

# Maritime Design and Installation Guidelines



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**MARITIME DESIGN AND INSTALLATION GUIDELINES (DIGs)**

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## DESIGN AND INSTALLATION GUIDELINES

### Introduction

Mandatory and optional specifications for all Inmarsat equipment installed on board SOLAS ships are defined in the appropriate System Definition Manuals (SDMs) or Technical Requirements Document (TRD) for the relevant Inmarsat system. The SDMs and TRDs are published by Inmarsat Ltd. with a view to ensuring that ship earth stations will perform adequately and not endanger the integrity of the Inmarsat system.

The “Design and Installation Guidelines” provide general information on the design and installation of Inmarsat equipments operating within the Global Maritime Distress and Safety System, GMDSS.

These guidelines are arranged in sections; a general section and a section for each of the Inmarsat systems that are able to participate in the GMDSS.

The following International Electrotechnical Commission (IEC) standards and International Maritime Organisation (IMO) documents are relevant to the operation of ship earth stations within the GMDSS:

| Authority | Document   | Description  | Date          |
|-----------|------------|--|---------------|
| IEC       | 60533      | Electrical and electronic installations in ships – Electromagnetic compatibility   | November 1999 |
| IEC       | 60945      | Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results   | October 2002  |
| IEC       | 61097-4    | Global maritime distress and safety system (GMDSS) – Part 4: Inmarsat C ship earth station and Inmarsat enhanced group call (EGC) equipment – Operational and performance requirements, methods of testing and required test results | October 2007  |
| IEC       | 61097-10   | Global maritime distress and safety system (GMDSS) – Part 10: Inmarsat B ship earth station equipment – Operational and performance requirements, methods of testing and required test results                                       | June 1996     |
| IEC       | 61097-13   | Global maritime distress and safety system (GMDSS) – Part 13: Inmarsat F77 ship earth station equipment – Operational and performance requirements, methods of testing and required test results                                     | May 2003      |
| IMO       | A.570(14)  | Type approval of ship earth stations   | November 1985 |
| IMO       | A.663.(16) | Performance standards for INMARSAT standard-C ship earth stations capable of transmitting and receiving direct-printing communications   | October 1989  |
| IMO       | A.664(16)  | Performance standards for enhanced group call equipment  | October 1989  |

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| Authority | Document     | Description  | Date          |
|-----------|--------------|--|---------------|
| 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 | November 1991 |
| IMO       | A.701(17)    | Carriage of Inmarsat enhanced group call SafetyNET receivers under the global maritime distress and safety system (GMDSS)                                      | November 1991 |
| IMO       | A.807(19)    | Performance standards for INMARSAT-C ship earth stations capable of transmitting and receiving direct-printing communications (Amended by MSC.68(68))          | November 1995 |
| IMO       | A.808(19)    | Performance standards for ship earth stations capable of two-way communications  | November 1995 |
| IMO       | A.813(19)    | General requirements for electromagnetic compatibility (EMC) for all electrical and electronic ship's equipment  | November 1995 |
| IMO       | A.814(19)    | Guidelines for the avoidance of false distress calls   | November 1995 |
| IMO       | A.886(21)    | Procedure for the adoption of, and amendments to, performance standards and technical specifications   | November 1999 |
| IMO       | A.1001(25)   | Criteria for the provision of mobile satellite communication systems in the global maritime distress and safety system (GMDSS) <i>[Replaces A.888(21)]</i>     | November 2007 |
| IMO       | MSC Circ.862 | Clarification of certain requirements in IMO performance standards for GMDSS equipment   | May 1998      |
| IMO       | MSC.68(68)   | Amendments to performance standards for shipborne radiocommunications equipment  | June 1997     |
| IMO       | MSC.129(75)  | Maritime Safety and Safety related radiocommunications   | May 2002      |
| IMO       | MSC.130(75)  | Performance standards for Inmarsat ship earth stations capable of two-way communications   | May 2002      |

## General

The IMO documents listed in the introduction of this document form the basis for both International and national GMDSS requirements for Inmarsat equipment, which are required to satisfy the carriage requirements of Chapter IV and V of the SOLAS Convention.

The IEC documents listed in the introduction of this document are normally used to perform national and international type-testing requirements and often form the basis for national type approval requirements.

IEC type approval ensures compliance with the requirements stated within the relevant IEC and IMO documents and Inmarsat approval ensures that the equipment is safe to use over the space segment.

Inmarsat approval and service activation are mandatory requirements before access to any part of the Inmarsat system is granted.

Environmental testing of the equipment is mandatory in the Inmarsat system definition manuals for each equipment and approval testing requires compliance with the specifications contained in the relevant IEC and IMO documents.

Requirements and specifications for the testing and operation of the GMDSS aspects of relevant Inmarsat equipment shall be in accordance with the relevant IMO and IEC documents.

## 1 Technical Requirements

1.1 The Mobile Earth Station equipment shall be type-approved by Inmarsat Ltd. and should comply with the environmental conditions specified in the Inmarsat Technical Requirements and, where applicable, IEC 60945. Operational and performance requirements should be tested in accordance with the appropriate IEC standards.

1.2 Equipment, which:

.1 forms part of the global maritime distress and safety system; or

.2 is required by regulation V/12 of the 1974 SOLAS Convention as amended and other electronic navigational aids, where appropriate;

should comply with all applicable requirements and performance standards adopted by the International Maritime Organization.

1.3 Where the equipment provides a facility additional to the requirements for compliance with the Global Maritime and Safety System (GMDSS) function for which the equipment is being used, the operation of such an additional facility shall not prevent the equipment from complying with the functional requirements of the GMDSS.

## 2 Operation

2.1 The number of operational controls, their design and manner of function, location, arrangement and size should provide for simple effective ergonomic operation. The controls should be arranged in a manner that minimises the risk of inadvertent operation.

2.2 All operational controls shall permit normal adjustments to be performed easily and should be easy to identify from the position from which the equipment is normally operated. Controls not required for normal operation should not be readily accessible.

2.3 The design of the equipment shall be such that any misuse of the controls shall not cause damage to the equipment or chance of injury to personnel.

2.4 No operator control on the equipment shall be able to alter mobile earth station identity.

2.5 Where a digital input panel with the digits "0" to "9" is provided, the digits should be arranged to conform to ITU-T E.161 – Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network.

However where an alphanumeric keyboard layout, as used on office equipment or data processing equipment, is provided the keyboard may be arranged in accordance with ISO Standard 3791 –1976.

2.6 It shall be possible to initiate and make distress alerts and/or distress calls from the position at which the vessel is normally navigated and from any other position designated for distress alerting. In addition, where a room or compartment is provided for radio communications, means to initiate distress alerts and calls should be fitted in that room.

2.7 A distress alert should be activated only by means of a dedicated button. This button should not be a key of an ITU-T digital input panel or an ISO keyboard provided on the equipment.

Clarification of certain requirements in IMO performance standards for GMDSS equipment is contained in IMO MSC Circular 862 dated May 1998; see following quoted extracts.

Quote

*Dedicated Distress Button*

*A dedicated distress button should not be a key of an ITU-T input panel or an ISO keyboard associated with the equipment and should be physically separated from functional buttons/keys used for normal operation. This button should be a single button for no other purpose than to initiate a distress alert.*

*Clearly identified*

*The distress button should be red in colour and marked "DISTRESS". Where a non-transparent protective lid or cover is used, it should also be marked "DISTRESS".*

*Protected against inadvertent activation*

*The required protection of the distress button should consist of a spring loaded lid or cover permanently attached to the equipment by e.g. hinges. It should not be necessary for the user to remove additional seals or to break the lid or cover in order to operate the distress button.*

*The operation of the distress button should generate a visible and audible indication. The distress button should be kept pressed for at least 3 seconds. A flashing light and an intermittent acoustic signal should start immediately. After 3 seconds the transmission of the distress alert is initiated and the indication should become steady.*

*At least two independent actions*

*Lifting of the protective cover or lid is considered the first action. Pressing the distress button as specified above is considered as the second independent action.*

*Interrupting the distress alert at any time*

*It should be possible to interrupt the repetitive transmissions of distress messages. Such operation should not interrupt the transmission of a distress alert or distress message in progress but should prevent repetitive transmissions of a distress message.*

Unquote

2.8 Adequate illumination should be provided within the equipment or in the area where the equipment is situated in order to enable the identification of controls and facilitate the reading of indicators at all times. Where appropriate, means should be provided for dimming the output of any equipment light source that is capable of interfering with navigation.

2.9 Where no other means of receiving distress urgency and safety broadcasts or an addressed distress alert relay are provided, and existing levels of aural signals from the equipment or its peripherals are considered inadequate, the equipment should be configured to actuate an aural/visual alarm of an appropriate level.

2.10 If a unit of equipment is connected to one or more other units of equipment, the performance of each should be maintained.

### 3 Power Supply

3.1 The equipment should normally be powered from the vessel's main source of supply of electrical energy. In addition, it should be possible to operate the equipment and all ancillary equipment necessary for its normal functioning, including the antenna tracking system, from an alternative source of energy.

3.2 If provision is made for operating the equipment from more than one source of electrical energy, arrangements for rapidly changing from one source to the other should be provided, but not necessarily incorporated within the equipment.

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3.3 Changing from one source of supply to another should not render the equipment inoperable or require the equipment to be re-initialised.

3.4 The equipment should continue to operate in accordance with these guidelines in the presence of variations of power supply normally to be expected in a vessel.

3.5 Means should be incorporated for the protection of the equipment from the effects of excessive current, voltage, transients and accidental reversal of power supply polarity.

### 4 Interference and compatibility

4.1 All reasonable and practicable steps should 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 the 1974 SOLAS Convention (as amended). (please refer to IEC standards 60533 and 60945).

4.2 Mechanical noise from equipment should be limited so as not to prejudice the hearing of any sounds on which the safe operation of the vessel may depend.

4.3 Each unit of equipment normally to be installed within the vicinity of a standard or steering magnetic compass should be clearly marked with the minimum safe distance at which it may be mounted from such compasses.

### 5 Safety Precautions

5.1 All steps should be taken to ensure that electromagnetic radio frequency energy radiated from the equipment shall not be a hazard to personnel.

5.2 As far as is practicable, accidental access to dangerous voltages should be prevented. All parts and wiring in which the direct or alternating voltages or both (other than radio frequency voltages) combine to give a peak voltage greater than 55 volts should be protected against accidental access and should be isolated automatically from all sources of electrical energy when the protective covers are removed. Alternatively, the equipment should be so constructed that access to such voltages may only be gained after having used a tool for this purpose, such as a spanner or screwdriver, and warning labels should be prominently displayed both within the equipment and on protective covers.

5.3 Means should be provided for earthing exposed metallic parts of the equipment but this should not cause any terminal of the source of electrical energy to be earthed.

5.4 Radio frequency signals at high radiation levels may be hazardous to health. Since safety regulations may vary from country to country and the actual field distribution around the antenna may be different for the various antenna designs, a single value for the Safe distance to the antenna cannot be standardised.

5.5 Equipment containing elements which are likely to cause X-radiation should comply with the following requirements:

- .1 external X-radiation from the equipment in its normal working condition should not exceed the limits laid down by the Administration concerned;
- .2 when X-radiation can be generated inside the equipment above the levels laid down by the Administration, a prominent warning should be fixed inside the equipment. The precautions to be taken when working on the equipment should be included in the equipment manual; and
- .3 if malfunction of any part of the equipment can cause an increase in X-radiation, adequate advice should be included in the information about the equipment. It should warn of the circumstances that could cause the increase and state the precautions that should be taken.

5.6 Provision should be made for protecting the equipment from excessive rise of temperature due to failure in any cooling system associated with the equipment.

Means may be provided for reducing the level of acoustic alarms. It should not be possible to disable any acoustic alarm.

### 6 Maintenance

6.1 The equipment should be so designed that the main units can be replaced readily, without elaborate recalibration or readjustment.

6.2 Equipment should be so constructed and installed that it is readily accessible for inspection and maintenance purposes.

6.3 Adequate information should be provided to enable the equipment to be properly operated and maintained:

- .1 in the case of equipment so designed that fault diagnosis and repair is practicable down to component level, it should include full circuit diagrams, component layouts and a components parts list; and
- .2 in the case of equipment containing complex modules in which fault diagnosis and repair down to component level is not practicable, it should contain sufficient information to enable a defective complex module to be located, identified and replaced.

The requirements of .1 above should be met in respect of other modules and those discrete components which do not form part of modules.

### 7 Marking and Identification

7.1 Each unit of the equipment should be externally marked with the following information, which should be clearly visible in the normal installed position:

- .1 identification of the manufacturer;
- .2 equipment type/number or model identification under which it was type tested; and
- .3 serial number of the unit
- .4 Optionally, software version

7.2 The power supply or supplies from which the equipment is intended to operate should be clearly indicated

7.3 A label displaying the distances from the antenna which result in radiation levels of  $100 \text{ W/m}^2$ ,  $25 \text{ W/m}^2$ ,  $10 \text{ W/m}^2$  and preferably  $5 \text{ W/m}^2$  should be attached to or nearby the antenna system and should be clearly visible in the normal operating position. Warning labels should be installed at appropriate locations so as to warn personnel against entering a hazardous area.

### 8 Durability and resistance to environmental conditions

8.1 Equipment should be capable of continuous operation under the conditions of various sea states, ship's motion, vibration, humidity and temperature likely to be experienced in ships.

8.2 The ship earth station equipment and facilities should be capable of operating satisfactorily in a marine environment. All metal surfaces including cabinets, racks, panels or enclosures should be resistant to or suitably treated against corrosion.

### 9 Installation

Equipment should be installed in such a manner that it can operate in accordance with these Guidelines.

### 10 Construction

10.1 In all respects, the mechanical and electrical design, construction and the finish of the equipment should conform to good standards of engineering practice, particularly with regard to reliability and safety. The equipment should be suitable for use on board ships at sea (IEC Publication 60092-101 Electrical Installations in Ships: Definitions and general requirements)

10.2 In view of possible operation of Inmarsat ship earth stations in ports while loading and unloading hazardous fuels or gases, the use of components that may, under normal operating conditions, produce arcs or

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sparks (motors using brushes, encapsulated relays, switches) or produce excessive heat (electric heaters) should be avoided. Where such equipment is included in the Above Deck Equipment, clear reference to this fact should be included in the manufacturer's description.

### 11 Testing

11.1 The equipment should be designed with attention to equipment reliability, ease of testing and maintenance.

11.2 It would be advantageous if the design were to include self-diagnostic facilities with measuring points and indicators for efficient fault finding.

11.3 The equipment should be tested in accordance with the relevant International Electrotechnical Commission standards (see Introduction, page 1).

### 12 Antenna/Above Deck Equipment (ADE)

12.1 For specific siting of different antennas/above deck equipment please refer to the relevant Annex.

12.2 Avoid siting the ADE at the following locations:

- .1 At the same level as other antennas (e.g. radar, GPS, other MESSs)
- .2 Where ship's personnel may be exposed to hazardous radiation;
- .3 close to the funnel or other locations which are subject to excessive pollution, since contamination of the ADE may result in signal degradation;
- .4 where the antenna may be exposed to excessive temperatures;
- .5 where the antenna may be subject to excessive vibration and shock. Avoid in particular locations affected by vibrations induced by the main engine/propeller whilst at sea.

12.3 The above-deck equipment should be separated, as far as is practicable, from the antennae of other communication and navigation equipment.

12.4 Particular directions, which result in obstruction of the main beam of the antenna, should be recorded and retained within the ship. This will enable a prediction of particular ship's locations and headings where degradation in performance may be expected.

12.5 The strength of the antenna mounting should be sufficient to withstand:

- .1 the joint weight of the ADE and a covering of ice and snow; and
- .2 the bending moment caused by the maximum values of pitch, roll and wind pressure that could be expected (taking a gust factor into account)

12.6 If a pedestal mount is used, it should be designed to minimise any vibration. Resonant frequencies near to those of the ADE should be avoided. Manufacturers are urged to provide such information to enable this requirement to be met.

High pedestals should be provided with platforms or steps for easy access and a guard rail for the safety of service personnel.

Pedestals should preferably leave a clearance of about 70 cm or more between the base of the ADE and the installation deck or platform for easy access. Where this is not the case, access should be possible through the platform or deck above which the ADE is mounted.

12.7 The ADE should be provided with a safe and easy means of access for maintenance. Where a pedestal mount is provided, it must provide for:

- .1 the routing of cables; and
- .2 safe access to the ADE for maintenance

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If possible, access to the ADE should open inwards. This is to avoid accidents, e.g. falling tools. It is also recommended that provision be made for the connection of a working lamp to the main power supply in the ADE.

At sea, any unsecured door or hatch constitutes a hazard, since it will be subject to violent motions in rough weather. Access hatches should be capable of being secured both in the open and closed condition.

The atmosphere within the ADE may become contaminated by gases and fumes from funnel exhausts or cargo spaces. Care is necessary when entering and working within the ADE to avoid the risk of asphyxiation.

Care should be taken to avoid accidental activation of the transmitter or antenna steering system whilst personnel are within the hazardous zone of the ADE, if activation poses a threat to their safety.

12.8 Means should be provided to enable metal components and structures within the ADE to be earthed to the vessels hull.

## **Annex A – System specific guidelines for Inmarsat B**

### **A1 Technical Requirements**

A1.1 The Mobile Earth Station equipment shall be of a type approved by Inmarsat Ltd. and should comply with the environmental conditions specified in the Inmarsat System Definition Manual (SDM) for Inmarsat B and, where applicable, IEC 60945. Operational and performance requirements should be tested in accordance with IEC 61097-10.

### **A2 Operation**

*Clarification of certain requirements on distress alerting in IMO performance standards for GMDSS equipment is contained in IMO MSC Circular 862 of 22 May 1998.*

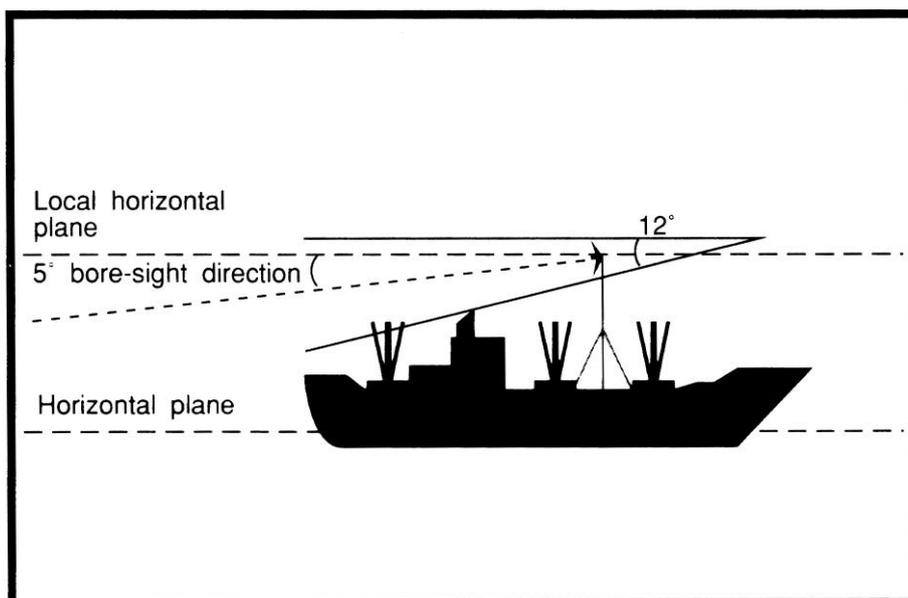
(See page 4)

### **A3 Power Supply**

A3.1 Changing from one source of supply to another or any interruption of up to 60 s duration of the supply of electrical energy should not require the equipment to be manually re-initialised and should not result in loss of received messages stored in the memory.

### **A4 Antenna Siting**

A4.1 For directional antennae, the ADE should be located high enough and in such a position that no obstacles appear in any azimuth directions down to -5 degrees elevation. This means that there should be no obstacle within the main beam of the antenna, which can be shaped as a 12 degrees angle cone emanating from the perimeter of the antenna reflector, as shown in Figure A1.



**Figure A1: Above Deck Equipment /Antenna Location Inmarsat B**

A4.2 The siting of the antenna needs careful consideration, taking into account the adverse effect of high levels of vibration which might be introduced by the use of a tall mast and the need to minimize shadow sectors. Objects, especially those within 10 m of the radome which cause a shadow sector of greater than 6 degrees, are likely to significantly degrade the performance of the equipment.

A4.3 In practice, the presence of some metallic objects in the propagation path between the antenna and the satellite is difficult to avoid for all azimuth directions. Preferably, all obstructions within 3 m of the antenna should be avoided. In general, obstructions less than 15 cm in diameter can be ignored beyond this distance.

A4.4 Particular directions, which result in obstruction of the main beam of the antenna, should be recorded and retained within the ship. This will enable a prediction of particular ship's locations and headings where degradation in performance may be expected.

**A5 Cross References**

A5.1 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 as applicable to Inmarsat B.

| IMO A.694(17) | Inmarsat B  |
|---------------|-------------|
| 1.1           | See Note A1 |
| 1.2           | 1.3         |
| 2             | 9           |
| 3.1           | 2.1         |
| 3.2           | 2.2         |
| 3.3           | 2.8         |
| 3.4           | 2.3         |
| 3.5           | 2.10        |
| 3.6           | 2.5         |
| 4.1           | 3.4         |
| 4.2           | 3.5         |
| 4.3           | 3.2         |
| 5             | 8.1         |
| 6.1           | 4.1         |
| 6.2           | 4.2         |

| IMO A.694(17) | Inmarsat B |
|---------------|------------|
| 6.3           | 4.3        |
| 7.1           | 5.2        |
| 7.2           | 5.3        |
| 7.3           | 5.1        |
| 7.4.1         | 5.5.1      |
| 7.4.2         | 5.5.2      |
| 7.4.3         | 5.5.3      |
| 8.1           | 6.1        |
| 8.2           | 6.2        |
| 8.3.1         | 6.3.1      |
| 8.3.2         | 6.3.2      |
| 9.1           | 7.1.1      |
| 9.2           | 7.1.2      |
| 9.3           | 7.1.3      |

**Note A1:** *References to the applicability of General Requirements and Performance Standards are covered in the Introduction on page 1.*

A5.2 IMO Resolution A.808(19) “Recommendation on performance standards for ship earth stations capable of two-way communications” as applicable to Inmarsat B.

| IMO A.808(19) | Inmarsat B |
|---------------|------------|
| 1             | A3.1       |
| 2             | 1.1        |
| 3.1           | 2.4        |
| 3.2           | 2.6        |
| 3.3           | 2.9        |
| 3.4           | 2.6        |
| 3.5           | 2.7        |
| 3.6.1         | 2.7        |

| IMO A.808(19) | Inmarsat B |
|---------------|------------|
| 3.6.2         | 2.7        |
| 3.7           | 2.7        |
| 4             | 7.3        |
| 5.1           | 3.1        |
| 5.2           | 3.3        |
| 6.1           | A4.1       |
| 6.2           | A4.2       |
| 6.3           | 12.3       |

## **Annex B – System specific guidelines for Inmarsat C**

### **B1 Introduction**

B1.1 The enhanced group call equipment shall be capable of producing a printed copy of received information. Received EGC messages may be stored, with indication that the message has been received, for later printing except Maritime Safety Information (MSI) which has been designated “Urgency” or “Distress” priority, which shall be printed out upon receipt.

B1.2 The enhanced group call installation may be either separate or combined with other installations.

### **B2 Technical Requirements**

B2.1 The Mobile Earth Station equipment shall be of a type approved by Inmarsat Ltd. and should comply with the environmental conditions specified in the Inmarsat System Definition Manual (SDM) for Inmarsat C and, where applicable, IEC 60945. Operational and performance requirements should be tested in accordance with IEC 61097-4.

### **B3 Operation**

B3.1 Facilities should be provided to automatically update the ship’s position at the time at which the position was determined from a suitable electronic position-fixing device which may be an integral part of the equipment. For equipment which does not have an integral electronic position-fixing device, such facilities should include a suitable interface conforming to the appropriate international standard.

B3.2 Provision should also be made for manual entry of position information and of the time at which the position was determined.

B3.3 An alarm should be activated when no position data is received from the electronic position-fixing device or, in the case of manual input, the position information is over 4 hours old. Any position information not updated for more than 24 hours should be clearly identified (*applies to Inmarsat C ship earth stations, which forms part of the GMDSS, if installed on or after 23 November 1996*).

B3.4 Means should be provided to enter the ship’s position and area code manually so that area group calls can be received. Optionally, the ship’s position, as determined by the navigational equipment, may be entered automatically and the area code automatically derived therefrom.

B3.5 Provision shall be made for a specific audio/visual indication at the position from which the vessel is normally navigated to indicate receipt of a distress or urgency message. It should not be possible to disable this alarm. It should only be possible to reset this alarm manually.

B3.6 The equipment should indicate when it is not correctly tuned or synchronised to the enhanced group call carrier.

B3.7 Any message should be printed irrespective of the character error rate of its reception. A low line mark should be printed whenever a character is received mutilated.

B3.8 Means should be provided not to reprint the same message after it has been received without error.

B3.9 Acceptance or rejection of service code types shall be under operator control except that the receiver shall always receive relevant navigational warnings, meteorological warnings, SAR information and “To mobile” distress alerts which are directed to a geographical area within which the ship is operating.

B3.10 The printing device should be capable of printing at least the International Alphabet 5 (IA5) character set. Other character sets may optionally be used.

B3.11 The printing device should be able to print at least 40 characters per line.

B3.12 The signal processor and printing device should ensure that if a word cannot be accommodated in full in a line it should be transferred to the next line. The printing device should automatically feed 5 lines after completing the printed message.

B3.13 A local audible alarm shall be sounded to give advanced warning of a printer “low paper” condition.

**B4 Power Supply**

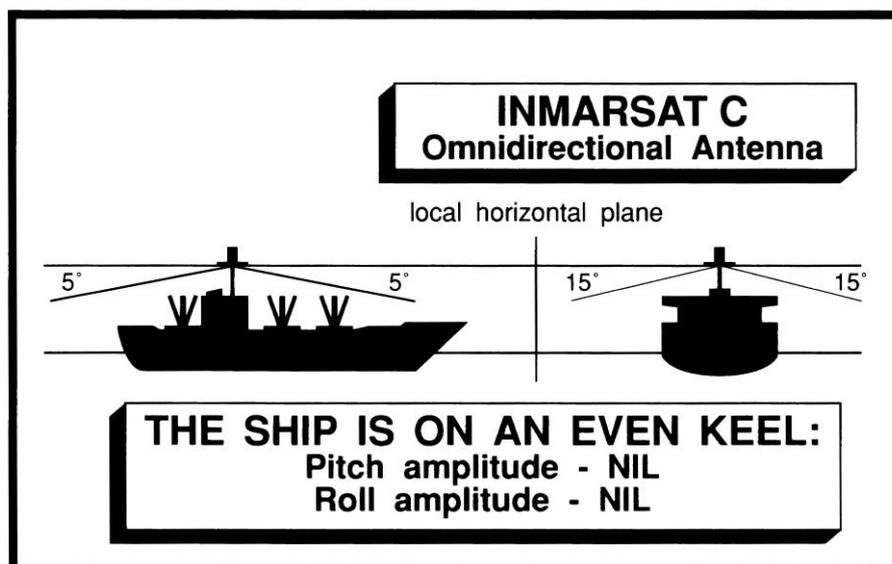
B4.1 The ship earth station including enhanced group call equipment should normally be powered from the ship's main source of supply of electrical energy. In addition, it should be possible to operate the ship earth station, the enhanced group call receiver and all equipment necessary for its normal functioning from an alternative source of energy.

B4.2 Changing from one source of supply to another or any interruption of up to 60 s duration of the supply of electrical energy should not require the equipment to be manually re-initialised and should not result in loss of received messages stored in the memory.

**B5 Antenna siting**

B5.1 An omni-directional antenna for ship earth stations should, if practicable, and for EGC receivers it is desirable that the antenna be sited in such a position that no obstacle likely to degrade significantly the performance of the equipment appears in the fore and aft directions down to  $-5$  degrees and in the port and starboard directions down to  $-15$  degrees, as shown in Figure C1.

B5.2 For omni-directional antennas, objects, especially those within 1 metre of the antenna, which cause a shadow sector of greater than 2 degrees, are likely to degrade significantly the performance of the equipment.



**Figure B1: Above Deck Equipment/Antenna Location Inmarsat C**

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### B6 Cross References

B6.1 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 as applicable to Inmarsat C.

| IMO A.694(17) | Inmarsat C  |
|---------------|-------------|
| 1.1           | See Note B1 |
| 1.2           | 1.3         |
| 2             | 9           |
| 3.1           | 2.1         |
| 3.2           | 2.2         |
| 3.3           | 2.8         |
| 3.4           | 2.3         |
| 3.5           | 2.10        |
| 3.6           | 2.5         |
| 4.1           | 3.4         |
| 4.2           | 3.5         |
| 4.3           | 3.2         |
| 5             | 8.1         |
| 6.1           | 4.1         |
| 6.2           | 4.2         |

| IMO A.694(17) | Inmarsat C |
|---------------|------------|
| 6.3           | 4.3        |
| 7.1           | 5.2        |
| 7.2           | 5.3        |
| 7.3           | 5.1        |
| 7.4.1         | 5.5.1      |
| 7.4.2         | 5.5.2      |
| 7.4.3         | 5.5.3      |
| 8.1           | 6.1        |
| 8.2           | 6.2        |
| 8.3.1         | 6.3.1      |
| 8.3.2         | 6.3.2      |
| 9.1           | 7.1.1      |
| 9.2           | 7.1.2      |
| 9.3           | 7.1.3      |

**Note B1:** References to the applicability of General Requirements and Performance Standards are covered in the Introduction on page 1.

B6.2 IMO Resolution A.664(16) “Performance Standards for Enhanced Group Call Equipment” as applicable to Inmarsat C .

| IMO A.664(16) | Inmarsat C |
|---------------|------------|
| 1.1           | B6.1       |
| 1.2           | B1.1       |
| 1.3           | B1.2       |
| 2             | B2.1       |
| 3.1           | B3.4       |
| 3.2           | B3.5       |
| 3.3           | B3.6       |
| 3.4           | B3.7       |
| 3.5           | B3.9       |
| 3.6           | B3.8       |

| IMO A.664(16) | Inmarsat C |
|---------------|------------|
| 3.7           | B3.10      |
| 3.8           | B3.11      |
| 3.9           | B3.12      |
| 4.1           | B4.1       |
| 4.2           | B4.2       |
| 5.1           | B5.1       |
| 5.2           | B5.3       |
| 5.3           | B5.2       |
| 5.4           | B5.3       |

B6.3 IB Resolution A.807(19) “Performance standards Inmarsat C ship earth stations capable of transmitting and receiving direct printing communications” as applicable to Inmarsat C.

| IMO A.807(19) | Inmarsat C |
|---------------|------------|
| 1.1           | B6.1       |
| 1.2           | B6.2       |
| 2             | B2.1       |
| 3.1           | 2.4        |
| 3.2           | 2.6        |
| 3.3           | 2.7        |
| 3.4           | 2.7        |
| 3.5           | 2.7        |

| IMO A.807(19) | Inmarsat C |
|---------------|------------|
| 3.6           | B3.1       |
| 3.8.1         | B3.1       |
| 3.8.2         | B3.2       |
| 4             | 7.3        |
| 5.1           | B4.1       |
| 5.2           | B4.2       |
| 6.1           | B5.1/B5.2  |
| 6.1           | B5.3       |

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- B6.4 IMO Resolution MSC.68(68), Annex 4 “Amendments to Resolution A.807(19) – “Performance standards for Inmarsat C ship earth stations capable of transmitting and receiving direct printing communications” as applicable to Inmarsat C.

| IMO MSC.68(68),<br>Annex 4 | Inmarsat C |
|----------------------------|------------|
| 3.8                        | B3.1       |
| 3.9                        | B3.2       |
| 3.10                       | B3.3       |

## **Annex C – System specific guidelines for Inmarsat F77**

### **C1 Technical Requirements**

C1.1 The Mobile Earth Station equipment shall be of a type approved by Inmarsat Ltd. and should comply with the environmental conditions specified in the Inmarsat System Definition Manual (SDM) for Inmarsat F77 and, where applicable, IEC 60945. Operational and performance requirements should be tested in accordance with IEC 61097-13

### **C2 Operation**

*Clarification of certain requirements on distress alerting in IMO performance standards for GMDSS equipment is contained in IMO MSC Circular 862 of 22 May 1998.*

(See page 4)

C2.1 A distress call should be activated only by means of a dedicated button. This button should not be a key of an ITU-T digital input panel or an ISO keyboard provided on the equipment.

C2.2 Any system currently being designed for use in the GMDSS after 1 February 1999 should be able to recognize the four levels of priority as described in paragraph E2.5.

C2.3 Mobile-satellite communication systems and coast earth stations used for providing other mobile-satellite communications in addition to maritime communications should be capable of automatically recognizing requests for maritime communications from:

- .1 ship earth stations; and
- .2 recognized entities of importance for safety at sea, such as MRCCs, hydrographic and meteorological offices, medical centres, etc., registered with the coast earth station.

C2.4 The system should process such maritime communications in the ship-to-shore and shore-to-ship directions for levels 1 to 3 with priority over other communications.

C2.5 The satellite system and the coast earth stations should be capable of processing maritime distress, urgency, safety and routine communications in accordance with the message priority as defined by the ITU Radio Regulations. The order of processing these communications should be:

- .1 distress;
- .2 urgency;
- .3 safety; and
- .4 other communications.

C2.6 In processing maritime distress, urgency, safety and routine communications, the satellite system and the coast earth stations should be capable of:

- .1 automatically recognizing the message or access priority for ship-to-shore communications;
- .2 automatically recognizing the message or access priority for shore-to-ship communications from, as a minimum, recognized entities of importance for safety at sea, registered by the coast earth station;
- .3 preserving and transferring the priority;
- .4 giving distress alerts and distress messages immediate access, if necessary by pre-emption of ongoing communications of level 4;
- .5 automatically recognizing maritime distress communications, and of routing automatically maritime distress alerts/messages directly to the associated MRCC, or responsible RCC if this capability exists; and

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- .6 processing maritime urgency and safety communications in the ship-to-shore and shore-to-ship directions with adequate priority, for example by allocating the first vacant channel, if no channel is immediately available.
- .7 Selection and use of message or access priority for urgency and safety transmissions by ship earth stations should preferably be automatic and should be restricted to calls to special, recognized entities such as medical centres, maritime assistance, hydrographic and meteorological offices, etc., as defined for the coast earth station. The coast earth station should automatically route such calls directly to the relevant entity.

### C3 Reception of distress alerts

The satellite system should allow for addressing a maritime distress alert to a specific coast earth station chosen by the ship's operator and covering the area concerned, but should also provide for automatic routing of manually initiated maritime distress alerts even if no specific CES is selected.

### C4 Control of ship earth stations

Access control arrangements for controlling and giving, or temporarily rejecting, access for ship earth stations to the system should at any time allow ship earth stations access for transmission of maritime distress alerts/calls and distress messages.

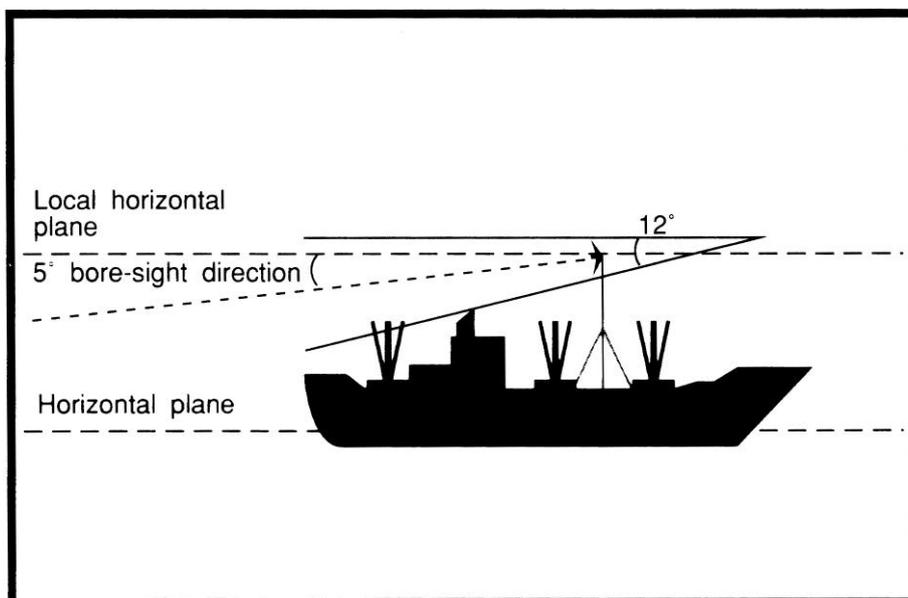
### C5 Test facilities

The system should provide facilities making it possible for ship earth stations to test the distress capability of their stations without initiating a distress alert/call.

### C6 Power Supply

C6.1 Changing from one source of supply to another or any interruption of up to 60 s duration of the supply of electrical energy should not require the equipment to be manually re-initialised and should not result in loss of received messages stored in the memory.

**C7 Antenna Siting** C7.1 For directional antennae, the ADE should be located high enough and in such a position that no obstacles appear in any azimuth directions down to -5 degrees elevation. This means that there should be no obstacle within the main beam of the antenna, which can be shaped as a 12 degrees angle cone emanating from the perimeter of the antenna reflector, as shown in Figure E1.



**Figure C1: Above Deck Equipment /Antenna Location Inmarsat F77**

C7.2 The siting of the antenna needs careful consideration, taking into account the adverse effect of high levels of vibration which might be introduced by the use of a tall mast and the need to minimize shadow sectors. Objects, especially those within 10 m of the radome which cause a shadow sector of greater than 6 degrees, are likely to significantly degrade the performance of the equipment.

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C7.3 In practice, the presence of some metallic objects in the propagation path between the antenna and the satellite is difficult to avoid for all azimuth directions. Preferably, all obstructions within 3 m of the antenna should be avoided. In general, obstructions less than 15 cm in diameter can be ignored beyond this distance.

C7.4 Particular directions, which result in obstruction of the main beam of the antenna, should be recorded and retained within the ship. This will enable a prediction of particular ship's locations and headings where degradation in performance may be expected.

### C8 Cross References

C8.1 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 as applicable to Inmarsat F77.

| IMO A.694(17) | Inmarsat F77 |
|---------------|--------------|
| 1.1           | See Note C1  |
| 1.2           | 1.3          |
| 2             | 9            |
| 3.1           | 2.1          |
| 3.2           | 2.2          |
| 3.3           | 2.8          |
| 3.4           | 2.3          |
| 3.5           | 2.10         |
| 3.6           | 2.5          |
| 4.1           | 3.4          |
| 4.2           | 3.5          |
| 4.3           | 3.2          |
| 5             | 8.1          |
| 6.1           | 4.1          |
| 6.2           | 4.2          |

| IMO A.694(17) | Inmarsat F77 |
|---------------|--------------|
| 6.3           | 4.3          |
| 7.1           | 5.2          |
| 7.2           | 5.3          |
| 7.3           | 5.1          |
| 7.4.1         | 5.5.1        |
| 7.4.2         | 5.5.2        |
| 7.4.3         | 5.5.3        |
| 8.1           | 6.1          |
| 8.2           | 6.2          |
| 8.3.1         | 6.3.1        |
| 8.3.2         | 6.3.2        |
| 9.1           | 7.1.1        |
| 9.2           | 7.1.2        |
| 9.3           | 7.1.3        |

**Note C1:** References to the applicability of General Requirements and Performance Standards are covered in the Introduction on page 1.

C8.2 IMO Resolution A.888(21) "Criteria for the provision of Mobile-Satellite communication systems in the Global Maritime Distress and Safety System (GMDSS)" as applicable to Inmarsat F77.

| IMO A.888(21) | Inmarsat F77 |
|---------------|--------------|
| 3.3.1.1       | C2.3/C2.4    |
| 3.3.1.2       | C2.5         |
| 3.3.1.2.1     | C2.3.1       |
| 3.3.1.2.2     | C2.5.2       |
| 3.3.1.2.3     | C2.5.3       |
| 3.3.1.2.4     | C2.5.4       |
| 3.3.1.3.1     | C2.6.1       |
| 3.3.1.3.2     | C2.6.2       |

| IMO A.888(21) | Inmarsat F77 |
|---------------|--------------|
| 3.12          | C5           |
| 3.3.1.3.3     | C2.6.3       |
| 3.3.1.3.4     | C2.6.4       |
| 3.3.1.3.5     | C2.6.5       |
| 3.3.1.3.6     | C2.6.6       |
| 3.3.1.4       | C2.6.7       |
| 3.10          | C3           |
| 3.11          | C4           |

C8.3 IMO Resolution A.808(19) "Recommendation on performance standards for ship earth stations capable of two-way communications" as applicable to Inmarsat F77.

| IMO A.808(19) | Inmarsat F77 |
|---------------|--------------|
| 1             | C8.1         |
| 2             | 1.1          |
| 3.1           | 2.4          |
| 3.2           | 2.6          |
| 3.3           | 2.9          |
| 3.4           | 2.6          |
| 3.5           | 2.7          |
| 3.6           | 2.7          |

| IMO A.808(19) | Inmarsat F77 |
|---------------|--------------|
| 3.7           | 2.7          |
| 4             | 7.3          |
| 5.1           | 3.1          |
| 5.2           | 3.3          |
| 6.1           | C7.1         |
| 6.2           | C7.2         |
| 6.3           | 12.3         |

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### Glossary

| Abbreviation     | Description  |
|------------------|--|
| ADE              | Above Decks Equipment  |
| ALC              | Automatic level control  |
| BDE              | Below Decks Equipment  |
| CCIR             | Previous name for ITU-R  |
| CCITT            | Previous name for ITU-T  |
| CES              | Coast Earth Station  |
| DIGs             | Design and Installation Guidelines                                       |
| EGC              | Enhanced Group Call (Inmarsat C)   |
| ELT              | Emergency Locator Transmitter  |
| EPIRB            | Emergency Position Indicating Radio Beacon                               |
| GMDSS            | Global Maritime Distress and Safety System                               |
| grp              | Glass reinforced plastic   |
| HF               | High Frequency   |
| IEC              | International Electrotechnical Commission                                |
| IHO              | International Hydrographic Office  |
| IMO              | International Maritime Organisation                                      |
| IMSO             | International Mobile Satellite Organisation                              |
| ITU              | International Telecommunication Union                                    |
| ITU-R            | ITU Radiocommunication sector (formerly CCIR)                            |
| ITU-T            | ITU Telecommunication Standardisation Sector (formerly CCITT)            |
| LCD              | Liquid Crystal Display   |
| LES              | Land Earth Station   |
| MES              | Mobile Earth Station   |
| MF               | Medium Frequency   |
| MRCC             | Maritime Rescue Co-ordination Centre                                     |
| MSC              | Maritime Safety Committee (IMO)  |
| MSI              | Maritime Safety Information  |
| NCS              | Network Co-ordination Station (Inmarsat)                                 |
| NOC              | Network Operations Centre (Inmarsat)                                     |
| Radome           | Protective housing for satellite terminal antenna, usually made from grp |
| RCC              | Rescue Co-ordination Centre  |
| RF               | Radio Frequency  |
| RR               | Radio Regulations  |
| SafetyNET        | Service used to promulgate MSI using Inmarsat C                          |
| SAR              | Search and Rescue  |
| SART             | Search and Rescue Transponder  |
| SDM              | System Definition Manual   |
| SES              | Ship Earth Station   |
| SOLAS            | International Convention for the Safety of Life at Sea, 1974, as amended |
| TRD              | Technical Requirements Document  |
| VDU              | Visual Display Unit  |
| VHF              | Very High Frequency  |
| W/m <sup>2</sup> | Watts per square metre (a measurement of radiated power)                 |
| WMO              | World Meteorological Organisation  |
| WWNWS            | World Wide Navigational Warning System                                   |

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