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COM/Circ.103
31 May 1990

BSH

Ref. A1/A/5 INMARSAT

DESIGN AND INSTALLATION GUIDELINES FOR INMARSAT
STANDARD-C SHIP EARTH STATIONS AND ENHANCED
GROUP CALL (EGC) RECEIVERS

The Maritime Safety Committee at its fifty-eight session (MSC 58/25, paragraph 9.21) approved for circulation to Member Governments for information the Design and Installation Guidelines for INMARSAT Standard-C ship earth stations and enhanced group call (EGC) receivers, attached.

W/3843e

ANNEX**DESIGN AND INSTALLATION GUIDELINES
FOR STANDARD-C SHIP EARTH STATION****PURPOSE AND SCOPE**

Mandatory and optional specifications for Standard-C ship earth stations are defined in the Technical Requirements for INMARSAT Standard-C Ship Earth Stations hereby referred to as the TRD (Standard-C System Definition Manual, Module 4). This is published by INMARSAT with a view to ensuring that ship earth stations will perform adequately and not endanger the integrity of the system operation.

These Guidelines provide general information on design and installation of ship earth stations as well as on safety aspects and electromagnetic compatibility with other equipment.

The Guidelines are arranged in two parts.

The text of Part A reflects performance standards that have been adopted by the International Maritime Organization (IMO) in two of their documents:

General Requirements for Shipborne Radio Equipment Forming Part of the Future Global Maritime Distress and Safety System, IMO Resolution A.569(14); and Performance Standards for INMARSAT Standard-C Ship Earth Stations, capable of transmitting and receiving direct-printing communications, IMO Assembly Resolution A.663(16).

These IMO documents will form the basis for national licensing requirements for those ship earth stations which are used to satisfy the carriage requirements of the SOLAS Convention.

For all other ship earth stations, both Part A and Part B should be interpreted as suggested guidelines with the following qualifications:

- (a) INMARSAT makes type-approval a mandatory condition of access to the INMARSAT system (refer to Section A1.1);
- (b) the additional ship motion conditions for a stabilized antenna specified in the TRD for optional capabilities are non-mandatory recommendations from INMARSAT's point of view. Alternative or restricted ranges of environmental conditions may be appropriate for particular applications (refer to Section A1.1); and
- (c) the INMARSAT TRD does not specify the capability to initiate distress calls from locations other than the position at which the ship earth station is normally operated, as a mandatory requirement (refer to paragraph A3.1).

Part B contains supplementary guidelines on design and installation aspects.

PART A DESIGN AND INSTALLATION ASPECTS

A1 TECHNICAL REQUIREMENTS

A1.1 The ship earth station should be type-approved by INMARSAT and should comply with the environmental conditions specified in the INMARSAT technical requirements for Standard-C ship earth stations.

A1.2 Where equipment provides a facility which is additional to the minimum requirements of Part A, the operation and, as far as is reasonably practicable, any malfunction of such an additional facility should not prevent the equipment from complying with Part A.

A1.3 The performance of any Enhanced Group Call facility provided by the ship earth station should be in accordance with the Design and Installation Guidelines for Enhanced Group Call receivers.

A2 CONTROLS

A2.1 The number of operational controls, their design and manner of function, location, arrangement and size, should provide for simple, quick and effective operation. The controls should be arranged in a manner which minimizes the chance of inadvertent operation.

A2.2 All operational controls should permit normal adjustments to be performed easily and should be easy to identify from the position at which the equipment is normally operated. Controls not required for normal operation should not be readily accessible.

A2.3 The design of the equipment should be such that misuse of the controls should not cause damage to the equipment or injury to personnel.

A2.4 No control external to the equipment should be available for alteration of the ship earth station identity.

A2.5 Where a digital input panel with the digits "0" to "9" is provided, the digits should be arranged to conform with the relevant CCITT Recommendations.¹

A3 OPERATION

A3.1 It should be possible to initiate and make distress calls from the position at which the ship is normally navigated and from at least one other position designated for distress alerting. The means for initiating a distress call should be easy to operate and protected against inadvertent activation.

A3.2 Adequate illumination should be provided in the equipment or in the ship to enable identification of controls and facilitate reading of indicators at all times. Where appropriate, means should be provided for dimming the output of any equipment light source which is capable of interfering with navigation.

1 CCITT Recommendation E.161/Q.11

A4 POWER SUPPLY

A4.1 The ship earth station should normally be powered from the ship's main source of electrical energy. In addition, it should be possible to operate the ship earth station and all equipment necessary for its normal functioning, including the antenna tracking system, where provided, from an alternative source of energy.

A4.2 If provision is made for operating 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 in the equipment.

A4.3 Changing from one source of supply to another or any interruption up to 60 seconds duration of the supply of electrical energy should not require the equipment to be manually re-initialized and should not lose received messages stored in the memory.

A4.4 Equipment should continue to operate in accordance with these Guidelines in the presence of variations of power supply normally to be expected in a ship.

A4.5 Means should be incorporated for the protection of equipment from the effects of excessive current, voltage, transients and accidental reversal of the power supply polarity.

A5 INTERFERENCE AND COMPATIBILITY

A5.1 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 Chapter IV and Chapter V of the 1974 SOLAS Convention.²

A5.2 Mechanical noise from all units should be limited so as not to prejudice the hearing of sounds on which the safety of the ship might depend.

A5.3 Each unit of equipment normally to be installed in the vicinity of a standard or a steering magnetic compass should be clearly marked with the minimum safe distance at which it may be mounted from such compasses.

A5.4 If any equipment is connected to one or more other devices, the performance of each should be maintained.

A6 SAFETY PRECAUTIONS

A6.1 All steps should be taken to ensure that electromagnetic radio frequency energy radiated from the equipment shall not be a hazard to personnel.

2 IEC Publication 533, "Electromagnetic Compatibility of Electrical and Electronic Installations in Ships"

A6.2 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.

A6.3 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.

A6.4 In order to permit a warning of potential radiation hazards to be displayed in appropriate locations, a label should be attached to the radome indicating the distances external to the radome at which radiation levels of 100 W/m^2 , 25 W/m^2 and 10 W/m^2 exist. However, the distances which are within a radome need not be indicated.

A6.5 Equipment containing elements such as vacuum tubes which are likely to cause X-radiation should comply with the following requirements:

- (a) external X-radiation from the equipment in its normal working condition should not exceed the limits laid down by the Administration concerned;
- (b) 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
- (c) 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.

A7 MAINTENANCE

A7.1 The equipment should be so designed that the main units can be replaced readily, without elaborate recalibration or readjustment.

A7.2 Equipment should be so constructed and installed that it is readily accessible for inspection and maintenance.

A7.3 Adequate information should be provided to enable the equipment to be properly operated and maintained:

- (a) 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

- (b) 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 (a) above should be met in respect of other modules and those discrete components which do not form part of modules.

A8 MARKING AND IDENTIFICATION

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

- (a) identification of the manufacturer;
- (b) equipment type/number or model identification under which it was type tested; and
- (c) serial number of the unit.

A9 DURABILITY AND RESISTANCE TO ENVIRONMENT

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.³

A10 INSTALLATION

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

A11 ANTENNA SITING

A11.1 Where an omnidirectional antenna is used, it should, if practicable, 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.

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

A11.2 Where a stabilized directive antenna is used, it should, if practicable, be sited in such a position that no obstacle, likely to degrade significantly the performance of the equipment, appears in any azimuth down to -5 degrees.

For directive antennas with a gain of approximately 20 dBi, objects, especially those within 10m of the antenna, which cause a shadow sector of greater than 6 degrees, are likely to degrade significantly the performance of the equipment.

3 IEC Standard Publication 92-101, "Electrical Installations in Ships".

**CROSS-INDEX BETWEEN IMO DOCUMENTS AND INMARSAT
DESIGN AND INSTALLATION GUIDELINES, PART A**

- 1 General requirements for shipborne radio equipment forming part of the Future Global Maritime Distress and Safety System. IMO Resolution A.569(14) adopted on 20 November 1985.

The table below enables each paragraph of the IMO document to be related to the corresponding paragraphs of the INMARSAT Design and Installation Guidelines.

IMO DOCUMENT	INMARSAT PART A DIG
1.1	See note 1
1.2	A1.2
2	A10
3.1	A2.1
3.2	A2.2
3.3	A3.2
3.4	A2.3
3.5	A5.4
3.6	A2.5
4.1	A4.4
4.2	A4.5
4.3	A4.2
5	A9
6.1	A5.1
6.2	A5.2
6.3	A5.3
7.1	A6.2
7.2	A6.3
7.3	A6.1
7.4	A6.5
7.4.1	A6.5a
7.4.2	A6.5b
7.4.3	A6.5c
8.1	A7.1
8.2	A7.2
8.3	A7.3
8.3.1	A7.3a
8.3.2	A7.3b
9	A8
9.1	A8a
9.2	A8b
9.3	A8c

Note 1: References to the applicability of General Requirements and Performance Standards are covered by the introductory section of the Design and Installation Guidelines, entitled "Purpose and Scope".

2 **Performance Standards for INMARSAT Standard-C Ship Earth Stations capable of transmitting and receiving direct printing communications. IMO Assembly Resolution A.663(16).**

The table below enables each paragraph of the IMO document to be related to the corresponding paragraphs of the INMARSAT Design and Installation Guidelines.

IMO DOCUMENT	INMARSAT PART A DIG
1.1	See note 1
1.2	A1.3
2	A1.1
3.1	A2.4
3.2	A3.1
4	A6.4
5.1	A4.1
5.2	A4.3
6.1	A11.1
6.2	A11.2

Note 1: References to the applicability of General Requirements and Performance Standards are covered by the introductory section of the Design and Installation Guidelines, entitled "Purpose and Scope".

3 **INMARSAT Design and Installation Guidelines**

The table below enables each paragraph to be related to the corresponding paragraphs of the IMO documents.

INMARSAT	IMO DOCUMENTS	
	SRE*	SES**
Part A DIG		
Note 1	1.1	1.1
A1.1	-	2
A1.2	1.2	-
A1.3	-	1.2
A2.1	3.1	-
A2.2	3.2	-
A2.3	3.4	-
A2.4	-	3.1
A2.5	3.6	-
A3.1	-	3.2
A3.2	3.3	-
A4.1	-	5.1
A4.2	4.3	-
A4.3	-	5.2
A4.4	4.1	-
A4.5	4.2	-
A5.1	6.1	-
A5.2	6.2	-
A5.3	6.3	-
A5.4	3.5	-
A6.1	7.3	-
A6.2	7.1	-
A6.3	7.2	-
A6.4	-	4
A6.5	7.4	-
A6.5a	7.4.1	-
A6.5b	7.4.2	-
A6.5c	7.4.3	-
A7.1	8.1	-
A7.2	8.2	-
A7.3	8.3	-
A7.3a	8.3.1	-
A7.3b	8.3.2	-
A8	9	-
A8a	9.1	-
A8b	9.2	-
A8c	9.3	-
A9	5	-
A10	2	-
A11.1	-	6.1
A11.2	-	6.2

Note 1: References to the applicability of General Requirements and Performance Standards are covered by the introductory section of the Design and Installation Guidelines, entitled "Purpose and Scope".

* General Requirements for Shipborne Radio Equipment Forming Part of the Future Global Maritime Distress and Safety System: IMO Resolution A.569(14) adopted on 20 November 1985

** Performance Standards for INMARSAT Standard-C Ship Earth Stations capable of transmitting and receiving direct printing communications. IMO Assembly Resolution A.663(16).

PART B SUPPLEMENTARY GUIDELINES

B1 CONSTRUCTION

B1.1 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 (for instance: IEC Publication 92-101 Electrical Installations in Ships).

B1.2 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 sparks (motors using brushes, unencapsulated relays, switches) or produce excessive heat (electric heaters) should be avoided. Where such equipment is included in the Externally Mounted Equipment, clear reference to this fact should be included in the manufacturer's description.

B1.3 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.

B2 LABELLING

B2.1 The power supply or supplies from which the equipment is intended to operate should also be clearly indicated.

B2.2 The possibility of labelling the 9 digit ITU ship earth station identity should be provided. Such labelling should take into account changes in the ship earth station identity.

B3 TESTING

B3.1 The equipment should be designed with attention to equipment reliability and ease of maintenance.

B3.2 It would be an advantage if the design were to include self-diagnostic facilities with measuring points and indicators for quick fault finding.

B4 OPERATION

It would be an advantage if the design were to include the capability of use from remote locations. Remote indication(s) of incoming calls should be included when using remote locations.

B5 SAFETY PRECAUTIONS

B5.1 Provision should be made for protecting the equipment from excessive rise of temperature in any part of it due to failure in any cooling system associated with the equipment.

B5.2 Means should be provided for reducing the level of acoustic alarms.

B5.3 Radio frequency signals at high radiation levels are known to 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 given.

Preferably, the radiation levels in the vicinity of the antenna should be measured. The distances from the antenna which result in radiation levels of 100 W/m^2 , 25 W/m^2 and 10 W/m^2 should be recorded.

A label displaying these distances should be attached to 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 the hazardous area.

If measured information is not available, the radiation levels outside the radome can be assessed by using the graph as shown in Figure B5.1.

B6 ANTENNA LOCATIONS

Preferably, the antenna should be located high enough and in such a position that no obstacles appear in any azimuth directions down to -15 degrees elevation as shown in Figure B6.1.

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.

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

B7 RELATION TO OTHER ANTENNAS

Locations at the same level as the ship's radar antenna, or other ship earth stations should be avoided.

B8 OTHER GENERAL PRECAUTIONS

Avoid locations:

- (a) where ship personnel may be exposed to hazardous radiation;
- (b) near to the funnel or other locations, which are subject to much dust and smoke, since contamination of the radome may result in signal degradation;
- (c) where the antenna might be exposed to extremely high temperatures;
- (d) affected by severe vibration and shock; and
- (e) near to loading points of hazardous liquids or gases in view of explosion hazards.

Avoid in particular those locations affected by continuous vibration induced by engine/propeller operation whilst at sea.

B9 MOUNTING OF THE Externally Mounted Equipment

B9.1 Strength

The strength should be sufficient to withstand:

- (a) the joint weight of Externally Mounted Equipment and covering ice and snow; and
- (b) the bending moment caused by the maximum values of roll, pitch and wind pressure to be expected (taking the gust factor also into account).

Resonance frequencies near to those of the Externally Mounted Equipment should be avoided. Manufacturers should provide the relevant resonance frequency information to enable this requirement to be met.

B9.2 Access

The Externally Mounted Equipment should be provided a safe and easy means of access.

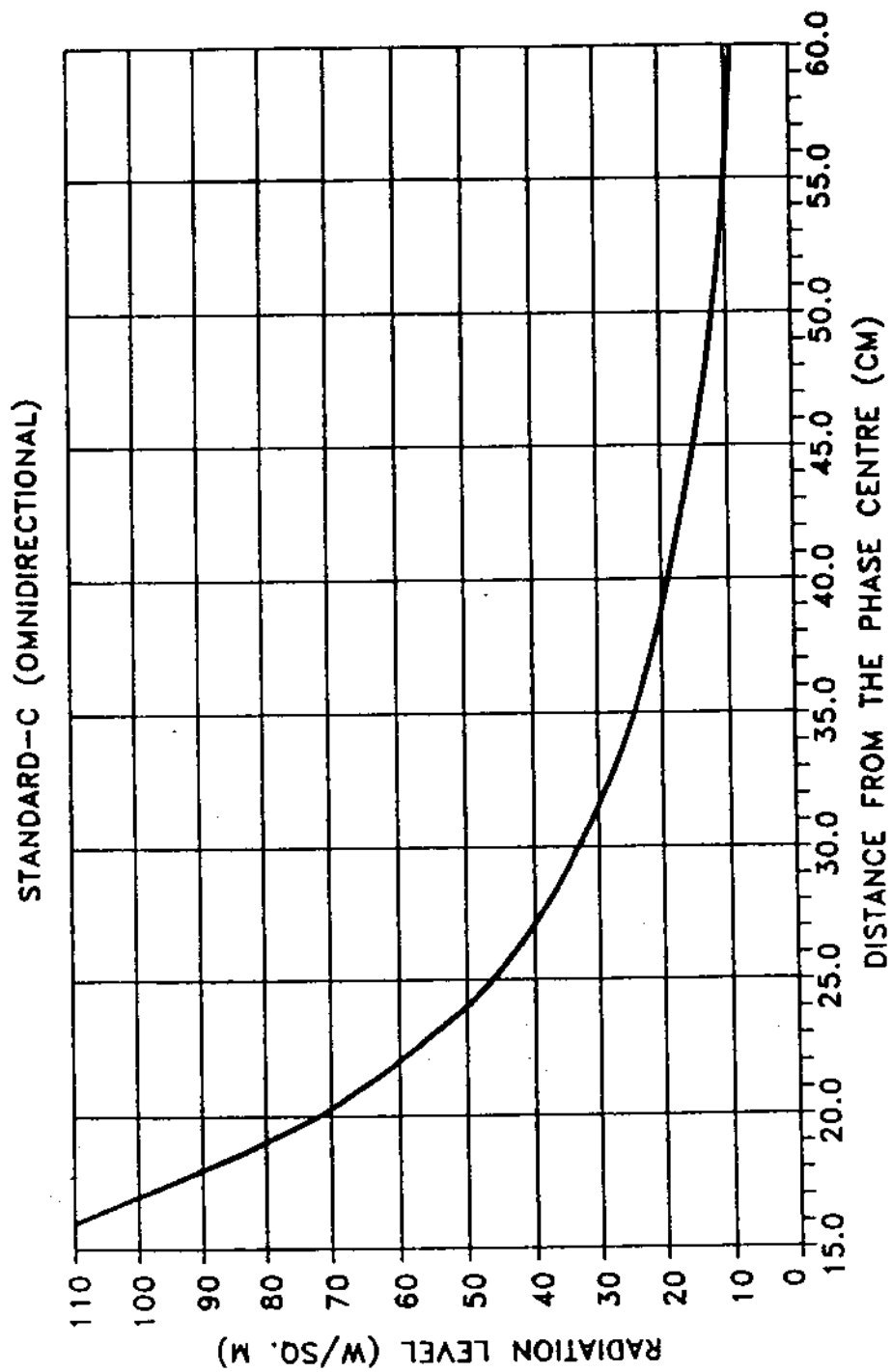
Care should be taken to avoid accidental activation of the transmitter whilst personnel are within the hazardous zone of the Externally Mounted Equipment, if activation poses a threat to their safety.

As a source of general information concerning the safety of people working aboard ships, either aloft or with radio and electrical equipment, see for instance: Code of Safe Working Practices for Merchant Seamen - British Department of Trade.

B9.3 Earthing

Means should be provided to enable the Externally Mounted Equipment to be earthed to the hull of the ship.

**FIG. B5.1: LEVEL OF RADIATION
OUTSIDE THE RADOME**



**FIG. B6.1: ANTENNA LOCATION
STANDARD-C (OMNIDIRECTIONAL)**



LOCAL HORIZONTAL PLANE



**THE SHIP IS ON AN EVEN KEEL;
PITCH AMPLITUDE -0°;
ROLL AMPLITUDE -0°**

DESIGN AND INSTALLATION GUIDELINES FOR ENHANCED GROUP CALL RECEIVER

PURPOSE AND SCOPE

Mandatory and optional specifications for enhanced group call receivers are defined in the Technical Requirements for INMARSAT Enhanced Group Call Receivers. This is published by INMARSAT with a view to ensuring that enhanced group call receivers will perform adequately in the INMARSAT system.

These Guidelines provide general information on design and installation of dedicated or non-dedicated receivers, the antenna, antenna amplifier and downconverter of the INMARSAT type-approved ship earth stations, that can be shared for the reception of enhanced group call messages.

These Guidelines also provide general information on safety aspects and electromagnetic compatibility with other equipment.

The Guidelines are arranged in two parts.

The text of Part A reflects performance standards that have been adopted by the International Maritime Organization in two of their documents:

General Requirements for Shipborne Radio Equipment Forming Part of the Future Global Maritime Distress and Safety System, IMO Resolution A.569(14); and

Performance Standards for Enhanced Group Call Equipment, IMO Assembly Resolution A.664(16).

These IMO documents will form the basis for national licensing requirements for enhanced group call receivers which are used to satisfy the carriage requirements of the SOLAS Convention.

For all other enhanced group call receivers, both Part A and Part B should be interpreted as suggested guidelines with the following qualification:

INMARSAT makes type-approval a mandatory condition of access to the INMARSAT system (refer to Section A1.1).

Part B contains supplementary guidelines on design and installation aspects.

PART A DESIGN AND INSTALLATION ASPECTS

A1 TECHNICAL REQUIREMENTS

A1.1 The enhanced group call receiver should be type-approved by INMARSAT and should comply with the environmental conditions specified in the INMARSAT technical requirements for the enhanced group call receiver.

A1.2 Where equipment provides a facility which is additional to the minimum requirements of Part A, the operation and, as far as is reasonably practicable, any malfunction of such an additional facility should not prevent the equipment from complying with Part A.

A1.3 The equipment should 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 vital messages referred to in paragraphs A3.2 and A3.5, which should be printed out upon receipt.

A1.4 The enhanced group call installation may be either separate or be combined with other installations.

A2 CONTROLS

A2.1 The number of operational controls, their design and manner of function, location, arrangement and size, should provide for simple, quick and effective operation. The controls should be arranged in a manner which minimizes the chance of inadvertent operation.

A2.2 All operational controls should permit normal adjustments to be performed easily and should be easy to identify from the position at which the equipment is normally operated. Controls not required for normal operation should not be readily accessible.

A2.3 The design of the equipment should be such that misuse of the controls should not cause damage to the equipment or injury to personnel.

A2.4 Means should be provided to enter the ship's position and area code manually so that area group calls can be received. Automatic entry of the ship's position from the navigational equipment and automatic translation from the ship's position to its area code may be performed optionally.

A2.5 Where a digital input panel with the digits "0" to "9" is provided, the digits should be arranged to conform with the relevant CCITT Recommendations.*

A3 OPERATION

A3.1 Provisions should be made for a specific aural alarm and visual indication at the position from which the ship is normally navigated to indicate receipt of a distress or urgency call or a call having a distress category. It should not be possible to disable this alarm. It should be possible only to reset this alarm manually.

A3.2 Adequate illumination should be provided in the equipment or in the ship to enable identification of controls and facilitate reading of indicators at all times. Where appropriate, means should be provided for dimming the output of any equipment light source which is capable of interfering with navigation.

A3.3 The equipment should indicate when it is not correctly tuned or synchronized to the enhanced group call carrier.

A3.4 Any message should be printed regardless of the character error rate of its reception. The equipment should print a low line mark if a character is received mutilated.

*/ CCITT Recommendation E.161/Q11

A3.5 Acceptance or rejection of service codes^{*/} should be under the operator's control except that equipment should be unable to reject relevant navigational warnings, meteorological warnings, search and rescue information and certain special warnings, which are directed to a geographical area within which the ship is operating.

A3.6 Means should be provided not to print the same message after the message has been received without errors.

A3.7 The printing device should be capable of printing at least the Standard IA Number 5 character set. Other character sets are optionally used according to ISO 2022 or CCITT Recommendation T.61.

A3.8 The printing device should be able to print at least 40 characters per line.

A3.9 The signal processor and printing device should ensure that if a word can not be accommodated in full on its line it should be transferred to the next line. The printing device should automatically feed 5 lines after completing the printed messages.

A4 POWER SUPPLY

A4.1 The enhanced group call receiver should normally be powered from the ship's main source of electrical energy. In addition, it should be possible to operate the enhanced group call receiver, and all other equipment necessary for its normal functioning, including the antenna tracking system, where provided, from an alternative source of energy.

A4.2 If provision is made for operating 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 in the equipment.

A4.3 Changing from one source of supply to another or any interruption up to 60 seconds duration of the electrical energy should not require the equipment to be manually re-initialized and should not lose received messages stored in the memory.

A4.4 Equipment should continue to operate in accordance with these Guidelines in the presence of variation of power supply normally to be expected in a ship.

A4.5 Means should be incorporated for the protection of equipment from the effects of excessive current, voltage, transients and accidental reversal of the power supply polarity.

^{*/} The meaning of the service codes is the same as for the NAVTEX system (CCIR Recommendation 540 and the NAVTEX manual).

A5 INTERFACE AND COMPATIBILITY

A5.1 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 SOLAS Convention.*/

A5.2 Mechanical noise from all units should be limited so as not to prejudice the hearing of sounds on which the safety of the ship might depend.

A5.3 Each unit of equipment normally to be installed in the vicinity of a standard or a steering magnetic compass should be clearly marked with the minimum safe distance at which it may be mounted from such compasses.

A5.4 If any equipment is connected to one or more other devices the performance of each should be maintained.

A6 SAFETY PRECAUTIONS

A6.1 All steps should be taken to ensure that electromagnetic radio frequency energy radiated from the equipment shall not be a hazard to personnel.

A6.2 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.

A6.3 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.

A6.4 Equipment containing elements such as vacuum tubes which are likely to cause x-radiation should comply with the following requirements:

- (a) external X-radiation from the equipment in its normal working condition should not exceed the limits laid down by the Administration concerned;
- (b) 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
- (c) 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.

*/ IEC Publication 533, "Electromagnetic Compatibility of Electrical and Electronic installations in Ships"

A7 MAINTENANCE

A7.1 The equipment should be so designed that the main units can be replaced readily, without elaborate recalibration or readjustment.

A7.2 Equipment should be so constructed and installed that it is readily accessible for inspection and maintenance.

A7.3 Adequate information should be provided to enable the equipment to be properly operated and maintained:

- (a) 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
- (b) 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 (a) above should be met in respect of other modules and those discrete components which do not form part of modules.

A8 MARKING AND IDENTIFICATION

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

- (a) identification of the manufacturer;
- (b) equipment type/number of model identification under which it was type tested; and
- (c) serial number of the unit.

A9 DURABILITY AND RESISTANCE TO ENVIRONMENT

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.*

A10 INSTALLATION

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

A11 ANTENNA SITING

A11.1 Where an omnidirectional antenna is used, it should, if practicable, 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.

* / IEC Standard Publication 92-101, "Electrical Installations in Ships".

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

A11.2 Where a stabilized directive antenna is used, it should, if practicable, be sited in such a position that no obstacle, likely to degrade significantly the performance of the equipment, appears in any azimuth down to -5 degrees.

For directive antennas with a gain of approximately 20 dBi, objects, especially those with 10m of the antenna, which cause a shadow sector of greater than 6 degrees, are likely to degrade significantly the performance of the equipment.

Cross-index between IMO Documents and INMARSAT Design and Installation Guidelines, Part A

- 1 **General requirements for shipborne radio equipment forming part of the Future Global Maritime Distress and Safety System. IMO Resolution A.569(14) adopted on 20 November 1985.**

The table below enables each paragraph of the IMO document to be related to the corresponding paragraphs of the INMARSAT Design and Installation Guidelines.

IMO DOCUMENT	INMARSAT DIG, PART A
1.1	See Note 1
1.2	A1.2
2	A10
3.1	A2.1
3.2	A2.2
3.3	A3.2
3.4	A2.3
3.5	A5.4
3.6	A2.5
4.1	A4.4
4.2	A4.5
4.3	A4.2
5	A9
6.1	A5.1
6.2	A5.2
6.3	A5.3
7.1	A6.2
7.2	A6.3
7.3	A6.1
7.4	A6.4
7.4.1	A6.5a
7.4.2	A6.5b
7.4.3	A6.5c
8.1	A7.1
8.2	A7.2
8.3	A7.3
8.3.1	A7.3a
8.3.2	A7.3b
9	A8
9.1	A8a
9.2	A8b
9.3	A8c

Note 1 References to the applicability of General Requirements and Performance Standards are covered by the introductory section of the Design and Installation Guidelines, entitled "Purpose and Scope".

2. **Performance Standards for Enhanced Group Call Equipment. IMO Assembly Resolution A.664(16).**

The table below enables each paragraph of the IMO document to be related to the corresponding paragraphs of the INMARSAT Design and Installation Guidelines.

IMO DOCUMENT**INMARSAT DIG, PART A**

1	See Note 1
1.2	A1.3
1.3	A1.4
2	A1.1
3.1	A2.4
3.2	A3.1
3.3	A3.3
3.4	A3.4
3.5	A3.5
3.6	A3.6
3.7	A3.7
3.8	A3.8
3.9	A3.9
3.10	A3.10
4.1	A4.1
4.2	A4.3
5.1	A11.1
5.2	A11.2

Note 1 References to the applicability of General Requirements and Performance Standards are covered by the introductory section of the Design and Installation Guidelines, entitled "Purpose and Scope".

3

INMARSAT Design and Installation Guidelines

The table below enables each paragraph to be related to the corresponding paragraphs of the IMO documents.

INMARSAT DIG, Part A	IMO Documents	
	SRE*	SES**
Note 1	1.1	1
A1.1	-	2
A1.2	1.2	-
A1.3	-	1.2
A1.4	-	1.3
A2.1	3.1	-
A2.2	3.2	-
A2.3	3.4	-
A2.4	-	3.1
A2.5	3.6	-
A3.1	-	3.2
A3.2	3.3	-
A3.3	-	3.3
A3.4	-	3.4
A3.5	-	3.5
A3.6	-	3.6
A3.7	-	3.7
A3.8	-	3.8
A3.9	-	3.9
A3.10	-	3.10
A4.1	-	4.1
A4.2	4.3	-
A4.3	-	4.2
A4.4	4.1	-
A4.5	4.2	-
A5.1	6.1	-
A5.2	6.2	-
A5.3	6.3	-
A5.4	3.5	-
A6.1	7.3	-
A6.2	7.1	-
A6.3	7.2	-
A6.4	7.4	-
A6.5a	7.4.1	-
A6.5b	7.4.2	-
A6.5c	7.4.3	-
A7.1	8.1	-
A7.2	8.2	-
A7.3	8.3	-
A7.3a	8.3.1	-
A7.3b	8.3.2	-
A8	9	-
A8a	9.1	-
A8b	9.2	-
A8c	9.3	-
A9	5	-
A10	2	-
A11.1	-	5.1
A11.2	-	5.2

Note 1 References to the applicability of General Requirements and Performance Standards are covered by the introductory section of the Design and Installation Guidelines, entitled "Purpose and Scope".

* General Requirements for Shipborne Radio Equipment Forming Part of the Future Global Maritime Distress and Safety System: IMO Resolution A.569(14) adopted on 20 November 1985.

** Performance Standards for Enhanced Group Call Equipment. IMO Assembly Resolution A.664(16).

PART B SUPPLEMENTARY GUIDELINES

B1 CONSTRUCTION

B1.1 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 (for instance: IEC publication 92-101 Electrical Installations in Ships).

B1.2 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 sparks (motors using brushes, unencapsulated relays, switches) or produce excessive heat (electric heaters) should be avoided. Where such equipment is included in the ADE, clear reference to this fact should be included in the manufacturer's description.

B1.3 The enhanced group call receiver and facilities should be capable of operating satisfactorily in a marine environment. All metal surfaces should be resistant to or suitably treated against corrosion.

B2 LABELLING

B2.1 The power supply or supplies from which the equipment is intended to operate should also be clearly indicated.

B3 TESTING

B3.1 The equipment should be designed with attention to equipment reliability and ease of maintenance.

B3.2 It would be an advantage if the design were to include self-diagnostic facilities with measuring points and indicators for quick fault finding.

B4 OPERATION

It would be an advantage if the design were to include the capability of use from remote locations. Remote indication(s) of incoming calls should be included when using remote locations.

B5 SAFETY PRECAUTIONS

B5.1 Provision should be made for protecting the equipment from excessive rise of temperature in any part of it due to failure in any cooling system associated with the equipment.

B5.2 Means should be provided for reducing the level of acoustic alarms.

B6 ANTENNA LOCATIONS

Preferably, the antenna should be located high enough and in such a position that no obstacle appears in all azimuth directions down to the lowest elevation angle limited by the minimum G/T profile at which a reliable link operation is performed with a satellite at 5° elevation and expected pitch and roll amplitudes.

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.

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

B7 RELATION TO OTHER ANTENNAS

Locations at the same level as the ship's radar antenna or of other ship earth stations should be avoided.

B8 OTHER GENERAL PRECAUTIONS

Avoid locations:

- (a) near to the funnel or other locations, subject to much dust and smoke, since contamination of the radome may result in signal degradation;
- (b) where the antenna might be exposed to extremely high temperatures; and
- (c) affected by severe vibration and shock.

Avoid in particular those locations affected by continuous vibration induced by engine/propeller operation whilst at sea.

B9 MOUNTING OF THE ABOVE DECK EQUIPMENT

Any elements of an INMARSAT ship earth stations which are shared by the EGC receiver should adhere to the design and installation guidelines for the shared SES equipment.

B9.1 Strength

The strength should be sufficient to withstand:

- (a) the joint weight of Above Deck Equipment and covering ice and snow; and
- (b) the bending moment caused by the maximum values of roll, pitch and wind pressure to be expected (taking the gust factor also into account).

B9.2 Access

As a source of general information concerning the safety of people working aboard ships, either aloft or with radio and electrical equipment, see for instance: Code of Safe Working Practices for Merchant Seamen - British Department of Trade.

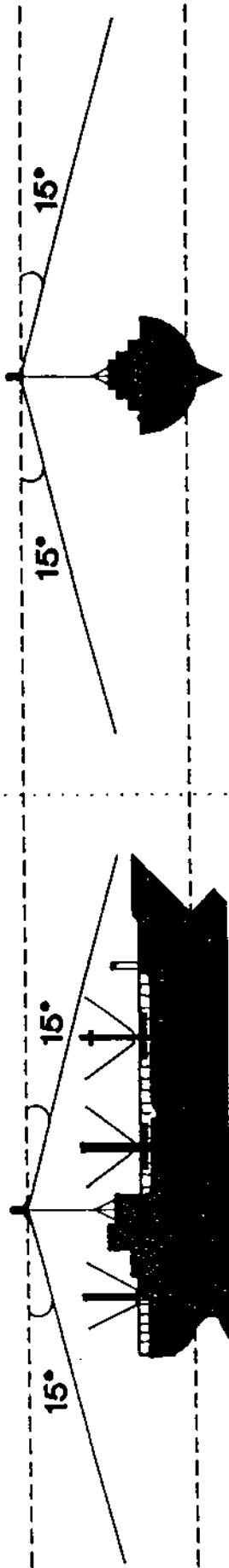
B9.3 Earthing

Means should be provided to enable the ADE to be earthed to the hull of the ship.

**FIG. B6.1: ANTENNA LOCATION
EGC RECEIVER (OMNIDIRECTIONAL)**



LOCAL HORIZONTAL PLANE



**THE SHIP IS ON AN EVEN KEEL;
PITCH AMPLITUDE -0°;
ROLL AMPLITUDE -0°**