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Incorporating corrigendum December 2021

BSI Standards Publication

Global maritime distress and safety system (GMDSS)

Part 2: Cospas-Sarsat EPIRB — Emergency position indicating radio beacon operating on 406 MHz — Operational and performance requirements, methods of testing and required test results

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National foreword

This British Standard is the UK implementation of IEC 61097-2:2021, incorporating corrigendum December 2021. It supersedes BS IEC 61097-2:2002, which is withdrawn.

The start and finish of text introduced or altered by corrigendum is indicated in the text by tags. Text altered by IEC corrigendum December 2021 is indicated in the text by [AC1⟩ ⟨AC1].

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A list of organizations represented on this committee can be obtained on request to its committee manager.

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INTERNATIONAL STANDARD

Global maritime distress and safety system (GMDSS) – Part 2: Cospas-Sarsat EPIRB – Emergency position indicating radio beacon operating on 406 MHz – Operational and performance requirements, methods of testing and required test results

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GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 2: Cospas-Sarsat EPIRB – Emergency position indicating radio beacon operating on 406 MHz – Operational and performance requirements, methods of testing and required test results

FOREWORD

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IEC 61097-2 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. It is an International Standard.

This fourth edition cancels and replaces the third edition published in 2008. This edition constitutes a technical revision.

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

a) revision of the Scope to incorporate new IMO performance standards published in 2019;
b) addition of requirements and tests for second generation beacons designed for operation with the Cospas-Sarsat medium earth orbit (MEO) satellite constellation;
c) addition of an AIS locating device, a night vision light and an optional return link service (RLS);

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d) reduction of the minimum duty cycle of the 121,5 MHz homing signal;

e) addition of requirements for an internal GNSS receiver including a related range of additional GNSS tests in Annex B;

f) inclusion of a new Clause 3 for terms, definitions and abbreviated terms;

g) addition of a new Annex E for the AIS locating signal specification, a new Annex F for symbols and a new Annex G for IEC 61162-1 RLM sentence notes;

h) deletion of the original Annex E which is now of historic interest.

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

FDIS	Report on voting
80/999/FDIS	80/1002/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 61097 series, published under the general title *Global maritime distress and safety system (GMDSS)*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

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

The contents of the corrigendum 1 (2021-12) have been included in this copy.

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GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM (GMDSS) –

Part 2: Cospas-Sarsat EPIRB – Emergency position indicating radio beacon operating on 406 MHz – Operational and performance requirements, methods of testing and required test results

1 Scope

This part of IEC 61097 specifies the minimum performance requirements, technical characteristics and type-testing requirements of the emergency position-indicating radio beacon used in the Cospas-Sarsat satellite system (EPIRB), as required by the International Convention for Safety of Life at Sea (SOLAS) as amended, and which is associated with IEC 60945. When a requirement in this document is different from the requirements in IEC 60945 or other standards, the requirement in this document takes precedence.

This document incorporates the performance standards of IMO Resolution MSC.471(101), the International Telecommunication Union (ITU) Radio Regulations as well as the technical characteristics for such transmitters contained in Recommendation ITU-R M.633, and takes account of the general requirements contained in IMO Resolution A.694(17).

This document also includes minimum performance standards for a non-float-free EPIRB without float-free release mechanism (see Annex C).

NOTE 1 Although a number of the requirements and tests can be similar, this document is not intended to be used with 406 MHz ship security alert system (SSAS) beacons.

All texts of this document, whose wording is identical to that in the IMO Resolutions A.662(16), A.694(17), and MSC.471(101) will be printed in *italics* and the Resolution/Recommendation and paragraph number indicated between brackets.

NOTE 2 Classes of EPIRBs considered in this document are:

– Class 0: Category 1 Float-free (−55 °C to +70 °C). The float-free release mechanism (A.662(16)) is capable of operating throughout the temperature range of −30 °C to +65 °C and of surviving a stowage temperature range of −55 °C to +70 °C.

– Class 1: Category 1 Float-free (−40 °C to +55 °C). The float-free release mechanism (A.662(16)) is capable of operating throughout the temperature range of −30 °C to +65 °C and of surviving a stowage temperature range of −40 °C to +65 °C.

  These classes are not required by IMO Resolutions but can be applied at the discretion of each Administration.

– Class 2: Category 1 Float-free (−20 °C to +55 °C). The float-free release mechanism (A.662(16)) is capable of being stowed and of operating throughout the temperature range of −30 °C to +65 °C.

NOTE 3 Category 2 Non float-free, EPIRBs in all classes are considered in Annex C.

NOTE 4 All classes include a 121,5 MHz homing device, described in Annex D.

NOTE 5 All classes include an AIS locating signal, described in Annex E.

NOTE 6 All classes include beacon position data, obtained from a navigation device internal to the EPIRB and can also provide an external navigation input as described in Annex B.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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IEC 60945:2002, *Maritime navigation and radiocommunication equipment and systems – General Requirements – Methods of testing and required test results*

IEC 61097-14:2010, *Global maritime distress and safety system (GMDSS) – Part 14: AIS search and rescue transmitter (AIS-SART) – Operational and performance requirements, methods of testing and required test results*

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

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

IEC 61108-3, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 3: Galileo receiver equipment – Performance requirements, methods of testing and required test results*

IEC 61108-5:2020, *Maritime navigation and radiocommunication equipment and systems – Global navigation satellite systems (GNSS) – Part 5: BeiDou navigation satellite system (BDS) – Receiver equipment – Performance requirements, methods of testing and required test results*

ISO 15734, *Ships and marine technology – Hydrostatic release units*

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

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

IMO Resolution 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 Resolution MSC.48(66):1996, *Adoption of the International life-saving appliance (LSA) code, as amended by IMO Resolutions MSC.207(81), MSC.218(82) and MSC.272(85)*

IMO Resolution MSC.471(101):2019, *Performance standards for float-free emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz*

ITU Radio Regulations

ITU-R Recommendation M.585, *Assignment and use of identities in the maritime mobile service*

ITU-R Recommendation M.1371-5:2014, *Technical characteristics for an automatic identification system using time-division multiple access in the VHF maritime mobile band*

Cospas-Sarsat
C/S T.001, *Specification for Cospas-Sarsat 406 MHz Distress Beacons*
C/S T.007, *Cospas-Sarsat 406 MHz Distress Beacon Type Approval Standard*
C/S T.012, *Cospas-Sarsat 406 MHz Frequency Management Plan*
C/S T.018, *Specification for Second-Generation Cospas-Sarsat 406 MHz Distress Beacons*
C/S T.021, *Cospas-Sarsat Second Generation 406 MHz Distress Beacon Type Approval Standard*

United Nations, *Recommendations on the Transport of Dangerous Goods: Manual of Tests and Criteria, 7th Revised Edition, PART III, Section 38.3 (ST/SG/AC.10/11/Rev.7)*, as amended

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3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1.1
Hex ID
hexadecimal characters that uniquely identify each 406 MHz beacon

Note 1 to entry: First generation beacons use 15 hexadecimal characters. Second generation beacons use 23 hexadecimal characters.

3.2 Abbreviated terms

AIS	automatic identification system
AIS 1	channel 2087 (161,975 MHz)
AIS 2	channel 2088 (162,025 MHz)
COG	course over ground
EIRP	effective isotropic radiated power
EPIRB	emergency position-indicating radio beacon
FGB	first generation beacon
GNSS	global navigation satellite system
PERP	peak effective radiated power
RLM	return link message
RLS	return link service
RF	radio frequency
SGB	second generation beacon
SOG	speed over ground
SOTDMA	self-organizing time division multiple access
TTFF	time to first fix
TTFFT	time to first fix transmission (that is the time until the first GNSS fix is encoded into and transmitted in a 406 MHz signal)
UTC	coordinated universal time

4 Performance requirements

4.1 Compliance

(MSC.471(101)/A.1) *The emergency position-indicating radio beacon (EPIRB) shall, in addition to meeting the requirements of the Radio Regulations, the relevant ITU-R Recommendations and the general requirements set out in resolution A.694(17) comply with* the performance standards given in MSC.471(101).

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In addition to MSC.471(101) the EPIRB shall also comply with the applicable requirements in either Cospas-Sarsat documents C/S T.001, and C/S T.012 or Cospas-Sarsat document C/S T.018.

NOTE Compliance with documents C/S T.001 or C/S T.018 is demonstrated by testing to documents C/S T.007 or C/S T.021 respectively (see 6.1.2).

The radio frequency of operation of the equipment shall at all times be within the limits defined by the Radio Regulations.

4.2 General

(See 6.1.6, 6.2.1, 6.2.2, 6.3.2, 6.3.4 and 6.3.7)

The following are general requirements for the EPIRB.

a) The EPIRB shall be (SOLAS IV/7.1.6.3) *ready to be manually released and capable to be carried by one person into a survival craft.*

b) (MSC.471(101)/A.2.1) *The EPIRB shall be capable of transmitting a distress alert, including encoded position information from a receiver using a recognised global navigation satellite system (GNSS) with global coverage, to satellites equipped with a search and rescue 406 MHz processor or repeater.*

c) The EPIRB shall be designed to operate according to this document when floating in the sea and shall also be capable of operating on board a ship and on a survival craft.

d) (MSC.471(101)/A.2.2) *The EPIRB shall be of an automatic float-free type. The equipment, mounting and releasing arrangements shall be reliable and operate satisfactorily under the most extreme conditions likely to be met with at sea.*

e) (A.662(16)/1) *Float-free release and activation arrangements shall enable the automatic release of the EPIRB from a sinking ship and its automatic activation.* Table 1 *shows the correct combination of control functions to prevent or enable activation.*

Table 1 – EPIRB control functions

Control position		EPIRB condition		EPIRB-mount or release mechanism status		Transmitter status	
ON	READY	WET [a]	DRY	OUT	IN	ON	OFF
X		X		X		X	
X		X			X	X	
X			X	X		X	
X			X		X	X	
	X	X		X		X	
	X	X			X		X
	X		X	X			X
	X		X		X		X

[a] Floating or immersed in water.

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f) (A.694(17)/1.2) *Where a unit of equipment provides a facility which is additional to the minimum requirements of this* document, such as return link service (RLS) functionality or the possibility of connecting external navigation data, *the operation, and as far as is reasonably practicable, the malfunction of such additional facility* shall *not degrade the performance of the equipment below those minimum standards*. The additional facility shall, as a minimum, meet the appropriate requirements of IEC 60945, as applicable. Where such an additional facility exists, it shall not prevent the EPIRB fully conforming to the requirements of this document during normal combined operation. Any internal or external navigation device connected to, or forming part of, the EPIRB shall comply with the requirements of Annex B. Any EPIRB with optional RLS functionality shall comply with the appropriate requirements of C/S T.001 or C/S T.018 as applicable and 5.8.

g) The EPIRB shall be a single integral unit. No part of it shall be detachable without the use of tools.

h) The EPIRB shall (MSC.471(101)/A.2.3.11) *be provided with a low-duty cycle* white *light* (of at least effective 0,75 cd) *active during darkness* and all other lighting conditions, *visible to the human eye* and flashing at a rate of 20 to 30 times per minute, with a flash duration of between 10^{-6} s and 10^{-1} s for the operating lifetime of the EPIRB to indicate its position for the nearby survivors and rescue units.

   This light shall be mounted so that it produces effective 0,75 cd or greater over as great a portion of the upper hemisphere as is practical. The arithmetic mean of the light output over the entire upper hemisphere shall not be less than effective 0,50 cd. No measured points (see Table 2) shall have an effective luminous intensity of less than 0,2 cd.

   NOTE 1 There can be areas of lower intensity at non measured points around the EPIRB and as the elevation increases to allow for mounting bushes, controls and the antenna, etc. and for the fact that, at higher elevation angles, the range to rescue units is reduced.

i) The EPIRB shall (MSC.471(101)/A.2.3.11) *be provided with a low-duty cycle light* active during all lighting conditions *detectable by all types of night vision devices* for the operating lifetime of the EPIRB.

   The night vision low-duty cycle light shall have a dominant wavelength between 770 nm to 890 nm and shall have an average radiant intensity of at least 2,5 mW/sr, flashing at a rate of 20 to 30 times per minute, with a flash duration between 66 ms and 500 ms for the operating lifetime of the EPIRB.

   This night vision low-duty cycle light shall be mounted so that it produces light output over as great a portion of the upper hemisphere as is practical. The arithmetic mean of the light output over the upper hemisphere above 20° elevation shall not be less than 2,5 mW/sr. No measured points (see Table 3) shall have a radiant intensity of less than 0,25 mW/sr.

   NOTE 2 There can be areas of lower intensity at non measured points around the EPIRB and as the elevation increases to allow for mounting bushes, controls and the antenna, etc. and for the fact that at higher elevation angles the range to rescue units is reduced.

j) The flashes of the low-duty cycle white light and the low-duty cycle night vision light may be synchronous or asynchronous with respect to each other. The low-duty cycle white light and the low-duty cycle night vision light may be a combined light, provided all the conditions in h) and i) are complied with.

k) The EPIRB shall (MSC.471(101)/A.2.3.14) *be provided with a 121,5 MHz beacon primarily for homing by aircraft*.

l) The EPIRB shall (MSC.471(101)/A.2.3.15) *be provided with an* internal *GNSS receiver for position fixes and an associated indication that GNSS signal reception is satisfactory or unsatisfactory*.

m) The EPIRB shall (MSC.471(101)/A.2.3.16) *be provided with an automatic identification system (AIS) locating signal in accordance with the Recommendation ITU-R M.1371, Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile frequency band*.

n) The EPIRB should have an exterior design that precludes sharp edges to prevent damage to inflatable survival craft.

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4.3 Operational

4.3.1 Prevention of inadvertent activation

(See 6.3.1 and 6.5.2)

The EPIRB shall:

a) (MSC.471(101)/A.2.3.1) *be fitted with adequate means to prevent inadvertent activation and deactivation*;

b) not automatically activate when water washes over it while in its release mechanism, see Table 1;

c) be designed to limit any inadvertent continuous 406 MHz transmission to a maximum of 45 s.

4.3.2 Immersion, buoyancy and drop into water

(See 6.3.2 and 6.17)

The EPIRB shall:

a) (MSC.471(101)/A.2.3.2) *be so designed that the electrical portions are watertight at a depth of 10 m for at least 5 min. Consideration shall be given to a temperature variation of 45 °C during transitions from the mounted position to immersion. The harmful effects of a marine environment, condensation and water leakage shall not affect the performance of the beacon;*

b) (MSC.471(101)/A.2.3.6) *be capable of floating upright in calm water and have positive stability and sufficient buoyancy in all sea conditions;*

c) (MSC.471(101)/A.2.3.7) *be capable of being dropped into the water without damage from a height of 20 m* and of being dropped onto a hard surface from 1m.

4.3.3 Activation

(See 6.3.3)

The following describes the activation of the EPIRB.

NOTE Beacon activation is defined as the point in time at which the initiation of the activation event of the beacon occurs e.g. the activation event is either pressing of the "ON" button, or water sensor immersion.

a) The EPIRB shall (MSC.471(101)/A.2.3.3) *be automatically activated after floating free* or when floating in the water, irrespective of the settings of any control. See Table 1.

b) The EPIRB shall (MSC.471(101)/A.2.3.4) *be capable of repetitive manual activation and* manual *deactivation*.

c) Manual deactivation shall not prevent automatic activation of the EPIRB when automatically released from its release mechanism or when floating in the water.

d) When the EPIRB is manually activated, the low-duty cycle lights (see 4.2 h), i) and j)) shall begin flashing within 2 s, in any lighting condition and when automatically activated it shall begin flashing within 15 s or prior to the first 406 MHz transmission if this is sooner, in any lighting conditions.

e) Distress, homing and locating signals shall comply with 5.2, 5.5 and 5.6.

f) The EPIRB shall (MSC.471(101)/A.2.3.5) *be provided with means to indicate that signals are being emitted*. The low-duty cycle light operating in accordance with 4.2 h), is an acceptable indication.

g) Once automatically activated, when the EPIRB is removed from the water and allowed to dry, it shall cease activation.

4.3.4 Self-test

(See 6.3.4)

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4.3.4.1 General

The EPIRB shall (MSC.471(101)/A.2.3.8) *be capable of being tested, without using the satellite system, to determine that the EPIRB is capable of operating properly*.

Activation of the test facility shall reset automatically.

The transmitted signals shall be emitted in order of ascending frequency. If the EPIRB radiates both 121,5 MHz and 243 MHz simultaneously, then these signals shall be transmitted twice in the sequence to cover both frequencies.

The self-test shall comply with either 4.3.4.2 and 4.3.4.4 or 4.3.4.3 and 4.3.4.4 below as applicable.

4.3.4.2 First generation beacons (FGBs)

The self-test transmission shall comply with C/S T.001. When the self-test mode is activated, the EPIRB shall emit a single modulated burst at nominal power which shall always provide the beacon 15 Hex ID.

The 121,5 MHz auxiliary radio locating device signal shall also be transmitted during the self-test, but it shall not exceed three audio sweeps or 1 s, whichever is greater.

The AIS locating signal shall also be transmitted during the self-test and shall consist of two single VHF pulses lasting no more than 26,6 ms each, one transmitted on AIS 1 and the other on AIS 2. The pulse shall be coded as Message 14 containing the Hex ID of the EPIRB on one channel and "EPIRB TEST" on the other channel. Valid AIS slot timing is not required for this test.

The self-test function shall also check the battery in accordance with 4.3.9 and the functioning of the GNSS receiver (it is not necessary to obtain a GNSS position during this test), and if the EPIRB has RLS functionality and has been programmed with an RLS protocol then indicate the RLS capability (see [AC1⟩ 5.8.2 ⟨AC1]).

An indication shall be provided to indicate that all parts of the self-test were passed successfully or that there was a failure.

4.3.4.3 Second generation beacons (SGBs)

When the self-test mode (see C/S T.018) is activated, the EPIRB shall emit a single 406 MHz modulated burst at nominal power with the self-test pseudo-random noise (PRN) sequence. It shall be possible to create the 23 Hex ID of the beacon from the transmitted message. The encoded position bits in the message shall be set to their default values. The bits in rotating field #0 shall be set as follows.

– Elapsed time since activation	Zero
– Time from last encoded position	2047
– Altitude of encoded position	All 1's
– Dilution of precision	All 1's
– Automated/Manual activation notification	Manual activation by user
– Remaining battery capacity	Actual value at time of test if capable, if not All 1's
– GNSS status	No Fix

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The 121,5 MHz auxiliary radio locating device signal shall not exceed three audio sweeps or 1 s, whichever is greater.

The AIS locating signal shall also be transmitted during the self-test and shall consist of two single VHF pulses lasting no more than 26,6 ms each, one transmitted on AIS 1 and the other on AIS 2. The pulse shall be coded as Message 14 containing the Hex ID of the EPIRB on one channel and "EPIRB TEST" on the other channel. Valid AIS slot timing is not required for this test.

The self-test function shall also check the battery in accordance with 4.3.9 and the functioning of the GNSS receiver (it is not necessary to obtain a GNSS position during this test), and if the EPIRB has RLS functionality and has been programmed with an RLS protocol then indicate the RLS capability (see [AC1⟩ 5.8.2 ⟨AC1]).

An indication shall be provided to indicate that all parts of the self-test were passed successfully or that there was a failure.

4.3.4.4 GNSS self-test

All EPIRBs shall provide for a GNSS self-test and related indicator in accordance with either C/S T.001 or C/S T.018 as appropriate. In addition, during the GNSS self-test, if a position is acquired, the EPIRB shall transmit a single self-test burst at 406 MHz containing the location data and an AIS burst in accordance with E.2.7.2.

EPIRBs shall provide for a minimum of at least 10 GNSS self-tests over the life of the battery, from its manufacturing date to its expiry date (see 5.9.2).

4.3.5 Colour and retro-reflecting material

(See 6.3.5)

The EPIRB shall (MSC.471(101)/A.2.3.9) *be of highly visible yellow/orange colour and be fitted with retro-reflecting material*.

The minimum area of retro-reflective material visible above the waterline of the EPIRB shall be at least 25 cm^2. This shall be achieved by retro-reflective material, at least 25 mm wide, with at least 5 cm^2 viewable from every angle on the horizon.

The retro-reflective material shall also meet the performance requirements of IMO Resolution A.658(16), Annex 2.

4.3.6 Lanyard

(See 6.3.6)

The EPIRB shall (MSC.471(101)/A.2.3.10) *be equipped with a buoyant lanyard*, firmly attached to it, *suitable for use as a tether (to a liferaft, lifeboat or person in the water but not to the ship), which* shall *be so arranged as to prevent its being trapped in the ship's structure when floating free*.

The buoyant lanyard shall have a length of 5 m to 8 m. The breaking strength of the lanyard and its attachment to the EPIRB shall be at least 245 N. The lanyard shall be of a highly visible yellow/orange colour and shall not rot or deteriorate in a marine environment.

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4.3.7 Exposure to the marine environment

(See 6.3.7 and 6.17)

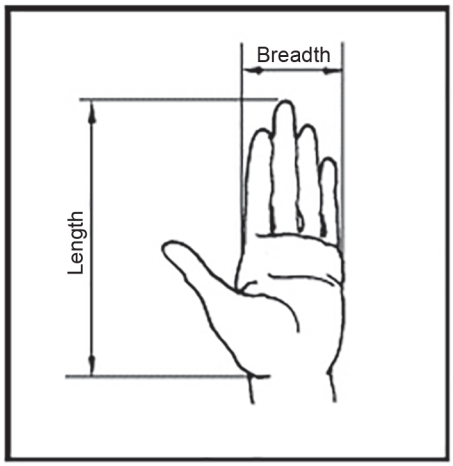
The EPIRB shall not (MSC.471(101)/A.2.3.12), including the labelling, *be unduly affected by sea water or oil or both*; and (MSC.471(101)/A.2.3.13) *be resistant to deterioration in prolonged exposure to sunlight*.

4.3.8 Ergonomics

(See 6.3.8)

The EPIRB shall have all controls of sufficient size for simple and satisfactory operation.

Each individual control or operation necessary to deploy or activate the EPIRB, including, but not limited to, removing the EPIRB from its bracket, manual activation and deactivation, transfer to a survival craft, deploying the lanyard and deploying (de-stowing) any other retention (carriage) means, shall be able to be readily and easily accomplished with a single hand (while if necessary the EPIRB is supported by some means). The design shall encompass a range of hand sizes (as defined in Figure 1) from a bare small hand to a large hand wearing an immersion suit mitten or glove (complying with the IMO Life-Saving Appliance Code Resolution MSC.48 (66), section 2.3) of appropriate size.



IEC

Hand sizes	Small	Large
Breadth	< 69 mm	> 96 mm
Length	< 158 mm	> 206 mm

Figure 1 – Hand sizes

The EPIRB shall be provided with some means to facilitate secure hands-free carriage (e.g. for transfer to a survival craft). The carrying means shall be determined by the manufacturer and sized so as to accommodate persons as defined in Figure 1 ranging from a person with a small bare hand to a person with a large hand wearing the gloves from an immersion suit (complying with the IMO Life-Saving Appliance Code Resolution MSC.48 (66), section 2.3) of appropriate size. The method of carriage shall not depend on any external interface or means which is not an integral part of the EPIRB (e.g. depending upon a pocket, pouch, loop, clip or hook and loop tape installed on clothing or an immersion suit is not acceptable).

Where the EPIRB is supplied with a float free release mechanism, the carrying means shall be designed to minimise the possibility of snagging when the EPIRB floats free.

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The minimum breaking force of any handle, loop or other hands-free retention means shall be 245 N.

4.3.9 Indication of insufficient battery energy

(See 6.3.9)

The EPIRB shall be provided with means to indicate that the beacon battery may not have sufficient energy to support beacon operation for the manufacturer-declared minimum operating lifetime in accordance with C/S T.001 or C/S T.018 as applicable.

NOTE The intent of this indication is to indicate to the user during a self-test if the beacon has been previously activated for an extended period of time, such that it can no longer meet the minimum operating lifetime requirement.

4.4 Control and indicator functions

(See 6.4)

4.4.1 Control functions

(MSC.471(101)/A.3.1) *When the EPIRB is manually operated a distress alert shall be initiated only by means of a dedicated distress alert activator* (see Table 1).

The dedicated activator shall:

a) (MSC.471(101)/A.3.2.1) *be clearly identified; and*

b) (MSC.471(101)/A.3.2.2) *be protected against inadvertent operation.*

(MSC.471(101)/A.3.3) *Manual distress alert initiation* shall *require at least two independent actions* in sequence to activate the EPIRB.

The two or more independent means of activation shall be capable of multiple use.

The following actions shall not be counted as one of the two independent actions required to manually activate the EPIRB by use of the controls:

– manual removal from the bracket; or

– inversion (e.g. turning the EPIRB upside down).

(MSC.471(101)/A.3.4) *The EPIRB shall not be automatically activated after being manually removed from the release mechanism* (dry EPIRB condition).

4.4.2 Indicator functions

The following indications are required on the EPIRB.

a) Low-duty cycle white light (see 4.2 h), 〖AC1〗 4.3.3 d) 〈AC1〗 and 〖AC1〗 4.3.3 f) 〈AC1〗)
The function of this light is to indicate when the EPIRB is active/on and may also indicate that signals are being emitted.

b) Self-test and GNSS self-test indicator(s) (see 4.3.4.1, 4.3.4.2, 4.3.4.3, 4.3.4.4 and 4.3.9)
The function of this indicator(s) is to inform the user if the EPIRB passes or fails the self-test or GNSS self-test and if the battery has insufficient energy.

c) GNSS indicator (see 4.2 l))
The function of this indicator is to inform the user if the EPIRB GNSS reception is satisfactory or unsatisfactory (i.e. if a current position is available to encode into the EPIRB message, or is not available, or fails to meet accuracy requirements).

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d) Transmitter indicator

The function of this indicator is to inform the user that signals are being emitted (e.g. at 406 MHz). The low-duty cycle light may be used to provide such indication.

e) RLS indicator (if applicable)

This indicator provides a unique distinct indication of the RLS function in the EPIRB in accordance with C/S T.001 or C/S T.018 as applicable. Examples of means of compliance include a separate indicator, or a distinct indication such as a different colour used only for RLS in a combined indicator.

Indicators b), c), and e) above, may all be separate indicators on the EPIRB or their functions may be combined into fewer indicators at the discretion of the manufacturer, provided that in all cases each function is clearly defined and easily distinguishable from other functions.

4.5 Float-free arrangements

4.5.1 General

(See 6.5.1, 6.5.2, 6.5.3, 6.6.5 and 6.17)

The float-free arrangement shall:

a) (A.662(16)/2.1) *be designed so that the release mechanism shall operate before reaching a water depth of 4 m in any orientation*. Any hydrostatic release unit used in the float-free release mechanism shall comply with IMO Lifesaving Appliance Code (IMO Resolution MSC.48(66)), paragraph 4.1.6.3 and ISO 15734;

b) (A.662(16)/2.4) *be constructed to prevent release when seas wash over the unit*;

c) allow the EPIRB to function in accordance with the requirements of Table 1;

d) (A.662(16)/2.3) *be constructed of non-corrosive compatible materials, so as to prevent deterioration which may cause any malfunction of the unit. Galvanizing or other forms of metallic coating on parts of the float-free release mechanism* shall *not be accepted;*

e) to the maximum extent possible prevent inadvertent activation of the EPIRB in the bracket due to movement. The design shall allow for the effects of a normal marine environment, (e.g. motion, vibrations, bumping) and any potential normal wear and tear and aging of flexible and elastic parts of the bracket (e.g. cushions, spacers, back-stops);

f) to the maximum extent possible be so designed as to ensure that the EPIRB cannot be placed in its mounting bracket incorrectly such that the automatic activation disabling feature of the bracket is rendered inoperable allowing the EPIRB to be activated when water washes over it and thus give rise to false alerts;

g) (A.662(16)/2.5) including the labelling, *not be unduly affected by seawater or oil or prolonged exposure to sunlight*.

4.5.2 External power or data connection

(See 6.5.4)

(A.662(16)/3) For the EPIRB *requiring external power or data connection, or both, the means of connection* shall *not inhibit the release from the release mechanism or activation of the EPIRB.*

4.5.3 Ability to check the automatic release

(See 6.5.5)

(A.662(16)/4) If the hydrostatic release unit is resettable or capable of being tested, *it* shall *be possible to assess the proper functioning of the automatic release mechanism by a simple method without activation of the* EPIRB.

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4.5.4 Manual release

(See 6.5.6)

(A.662(16)/5) *It* shall *be possible to release the EPIRB manually from the float-free mechanism*, without tools.

4.6 Environment for EPIRB

4.6.1 General

(MSC.471(101)/A.2.5) *The EPIRB* shall *be so designed as to operate under any of the following environmental conditions.*

4.6.2 Temperature and icing

(See 6.2.2, 6.6.1 and 6.17)

a) Ambient temperatures of −55 °C to +70 °C for class 0.

b) Ambient temperatures of −40 °C to +55 °C for class 1.

c) (MSC.471(101)/A.2.5.1) *Ambient temperatures of −20 °C to +55 °C* for class 2.

d) (MSC.471(101)/A.2.5.2) *Icing*, which may occur when a cold EPIRB is submerged in water.

4.6.3 Wind speed

(See 6.6.3)

(MSC.471(101)/A.2.5.3) *Relative wind speeds up to 100 knots (52 m/s).*

4.6.4 Stowage

(See 6.6.4 and 6.17)

(MSC.471(101)/A.2.5.4) *After stowage at temperatures between* −55 °C and +70 °C for class 0, between −40 °C and +70 °C for class 1 and between *−30 °C and +70 °C* for class 2.

NOTE In this document the term "stowage" is generally used when referring to non-operational equipment temperature ranges. However, in some standards such as IEC 60945, the alternative term "storage" is used. These terms are considered interchangeable in the context of their use in this document.

4.6.5 Shock, vibration and other environmental conditions

(See 6.6.5 and 6.17)

The installed EPIRB shall *(MSC.471(101)/A.2.6.2) be capable, while mounted on board, of operating properly over the ranges of shock and vibration and other environmental conditions normally encountered above deck on sea-going vessels.*

4.7 Environment for float-free arrangement

(See 6.6.2, 6.7 and 6.17)

The float-free arrangement shall:

a) (A.662(16)/2.2) *be capable of operating throughout the temperature range of −30 °C to +65 °C* for all classes of EPIRB;

b) (A.662(16)/2.6) *be capable of operating properly after exposure to shock and vibration and other severe environmental conditions encountered above deck on seagoing vessels;*

c) (A.662(16)/2.7) *if the ship navigates in areas where icing may be expected, be so designed as to minimize the formation of ice and prevent its effects from hindering the release of the* EPIRB *as far as practicable;*

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d) not be damaged in stowage throughout the following temperature ranges

ambient temperatures of −55 °C to +70 °C for Class 0;

ambient temperatures of −40 °C to +65 °C for Class 1;

ambient temperatures of −30 °C to +65 °C for Class 2.

NOTE The stowage and operating temperature ranges for the EPIRB are different to those of the float-free arrangement.

4.8 Interference – Electromagnetic compatibility

(See 6.8, 6.18, 6.19 and 6.21)

(A.694/6.1) *All reasonable and practicable steps* shall *be taken to ensure electromagnetic compatibility between the equipment concerned and other radiocommunication and navigational equipment carried on board in compliance with the relevant requirements of chapters III, IV and V of the SOLAS Convention.*

Refer to the appropriate subclauses of Clause 6 and IEC 60945 for the requirements.

4.9 Maintenance

(See 6.9)

Shore-based maintenance of EPIRBs should be carried out in accordance with IMO guidelines as set out in MSC/Circ.1039 as amended.

Annual testing of EPIRBs should be carried out in accordance with IMO guidelines as set out in MSC.1/Circ.1040/Rev.1 as amended.

The design of the EPIRB shall allow annual testing and shore-based maintenance to be performed in accordance with the above requirements.

As defined in 4.2 g), the EPIRB is a single integral unit, which is not suited for on-board repairs.

As a consequence, the equipment shall be so constructed that it is readily accessible for inspection and testing purposes only, access to the interior of the EPIRB shall only be possible with the use of tools.

4.10 Safety precautions

(See 6.10 and 6.20)

All practicable steps shall be taken to ensure that the equipment is in accordance with the appropriate clauses of IEC 60945, including compass safe distance.

In addition, the battery shall not release toxic or corrosive products outside the EPIRB during or subsequent to stowage at temperatures between −55 °C and +75 °C, and shall comply with the United Nations Recommendations on the Transport of Dangerous Goods, Manual of Tests and Criteria, 7th Revised Edition, PART III, Section 38.3 (ST/SG/AC.10/11/Rev.7 as amended).

Moreover, the EPIRB and specially the battery shall not be hazardous to any person handling, using or performing manufacturer approved servicing of the device or to any vehicle or equipment in which it is transported, housed or installed under any of the conditions specified in this document.

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4.11 Equipment manuals

(See 6.11)

The equipment manual shall provide adequate information to enable the equipment to be properly stowed, installed, operated, tested and maintained, in this respect it shall include:

- an overview of the current Cospas-Sarsat system;
- complete instructions for the operation, the self-test of the EPIRB, including the GNSS self-test and testing of the AIS locating signal, to provide guidance to the operator towards maximizing radio transmissions and self-locating performance, including a warning not to obstruct the GNSS antenna's view of the sky;
- cautions and recommendations to prevent false alerts;
- instructions for licensing and registration (including either in the manual or separately the Hex ID of the EPIRB and the AIS User ID), registration renewal and a discussion on the importance of accurate registration;
- battery information including replacement instructions, battery type, and safety information regarding battery use and disposal;
- a warning such as the following – *If this Beacon is kept above room temperature for prolonged periods of time then the Battery Capacity will be degraded and either the Battery should be replaced earlier than the date stated on the beacon, or the quoted 48 hour operating life of the beacon may be reduced. The effect is more pronounced as the temperature increases;*
- guidance on the expected life of the EPIRB and its mounting bracket;
- instructions on reregistration or recoding of the EPIRB when transfer of ownership or change of vessel occurs;
- instructions on disposal of the EPIRB at the end of life, including measures to prevent false alerts during disposal and deregistration;
- an instruction to replace the battery when the battery status indicator informs the user that the beacon may not have sufficient energy to support beacon operation for the declared operating lifetime of the EPIRB;
- the minimum operating life-time and operating and stowage temperatures;
- the purpose of the lanyard and a precaution against using it to secure the EPIRB to the ship in distress;
- a recommendation against attempting to operate the EPIRB inside a covered life raft or lifeboat or under any similar cover or canopy;
- the servicing and/or replacement of any hydrostatic release unit and any associated components subject to aging, such as release rods;
- manufacturer recommendations, if any, on periodic functional testing;
- a recommendation to limit self-testing to that recommended by the beacon manufacturer;
- information on how to maintain the EPIRB as required by 4.9;
- a note to keep the original EPIRB packaging, since it may be needed if the EPIRB has to be shipped for servicing. UN requirements for shipping some batteries as hazardous goods require certain packaging standards and labelling;
- instructions for the safe transportation or shipping of the EPIRB or the location where such information can be obtained by the user;
- warranty information;
- a warning to the effect that the EPIRB shall not be operated except in an emergency;
- (A.694(17)/2) instructions to ensure that the EPIRB is *installed in such a manner that it is capable of meeting the requirements of all applicable IMO performance standards*, which can be achieved by meeting all the requirements of this specification. The installation instructions shall, as a minimum, include the following guidance:

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- (A.662(16)/2.8) *be mounted in such a way that, after being released,* it is *not obstructed by the structure of the sinking ship* in a location that is not exposed to strong magnetic or electromagnetic fields, if these might activate the EPIRB;
- (IV/7.1.6.2) *be installed in an easily accessible position* to facilitate manual operation and testing;
- if possible, also be installed in a location that will provide as clear a view of the sky as is practical, orientated to facilitate satellite reception;
- not to install or operate the EPIRB in a location subject to high intensity RF fields (e.g radar or communications antennas);
- if the ability of the GNSS receiver in the EPIRB to obtain a fix can be impaired on the deck of a vessel due to interference from a GMDSS approved satellite communications system at a distance of 10 m, then an appropriate warning to this effect shall be included in the manual.

The equipment manual shall include information explaining the necessity to report EPIRB false alarms by the most expedient means to the nearest search and rescue authorities. The information that should be reported includes the EPIRB 15-Hex ID; date, time, duration and cause of activation; and position at time of deactivation.

4.12 Labelling

(See 6.12)

4.12.1 Equipment labelling

The label or labels shall be placed on the EPIRB itself, as needed.

(MSC.471(101)/A.5.1) *Labelling for operation controls and indicators* shall*, as far as possible, be understood through graphical images and symbols without the need for text.* The symbols provided in Annex F are recommended for this purpose. Text may be used in addition to symbols if required.

(MSC.471(101)/A.5.2) *In addition to the items specified in IMO Resolution A.694(17),* 6.3 and 9 (see appropriate clauses of IEC 60945) *on general requirements, the following* shall *be clearly indicated on the exterior of the equipment*:

a) (MSC.471(101)/A.5.2.1) *brief operating instructions*, to enable manual activation, deactivation and self-test (see 4.3.4), with any text used provided in at least English;

b) a warning to the effect that the EPIRB shall not be operated except in an emergency;

c) class (see Clause 1, as specified by the manufacturer, type of battery and (MSC.471(101)/A.5.2.2) expiry date for the primary battery used (see 5.9). Means shall be provided to change this date when the battery is replaced. The manufacturer shall make it clear by some means as to what day of the month the battery expires (e.g. text in the manual, day as well as month on the label, using 'end' before month);

d) the name of the ship and beacon identification data:

   1) (MSC.471(101)/A.5.2.3) the identity codes programmed into the transmitters of the EPIRB (i.e. the 15 Hex ID, as described in C/S T.001, or the 23 Hex ID as described in C/S T.018), together with the call sign or MMSI of the ship as required by the Administration and the maritime identification digits (MID) code and additionally the AIS user ID;

   2) country (i.e. name of country as programmed in the MID);

   3) a space for registration information (for instance decals) as required by administrations;

e) the location of the GNSS antenna and to provide this with a clear view of the sky during operation and if applicable information that the EPIRB may be interfaced to an external GNSS receiver.

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4.12.2 Float-free arrangement labelling

(A.662(16)/2.9) *The float-free arrangement* shall *carry a label* or labels *indicating clearly* with any text used provided in at least English:

a) *the operating instructions for manual release in pictorial form*;

b) the category (see Clause 1);

c) the stowage and operating temperature ranges of the float-free arrangement;

d) the maintenance and/or replacement date for the release mechanism, if applicable.

If the operating instructions label is not readily visible and readable in the installed arrangement, the instructions shall be provided in addition in pictorial form, on a waterproof placard suitable for installation close to the float-free arrangement.

4.12.3 Battery labelling

The battery shall be marked indelibly and legibly with the battery type, voltage, expiration date (month and year) and as appropriate, precautions associated with handling and disposal.

Additionally, a label shall be applied to either the interior of the EPIRB in a conspicuous place or on the battery pack itself warning that unauthorized battery replacement may lead to failure such as the following.

WARNING! Regulated lifesaving device. Unauthorized battery replacement may lead to failure.

4.13 Installation

(See 6.2.2 and 6.13)

The installed EPIRB shall:

a) (MSC.471(101)/A.2.6.1) *have local manual activation; remote activation may also be provided from the navigating bridge, while the device is installed in the float-free mounting;*

b) (MSC.471(101)/A.2.6.3) *be designed to release itself and float-free before reaching a water depth of 4 m at a list or trim of any angle.*

5 Technical characteristics

5.1 Transmitted frequency

(See 6.14.1)

C/S T.001 first generation EPIRBs distress alerting signal shall be transmitted on a frequency in the 406 MHz band as specified in the Cospas-Sarsat 406 MHz channel assignment table in C/S T.012.

The second generation EPIRBs distress alerting signal shall be transmitted at the frequency specified in C/S T.018.

5.2 Signal and message format

(See 6.14.1)

(MSC.471(101)/B.1) *The technical characteristics of the transmitted signal and the message format shall be in accordance with the requirements of the Cospas-Sarsat System document C/S T.001 or C/S T.018* as applicable.

For FGBs, the first 406 MHz transmission (with or without encoded position) shall not occur prior to the requirements of C/S T.001 but within no more than 2 min of activation of the EPIRB

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For SGBs, 406 MHz transmissions shall commence in accordance with C/S T.018.

Measures shall be taken to ensure that 406 MHz transmissions take priority and do not clash with either 121,5 MHz or AIS transmissions. 406 MHz and AIS transmissions shall be interleaved. The EPIRB software shall monitor projected transmission timings and in the event that the software sees a potential clash occurring, the 406 MHz transmission shall take precedence over the AIS transmission. It is acceptable to either shift the 406 MHz signal within the randomization requirements of Cospas-Sarsat, or omit a single AIS pulse from the sequence of eight pulses in order to avoid the clash.

For second generation beacons, when the cancellation function is initiated, the 121,5 MHz homing signal and the AIS locating signal may be stopped immediately or may continue until the beacon shuts off.

5.3 Distress message memory

(See 6.14.1)

(MSC.471(101)/B.2) *Provisions* shall *be included for storing the fixed portion of the distress message in the EPIRB using non-volatile memory.*

5.4 Beacon identification code

(See 6.14.1)

(MSC.471(101)/B.3) *A unique beacon identification code* shall *be made part of all 406 MHz messages. For EPIRBs compliant with C/S T.001 this identification code* shall *include a 3-digit maritime identification digits (MID) code to denote the country in which the beacon is registered, followed by either*

a) *the trailing 6 digits of the ship station identity in accordance with Recommendation ITU-R M.585, Assignment and use of identities in the maritime mobile service, or*

b) *a unique serial number, or*

c) *a radio call sign.*

Preference is given to the method in sub-paragraph a) above.

For EPIRBs compliant with C/S T.018 this identification code shall *include a 3-digit maritime identification digits (MID) code to denote the country in which the beacon is registered, followed by a unique serial number and either the maritime mobile service identity or a radio call sign.*

5.5 121,5 MHz homing signal

(See 6.14.2 and Annex D)

(MSC.471(101)/B.4) *The 121,5 MHz homing signal* shall:

a) *have a 121,5 MHz transmitting duty cycle not less than 50 % (1,125 s on, 1,125 s off) and if more than 50 %, the on time* shall *be increased beyond 1,125 s and the off time reduced accordingly.* In addition the signal may also be interrupted for up to a maximum of 2 s during the transmission of the 406 MHz signal and if applicable for the transmission of a Morse letter or an AIS burst (see Figure 2);

   The following formula shall be used to determine the minimum 121,5 MHz swept tone transmission time. In any time period 'T' seconds

   Minimum 121,5 swept tone transmission time in time 'T' = $(T - ((X1 \times (T_m + 2)) + (0{,}05 \times X2)))$ / 2 s

   where

   $X1$ is the number of 406 transmissions in time 'T';

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