3 with the inputs both open and short-circuited. The above signal to no signal performance shall be met in the presence of out-of-band input signals.

5.6.5 Signal noise level – Signal to noise and distortion

(See 6.2.2.4)

With all other microphone input ports, except the one in use, short-circuited, the reproduced signal to noise and distortion (SINAD) ratio shall be at least 24 dB across the frequency band as defined in 5.6.3 and with input levels in the range of 0 dB to −20 dB relative to the reference signal level for all microphone input ports.

5.6.6 Ability to handle complex signals

(See 6.2.2.5)

A bridge area microphone input port shall be able to meet the requirement for audio frequency response while 16 sinusoidal signals are applied simultaneously from the following list:

150 Hz, 190 Hz, 241 Hz, 306 Hz, 380 Hz, 491 Hz, 570 Hz, 789 Hz, 1 000 Hz, 1 267 Hz, 1 606 Hz, 2 000 Hz, 2 581 Hz, 3 000 Hz, 4 145 Hz and 5 000 Hz.

NOTE This requirement demonstrates that the audio system will be capable of reproducing a voice in the presence of background noise.

5.6.7 Suppression of low frequency out band noise

(See 6.2.2.6)

The bridge area microphone input ports shall be able to operate according to this standard while a 20 Hz sinusoidal signal with amplitude 19 dB above the reference signal level is present.

NOTE This requirement is to demonstrate that the audio system can suppress low frequency noise from 60 Hz and below which might otherwise cause clipping.

5.6.8 Microphones

(See 6.2.2.7)

5.6.8.1 Audio noise level – Signal to noise and distortion

The reproduced signal to noise and distortion (SINAD) ratio shall be at least 24 dB with input applied to the microphone measured at 500 Hz, 1 000 Hz and 2 000 Hz with levels of 85 dB SPL, 75 dB SPL and 65 dB SPL. This performance shall be achieved while a 20 Hz sinusoidal signal with amplitude 19 dB above the reference signal level is present.

5.6.8.2 Audio frequency response

The level of signal recovered from the VDR shall not vary by more than 12 dB on playback within the 150 Hz to 6 000 Hz frequency range referred to the average value within this frequency range. This performance shall be achieved while a 20 Hz sinusoidal signal with amplitude 19 dB above the reference signal level is present.

5.7 Communications audio

5.7.1 Input interfaces

The audio connection with the designated VHF equipment shall be in accordance with the requirements of IEC 61097-7. For the purposes of testing, the connection shall be via a plug/socket combination referred to hereafter as the input port.

5.7.2 Reference signal

The reference signal level for both transmitted and received communications audio is defined as 0,775 V r.m.s.

5.7.3 Audio frequency response

(See 6.2.3.1)

With a signal level 6 dB below the reference signal level applied to the VHF radio communications input port of the VDR and with its frequency continuously swept at a rate not exceeding 0,1 octaves per second over the range of 150 Hz to 3 500 Hz, the level of the signal recovered from the VDR on playback shall not vary by more than 6 dB.

5.7.4 Quality index

(See 6.2.3.2)

The quality of the recording for the VHF radio communications port shall be established and shall not be less than that corresponding to the quality value for the speech transmission index of 0,75 (see IEC 60268-16 STIPA method).

5.7.5 Audio noise level – Signal to no signal

(See 6.2.3.3)

With no signal applied to a VHF radio communications port, the reproduced signal shall be at least 48 dB below the output level produced by an input equal to the reference signal level. This requirement shall be met across the frequency band as defined in 5.7.3 with the input port both open and short-circuited. The above signal to no signal performance shall be met in the presence of out-of-band input signals and also at the reference signal level.

5.7.6 Signal noise level – Signal to noise and distortion (SINAD)

(See 6.2.3.4)

The reproduced SINAD ratio shall be at least 24 dB across the frequency band as defined in 5.7.3 and with input levels in the range of 0 dB to −20 dB relative to the reference signal level.

5.8 Screen image capture

(See 6.2.4)

5.8.1 Input interface

5.8.1.1 Source and acquisition

5.8.1.1.1 Buffered radar display video output

Where the VDR is capable of being connected to a buffered video output from the display whose image it is to record this shall meet fully the tests of 6.2.4 with buffered outputs meeting the electrical specifications of VESA DMT, where that standard refers to display monitors having screen resolutions between 640 × 350 and 1 280 ×1 024 and refresh rates between 60 Hz and 85 Hz and 1 600 × 1 200 with a refresh rate of 60 Hz.

5.8.1.1.2 LAN display image output

Where the VDR is capable of being connected to a LAN interface this shall be done according to IEC 61162-450 and/or according to IEC 62388:2007, Clause H.2.

NOTE 1 IEC 62388:2007, Clause H.2 is provided for compatibility with older display equipment. IEC 61162-450 is recommended for new display equipment.

Image data shall be provided to the VDR in one of the following formats:

".bmp" – (Microsoft GDI – Bitmap reference);

NOTE 2 The .bmp format image file is efficiently reduced by .zip compression.

".png" – (ISO/IEC 15948);

“.jpg” – (ISO/IEC 10918) or

".jp2" – (JPEG 2000 – ISO/IEC 15444 in a lossless format).

In order to satisfy the subjectively lossless playback requirement of 5.8.2.2, the received .jpg file shall be fully recoverable at the playback suite (Annex C).

NOTE 3 IEC 62388 and IEC 61162-450 require that image quality complies with the subjectively lossless requirement of 5.8.2.2.

5.8.1.1.3 Display image acquisition interval

The VDR shall record a series of single and complete screen image frames. One complete screen image frame shall be acquired from each display at intervals of 15 s or less.

5.8.1.1.4 Display image prioritisation scheme

Within each class with type “Xband”, “Sband” and “ECDIS” (see Annex E) one image shall be stored at an interval not exceeding 15 s. The most recent image from each location shall be stored in turn. An individual image shall only be recorded once in each element of the final recording medium.

If the “Active” status for a location is indicated as “standby” it shall record this image at an interval not less than 10 min and not exceeding 30 min.

5.8.2 Image outputs

5.8.2.1 Format and resolution

When used with the playback system, the resolution of the output image shall be equal to or greater than the resolution of the image input.

5.8.2.2 Fidelity

The recording shall be subjectively lossless, as determined by the objective tests described in 6.2.4.1 to 6.2.4.6. In addition to those objective tests, the screen display on the playback system shall be a subjectively satisfactory facsimile of the original display as determined by the test described in 6.2.4.7

5.9 Radar data – Post-display selection

(See 6.2.4)

The screen image shall be captured from each display that is showing either of the two radars required by SOLAS according to 5.8. The identity of the display from which the image was captured shall be recorded by the method described in Annex E.

Where a radar required by SOLAS is being shown on more than one display, the screen images containing that radar shall be recorded selectively in sequence such that the rate of occurrence of those displays in the record is the same, and at least one is recorded per interval. Where it is not possible to determine which images contain either of the radars required by SOLAS, all images shall be recorded (see 5.8.1.1.4).

NOTE In the case of a ship fitted with an INS, ‘radar display’ signifies ‘collision avoidance task and functions display’.

5.10 ECDIS data

(See 6.2.4)

The screen image shall be captured from each display that is showing the navigation ECDIS required by SOLAS according to 5.8 using only a LAN display video output as described in 5.8.1.1.2. The identity of the display from which the image was captured shall be recorded by the method described in Annex E.

Where it is not possible to determine which images contain the navigation ECDIS required by SOLAS, all images shall be recorded (see 5.8.1.1.4).

NOTE In the case of a ship fitted with an INS, ‘ECDIS display’ signifies ‘route monitoring task and functions display’.

The cell name, edition number and update number of the currently displayed cells shall be recorded by the method described in Annex G.

5.11 Configuration data

(See 6.1.2.2)

5.11.1 Distribution of data in final recording media

The complete configuration data shall be downloadable from each item of the final recording medium.

5.11.2 Protection

The configuration data shall be protected against unauthorised change, for example through the use of a key, password or similar means.

5.11.3 Synchronisation of sensor and configuration data

Where the configuration data is changed a means shall be provided to ensure that the contemporaneous configuration data can be applied to each item of sensor data for the time it was recorded.

5.12 Operational performance test

(See 6.1.5)

The VDR installation shall provide an operational performance test on individual sensors connected to it to ensure that the sensor data can be received and interpreted using the configuration data and displayed as information.

This shall include the

- initiation of the bridge audio microphone test on demand,
- qualitative evaluation of recently recorded data, excluding bridge audio.

The VDR installation shall also indicate the number of hours of data stored on each element of the final recording medium and the minimum compliant periods defined in 4.5.4 shall also be indicated.

5.13 Bridge alert management system

(See 6.3)

The VDR shall output alerts to a bridge alert management system if fitted.

6 Methods of testing and required test results

6.1 General

6.1.1 Test setup

6.1.1.1 Equipment under test (EUT)

In this Clause, except where specifically stated otherwise, any reference to the equipment under test (EUT) shall be interpreted as comprising all the parts of a shipborne VDR configuration including:

a) IEC 61162 port(s);

b) microphone(s) and associated self-test device;

c) communications audio input(s) unit;

d) screen image capture input unit(s);

e) control and display unit(s);

f) the final recording medium;

g) power supply unit(s);

h) playback equipment;

i) equipment required for the operational performance test;

j) all other item(s) declared by the manufacturer;

k) manufacturer's documentation.

The EUT shall be installed in the test facility using interconnection and input cabling and methods representative of a normal installation, but this material and installation shall not be considered part of the EUT.

NOTE Where an external computer is required to perform the operational playback test, this does not form part of the EUT.

6.1.1.2 Standard input data

Except where input data is detailed for individual tests, the following shall be applied for all general performance tests and checks. Test data streams for the audio and radar inputs shall be chosen to exercise the data processing methods. A copy of the data set shall be retained for comparison purposes.

- Bridge audio – the maximum number of microphones specified by the manufacturer shall be connected to the EUT. Audio signals consisting predominantly of speech at a level of approximately 75 dBA shall be presented to each microphone input port. A common loudspeaker may be used.
- Communications audio – the maximum number of communications audio inputs specified by the manufacturer shall be connected to the EUT. Audio signals consisting predominantly of speech shall be presented to each input.
- Screen image data – test signals equivalent to the maximum number of parallel recorded screen images as specified by the manufacturer shall be presented to the EUT.
- IEC 61162 data inputs – a representative data signal consisting of a continuous stream of appropriate IEC 61162 sentences shall be applied to each IEC 61162 input port. A timed log shall be kept of the input data to enable comparisons to be made.

6.1.1.3 Full performance test

The recorded data shall be viewed using the playback equipment (see 6.1.2). Sufficient detailed examinations shall be made throughout the specified duration of the recording to ensure that recording was continuous and consistent with the standard input data. Examinations of 25 random samples of 30 s duration shall be made on all data channels throughout the duration of the recording.

6.1.1.4 Performance check

An abbreviated qualitative examination shall be made at least once on each data channel at the start of the check and then of 10 random samples of 30 s duration as appropriate to the individual test.

6.1.2 Download and playback equipment

6.1.2.1 Recording and saving of data

(See 4.5.1/Annex C)

The manufacturer shall demonstrate to the satisfaction of the testing authority that the data saved to each item of the final recording medium (see 4.5.1 and Annex C) can be downloaded

from any item within the time specified in Annex C and reproduced with the supplied playback software.

A user defined period of recorded data and configuration data shall be downloaded from the specified item of final recording medium. All the available operational performance test records shall be downloaded. The start and end points and completeness of the downloaded data shall be confirmed.

6.1.2.2 Configuration data

(See 4.4.2/4.6.19/5.11)

The manufacturer shall demonstrate that the configuration data has been used to interpret the recorded sensor data correctly, for example, the location and status of a fire door, the conversion into engineering units and quantities, the data source, etc.

The equipment shall demonstrate that configuration data contemporaneous with each data item of sensor data is downloadable from each item of the final recording medium.

6.1.3 Sequence of tests

Except where specifically stated otherwise, the tests shall all be conducted on a single EUT but may be performed in any sequence agreed between the manufacturer and the test authority.

6.1.4 Requirements to be checked by inspection only

The testing authority shall check, by inspection of the EUT, manufacturing drawings and other relevant documentation to be provided by the manufacturer, compliance with all requirements of Clause 4 and Clause 5, including those for where no test is specified in these Clauses. This inspection shall include, but not be limited to, items in the following list. The result of this inspection shall be stated in the test report.

a) Resistance to tampering (see 4.3.4.1.4, 4.4.3 and 5.2.3).

   Particular reference shall be made to the following:

   1) access to any physical part of the system except the data output interface shall require the use of tools or keys;

   2) any access to the final recording medium shall leave easily recognisable evidence of tampering, e.g. seals or stickers, etc.;

   3) operation of any controls or keyboard keys, or any combination of these, shall not affect recording;

   4) termination of recording shall only be possible by means of a key or other secure method;

   5) recorded data shall be protected against unauthorised access by use of a password.

b) Access to data in a capsule (see 4.3.4.3).

c) Marking (see 4.3.4.4).

d) Performance test (see 4.3.6).

e) Selection of data items (see 4.4.1).

f) Power source (see 4.5.2).

g) Long term retention (see 5.4.1).

h) Documentation (see 5.5).

6.1.5 Environmental test conditions for normal operation

(See 4.3.1)

The special conditions and tests for survival of data after an incident are given in 6.1.13 and 6.1.14.

The manufacturer shall determine which components of the VDR system will be protected or exposed, as defined in IEC 60945.

Prior to and after detailed tests, the equipment shall be subjected to a series of performance checks to demonstrate that it satisfies the relevant requirements of IEC 60945.

It is important to ensure, either by test in the EUT or separately, that the battery of the dedicated reserve power source meets the requirements of 4.5.3 and 6.1.7 at the extreme operating temperatures specified in IEC 60945.

6.1.6 Recording duration

(See 4.5.4)

6.1.6.1 Test method for fixed and float-free recording medium

The equipment shall operate continuously using normal external electrical power, recording test signals specified in 6.1.1.2 for a duration in excess of 48 h.

6.1.6.2 Required results

By a series of performance checks recording shall be demonstrated to be continuous in compliance with the requirements of 4.5.4.

6.1.6.3 Test method for long-term recording medium

The manufacturer shall supply the long-term storage medium completely full with recorded data and this shall represent a continuous record of the signals specified in 6.1.1.2 of at least the minimum period for the long-term recording medium specified in 4.5.4. The equipment shall operate continuously using normal external electrical power, recording test signals specified in 6.1.1.2 for a duration in excess of 48 h.

6.1.6.4 Required results

By a series of performance checks recording shall be demonstrated to be continuous in compliance with 4.5.4.

6.1.7 Reserve power source

(See 4.5.3)

6.1.7.1 Test method

Whilst operating the EUT using normal external electrical power, and recording test signals as specified in 6.1.1.2 the power shall be removed for a period in excess of 2 h. The normal external electrical power shall then be restored for a period of 10 min and the test then terminated.

6.1.7.2 Required results

A caution shall be generated when the normal external electrical power is removed.

The EUT shall continue to operate from its reserve source of power for 2 h and shall then terminate automatically in accordance with 4.5.3.

After normal external electrical power has been restored it shall be demonstrated by performance checks that

a) the VDR resumes normal operation,

b) in the most recent 48 h of each item of the final recording medium 45 h 50 min of recording prior to power interruption has been retained, followed by 2 h of recording of bridge audio, followed by 10 min of normal recording.

6.1.8 Recharging of reserve source of power

(See 4.5.3)

6.1.8.1 Test method

On completion of the test of 6.1.7, normal external electrical power supply shall be maintained for a continuous period of 10 h. Test 6.1.7 shall then be repeated.

6.1.8.2 Required results

It shall be demonstrated that the reserve source of power was recharged sufficiently to operate the equipment for 2 h, as specified in 6.1.7.2.

6.1.9 Brief interruption of electrical power

(See 4.5.2)

6.1.9.1 Test method

The test of 6.1.7.1 shall be repeated, but normal external electrical power shall be restored after a period of 3 min instead of 2 h.

6.1.9.2 Required results

The alert behaviour of 6.1.7.2 shall occur. After normal external electrical power has been restored it shall then be demonstrated by performance checks that

a) the VDR resumes normal operation within 1 min after normal restoration of power,

b) in the most recent 48 h of each item of the final recording medium at least 47 h 45 min of recording prior to the power interruption has been retained,

c) recording of bridge audio continued during the power interruption.

6.1.10 Recording integrity

(See 4.4.4)

For each of the following it shall be demonstrated that a caution is activated.

a) Power supply

Whilst operating using normal external electrical power, this power shall be removed.

NOTE This test is included in the tests of 6.1.7, 6.1.8 and 6.1.9.

b) Record function error

The manufacturer shall demonstrate that if the test data signals (screen image, audio and data) are not being correctly recorded on any item of the final recording medium, the caution shall identify the item.

The manufacturer shall demonstrate by documentary evidence that the bit error rate for data recording does not exceed 1 in 10^8.

c) Microphone functionality

The manufacturer shall demonstrate that there is an unobtrusive acoustic test of all microphones and that, when a microphone malfunction is detected, a caution is activated. The acoustic test shall occur automatically at least once every 12 h and be executable on demand.

d) Final recording medium capacity

It shall be demonstrated that three independent cautions are generated, one for each element of the final recording medium.

6.1.11 Maintenance of sequential records

(See 4.3.2)

The manufacturer shall demonstrate that the VDR maintains sequential records as required by 4.3.2.

6.1.12 Co-relation in date and time

(See 4.3.3/5.1)

6.1.12.1 Test method

The VDR shall record the test data set of 6.1.1.2 for a period of 30 min. This recorded data shall be replayed.

6.1.12.2 Required results

The time indices of the replayed data shall meet the requirements of 4.3.3 and 5.1.

6.1.13 Design and construction of the fixed protective capsule

(See 4.3.4.1.2/5.2.1/5.4.2.1)

6.1.13.1 Definition of EUT for 6.1.13

For these tests only, any reference to “the EUT” shall mean

a) the protective capsule, complete with all internal fittings, linings, heat insulators,
b) the final recording medium, as normally installed inside the capsule,
c) any power supply units or batteries that normally form part of the capsule contents,
d) all mounting hardware and release mechanism(s),
e) the acoustic beacon or a mechanically equivalent dummy,
f) the normal electrical or other cable through which data is transferred between the main units of the VDR and the fixed recording medium during normal operation.

6.1.13.2 Test data to be pre-loaded into the fixed recording medium

Test data signals as specified in 6.1.1.2 shall be recorded for 48 h.

6.1.13.3 Tests and test sequence

The EUT shall be subjected to the tests of 6.1.13.4 to 6.1.13.8 inclusive, in the order listed

a) shock,
b) penetration,
c) low temperature fire test,
d) high temperature fire test,
e) deep-sea pressure and sea water immersion.

These tests shall normally be carried out on a single EUT. If more than one EUT is used, the following sequences are acceptable:

If two EUTs are used the sequence of tests shall be:

a), b) on one unit and c), d), and e) on the other, or

a), b), c), and e) on one unit and a), b), d), and e) on the other.

If three EUTs are used the sequence of tests shall be:

a), and b) on one unit, c), and e) on the second unit, and d), and e) on the third unit.

As a minimum, the fire test and the deep-sea immersion tests shall be conducted on the same EUT. However, it is not a mandatory requirement that a single EUT shall survive the other tests in addition to these.

The deep-sea immersion test can be carried out on the final recording medium in the EUT alone if it can be shown that the final recording medium cannot be damaged as a consequence of collapse of the protective capsule.

6.1.13.4 Shock

The EUT shall be secured to the test rig in accordance with the manufacturer's normal installation instructions.

It shall then be subjected to the test requirements of Clause 11 of IEC 60068-2-27:2008, with the following parameters:

a) pulse shape – half sine;

b) tolerances – as in Figure 2;

c) velocity change – not applicable;

d) cross axis motion – not applicable;

e) excitation axis, testing attitude and testing axes – 3 axis;

f) method of mounting – fastened to the testing machine or table using the normal shipboard installation mounting arrangements specified by the manufacturer;

g) severity – 50 g, duration of the nominal pulse 11 ms;

h) direction and number of shocks – 3 shocks in 2 directions on each axis;

i) pre-conditioning – nil;

j) initial measurements – see 6.1.3;

k) functional performance test – see 6.1.13.8;

l) operating modes and functional monitoring;

m) recovery – not applicable;

n) acceptance and rejection criteria – see 6.1.13.8;

o) final measurements – see 6.1.13.8;

6.1.13.5 Penetration

The EUT shall be secured to the test rig in accordance with the manufacturer's normal installation instructions.

The protective capsule shall be subjected to the requirements of EUROCAE 2-4.2.2 of ED-112. The mass used shall be 250 kg, with a pin diameter of 100 mm, dropped from a height of 3 m.

6.1.13.6 Fire

(See 4.3.4.2)

The protective capsule shall be subjected to a low temperature fire test for 10 h at 260 °C and a high temperature test of 1 h at 1 100 ºC to the requirements of EUROCAE ED-112.

NOTE If an actual acoustic beacon is used during the test, caution is recommended due to possible explosion of the battery.

6.1.13.7 Deep-sea pressure and sea water immersion

The protective capsule shall be subjected to the requirements of EUROCAE 2-4.2.6 of ED-112. Both the 6 000 m 24-h test described in paragraph 1 and the 3 m 30-day test described in paragraph 2 shall be carried out.

6.1.13.8 Required results of 6.1.13.4 to 6.1.13.7

After completion of the test sequences, all the release mechanisms shall function according to the appropriate specifications.

After completion of the tests, the stored data shall be retrieved following the manufacturer's instructions, which may include error correcting. Repairs to the final recording medium shall be limited to connectors and cables. For the purposes of playback, the final recording medium may be removed from the EUT and installed into standard replay equipment as supplied by the recorder manufacturer. Recordings shall meet the requirements of the performance test specification as set out 6.1.1.3 with at least 99 % of the data being recoverable. Thermal, mechanical or corrosive damage to the recording medium incurred during the test that results in the loss of data, shall constitute a failure.

The under water locator beacon need not survive the fire tests, but shall remain attached to the protective capsule throughout.

6.1.13.9 Aid(s) to location

(See 5.3.1)

The acoustic beacon shall be tested for compliance with SAE AS 8045A.

6.1.14 Design and construction of the float-free capsule

(See 4.3.4.1.3/5.2.2/5.4.2.2)

6.1.14.1 Definition of EUT for this subclause

For these tests only, any reference to "the EUT" shall mean

a) the float-free recording medium, complete with all internal fittings,

b) the final recording medium, as normally installed inside the capsule,

c) any power supply units or batteries that normally form part of the capsule contents,

d) all mounting hardware and release mechanism(s), including the automatic release mechanism,

e) the normal electrical or other cable through which data is transferred between the main units of the VDR and the final recording medium during normal operation.

6.1.14.2 Test data to be pre-loaded into the final recording medium

Test data signals as specified in 6.1.1.2 shall be recorded for 48 h.

6.1.14.3 Tests

The EUT shall be subjected to the tests of IEC 61097-2, as relevant, followed by 6.1.14.4, and in any order, 6.1.14.5 and 6.1.14.6.

6.1.14.4 Data integrity under float-free operation

(See 5.4.2.2)

The EUT shall be tested to verify that the data stored up to the moment of releasing the capsule is not corrupted by the deployment of the capsule or by the transmission of locating and homing signals.

a) Performance checks shall be performed on the capsule after being released under different deployment scenarios, including:
   - having been manually released after manually set to the transmission mode;
   - having been manually released without being set to the transmission mode;
   - automatic release; and
   - with different sequences of disconnecting data and power inputs, if relevant.

   These checks may be combined with the tests of IEC 61097-2.

b) The EUT, with a full set of data stored, shall be set into the test transmission mode (in a suitable arrangement in order not to alert SAR facilities, and not floating in water, in order to represent the worst case condition). The beacon transmissions shall be maintained for a duration of 7 days.

6.1.14.5 Required results

After completion of the tests, the stored data shall be retrieved following the manufacturer's instructions, which may include error correcting. Repairs to the final recording medium shall be limited to connectors and cables. Mechanical or corrosive damage to the recording medium incurred during the test that results in corruption or loss of data, shall constitute a failure. For the purposes of playback, the recording medium may be removed from the EUT and installed into standard replay equipment as supplied by the manufacturer. Recordings shall meet the requirements of the performance test specification as set out in 6.1.1.3 with at least 99 % of the data being recoverable.

6.1.14.6 Aid(s) to location

(See 5.3.2)

The radio transmitter and light shall be tested for compliance to the appropriate parts of IEC 61097-2 and IMO A.662(16), but with a required duration of seven days.

6.1.14.7 Means to facilitate grappling and recovery

The float-free capsule shall be checked visually for means to facilitate grappling and recovery. Check that the design of the means to facilitate grappling and recovery does not increase the risk of fouling during release, and that the documentation contains appropriate installation instructions.

6.1.15 Operational performance test

(See 5.12)

6.1.15.1 Bridge audio test

Initiate the bridge microphone test defined in 6.1.10 c) and confirm that the EUT automatically indicates correctly and identifies the result for each configured bridge audio microphone, (for example conning position microphone – fail)

Repeat the above with each microphone disconnected in turn.

6.1.15.2 Qualitative data test

The configuration data within the EUT shall correspond to the standard input data (see 6.1.1.2).

It shall be confirmed that the EUT indicates correctly and identifies using the configuration data, on demand;

a) for each screen display configured as connected, a recent image from each display if received within the last minute and otherwise that none has been received,

b) for every other configured device in the IEC 61162 series data:

- whether the device has communicated in the last minute
- the most recent received parameter values after conversion to operational values using the configuration data.

Repeat the above with a selection of devices disconnected or removed from the IEC 61162 data input.

6.1.15.3 Capacity test

It shall be confirmed that the period of data stored in hours reported for each element of the final recording medium indicates correctly, and that the minimum compliant period for each element is also indicated.

6.1.16 Power source

(See 4.5.2)

It shall be confirmed that the VDR operates at all times when electrical power is applied.

6.2 Data items to be recorded

6.2.1 Date/time – Ship's position – Speed – Heading

(See 4.6.1/4.6.2/4.6.3/4.6.4)

6.2.1.1 Test method

The test method and result required are the same for these four parameters.

Present the date/time, ship's position, speed and heading data, one at a time, conforming to the format specified in Annex A to the port designated for the relevant parameter. The data shall be presented at a rate greater than once per second and changed at a rate less than once per second. Record the data for 30 min. Replay the data.

6.2.1.2 Required results

All the changed data shall be accurately reproduced at a rate of at least once per second.

6.2.2 Bridge audio

(See 4.6.5)

6.2.2.1 Audio frequency response for bridge audio

(See 5.6.3)

6.2.2.1.1 Test method

The following test equipment is required:

a) sweep frequency audio signal generator;

b) audio power meter;

c) frequency counter.

With all other area microphone input ports short-circuited, connect the audio signal generator to the port under test and adjust its output to obtain a signal capable of continuously sweeping over the frequency range. Adjust the sweep frequency rate to 0,1 octave per second. Set the level to 6 dB below the reference signal level at the equipment input. Record this signal.

Replay the recording and measure the output level and frequency. Determine the level variation over the frequency band. Repeat for all other microphone input ports.

Repeat the tests with the input set at 45 dB below the reference signal level.

6.2.2.1.2 Required results

The test results shall meet the requirements of 5.6.3.

6.2.2.2 Quality index for bridge audio

(See 5.6.4)

6.2.2.2.1 Single port

(See 5.6.4.1)

6.2.2.2.1.1 Test method

The following test equipment is required:

a) STIPA signal generator;

b) STIPA analyser;

c) pink noise generator;

d) audio band-pass filter (150 Hz to 6 000 Hz).

NOTE 1 Pink noise has the same power in each octave.

With all other microphone input ports short-circuited, connect the signal generator to the port under test. Adjust the signal generator to a level equivalent to 75 dBA. Record the signal using the STIPA method.

NOTE 2 The measurement is only applicable within the VDR recording pass band 150 Hz to 6 000 Hz

Replay the recording and analyse the STI. Repeat for all other area microphone input ports.

6.2.2.2.1.2 Required results

The test results shall meet the requirements of 5.6.4.1.

6.2.2.2.2 Multiple ports

(See 5.6.4.2)

6.2.2.2.2.1 Test method

With all other microphone input ports having an electrical input equivalent to 65 dBA of band limited pink noise, connect the signal generator to the port under test. Adjust the signal generator to a level equivalent to 75 dBA. Record the signal using the STIPA method.

Replay the recording and analyse the result. Repeat for all other microphone input ports.

6.2.2.2.2.2 Required results

The test results shall meet the requirements of 5.6.4.2.

6.2.2.3 Signal noise level – Signal to no signal

(See 5.6.4.3)

6.2.2.3.1 Test method

The following test equipment is required:

a) audio signal generator;

b) third octave filters according to IEC 61260;

c) audio power meter.

With all other microphone input ports short-circuited, connect the audio signal generator to the microphone input port under test. Record the signal.

Operate the recorder for 30 s for each of the following five input conditions, open, shorted, and with three separate out-of-band signals applied. For the out-of-band tests, connect the signal generator to each port under test and set the input signal to the reference signal level. Select, in turn, frequencies of 8 kHz, 10 kHz and 12,5 kHz. Replay the recordings measuring the linear-weighted noise level in the third octave bands. Table 1 is an example for entering this data. Enter the noise level in the third octave bands as a ratio relative to the output for the reference signal input, expressed in dB. Record the lowest value in the last row of the table. Repeat the test for the other microphone input ports.

6.2.2.3.2 Required results

The test results shall meet the requirements of 5.6.4.3.

Table 1 – Bridge audio, signal to no signal measurements

Reference level: _____

Centre frequency of third octave band	**Output linear-weighted level relative to reference level** dB				
			Out of band at reference level		
Hz	**Open**	**Shorted**	**8 000 Hz**	**10 000 Hz**	**12 500 Hz**
200					
250					
315					
400					
500					
630					
800					
1 000					
1 250					
1 600					
2 000					
2 500					
3 150					
4 000					
5 000					
Minimum signal to no-signal ratio =					

6.2.2.4 Signal noise level – Signal to noise and distortion

(See 5.6.5)

6.2.2.4.1 Test method

The following test equipment is required:

a) attenuator;

b) band-pass filter;

c) distortion meter.

With the other microphone input ports short-circuited, connect the port under test via an attenuator to the signal source of the distortion meter and record signals at third octave intervals over the band varying the level from the reference signal level to −20 dB in 5 dB steps recording the signal at each step. Replay the recordings and measure the total harmonic distortion plus noise for each test condition. Table 2 is an example for entering this data. Optionally, the measurement may be made after passing the replayed signal through a band-pass filter of 150 Hz to 6 000 Hz. Enter the distortion plus noise as a power ratio, expressed in dB. Record the lowest value in the last row of the table. Repeat the test for the other microphone input ports.

6.2.2.4.2 Required results

The test results shall meet the requirements of 5.6.5.

Table 2 – Bridge audio, signal to noise and distortion (SINAD) measurements

Reference level: _____

Frequency Hz	**Input relative to reference level**				
	0 dB	**−5 dB**	**−10 dB**	**−15 dB**	**−20 dB**
150					
200					
250					
315					
400					
500					
630					
800					
1 000					
1 250					
1 600					
2 000					
2 500					
3 150					
4 000					
5 000					
Minimum signal to noise and distortion ratio =					

6.2.2.5 Ability to handle complex signals

(See 5.6.6)

6.2.2.5.1 Test method

The following test equipment is required:

a) computer or signal generator which can generate complex signals;

b) computer with program which can perform FFT analysis.

With all other microphone input ports short-circuited, connect the audio signal generator to the port under test.

One of the 3 signals with frequency 190 Hz, 1 000 Hz and 4 145 Hz shall in turn be applied at the reference signal level while the remaining signals shall be applied at 30 dB below the reference signal level.

Record the 3 instances of the test signal, each instance shall be minimum 10 s long. Replay the recording and perform an FFT analysis on each instance of the test. Table 3 is an example of entering the data.

Repeat for all other microphone input ports.

Table 3 – Complex signals

Reference level: _____

Frequency	Level relative to reference level for signal applied at reference level		
Hz	**190 Hz**	**1 000 Hz**	**4 145 Hz**
150			
190			
241			
306			
380			
491			
570			
789			
1 000			
1 267			
1 606			
2 000			
2 581			
3 000			
4 145			
5 000			

6.2.2.5.2 Required results

At replay, the range of the signals applied at –30 dB shall, for each test (turn), be within 6 dB and no signal shall be above –24 dB or below –36 dB compared to the signal applied at the reference signal level.

6.2.2.6 Suppression of low frequency out band noise

(See 5.6.7)

6.2.2.6.1 Test method

Repeat the tests described in 6.2.2.1, 6.2.2.2, 6.2.2.3, 6.2.2.4 and 6.2.2.5 simultaneously with a signal of frequency 20 Hz with an amplitude +19 dB compared to the reference signal level applied to the port under test.

NOTE This test may be waived if the microphone frequency response has a sensitivity at 20 Hz at least 19 dB below the sensitivity at 1 kHz.

6.2.2.6.2 Required result

The tests shall meet the relevant requirements.

6.2.2.7 Microphones

(see 5.6.8.)

6.2.2.7.1 Test method

The measurements shall be made in an anechoic chamber using the recommended manufacturer setup (either flush with an IEC baffle as described in IEC 60268-5, or free field), or by another equivalent method.

a) With all other microphone input ports, except the one in use, short-circuited apply a signal to the microphone at frequencies of 500 Hz, 1 000 Hz and 2 000 Hz with the reference level given in 5.6.2 (i.e. 85 dB SPL for a microphone designed for use in a free field or 91 dB SPL for a microphone designed to be mounted in a console or wall). Operate the recorder for 30 s and record the signal. Replay the recordings and measure the SINAD ratio for each case. Repeat the measurements with a SPL –10 dB and –20 dB relative to the reference level.

b) With all other microphone input ports, except the one in use short-circuited, apply a signal to the microphone with a level of 75 dB SPL. Adjust the sweep frequency rate of the signal to 0,1 octave per second and sweep over the frequency range 150 Hz to 6 000 Hz. Record the signal. Replay the recording and measure the output level and frequency.

Repeat the measurements simultaneously with a signal of frequency 20 Hz with an amplitude +19 dB compared to the reference signal level applied to the microphone.

6.2.2.7.2 Required results

The following results are required:

a) the reproduced signal to noise and distortion (SINAD) ratio shall be at least 24 dB;

b) the level of the signal recovered from the VDR shall not vary by more than a total range of 12 dB on playback within the 150 Hz to 6 000 Hz frequency range.

6.2.3 Communications audio

(See 4.6.6)

6.2.3.1 Audio frequency response

(See 5.7.3)

6.2.3.1.1 Test method

The following test equipment is required:

a) sweep frequency audio signal generator;

b) audio power meter;

c) frequency counter.

Connect the audio signal generator to the port under test and adjust its output to obtain a signal which continuously sweeps over the frequency range. Adjust the sweep frequency rate to 0,1 octave per second. Set the level to 6 dB below the reference signal level at the equipment input. Record this signal.

Replay the recording and measure the output level and frequency. Determine the level variation over the frequency band.

6.2.3.1.2 Required results

The test results shall meet the requirements of 5.7.3.

6.2.3.2 Quality index

(See 5.7.4)

6.2.3.2.1 Test method

The following test equipment is required:

a) STIPA signal generator;

b) STIPA analyser.

Connect the STI signal generator to the port under test. Adjust the STIPA signal generator to a level 6 dB below the reference signal level. Record the signal.

Replay the recording and analyse the STI.

6.2.3.2.2 Required results

The test results shall meet the requirements of 5.7.4.

6.2.3.3 Audio noise level – Signal to no signal

(See 5.7.5)

6.2.3.3.1 Test method

The following test equipment is required:

a) audio signal generator;

b) A-weighted filter to IEC 61672-1;

c) third octave filters to IEC 61260;

d) audio power meter.

Connect the audio signal generator to the port under test. Record the signal. Operate the recorder for 30 s for each of the following five input conditions: open, shorted, and with three separate out-of-band signals applied. For the out-of-band tests, connect the signal generator to each port under test and set the input signal to the reference signal level. Select, in turn, frequencies of 5 kHz, 6,3 kHz and 8 kHz. Replay the recordings measuring the A-weighted noise level in the third octave bands. Table 4 is an example for entering this data. Enter the noise level in the third octave bands as a ratio relative to the output for the reference signal input, expressed in decibel. Record the lowest value in the last row of the table.

6.2.3.3.2 Required results

The test results shall meet the requirements of 5.7.5.

Table 4 – Communications audio, signal to no-signal measurements

Reference level: _____

Centre frequency of third octave band	**Output A-weighted level relative to reference level** dB				
			Out of band at reference level		
Hz	**Open**	**Shorted**	**5 000 Hz**	**6 300 Hz**	**8 000 Hz**
200					
250					
315					
400					
500					
630					
800					
1 000					
1 250					
1 600					
2 000					
2 500					
3 150					
Minimum signal to no-signal ratio =					

6.2.3.4 Audio noise level-signal to noise and distortion (SINAD)

(See 5.7.6)

6.2.3.4.1 Test method

The following test equipment is required:

a) attenuator;

b) band-pass filter;

c) distortion meter.

Connect the port under test via an attenuator to the signal source of the distortion meter and record signals at third octave intervals over the band varying the level from the reference signal level to –20 dB in 5 dB steps recording the signal at each step. Replay the recordings and measure total harmonic distortion plus noise for each test condition. Table 5 is an example for entering these data. Optionally the measurement may be made after passing the replayed signal through a band-pass filter of 150 Hz to 3 500 Hz. Enter the distortion plus noise as a power ratio, expressed in dB. Record the lowest value in the last row of the table.

6.2.3.4.2 Required results

The test results shall meet the requirements of 5.7.6.

Table 5 – Communications audio, signal to noise and distortion (SINAD) measurements

Reference level: _____

Frequency	Input relative to reference level				
Hz	**0 dB**	**−5 dB**	**−10 dB**	**−15 dB**	**−20 dB**
150					
200					
250					
315					
400					
500					
630					
800					
1 000					
1 250					
1 600					
2 000					
2 500					
3 150					
Minimum signal to noise and distortion ratio =					

6.2.4 Radar data, post-display selection and ECDIS

(See 4.6.7/4.6.8/5.8/5.9/5.10)

6.2.4.1 Fidelity test objective

The tests measure errors between input images, generated from a pre-determined test data set, and the output of a VDR that has recorded them. Recognising that the VDR requires a digitised image before it can store it, two different categories of errors are considered:

colour errors, where a feature is rendered in a different colour or brightness on the input image compared to the output image; and

positional errors, where an image feature is in a different position on the input image compared to the output image.

With regard to colour, the general aim is to permit only those errors that, ideally, a human observer would not notice and which, necessarily, could not introduce ambiguity.

With regard to position, small scaling errors are permitted if the linearity is good: for example, a small overall increase in the size of the image is acceptable, but a scaling of similar magnitude which varies over the image is not. For this reason, a linearity measure is applied in various ways to assess the acceptability of the errors that occur.

The definitions below are for the purposes only of 6.2.4.2 to 6.2.4.6 inclusive.

colour
triple of real values (r, g, b) specifying amounts of red, green and blue respectively, where $0 \leq r \leq 1$, $0 \leq g \leq 1$ and $0 \leq b \leq 1$. As such, 'colour' includes both hue and intensity

image
function which defines a colour for each value of a pair of real numbers (x, y) representing Cartesian co-ordinates, where $0 \leq x \leq 1$ and $0 \leq y \leq 1$

pixel
rectangular region of an image where the colour of the image is constant. The region is defined by two pairs (x_0,y_0) and (x_1,y_1) representing the Cartesian co-ordinates of diagonally opposite corners of the rectangle. The sides of the rectangle shall be parallel to the Cartesian axes and $x_0 < x_1$ and $y_0 < y_1$

input image
one of a number of pre-determined test images (see 6.2.4.4). The test images are defined mathematically and are made up of a grid of pixels of various colours

input image resolution
integers X and Y that represent respectively the numbers of pixels on the x and y co-ordinates of the input image(s) with which the VDR manufacturer declares the VDR will operate

output image
image that is produced by the playback equipment when a recording of the original image is played back

bit-mapped image
image composed entirely of pixels and for each pixel, the products Xx_0, Yy_0, Xx_1 and Yy_1 are integers

6.2.4.2 Principles of the fidelity test

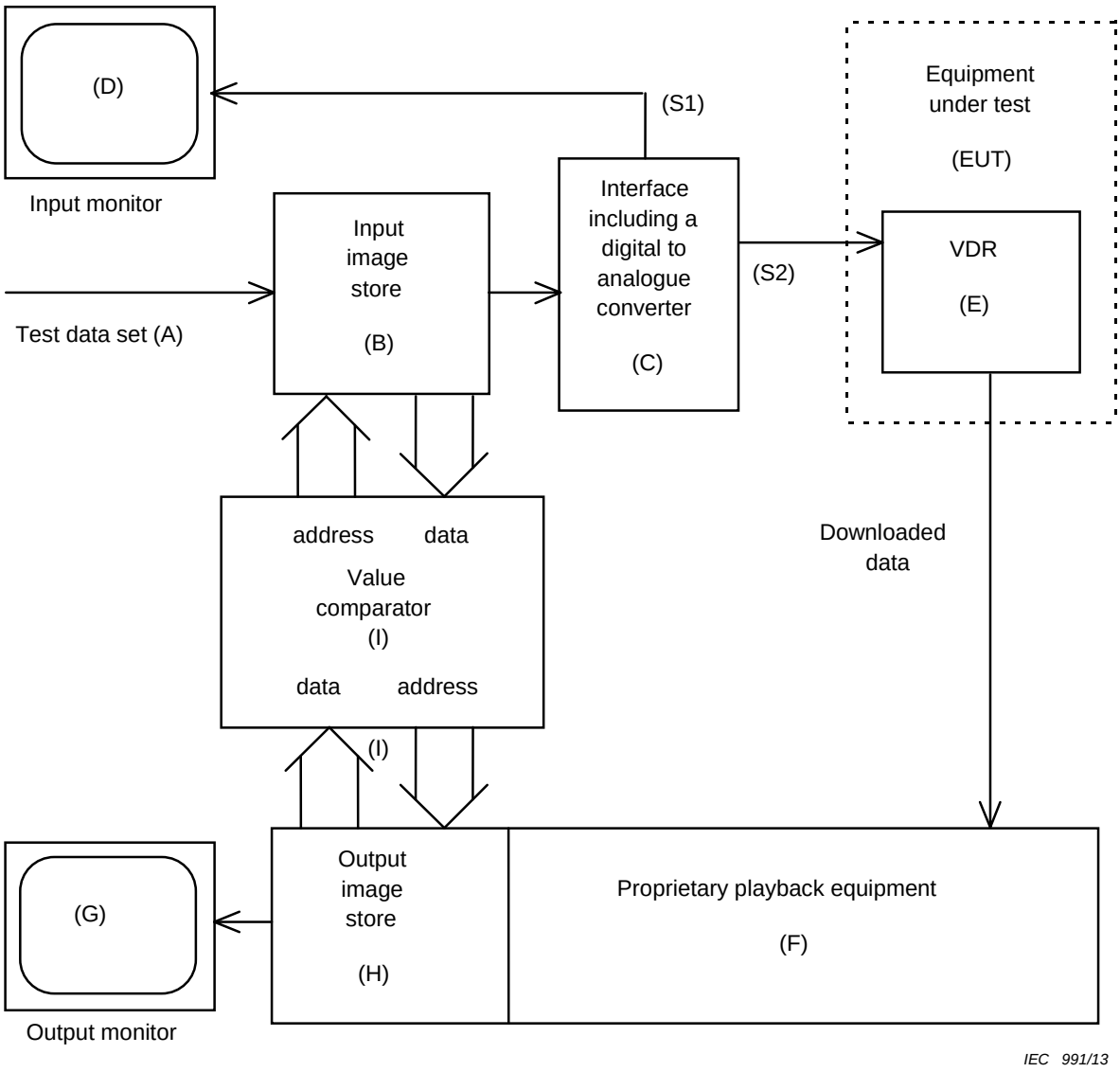
The manufacturer shall declare at what X,Y resolutions of input images, specified in 5.8.1.1.1, the VDR is designed to operate. All the test equipment shall operate at sufficiently high resolutions. The EUT is connected as shown in Figure 2.

A test data set (A), representing a pre-determined, bit-mapped, test image is loaded into the input image store (B). That store is then read via an interface that includes a digital to analogue converter (C) that, in its turn, provides two output signals.

Signals (S1) and (S2) are identical.

Signal (S1) shall meet the VESA DMTS and drives a monitor (D) that has been approved to the same standard.

Signal (S2) provides the input image to the EUT (E) and shall satisfy the requirements of 5.8.1.1.1.



NOTE Interface block (C) may not require a digital to analogue converter.

Figure 2 – Test set-up block diagram

During the test, the detailed timings of the video signals shall be varied within the limits allowed by the DMTS and by the additional limits required by 5.8.1.1.1.

The data stored in the final recording medium that relates to the recorded image shall be recovered by a means specified or supplied by the manufacturer and provided as an input to a playback equipment (F) that is also specified or supplied by the manufacturer. That playback equipment shall have two outputs. The first is a video signal meeting the DMTS that is connected to a monitor (G): the second is the digital data from an externally addressed output image store (H) which may be virtual or real.

The essence of the test is that the value comparator (I) obtains the red, green and blue values of some pixel, at an integer address xX,yY, from the input image store (B), and requests the value from output image store (H) for the same address. This is done for every pixel in the input image store.

The contents of the two image stores are divided into small rectangles that are compared individually. The positions of corresponding rectangles in the two images can be shifted slightly

relative to one another before comparison to allow for a certain amount of alignment error in the recorded images. The amount of shift is permitted to vary slightly over the image to allow for various non-linearities. Any shift shall be of the whole rectangle and of every address, corresponding to an input image pixel that it contains. Linearity is assessed separately in the x and y directions by considering individually the rows and columns of rectangles.

6.2.4.3 Comparison of images

A comparison of images is presented in Figure 3.

Errors in colour and position are determined separately: both are defined in terms of differences between the input digital image store (B) and the output digital image store (H). For analytical convenience and to make the test method independent of image resolution, pixel co-ordinates and the amplitudes of the analogue signals representing the values of red (r), green (g) and blue (b) signals are normalised prior to comparison by dividing their actual value by their maximum one.

For example $r = r_{\text{actual}} / R,\ 0 \le r_{\text{actual}} \le R,\ x = x_{\text{actual}} / X,\ 0 \le x_{\text{actual}} \le X$ etc.

All of the tests described in 6.2.4.4 and 6.2.4.5 shall be passed for each of the images in the test set defined in 6.2.4.2.

The x and y axes of the input image are each divided into integer n equal parts, where n = 8.

NOTE To assist comprehension, variable n is referenced in the following text, although its value is fixed at 8.

Thus the whole image is divided into n^2 rectangles indexed by two integer variables j and k, where $0 \le j \le n - 1$ and $0 \le k \le n - 1$. Rectangle (j,k) has diagonally opposite corners at co-ordinates $(j/n,k/n)$ and $((j + 1)/n,(k + 1)/n)$, and has its edges parallel to the Cartesian axes.

For each rectangle (j,k) a corresponding and equally sized rectangle is chosen in the output image, as specified by the manufacturer. That rectangle has its diagonally opposite corners at real co-ordinates $(p_{jk}/n,q_{jk}/n)$ and $((p_{jk} + 1)/n,(q_{jk} + 1)/n)$, where $0 \le p_{jk} \le n - 1$ and $0 \le q_{jk} \le n - 1$: its edges are parallel to the Cartesian axes. The correspondence between rectangles in the input and output images may be chosen afresh for each rectangle but shall remain constant for each test image. Figure 3 illustrates four of the 64 rectangles, with indicative displacements of the output, for the case when X = 1 280 and Y = 1 024.

6.2.4.4 Pre-determined test images

6.2.4.4.1 General

There are three test images that are specifically designed to work with the test method 6.2.4.3 so as to allow it to satisfy the test objective 6.2.4.1. As such, they are not suitable for use as part of any other test within this standard.

It is required that all of the tests of 6.2.4.4 and 6.2.4.5 shall be passed on test images 1, 2, and on at least three examples of test image 3.

6.2.4.4.2 Test image 1

This shall consist of overlaid horizontal and vertical bands of red (r=1, g=0, b=0), green (r=0, g=1, b=0), blue (r=0, g=0, b=1) and black (r=0, g=0, b=0). The colours of the bands shall be a repeating sequence of red, fixed-width black, green, fixed-width black, blue and variable-width black. The intersections between the horizontal and vertical bands shall comply with Table 6.

Table 6 – Intersection colours of test images 1 and 2

Vertical Horizontal	red	green	blue	black
red	red	green	blue	red
green	red	green	blue	green
blue	red	green	blue	blue
black	red	green	blue	black

The red, green, blue and fixed-width black bands shall be one pixel wide and the variable-width black bands shall have widths that change over the image.

The widths of the vertical variable-width black bands shall be the smallest integer that is greater than the value of the expression $0{,}5 + |\sin(2\pi x/X)\bullet X/20|$ where x is the x co-ordinate of the leftmost edge of the band. The widths of the horizontal variable-width black bands shall be the smallest integer that is greater than the value of the expression $0{,}5 + |\sin(2\pi y/Y)\bullet Y/15|$ where y is the y co-ordinate of the topmost edge of the band.

6.2.4.4.3 Test image 2

This shall be identical to test image 1 except that the expressions for the widths of the vertical and horizontal variable-width black bands shall be $0{,}5 + |\cos(2\pi x/X)\bullet X/20|$ and $0{,}5 + |\cos(2\pi y/Y)\bullet Y/15|$ respectively.

6.2.4.4.4 Test image 3

This shall consist of a palletised, pseudo-random collection of pixels having various colours. Each image shall be generated by the following algorithm:

a) pseudo-randomly select a value for I such that I is a real number on the interval $-1/8 \le I < 1/8$;

b) for each of the variables ρ, γ and β pseudo-randomly allocate one of the probabilities 0,78, 0,16, 0,04 and 0,02 to each of the numbers $1/8$, $3/8$, $5/8$ and $7/8$;

c) for each pixel in the image pseudo-randomly select a value for each of ρ, γ and β, with the allocated probabilities, from the numbers $1/8$, $3/8$, $5/8$ and $7/8$;

d) for each pixel set $r = I + \rho$, $g = I + \gamma$ and $b = I + \beta$.

6.2.4.5 Colour errors

6.2.4.5.1 Test method

For every pair (i) of input and output pixels, within each input and output rectangle that each contain (α) such pixels, the colour error $(C\varepsilon_i)$ is represented as

$$C\varepsilon_i = \left[u\left(r_{(\text{in})i} - r_{(\text{out})i}\right)^2 + v\left(g_{(\text{in})i} - g_{(\text{out})i}\right)^2 + w\left(b_{(\text{in})i} - b_{(\text{out})i}\right)^2\right]^{1/2}$$

Where u = 0,089 401, v = 0,344 569 and w = 0,012 996, being the squares of the ITU weightings for converting RGB values to luminance values.

The colour test metric (TM_{C}) is then: $TM_{\text{C}} = \alpha^{-1}\sum_{i=1}^{\alpha} C\varepsilon_i$

6.2.4.5.2 Required results

It is required that $TM_c \leq 0{,}05$ for each of the n^2 rectangles in the image.

6.2.4.6 Positional errors

For each of the n^2 rectangles of the input test image having their corners at j,k, there will be a corresponding output rectangle, whose bottom left-hand corner is at p_{jk},q_{jk}, that was specified by the manufacturer. It will probably be, but not necessarily, the output rectangle that gave the smallest value of TM_c. It shall be that which passed the tests of 6.2.4.5.

All positional errors are functions of some of the variables j, k, p_{jk} and q_{jk}. The test technique is to consider the pairs of data points j,p_{jk} and k,q_{jk} where, for each of the n values of k, there are n sets of j,p_{jk} and, for each of the n values of j, there are n sets of k,q_{jk}.

The j,p_{jk} set defines any horizontal position errors and the k,q_{jk} set defines any vertical position errors.

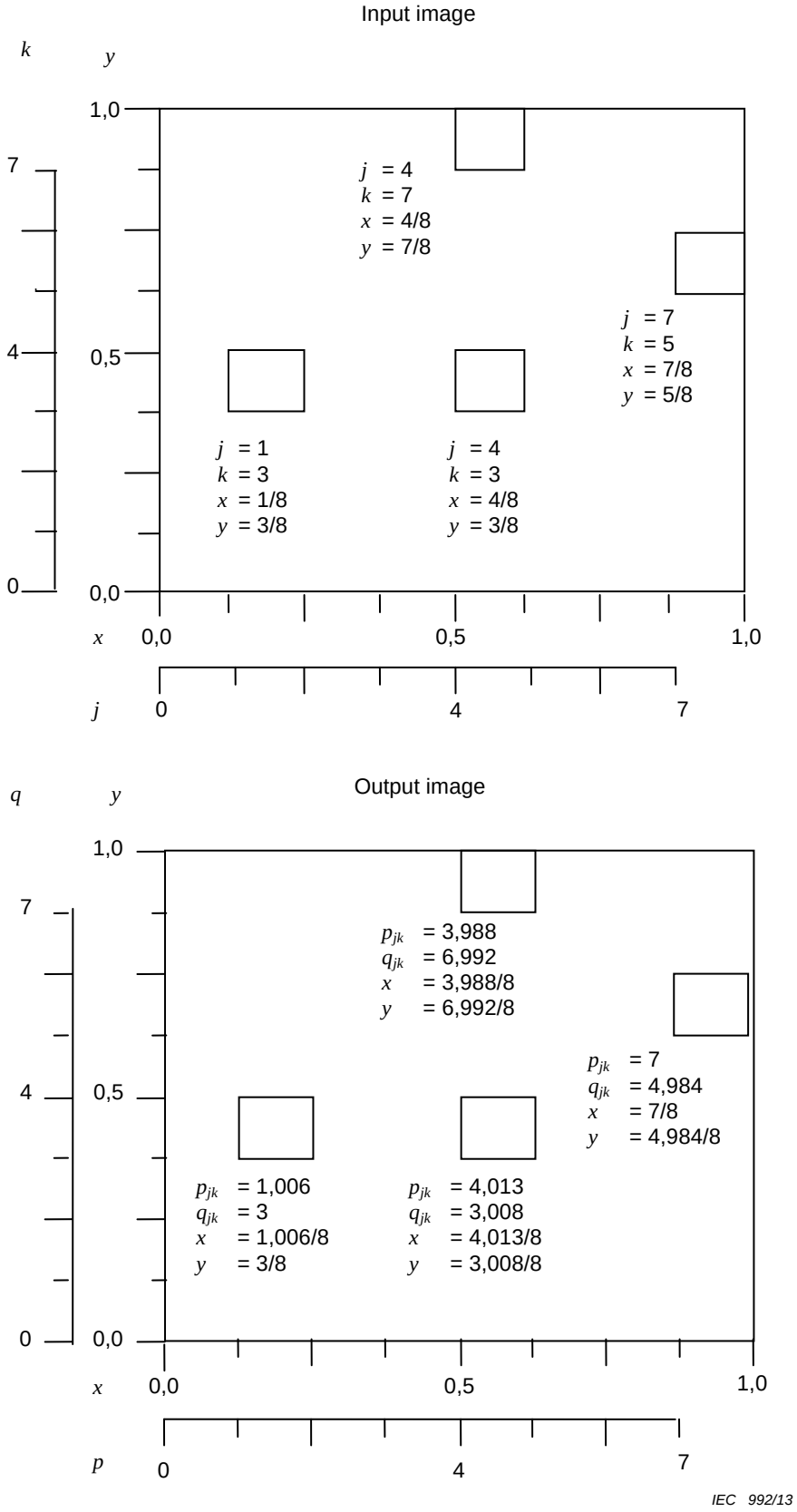


Figure 3 – Comparison of images

6.2.4.6.1 Horizontal position errors

6.2.4.6.1.1 Test method

For each of the n values of k, there will a row of rectangles on the input image each of whose left-hand edges are defined by the n possible values of j. For convenience and consistency of notation, *set* $i = j$, $x = j/n$ and $y = p_{jk}/n$.

If there are no positional errors then $y_i = x_i$ for all i, in terms of a linear equation $y_i = mx + c$, where $m = 1$ and $c = 0$. That will not be the case if there are horizontal positional errors. In that case there will be a best-fit line, of form $y = mx + c$, that has some of the data points lying off the line. The test technique is to set limits on the values of m and c (to limit linear offsets and scalings) and also on the amount by which data points can be displaced from the line (to limit non-linearities).

The possible errors are that the image can be scaled by some constant ($m \neq 1$), offset by some constant ($c \neq 0$) or displaced by different amounts at different parts of the image.

Where $y = mx + c$ is the best-fit line, there will be n values of y_i that have a horizontal error:

$$X\varepsilon_i = \left| mx_i + c - x_i \right|$$

The X linearity test metric TM_x is the mean value of all $X\varepsilon_i$ where $0 \leq i = j \leq n - 1$.

$$TM_x = n^{-1} \sum_{i=0}^{n-1} X\varepsilon_i$$

6.2.4.6.1.2 Required results

It is required that $0{,}99 \leq m + c \leq 1{,}01$ and that $-0{,}01 \leq c \leq 0{,}01$ for each of the n rows of rectangles indexed by k.

It is required that $TM_x \leq 0{,}002$ for each of the n rows of rectangles indexed by k.

In addition, because it would be undesirable to have any discontinuities within the image, it is required that $\left| (mx_i + c - y_i) - (mx_{i+1} + c - y_{i+1}) \right| \leq 0{,}005$ for all values of i, $0 \leq i = j \leq n - 2$.

NOTE For clarity the discontinuity expression is not simplified.

6.2.4.6.2 Vertical position errors

6.2.4.6.2.1 Test method

For each of the n values of j, there will be a row of rectangles on the input image each of whose bottom edges are defined by the n possible values of k. For convenience and consistency of notation, set $i = k$, $x = k/n$ and $y = q_{jk}/n$.

Hereafter, the analysis and method of test is the same as that used for horizontal errors.

If there are no positional errors then $y_i = x_i$ for all i, in terms of a linear equation $y_i = mx + c$, where $m = 1$ and $c = 0$. That will not be the case if there are vertical positional errors. In that case there will be a best-fit line, of form $y = mx + c$, that has some of the data points lying off the line. The test technique is to set limits on the values of m and c (to limit linear offsets and scalings) and also on the amount by which data points can displaced from the line (to limit non-linearities).

The possible errors are that the image can be scaled by some constant ($m \neq 1$), offset by some constant ($c \neq 0$) or displaced by different amounts at different parts of the image ($m_i \neq m_{i+1}$ or $c_i \neq c_{i+1}$ for all i).

Where $y = mx + c$ is the best-fit line, there will be n values of y_i that have a vertical error

$$Y\varepsilon_i = \left| mx_i + c - y_i \right|$$

The Y linearity test metric TM_y is the mean value of all $Y\varepsilon_i$ where $0 \leq i = k \leq n - 1$.

$$TM_y = n^{-1} \sum_{i=0}^{n-1} Y\varepsilon_i$$

6.2.4.6.2.2 Required results

It is required that $0{,}99 \leq m + c \leq 1{,}01$ and that $-0{,}01 \leq c \leq 0{,}01$ for each of the n columns of rectangles indexed by j.

It is required that $TM_y \leq 0{,}002$ for each of the n columns of rectangles indexed by j.

In addition, because it would be undesirable to have any discontinuities within the image, it is required that $\left| (mx_i + c - y_i) - (mx_{i+1} + c - y_{i+1}) \right| \leq 0{,}005$ for all values of i, $0 \leq i = k \leq n - 2$.

NOTE For clarity the discontinuity expression is not simplified.

6.2.4.7 Subjective evaluation

6.2.4.7.1 Test method

A series of images, from a radar complying with IEC 62388 and consistent with 4.6.7 and from an ECDIS complying with IEC 61174 and consistent with 4.6.8, including ones having small groups of isolated pixels, shall be recorded. These shall be played back alongside the original images. A competent person shall be called upon to compare the original and the recorded images.

6.2.4.7.2 Required results

It is required that, in the professional opinion of the competent person, the original and the recorded images are identical with regard to all operational respects.

NOTE The subjective assessment takes into account any effect of the relative screen brightness and contrast of the source image display and playback system display.

6.2.5 Other items

(See 4.6.9/4.6.10/4.6.11/4.6.12/4.6.13/4.6.14/4.6.15/4.6.16/4.6.17/4.6.18)

6.2.5.1 General

These tests are for the recorded items; echo sounder, main alarms, rudder order and response, engine order and response, hull openings (doors) status, watertight and fire door status, accelerations and hull stresses, wind speed and direction, AIS and rolling motion

6.2.5.2 Test method

The test method and result required is identical in all the items in this subclause.

Present the data, item by item, conforming to the format specified in Annex A to the port designated for the specific item. The data shall be presented at a rate greater than once per second and changed at a rate less than once per second. Record the data for 30 min. Replay the data.

6.2.5.3 Required results

It is required that all the changed data are accurately reproduced at a rate of at least once per second.

6.2.6 Electronic logbook

(See 4.6.20)

6.2.6.1 Test method

The test method is to send information from the electronic logbook via the IEC 61162 interface. The data shall be supplied at the maximum rate specified by the EUT manufacturer. The minimum average data rate shall be 1 kB/h. Record the data for 30 min. Replay the data.

6.2.6.2 Required results

The received data is faithfully reproduced.

6.3 Interfaces

(See 4.3.5/5.13)

The manufacturer shall demonstrate that all interfaces meet the requirements of 4.3.5.

Annex A
(normative)

IEC 61162 sentence formats

The sentences that shall be supported by the equipment are given in Table A.1.

Table A.1 – References in this standard

Parameter to be recorded	Subclause(s)	Sentence formatter
Date and time	4.6.1	ZDA
Ship's position and datum used	4.6.2	GNS, DTM, GLL, GGA, RMC, NSR[a]
Speed (water and/or ground)	4.6.3	VBW, VLW, VTG
Heading (true)	4.6.4	THS, HDT
Heading (magnetic)	4.6.4	HDG
Depth (echo sounder)	4.6.9	DPT
Alarms	4.6.10	ALR, ALA, FIR, WAT, ACM[a], HBT, ALC[a], ALF[a]
Rudder order/response manual	4.6.11	RSA, ROR
Rudder order/response automatic (heading or track control)	4.6.11	HTC, HTD
Engine order/response	4.6.12	ETL, PRC, TRC, TRD, RPM, XDR, ROR, RSA
Hull openings, watertight doors	4.6.13 & 4.6.14	DOR, GEN, XDR
Accelerations and hull stress	4.6.15	HSS, XDR
Wind speed and direction	4.6.16	MWV, MWD
AIS	4.6.17	VDM, VDO, ALR
VDR alert output		ALC[a], HBT

[a] These sentences are described in IEC 61924-2.

Annex B
(informative)

Mandatory alarms

IMO resolution MSC.333(90) requires in 5.5.10 the recording of mandatory alarms on the bridge as given in Resolution A.1021(26) Code on alert and indicators, Table 10.1.1 Location navigation bridge. This table is reproduced for information as Table B.1.

NOTE Table B.1 includes only the priority of alert specified by "A" (alarm) in A.1021(26) Table 10.1.1.

Table B.1 – Mandatory alarms on the bridge

IMO Instrument	Function
SOLAS II-1	
29.5.2	Steering gear power unit power failure
29.8.4	Steering control system power failure
29.12.2	Low steering gear hydraulic fluid level
30.3	Steering system electric phase failure/overload
31.2.7, 49.5	Propulsion machinery remote control failure
31.2.9, 49.7	Low propulsion starting air pressure
31.2.10	Imminent slowdown or shutdown of propulsion system
52	Automatic shutdown of propulsion machinery
51.1.3	Fault requiring action by or attention of the officer on watch (machinery alarm including automatic change-over alarm and alarm for all important pressures, temperatures, fluid levels and other essential parameters)
13.7.3.1	Watertight door low hydraulic fluid level
13.7.3.1	Watertight door low gas pressure
13.7.3.2	Loss of stored energy
13.7.8	Watertight door electrical power loss
35-1.2.6.2	High water level alarm
17-1.1.2, 17-1.1.3	Opening indicator
25.4	Water level pre-alarm
25.4	Water level main-alarm
51.2.2	Alarm system normal power supply failure
SOLAS II-2	
4.5.10.1.3	Hydrocarbon gas detection in tanker cargo pump rooms
7.4.1, 7.4.2	Fire detection in periodically unattended, automated or remotely controlled machinery space
20.3.1.3	Loss of required ventilation
10.5.6.4	Fixed local application fire-extinguishing system activation
SOLAS XII	
12.2	Water level pre-alarm
12.2	Water level main-alarm
Resolution A.481(XII)	
Annex 2, paragraph 7.3	Personnel alarm

Resolution MSC.128(75)	
Annex	BNWAS first stage audible alarm
4.1.2.3, 5.2.3	
Gas or chemical codes	
IBC 15.2.4	High and low temperature of cargo and high temperature of heat-exchanging medium
BCH 4.19.4	
IBC 15.5.1.6	High temperature in tanks
BCH 4.20.6	
IBC 15.5.1.7	Oxygen concentration in void spaces
BCH 4.20.7	
IBC 15.8.23.1	Malfunctioning of temperature controls of cooling systems
BCH 4.7.15(a)	
IGC 13.4.1	High and low pressure in cargo tank
GC 13.4.1	
IGC 13.6.4, 17.9	Gas detection equipment
GC 13.6.4, 17.11	
IGC 13.5.2	Hull or insulation temperature
GC 13.5.2	
IGC 17.18.4.4	Cargo high pressure, or high temperature at discharge of compressors
GC 17.12.2(d)(iv)	
IGC 17.14.4.3	Gas detecting system monitoring chlorine concentration
GC 17.12.5(d)(iii)	
IGC 17.14.4.4	High pressure in chlorine cargo tank
GC 17.12.5(d)(iv)	
IBC 15.5.2.5	High temperature in tanks
BCH 4.20.19	
IBC 15.5.2.6	Oxygen concentration in void spaces
BCH 4.20.20	
IBC 15.10.2	Failure of mechanical ventilation of cargo tanks
BCH 4.3.1(b)	
IGC 5.2.1.7,	Liquid cargo in the ventilation system
GC 5.2.5(b)	
IGC 8.4.2.1,	Vacuum protection of cargo tanks
GC 8.4.2(a)	
IGC 9.5.2,	Inert gas pressure monitoring
GC 9.5.2	
IGC 13.6.11	Gas detection equipment
GC 13.6.11	
IGC 17.14.1.4	Gas detection after bursting disk for chlorine
GC 17.12.5(a)(iv)	
IGS	
3.14.11	Low water level alarm
2000 HSC Code	
7.7.1.2	Fixed fire detection and fire alarm systems‘ power loss or fault condition

7.7.1.4	Fire detection signal
7.7.1.6	Fire detection manually operated call point section unit indicator
7.7.2.1	Fire detection for periodically unattended machinery spaces
7.8.5.3	Loss of required ventilation
9.1.14	Liquid cooling system failure
9.2.1	Automatic fire detection system
9.2.1	Bilge alarm
9.2.1	Remote machinery alarm system
9.4.2	Fuel line failure
9.4.5	Lubricating oil pressure or level falling below a safe level
9.5.6	Lubricating fluid supply failure or lubrication fluid pressure loss
10.3.12	Unattended space bilge alarm
11.2.1	Failure of any remote or automatic control system
11.4.1	Malfunction or unsafe condition
11.4.1.1	Indication of conditions requiring immediate action
12.5.1	Steering system electric overload
12.5.2	Steering system electric phase failure
12.6.3	Electrical distribution system low insulation level
2009 MODU Code	
7.4.2.7, 8.5.7	Propulsion machinery remote control failure
7.4.2.9, 8.5.9	Low starting air pressure
7.4.2.10	Imminent slowdown or shutdown of the propulsion
7.6.3	Steering gear phase failure/overload alarm
8.7.1	Fault requiring attention
8.7.3	Alarm system normal supply failure
9.10.1	Fire detection system alarm
9.11.1, 9.12.1	Gas detection and alarm system
FSS Code	
8.2.5.2.1, 9.2.5.1.2, 9.2.5.1.3	Fire detection or automatic sprinkler operation
8.2.5.2.1, 9.2.5.1.5, 9.2.5.1.2	Fire detection system fault
10.2.4.1.4	Smoke detection system power loss
10.2.4.1.3, 10.2.2.3	Smoke detection

Annex C
(normative)

Download and playback equipment for investigating authorities

C.1 Data output interface

C.1.1 General

(MSC.333(90) 9.1) *The VDR* shall *provide an interface for downloading the stored data and play back the information to an external computer. The interface* shall *be compatible with an internationally recognized format, such as Ethernet, USB, FireWire, or equivalent. It* shall *be possible to perform a download of the recorded data for a user-defined period of time.*

C.1.2 Data port

The data port shall be easily accessible and labelled: "Data" or, if located remotely from a VDR unit, "VDR-Data".

C.1.3 Cable length

The interface shall support at least up to 3 m length of cable for the connection to the external computer.

C.1.4 Ethernet Interface

If the interface is of the Ethernet type, it shall comply with IEEE 802.3u, Socket Type RJ 45.

C.1.5 USB Interface

If the interface is of the USB type, it shall be compatible with USB 2.0, Socket Type A.

C.2 Software for data downloading, playback and conversion

C.2.1 General

C.2.1.1 Provision of software

(MSC.333(90) 9.2.1) *A copy of the software program providing the capability to download the stored data and play back the information onto a connected external laptop* or other portable *computer and for the playback of the data* shall *be provided for each VDR installation.*

a) electronically stored within the VDR, and in such case shall be made available for downloading via the data output interface, or

b) provided on CD-ROM, DVD, or a USB-storage device, or

c) by a combination of a) and b).

C.2.1.2 Compatibility of software

(MSC.333(90) 9.2.2) *The software* shall *be compatible with an operating system available with commercial-off-the-shelf laptop computers and provided on a portable storage device such as a CD-ROM, DVD, USB-memory stick, etc.*

C.2.1.3 User license

The usage of the software shall be license-free for investigating authorities.

C.2.1.4 Drivers, tools, etc.

The software shall include all necessary drivers, tools, etc. that may be required for installation and operation on the portable computer.

C.2.1.5 Computers and operating software

The manufacturer shall declare that any externally required software is operable on COTS portable computers with COTS operating software, and shall document the pertinent requirements.

C.3 Downloading software

C.3.1 General

The downloading software shall allow downloading from the VDR, via the data output port to an external portable computer,

– data recorded by the VDR, as a minimum this shall include the stored data (see 4.5.1), and
– configuration information (see 4.4.2).

C.3.2 Playback software

The playback software, when installed on the external portable computer, shall allow playback of the information contained in the downloaded data and thus form the playback equipment (see 3.1.3).

C.3.3 Conversion software

C.3.3.1 General

(MSC.333(90) 9.2.5) *Where non-standard or proprietary formats are used for storing the data in the VDR, the software for converting the stored data into open industry standard formats* shall *be provided on the portable storage device or resident in the VDR.*

C.3.3.2 Digital sensor data

Data from digital sensors shall be provided in printable ASCII format as text file(s) according to ISO/IEC 8859-1.

NOTE 1 The IEC 61162-1 data format is an example of an acceptable ASCII format.

NOTE 2 Data may be packed in ".zip" format, which is not considered proprietary.

C.3.3.3 Configuration data

The configuration data shall be provided in printable ASCII format as text file(s) according to ISO/IEC 8859-1.

Data from digital sensor data and the configuration data shall be provided in printable ASCII format as text file(s) according to ISO/IEC 8859-1.

NOTE 1 The IEC 61162-1 data format is an example of an acceptable ASCII format.

NOTE 2 Data may be packed in ".zip" format, which is not considered proprietary.

C.3.3.4 Screen display image

Image data shall be provided in one of the following formats:

".bmp" – (Microsoft GDI – Bitmap Reference),

".png" – (ISO/IEC 15948), or
".jpg" – (ISO/IEC 10918)

NOTE Data may be packed in ".zip" format, which is not considered proprietary.

C.3.3.5 Audio

Audio data shall be provided in ".wav" (PCM WAVE) format – (EBU 3858).

C.3.3.6 Operational performance test results

Text data shall be provided in the same form as configuration data (C.3.3.2)

Image data shall be provided in the same form as screen display image (C.3.3.3)

C.3.3.7 Naming of files

The names of files provided in open industry standards shall comply with the following syntax:

YYMMDD,hhmmss,NN,????????.nnn

NOTE Spaces are not to be transmitted.

Where:

YYMMDD – year (last two digits), month and day
hhmmss – hours, minutes and seconds
NN – dependent on file type:
– Audio, ID as per 4.4.2 e and 4.4.2 f,
– Image files: ID as per 4.4.2 h,
– LAN image status and information text as per Clause E.2
– Data file: "DD"
– Configuration file as per 4.4.2: "CF"
– Operational performance test file as per 4.3.6: "OP"
???????? – IMO number of the vessel
nnn – file type

Date and time information shall be in UTC and referenced to the beginning of the file content.

C.4 Downloading of data

C.4.1 Affect to data and VDR operation

The process of downloading shall not affect the data in the VDR and any recording operation required by this standard shall continue during downloading.

C.4.2 Multiple downloads

Unless overwritten by normal system operation, it shall be possible to download the same saved recorded data several times.

C.4.3 Deletion of data

It shall not be possible to delete data in the VDR as part of the functions for downloading data.

C.4.4 Required time

The time period for downloading a recorded 12 h data set from the long-term recording medium, containing all data as required by 4.6 of this standard, shall not exceed 2,5 h, including

– connecting the cable to the data port,
– downloading required software and/or instructions,
– downloading a 12-h data set, and
– downloading configuration information.

C.4.5 Download data selection

The download program shall provide the user with the option to perform a download of the recorded data for a user-defined period of time.

C.5 Instructions

(MSC.333(90) 9.2.3) *Instructions for executing the software and for connecting the external laptop* or other portable *computer to the VDR* shall *be provided.*

Where detailed instructions are provided in digital format, at least basic instructions for connecting the external computer and for obtaining the presentation of the detailed instructions shall be provided in printed form. Detailed instructions shall also be included in the operation and maintenance manual or in a special investigation authority manual.

C.6 Packaging and storage

(MSC.333(90) 9.2.4) *The portable storage device containing the software, the instructions and any special (not commercial-off-the-shelf) parts necessary for the physical connection of the external laptop* or other portable *computer,* shall *be stored within the main unit of the VDR.*

The portable storage device shall be contained in a single package, duly sealed and clearly marked,

"DO NOT OPEN
important material
for the exclusive use by
Investigation Authorities"

and stored within or firmly attached to a main unit of the VDR.

Annex D
(informative)

Requirement/test – Cross-references

Table D.1 gives a cross reference between requirement and test subclauses.

Table D.1 – Subject list and subclauses *(1 of 2)*

Subject	Requirement subclause	Test subclause
Design and construction	4.3.1	6.1.5
Sequential records	4.3.2	6.1.11
Date/time correlation	4.3.3/5.1	6.1.12
Fixed recording medium	4.3.4.1.2/5.2.1/5.4.2.1	6.1.13
Float-free recording medium	4.3.4.1.3/5.2.2/5.4.2.2	6.1.14
Long-term recording medium	4.3.4.1.4/5.2.3	6.1.4
Assessment of final recording medium	4.3.4.2	6.1.13.6
Access to data in capsule	4.3.4.3	6.1.4
Visibility and marking	4.3.4.4	6.1.4
Interfaces	4.3.5/5.13	6.3
Performance test	4.3.6	6.1.4
Selection of data items	4.4.1	6.1.4
Configuration data	4.4.2/4.16.9/5.11	6.1.2.2
Resistance to tampering	4.4.3	6.1.4
Recording integrity	4.4.4	6.1.10
Recording and saving of data	4.5.1/Annex C	6.1.2.1
Power source	4.5.2	6.1.4/6.1.9/6.1.16
Reserve power source	4.5.3/4.6.5	6.1.7/6.1.8
Recording period	4.5.4/4.5.1/4.5.3	6.1.6
Date and time	4.6.1	6.2.1
Ship's position	4.6.2	6.2.1
Speed	4.6.3	6.2.1
Heading	4.6.4	6.2.1
Bridge audio	4.6.5/5.6	6.2.2
Communications audio	4.6.6/5.7	6.2.3
Radar	4.6.7/5.8/5.9	6.2.4
ECDIS	4.6.8/5.10	6.2.4
Echo sounder	4.6.9	6.2.5
Main alarms	4.6.10	6.2.5

Table D.1 *(2 of 2)*

Subject	Requirement subclause	Test subclause
Rudder orders, etc.	4.6.11	6.2.5
Engine orders, etc.	4.6.12	6.2.5
Hull openings	4.6.13	6.2.5
Watertight etc doors	4.6.14	6.2.5
Accelerations & hull stress	4.6.15	6.2.5
Wind speed	4.6.16	6.2.5
AIS	4.6.17	6.2.5
Rolling motion	4.6.18	6.2.5
Configuration data	4.6.19/4.4.2/5.11	6.1.2.2
Electronic logbook	4.6.20	6.2.6
Co-relation in date etc	5.1/4.3.3	6.1.12
Fixed protective capsule	5.2.1/4.3.4.1.2/5.4.2.1	6.1.13
Float-free capsule	5.2.2/4.3.4.1.3/5.4.2.2	6.1.14
Long-term recording medium	5.2.3/4.3.4.1.4	6.1.15
Location beacons	5.3	6.1.13.9/6.1.14.6
Long-term retention	5.4.1	6.1.4
Fixed recording medium	5.4.2.1/4.3.4.1.2/5.2.1	6.1.13
Float-free recording medium	5.4.2.2/4.3.4.1.3/5.2.2	6.1.14
Documentation	5.5	6.1.4
Bridge audio	5.6	6.2.2
Communications audio	5.7	6.2.3
Screen image capture	5.8	6.2.4
Radar	5.9	6.2.4
ECDIS	5.10	6.2.4
Configuration data	5.11/4.4.2/4.6.19	6.1.2.2
Operational performance test	5.12	6.1.15
Bridge alert management system	5.13/4.3.5	6.2.7

Annex E
(normative)

LAN image protocol

E.1 Overview

There are two possible protocols used for sending an image over LAN: TCP/IP based (IEC 62388:2007, Annex H) and UDP based (IEC 61162-450). In order to avoid important issues with timestamps for UDP, and to make it possible to record all radar displays and ECDIS display in turn possible, the following addition to the LAN protocols are necessary.

Implementing this should facilitate installation and integration between image transmitting equipment and the VDR. If equipment carriage requirements change or if it is wished to add more instruments to the recording, this protocol will also accommodate this.

Information on network design is given in Annex F.

E.2 Image status and information text

E.2.1 General

In order to distinguish signals coming from multiple monitors, the image transmitter shall identify itself in the 'Status and information text' field (included in the header of IEC 62388:2007, Table H.4) or the 'Status and information text' field (included in the binary image descriptor format of IEC 61162-450:2011, Table 10).

The characters of the field shall be 7-bit ASCII text. Each line of the field shall be terminated by a <CR><LF>.

E.2.2 General identifier

The first line of the status and information text field should be as follows:

"VDRI" "/" 1-digit "." 1-digit

This indicates the version which shall be "VDRI/1.0" for the version described in this annex. A receiver shall accept all "1.y" subversions, but issue an alert for "x.y", when $x > 1$.

If this line is not received, the receiver shall treat this as an unspecified image, and store it or discard it according to an installation-specific configuration.

E.2.3 Timestamp

Timestamp is required for IEC 61162-450 only. The timestamp or delay for a stream according to IEC 62388:2007, Annex H.2 is indicated in the standard header structure with the Data items timeSec and TimeNsec or with the Data item difftime.

The second line indicates the time the image appeared for the user as follows:

"Time" ":" <time>

"Time-ms" ":" <integer of milliseconds>

The timestamp is always in UTC format but given without indicator. The millisecond gives the number of milliseconds in addition to the second to the best of the ability of the sender.

Example:

Time: Sun, 04 Nov 2012 08:49:37

Time-ms: 230

NOTE 1 This timestamp is made at source immediately at data recording, e.g. just before the screenshot. The milliseconds are needed due to required time resolution of 0,05 s for VDR.

It is only practicable to use this value if the synchronization between the VDR and the source device (e.g. Radar) is sufficiently precise (in the range of milliseconds). The Delay data item may be used as an alternative method for synchronisation as follows:

“Delay” “:” <ms>

Delay gives the milliseconds, as an integer, from the screen capture to the first package sent accurate to the best of the ability of the sender.

If Delay is inserted, the timestamp value shall not be inserted.

NOTE 2 The destination device (e.g. VDR) uses this Delay value together with its system time to determine the timestamp for the transmitted data. Time tolerances between VDR and source device may be neglected, because the time reference of the VDR is always the system time of the VDR.

E.2.4 Class of image

The third line indicates the class of image as follows:

“Source” “:” <class>

where

<class> = <type> [“.” <identifier>]

<type> = “Xband” | “Sband” | “ECDIS” | “Conning” | “Combined” | “Alarm” | “Machine” | “AIS” | “Other” …

<identifier> = unsigned integer number

If a ship is fitted with two separate but otherwise identical systems, they shall be identified by <identifier>, for example:

- where a ship carries two X-band radar transceivers they may be designated as: “Source: Xband.1” and “Source: Xband.2”.
- where a ship carries two ECDIS, the ECDIS master computer may be designated as “Source:ECDIS.1”, while the ECDIS backup may be designated as “Source:ECDIS.2”.

Where an INS is fitted the route monitoring tasks and functions display shall be <type> “ECDIS”, and the collision avoidance tasks and functions display shall be <type> ”Xband” or “Sband” depending upon the transceiver selected.

E.2.5 Display location

The fourth line is used as a reference to the full location information of the corresponding display in the configuration data as follows:

“Location” “:” <location>

<location> = <string>, the maximum string length is 32 characters

The string is free text, for example, “Display no 2 from port” or “A2”. The location string shall be unique and remain constant for each physical display.

A VDR may choose to interpret “New” at the start of location string as a signal that the VDR configuration should be updated and issue an alert.

E.2.6 Active status

The fifth line is an optional message that may be used for ships with many workstations as follows:

```
[“Active” “:” “yes” | “no” | “unknown” | “standby”]
```

“yes” – indicates the controls on this location recently have been used.

“no” – indicates the controls have not detected any use recently.

“unknown” – no control use indicator is available, which is the default if the sentence is omitted.

“standby” – this station does not show any active content (for instance, radar is in standby) or is off.

E.2.7 Examples of status and information text

For a typical bridge with two radars and two ECDISs:

X-band Radar:

VDRI/1.0
Time: Thu, 16 Feb 2012 23:28:00
Time-ms: 230
Source: Xband
Location: No1
Active: yes

S-band Radar:

VDRI/1.0
Delay: 7103
Source: Sband
Location: No4
Active: standby

Master ECDIS:

VDRI/1.0
Time: Thu, 16 Feb 2012 23:28:08
Time-ms: 0
Source: ECDIS.1
Location: No2

Backup ECDIS:

VDRI/1.0
Delay: 2034
Source: ECDIS.2
Location: No3
Active: no

E.2.8 Transmitter configuration

A transmitter sending a display for VDR purposes according to IEC 61162-450 shall only use “RrUdP” (re-transmittable).

It is recommended that the transmitter default from the manufacturer should be configured as in Table E.1.

Table E.1 – Default values for transmitting equipment

Item	Configuration	Default
Transmission	Transmission to VDR	If it is a dedicated radar or ECDIS the transmission shall be on
UDP transmission mode (for 61162-450 only)	“RrUdP” (re-transmittable) (“RaUdP” is not permitted for any mandatory data)	“RrUdP” (re-transmittable)
IP destination for image	Any IP address and port	172.16.8.2 port 7096 for transfer according IEC 62388, Annex H.2 239.192.0.26, Port 60026 for transfer according IEC 61162-450
Source	“Xband”,“Xband.1”, “Xband.2”,“Sband”,“ECDIS”, “ECDIS.1”, “ECDIS.2” etc.	As appropriate
Location	Any string up to a maximum of 32 characters	“New” <brand> <model>, for example “New InCom T-65”
Active		For dedicated displays: Omitted (“unknown”). For multi-function displays: As appropriate.
Number of transmissions per 15 second period	1 to 15	1
Synchronization of message start send (according to satellite time or internal clock)	00,0 s to 14,5 s (within the 15 s slot)	00s for Xband, 04s for Sband, 08s for ECDIS, 12s for ECDIS backup, odd numbers for minor stations (navigation planning, bridge wings), 02s/06s/10s or 14s for other displays.
Speed	Auto-negotiate, 100 Mbit/s, …	Auto-negotiate 10 Mbit/s shall not be accepted as a result of auto-negotiation.

E.2.9 Receiver configuration

It is recommended the VDR receiver default settings from the manufacturer should be configured as shown in Table E.2.

Table E.2 – Default values for receiving equipment

Item	Configuration	Default
IP address	DHCP or 172.16.0.1-172.31.255.254	172.16.8.2 (port 7096 for receiving TCP/IP images)

Annex F
(informative)

Network for image transmission

F.1 General

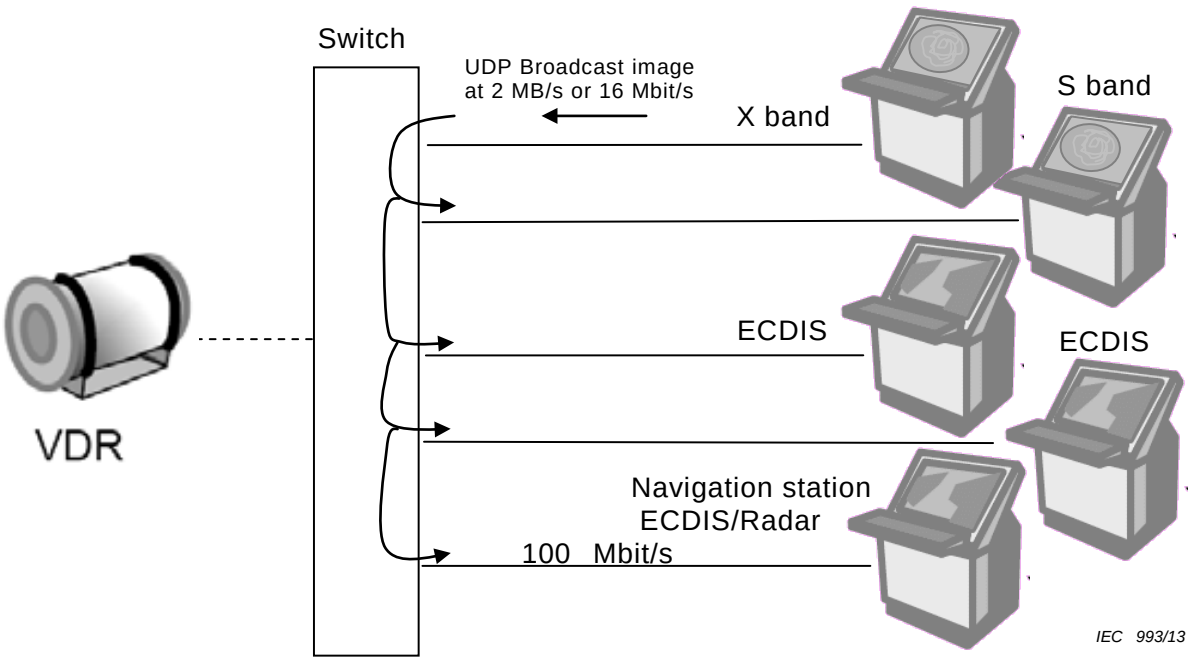
This informative annex provides guidance on network design in relation to image transmission to the VDR.

F.2 Network choice

There are two standards for network image transmission, namely TCP/IP type described in IEC 62388 and the UDP type described in IEC 61162-450. The TCP/IP image transmission will retransmit packets on the protocol layer automatically that did not arrive error free to the receiver. The UDP re-transmission protocol will also secure a retransmission for packets with errors but on the application layer and controlled by application. The UDP non-re-transmission protocol is not recommended as packet losses are likely.

F.3 Network topology examples

Figure F.1 shows a network with a switch.



NOTE Total theoretical traffic maximum on each workstation line 4 × 16 Mbit/s = 64 Mbit/s.

Average is 6 Mbit/s for 2 MB images transmitted once per 15 s.

Figure F.1 – Network with a switch

IEC 61162-450 dictates a maximum transmission rate of 2 MB/s per image transmitter. This has consequences for how quickly the network can become full. The simplest possible network with a switch would look like Figure F.1.

Due to the multicasts, that each station will transmit, the network can quickly fill up, if all stations decide to transmit at the same time, especially for more than 6 stations at the speed 100 Mbit/s. This can have consequences for the navigational data in the same network, causing the bridge to function badly in times of peak traffic (such as chart updates).

Another simple way to connect the stations to the VDR is to use direct connections, removing the switch as a source of failure and eliminating the multicast extra traffic, as shown in Figure F.2.

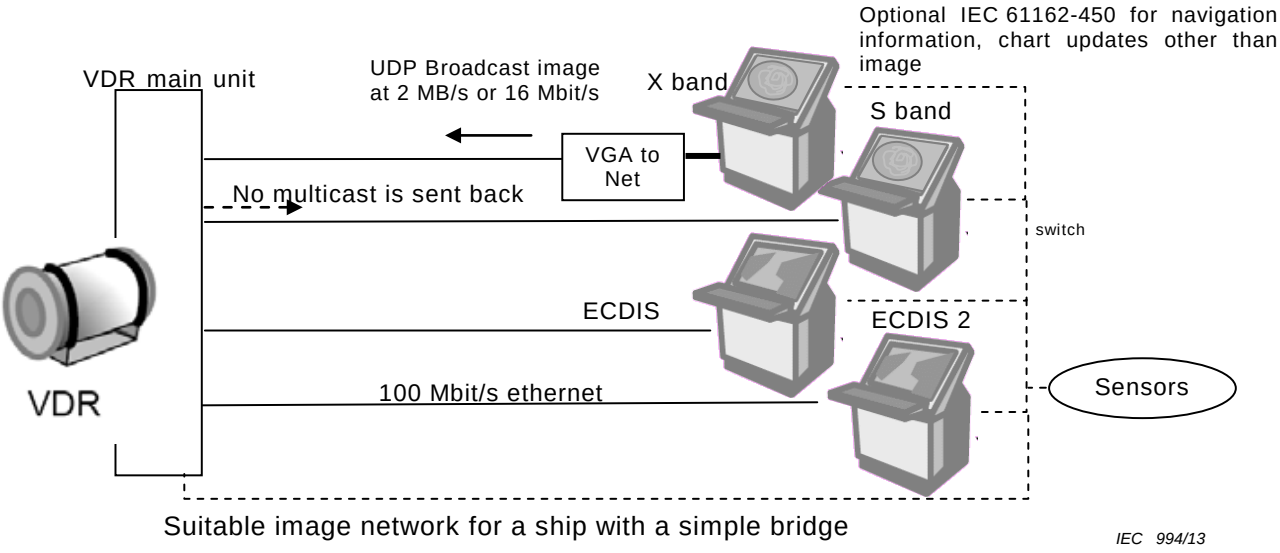


Figure F.2 – Network with direct connections

Ships with an extensive bridge (bridge wings, multiple stations, etc.) will have to use 1 000 Mbit/s Ethernet as shown in Figure F.3.

F.4 Service and installation

Care should be taken to ensure that all locations/stations that should transmit a mandatory image do so (even if not mandatory at current setting). In order to avoid situations, where the network will be slow or overload only at sea, a test or stress function should be implemented on stations, from which traffic can vary significantly (such as high AIS traffic, chart updates/consolidation, radar information).

Ethernet 1 000 Mbit/s links connections should not be set to auto-negotiate, so that they do not auto-negotiate to 100 Mbit/s.

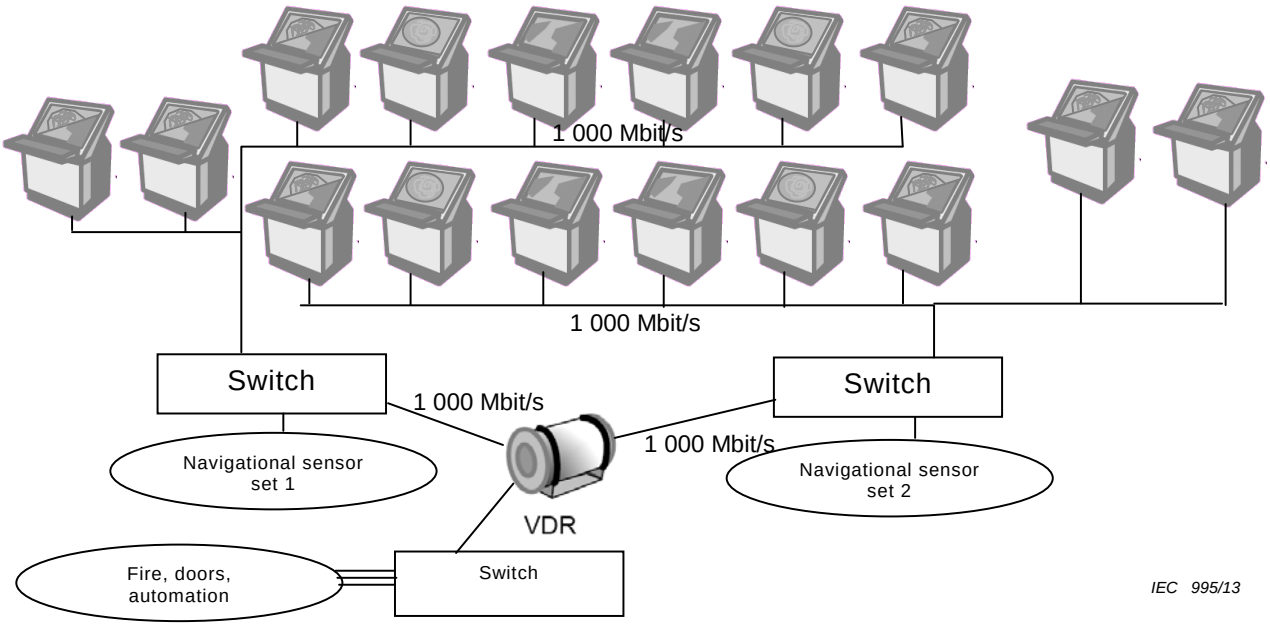


Figure F.3 – Network for a ship with an extensive bridge

Annex G
(normative)

ECDIS display source information

G.1 Overview

For the ECDIS, the charts used (cell name, edition and update number) are required to be recorded (see 4.6.8). In addition settings not visible on the recorded image that affect what is shown on the ECDIS display may be recorded.

The ECDIS display source information message shall be sent a minimum of every 10 min. If a change is made to the relevant information a message shall be sent up to at least a rate of 1 message per 2 s.

The message is sent as a data block (‘binary image’, retransmittable form) according to IEC 61162-450, where the datatype is set to ‘text/plain’.

If IEC 62388:2007, Clause H.2 protocol is used, this information is sent as an H.2 image, where the ‘datatype’ is set to ‘ITEXT’.

All relevant display source information data blocks shall be recorded.

A radar display may optionally send out a similar message.

G.2 Data block status and information text field

The status and information text field shall contain the same fields as for an ordinary image as defined in Annex E, except the ‘active’ field, which shall be omitted. The time indicator or delay time shall indicate the time, when the parameters were sampled.

G.3 Data text

The data shall be plain 7-bit ASCII characters following on from the fields defined in Annex E with lines separated by <CR><LF>. The text shall contain a sequence of data identifiers of the form:

<level data name> ”=” <data value>

where

<level data name> = [<level> “.” [<level> “.”] …] <dataname>

If two level data names are identical, they shall be concatenated in order of appearance. The levels shall be used to show a collapsible view of information, when played back in the VDR.

A level or dataname shall not contain spaces, but can contain “_” underscore, which may be replaced by a space when presented. For identification, level data names are case insensitive. A level and dataname can be identical. A level or dataname can start with “-“ (hyphen) to indicate a proprietary or non-standard dataname or level, in order to distinguish from future standard names.

G.4 Level data names

Possible units are “m”,”ft”, “fm”, “nm”, “mi” ,”kn”, “km”, “km/h”, “mi/h”, “s”, “min”, “h”. A <no> indicates a sequence of levels (for example chart.chart1, chart.chart2 etc.). A flag shall be indicated by flag-set or flag-unset (for automated presentation). If a feature is not available for this equipment, the parameter may be omitted. If other features such as alternative chart presentations, automatic cautionary warnings or vessel guidance exist, and those are not completely displayed including parameters, they shall also be added to this list.

G.5 Required information to be recorded

The chart information required to be recorded (see 4.6.8) is given in Table G.1.

Table G.1 – Required chart information

Configuration	Level data name	Example data value
Identifier (for verification of the file type only)	Identifier identifier.version	VDRI 1.0
Chart name	chart.chart<no.>	IT50074.000
Chart edition	chart.chart<no>.edition	1
Chart update number	chart.chart<no>.update	3

Example:

identifier=VDRI

identifier.version=1.0

chart.chart1=IT50074.000

chart.chart1.edition=1

chart.chart1.update=4

chart.chart2=IT400119.000

chart.chart2.edition=1

chart.chart2.update=3

G.6 Optional information to be recorded

Additional optional chart information which may be recorded is given in Table G.2.

Table G.2 – Additional chart information

Configuration	Level data name	Example data value
Chart issuing HO	chart.chart<no>.issuer	Italian Hydrographic Office
Chart comment	chart.chart.comment	(if available)
Safety contour	ownship.safety_contour	10m
Safety depth	ownship.satefy_depth	10m
Shallow contour	ownship.shallow_contour	2m
Deep contour	ownship.deep_contour	30m
Two shades (flag)	presentation.two_shades	flag-set

Configuration	Level data name	Example data value
Safe contour only (flag)	presentation.safe_contour_only	flag-set
Isolated dangers in unsafe waters shown (flag)	presentation.isolated_danger_in_unsafe_waters_shown	flag-set
Shallow pattern (flag)	presentation.shallow_pattern	flag-unset
Safe depths shown (flag)	presentation.safe_depths_shown	flag-unset
plain depth contour (flag)	presentation.plain_depth_contour	flag-unset
Quality symbol (flag)	presentation.quality_symbol	flag-unset
Low accuracy indicator (flag)	presentation.low_accuracy_indicator	flag-unset
NOAA aids shown (flag)	presentation.NOAA_aids_shown	flag-unset
ENC boundary (flag)	presentation.ENC_boundary	flag-unset
Chart boundary (flag)	presentation.chart_boundary	flag-unset
Use SCAMIN (flag)	presentation.use_SCAMIN	flag-set
INFORM symbol (flag)	presentation.INFORM_symbol	flag-unset
Picture symbol (flag)	presentation.picture_symbol	flag-unset
Text description symbol shown (flag)	presentation.text_description_symbol_shown	flag-unset
Overscale id (flag)	presentation.overscale_id	flag-set
Scale boundary shown (flag)	presentation.scale_boundary_shown	flag-set
lat/lon grid (flag)	presentation.lat/lon_grid	flag-unset
Mariners' objects are shown on this image (flag)	presentation.mariners_objects_are_shown	flag-unset
Text light info shown (flag)	presentation.text.light_info_shown	flag-unset
Text (important) (flag)	presentation.text.important	flag-set
Text (other) (flag)	presentation.text.other	flag-unset
National text shown (flag)	presentation.text.national	flag-unset
Periodic dates shown (flag)	presentation.text.periodic_dates	flag-unset
Text generic shown (flag)	presentation.text.generic	flag-set
Aids to navigation tooltips active (flag)	presentation.ui.aids_to_navigation_tooltips_active	flag-set
Light sectors (flag)	presentation.light.sectors	flag-unset
light shown with real length (flag)	presentation.light.real_length	flag-unset
highlight light sectors chosen (flag)	presentation.light.highlight_chosen_sectors	flag-unset
highlight light sectors all (flag)	presentation.light.highlight_all_sectors	flag-unset
highlight white sectors (flag)	presentation.light.highlight_white_sectors	flag-unset
Route shown on image (flag)	route.any	flag-unset
Route name shown	route.route<no>	Civitavecchia-Savona
Route checked (flag)	route.route<no>.checked	flag-set
Route charts used in check	route.route<no>.chart<no> and chart<no> associated sublevels	
Route name for voyage underway (if active)	route.underway	Civitavecchia-Savona
Waypoint shown (flag)	waypoint.waypoint<no>	name or ID
Waypoint position	waypoint.waypoint<no>.position	4220.02N,01057.58E
Radar overlay shown (flag)	presentation.radar	flag-unset

Configuration	Level data name	Example data value
Radar overlay source (if available)	Presentation.radar.source	Xband
Actual AIS data shown on image (flag)	presentation.ais.actual_AIS_data_shown	flag-unset
Actual ARPA data shown on image (flag)	presentation.arpa.actual_ARPA_data_shown	flag-unset
Tides shown (flag)	presentation.tides	flag-unset
Weather or other specific data layer shown (flag)	presenation.layer.layername<no> presentation.layer.layername<no>.issuer	pirate data Jeppesen
List of active alerts (alarms or caution), date set	alarm.alert<no> alarm.alert<no>.datetime	Position device not compliant 01 March 2012, 02:33:00
Antiground alarm time of prediction	alarm.antiground.time_of_prediction	5s
Dangers safety distance (grounding alarm)	alarm.dangers.safety_distance	200m
Guard zone sector	alarm.collision.guard_zone	90
Danger objects inside guard zone (flag)	alarm.collision.danger_objects_inside_zone	flag-unset
Depth alarm, more than, if active	alarm.depth.more_than	2m
Depth alarm, less than, if active	alarm.depth.less_than	11m
Target lost alarm active (flag)	alarm.arpa.target_lost	flag-unset
AIS target lost alarm active (flag)	alarm.ais.target_lost	flag-unset
AIS auto activation (flag)	alarm.ais.auto_activation	flag-set
AIS distance to dangerous	alarm.ais.distance_to_dangerous	0.5nm
AIS distance to activation	alarm.ais.distance_to_activation	0.5nm
AIS CPA/TCPA	alarm.ais.cpa alarm.ais.tcpa	0.5nm 15min
AIS visibility	alarm.ais.visibility	25nm
AIS past track time	presentation.ais.past_track	30s
ARPA past track if active in seconds	presentation.arpa.past_track	30s
ARPA distance to dangerous	alarm.arpa.distance_to_dangerous	0.5nm
ARPA Lost target alarm range	alarm.arpa.lost_target_alarm_range	0.5nm
ARPA CPA/TCPA	alarm.arpa.cpa alarm.arpa.tcpa	0.5nm 15min
Sonar past track if active in seconds	presentation.sonar.past_track	30s
Sonar distance to dangerous	presentation.sonar.distance_to_dangerous	0.5nm
Sonar Lost target alarm range	presentation.sonar.lost_target_alarm_range	0.5nm
Sonar CPA/TCPA	presentation.sonar.cpa presentation.sonar.tcpa	0.5nm 15min
Mode version	software.display_source_version	V1
Application name, version and version date release information	software.application<no> software.application<no>.version software.application<no>.date	ECDIS 1.2.234 1 March 2012
Brightness setting (xx/yy where yy is max)	presentation.brightness	5/100

Example:

identifier=VDRI

identifier.version=1.0

chart.chart1=IT50074.000

chart.chart1.edition=1

chart.chart1.update=4

chart.chart2=IT400119.000

chart.chart2.edition=1

chart.chart2.update=3

chart.chart1.issuer=Italian Hydrographic Office

chart.chart2.issuer=Italian Hydrographic Office

ownship.safety_contour=10m

ownship.satefy_depth=10m

ownship.shallow_contour=2m

ownship.deep_contour=30m

presentation.two_shades=flag-set

……

software.application1=ECDIS presentation application

software.application1.version=1.123.1

software.application1.date=20 March 2011

software.application2=Collision application

software.application2.version=1.123.1

software.application2.date=12 March 2011

software.application2=ENC import tool

software.application2.version=1.124.1

software.application2.date=13 March 2011

Bibliography

IEC 60268-5, *Sound system equipment – Part 5: Loudspeakers*

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

IEC 61924-2, *Maritime navigation and radiocommunication equipment and systems – Integrated navigation systems (INS) – Part 2: Modular structure for INS – Operational and performance requirements, methods of testing and required test results*

IEC 62065, *Maritime navigation and radiocommunication equipment and systems – Track control systems – Operational and performance requirements, methods of testing and required test results*

IEC 62288, *Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results*

ISO/IEC 8859-1, *Information technology – 8-bit single-byte coded graphic character sets – Part 1: Latin alphabet No.1*

ISO/IEC 10918 (all parts), *Information technology – Digital compression and coding of continuous-tone still images*

ISO/IEC 15444 (all parts), *Information technology – JPEG 2000 image coding system*

ISO/IEC 15948, *Information technology – Computer graphics and image processing – Portable Network Graphics (PNG): Functional specification*

ISO 8728, *Ships and marine technology – Marine gyro-compasses*

ISO 11674, *Ships and marine technology – Heading control systems*

ISO 16328, *Ships and marine technology – Gyro-compasses for high-speed craft*

ISO 16329, *Ships and marine technology – Heading control systems for high-speed craft*

ISO 22090-1, *Ships and marine technology – Transmitting heading devices (THDs) – Part 1: Gyro-compasses*

ISO 22090-2, *Ships and marine technology – Transmitting heading devices (THDs) – Part 2: Geomagnetic principles*

ISO 22090-3, *Ships and marine technology – Transmitting heading devices (THDs) – Part 3: GNSS principles*

IMO:1974, *International Convention for the Safety of Life at Sea (SOLAS), as amended*

IMO Circular MSC/Circ.982, *Guidelines on ergonomic criteria for bridge equipment and layout*

IMO Circular MSC.1/Circ.1222:2006, *Guidelines on annual testing of Voyage Data Recorders (VDR) and Simplified Voyage Data Recorders (S-VDR)*

IMO Circular MSC.1/ Circ.1389:2010, *Guidance on procedures for updating shipborne navigation and communication equipment*

IMO COMSAR 8/18, *Report to the Maritime Safety Committee*

IMO Resolution MSC.74(69):1998, *annex 2 – Recommendations on performance standards for track control systems*

IMO Resolution MSC.74(69):1998, *annex 4 – revision of A.224 – Performance standards for echo sounding equipment*

IMO Resolution A.424(XI):1979, *Performance standards for gyrocompasses*

IMO Resolution MSC.64(67):1996, *annex 3 – Performance standards for heading control systems*

IMO Resolution MSC.232(82):2006, *Revised performance standards for electronic chart display and information systems (ECDIS)*

IMO Resolution MSC.252(83):2007, *Performance standards for integrated navigation systems (INS)*

IMO Resolution MSC.302(87):2010*, Performance standards for bridge alert management (BAM)*

IMO Resolution A.526(13):1983, *Performance standards for rate-of-turn indicators*

IMO Resolution A.600(15):1987, *IMO ship identification number scheme*

IMO Resolution A.612(15):1987, *Performance standards for float-free VHF emergency position-indicating radio beacons*

IMO Resolution A.754(18):1993, *Recommendation on fire resistance tests for "A", "B" and "F" class divisions*

IMO Resolution A.803(19):1995, *Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling*

IMO Resolution A.805(19):1995, *Performance standards for float-free VHF emergency position-indicating radio beacons*

IMO Resolution A.813(19):1995, *General requirements for electromagnetic compatibility (EMC) for all electrical and electronic ship's equipment*

IMO Resolution A.819(19):1995, *Performance standards for shipborne global positioning system (GPS) receiver equipment*

IMO Resolution A.822(19):1995, *Performance standards for automatic steering aids (automatic pilots) for high-speed craft*

IMO Resolution A.823(19):1995, *Performance standards for automatic radar plotting aids (ARPAs)*

IMO Resolution A.824(19):1995, *Performance standards for devices to indicate speed and distance*

IMO Resolution A.953(23):2003, *World-wide radionavigation system*

European Broadcasting Union, *Technical specification Tech 3858, BWF – A format for audio files in broadcasting, Appendix A, RIFF WAVE (.WAV) file format*

IEEE 802.3u:1995, *Standard for Information Technology – Telecommunication and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 3*

Microsoft Developer Network (MSDN) Library – *Microsoft GDI – Bitmap Reference – BMP*

USB Implementers Forum Inc. – *Universal Serial Bus Revision 2.0 Specification*

_____

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch