

INTERNATIONAL STANDARD

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61996

First edition
2000-07

**Maritime navigation and radiocommunication
equipment and systems –**

**Shipborne voyage data recorder (VDR) –
Performance requirements –
Methods of testing and required test results**

*Matériels et systèmes de navigation et
de radiocommunication maritimes –*

*Enregistreurs de données de voyage (VDR) de bord –
Exigences de fonctionnement –*

Méthodes d'essai et résultats d'essai exigés

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND RADIOCOMMUNICATION
EQUIPMENT AND SYSTEMS –****Shipborne voyage data recorder (VDR) –
Performance requirements –
Methods of testing and required test results**

FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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International Standard IEC 61996 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

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

FDIS	Report on voting
80/248/FDIS	80/273/RVD

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A, B and C are for information only.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

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- withdrawn;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

A bilingual version of this standard may be published at a later date.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Shipborne voyage data recorder (VDR) – Performance requirements – Methods of testing and required test results

1 Scope

This International Standard specifies the minimum performance requirements, technical characteristics and 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 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 A.861.

NOTE All text of this standard, whose wording is identical to that of IMO Resolution A.861, is printed in *italics*, and the Resolution and associated performance standard paragraph numbers are indicated in brackets.

2 Normative references

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

IEC 60068-2-27:1987, *Environmental testing – Part 2: Tests – Test Ea and guidance: Shock*

IEC 60268-16:1998, *Sound system equipment – Part 16: Objective rating of speech intelligibility by speech transmission index*

IEC 60651:1979, *Sound level meters*

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

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

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

IEC 61097-7:1996, *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 61260:1995, *Electroacoustics – Octave-band and fractional-octave-band filters*

IMO A.658:1989, *Use and fitting of retro-reflective materials on life-saving appliances*

IMO A.662:1989, *Performance standards for float-free release and activation arrangements for emergency radio equipment*

IMO A.689:1991, *Testing of life saving appliances*

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

IMO A.810:1995, *Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz*

IMO A.812:1995, *Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating through the geostationary INMARSAT satellite system on 1,6 GHz*

IMO A.830:1995, *Code on alarms and indicators*

IMO A.861:1997, *Performance standards for shipborne voyage data recorders (VDRs)*

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

ITU-R M.632-3:1997, *Transmission characteristics of a satellite emergency position-indicating radio beacon (satellite EPIRB) system operating through geostationary satellites in the 1,6 GHz band*

ITU-R M.633-1:1990, *Transmission characteristics of a satellite emergency position-indicating radiobeacon (satellite EPIRB) system operating through a low polar-orbiting satellite system in the 406 MHz band*

Eurocae: ED56A – *Minimum operational performance specification (MOPS) for cockpit voice recorder system*

VESA:1996, *Video electronics standards association – Discrete monitor timings standard 1.0, Revision 0.7 (DMTS)*

SAE AS8045:1988, *Engineering Society for advancing mobility land sea air and space – Minimum performance standard for underwater locating devices – acoustic-self-powered*

3 Definitions and abbreviations

3.1 Definitions

3.1.1

recorder (VDR) (A.861/4.1)

complete system, including any items required to interface with the sources of input data, for processing and encoding the data, the final recording medium in its capsule, the power supply and dedicated reserve power source

3.1.2

sensor (A.861/4.2)

any unit external to the VDR to which the VDR is connected and from which it obtains data to be recorded

3.1.3

final recording medium (A.861/4.3)

item of hardware on which the data is recorded such that access to it would enable the data to be recovered and played back by use of suitable equipment

3.1.4

playback equipment (A.861/4.4)

equipment, compatible with the recording medium and the format used during recording, employed for recovering the data. It includes also the display or presentation hardware and software that is appropriate to the original data source equipment. Playback equipment is not normally installed on a ship and is not regarded as part of a VDR within this standard

3.1.5

dedicated reserve power source (A.861/4.5)

secondary battery, with suitable automatic charging arrangements, dedicated solely to the VDR, of sufficient capacity to operate it as required by 4.5.3

3.1.6

resolution

smallest detectable increment between two values

3.1.7

data

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

3.1.8

activation of a suitable alarm

mutable audible alarm and persistent visual indication, given according to the requirements of A.830, but with an audible level in the range of 55 dBA to 65 dBA

3.1.9

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

3.2 Abbreviations

EPFS	electronic position-fixing system
IMO	International Maritime Organization
INS	integrated navigation system
ITU	International Telecommunication Union
OOW	officer of the watch
ROV	remotely operated vehicle
SENC	system electronic navigation chart
SINAD	signal to noise and distortion
STI	sound transmission index

4 Performance requirements

4.1 General

Performance requirements described in this clause are specified by reference to the numbered paragraphs of IMO Resolution A.861.

4.2 Purpose (A.861/1)

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. This information is for use during any subsequent investigation to identify the cause(s) of the incident.

4.3 Operational requirements (A.861/5)

4.3.1 Design and construction (A.861/5.1.4)

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 (A.861/5.1.1)

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 (A.861/5.1.2, 5.4.1)

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 Protective capsule (A.861/5.1.3)

4.3.4.1 Final recording medium

The final recording medium shall be installed in a protective capsule. The capsule shall meet all the requirements of 4.3.4.2 and 4.3.4.3.

4.3.4.2 (A.861/5.1.3.1) *The capsule shall be capable of being accessed following an incident but secure against tampering*

The capsule shall enclose the final recording medium. The final recording medium shall not be accessible by standard operating procedures during normal ship operations.

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

4.3.4.3 (A.861/5.1.3.2) Recovery

The capsule shall *maximise the probability of survival and recovery of the final recorded data after any incident* (see 5.2).

4.3.4.3.1 Structure of the capsule

The capsule containing the final recording medium shall be designed to be installed on the external deck of the vessel. It may be designed to remain fixed to the ship in all circumstances. Alternatively, it may be designed to float free automatically if the ship sinks (see 5.2).

The capsule shall be designed to protect the stored data against the following (see 5.4):

- shock
- penetration
- fire
- deep-sea pressure and immersion

4.3.4.3.2 Visibility and marking (A.861/5.1.3.3)

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 and marked with the legend:

“VOYAGE DATA RECORDER – DO NOT OPEN –
REPORT TO AUTHORITIES”

4.3.4.3.3 (A.861/5.1.3.4) Location

The capsule shall be fitted with an appropriate device to aid location.

Both fixed and floatfree designs shall include an acoustic underwater beacon. In the case of a protective capsule intended for float-free operation, it shall also have a suitable radio transmitter, and a light (see 5.3).

4.3.5 Assessment of recording medium

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.

4.3.6 Interfaces (A.861/7)

Interfacing to the various sensors required shall be in accordance with the relevant international interface standard, IEC 61162 series, where possible (see annex A).

The interfaces for bridge audio, communications audio and radar 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.*

4.4 Data selection and security (A.861/5.1.4)

4.4.1 Selection of data items (A.861/5.2.1)

The minimum selections of operational data items to be recorded by the VDR are 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.

In addition to the operational data referred to in the preceding paragraph, 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 affect the recording of the mandatory items.

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;
- d) microphone locations and recording port allocation;
NOTE This does not imply channelization.
- e) VHF communications – which VHF(s) recorded;
- f) date and time – from which source obtained;
- g) ship's position – from which EPFS obtained and relative position on the vessel;
- h) other data inputs – identification of which equipment is supplying recorded data; sign conventions and identity of all alarm/door inputs;
- i) automatic insertion of date and time of last amendment.

4.4.2 Resistance to tampering (A.861/5.2.2)

The equipment shall be so designed that, as far as is practical, it is not possible to tamper with the selection of data being input to the equipment, the data itself nor that which has already been recorded. Any attempt to interfere with the integrity of the data or the recording shall be recorded.

4.4.3 Recording integrity (A.861/5.2.3)

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 alarm given if a non-correctable error is detected.

The VDR shall automatically continuously monitor the following (see 6.1.10):

- a) power supply;
- b) record function;
- c) bit error rate;
- d) microphone functionality.

Malfunction of any of the above shall generate an alarm in accordance with the relevant requirements of IMO A.830 at the position from which the vessel is normally navigated. It shall be possible to mute the alarm but a visual indication shall remain until the equipment is serviceable. It shall also indicate its alarm status by means of contacts of a relay (or equivalent) which is held energised in the no-alarm condition.

4.5 Continuity of operation

4.5.1 Operation (A.861/6)

The unit shall be entirely automatic in normal operation. Means shall be provided to ensure that the recorded data may be saved by an appropriate method following an incident, with minimal interruption to the recording process and without requiring opening of the protective capsule.

- a) Controls for use during the saving process shall be simple to use.
- b) The recording process to the final recording medium shall not be interrupted for more than 10 min during the saving process. The data recorded in the final recording medium shall not be erased.
- c) The data saved shall be automatically checked to ensure that it is identical to the recorded data on the final recording medium. Any failure shall be indicated.
- d) When the saving process is completed, means shall be provided to enable copies to be made of this or of data relating to subsequent incidents.

NOTE "saving process" – means – preserving a copy of the data contained in the final recording medium.

4.5.2 Power source (A.861/5.3.1)

To ensure that the VDR continues to record events during an incident, it shall be capable of operating from the ship's emergency source of electrical power. Whenever electrical power is available the VDR shall operate, except as permitted in 4.5.4 (see 6.1.15).

4.5.3 Reserve power source (A.861/5.3.2)

If the ship's emergency source of electrical power supply fails, the VDR shall continue to record bridge audio (see 4.6.5) from a dedicated reserve source of power for a period of 2 h. At the end of this 2 h period all recording shall cease automatically.

4.5.4 Recording period and duration (A.861/5.3.3)

Recording shall be continuous unless interrupted briefly in accordance with 4.5.1 or terminated in accordance with 4.5.3. The time for which all stored data items are retained shall be at least 12 h. 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 purposes whilst the vessel is in port;
- b) when the vessel is laid-up.

4.6 Data items to be recorded (A.861/5.4)

4.6.1 Date and time (A.861/5.4.1)

Date and time referenced to UTC, shall be obtained from a source external to the ship (for example, an EPFS or radio time signal) if available, or from an internal clock at least once per hour. 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 sufficient to reconstruct the history of the incident in detail, not worse than 1 s.

4.6.2 Ship's position (A.861/5.4.2)

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 0,0001 min of arc.