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## **GUIDELINES FOR THE INSTALLATION OF SHIPBORNE RADAR EQUIPMENT**

1 The Maritime Safety Committee, at its eighty-fourth session (7 to 16 May 2008), with a view to improving the safety of navigation, approved the circulation of the attached Guidelines for the installation of shipborne radar equipment.

2 Member Governments are invited to bring the information to the attention of all parties concerned.

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## ANNEX

### GUIDELINES FOR THE INSTALLATION OF A SHIPBORNE RADAR

#### 1 General

Information provided by radar is of vital importance for navigators and the safe navigation of ships.

Special care should be taken to ensure the correct installation of the radar, in order to improve the performance of the radar system.

This document contains guidelines for owners, ship designers, manufacturers, installers, yards, suppliers and ship surveyors. It does not replace documentation supplied by the manufacturer.

#### 2 Application

These guidelines apply to all shipborne radar installations mandated by the 1974 SOLAS Convention, as amended. The guidelines take into account resolution MSC.192(79) on Adoption of the revised performance standard for radar equipment.

#### 3 Definitions

- (a) CCRP: Consistent Common Reference Point: A location on own ship, to which all horizontal measurements such as target range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA) are referenced, typically the conning position of the bridge.
- (b) OOW: Officer of the Watch.

#### 4 Survey

Surveys on Convention ships should be carried out in accordance with the rules laid down in resolution A.948(23) – Revised Survey Guidelines under the harmonized system of survey and certification, and – Protocol of 1988 relating to the International Convention for the Safety of Life at Sea, 1974, as amended.

#### 5 Documentation

Prior to the radar installation, the following documentation should be made available and provided to the installer by the shipyard, owner or manufacturer as appropriate:

- (a) Scaled drawing(s) of the ship with views from the port, starboard, fore, aft and from above the vessel on which the radar and other antenna positions are indicated. Any ship structure or cargo that may obstruct or degrade radar performance should also be shown, for example masts, funnels, superstructure and containers. The possible turning and jib range of movable objects like cranes are to be indicated.

- (b) Scaled drawing of the antenna arrangement including the outline drawing for the rotation radius.
- (c) Drawing(s) of the bridge layout showing the position of the radar display unit(s) and additional locations (for example, electronic rooms) for housing radar units.
- (d) Manufacturers documentation describing the installation and interconnection of the radar system, the equipment units including radar frequency band and antenna size, and equipment type and evidence of type approval documentation.
- (e) List of auxiliary equipment connected with the radar system including manufacturer, type with block diagram (interconnection diagram) and evidence of type approval.
- (f) In the case of retrofit installations, a document agreed by the owner, installer and manufacturer stating that the use of original cabling, transmission lines and auxiliary units of the radar equipment may be retained.

## **6 Radar antenna installation**

Correct location of the radar antenna is an important factor of the performance of the radar system. Interference, either by reflecting constructions or other transmitters, may heavily reduce the radar performance by creating blind sectors, clutter on the radar display or generation of false echoes.

### **6.1 Interference**

Due care should be taken with regard to the location of radar antennas relative to other antennas which may cause interference to either equipment. The location of the antenna should comply with the following:

- (a) The radar antenna should be installed safely away from interfering high-power energy sources and other transmitting and receiving radio antennas.
- (b) The lower edge of a radar antenna should be a minimum of 500 mm above any safety rail.
- (c) Radar antennas in close proximity should have a minimum vertical elevation separation angle of 20° and a minimum vertical separation of 1 m where possible.

### **6.2 Location relative to masts, funnels and other constructions**

Due care should be taken with regard to the location of radar antennas relative to masts, funnels and other constructions.

The location of the antenna should comply with the following:

- (a) The antenna should generally be mounted clear of any structure that may cause signal reflections.

- (b) Ensure that any support or other obstacles are clear of the rotation of the antenna (see specific antenna outline drawing for rotational radius).
- (c) Install antenna and turning unit so that the installation complies with the compass safe distance for the equipment.

### **6.3 *Blind sectors and range***

To make full benefit from the radar, it is vitally important for the OOW that horizontal and vertical blind sectors for the radar antennae are minimized. The objective is to see the horizon freely through 360° as nearly as possible, noting the requirement of 7.1 below.

For all radar systems and where practical,

- (a) A line of sight from the radar antenna to the bow of the ship should hit the surface of the sea in not more than 500 m or twice the ship length, depending which value is smaller, for all load and trim conditions.
- (b) The radar antenna should be located in an elevated position to permit maximum target visibility.
- (c) Blind sectors should be kept to a minimum, and should not occur in an arc of the horizon from right ahead to 22.5° abaft the beam to either side.

**Note:** Any two blind sectors separated by 3° or less should be treated as one blind sector.

- (d) Individual blind sectors of more than 5°, or a total arc of blind sectors of more than 20°, should not occur in the remaining arc, excluding the arc in the above subparagraph (c).
- (e) For radar installations with two radar systems, where possible, the antennas should be placed in such a way as to minimize the blind sectors.

### **6.4 *Lifting radar equipment***

Where special equipment, such as cranes, hoists and jibs are required to install the radar system, consideration should be given to ensure that the radar system(s) are located such that the required equipment can be positioned to facilitate the installation. Radar equipment should be lifted in accordance with the information provided by the manufacturer.

## **7 General requirements**

- (a) All installations should facilitate protection of equipment, including cabling, from damage.
- (b) Safe service access should be provided using service platforms where necessary having a minimum size of 1m<sup>2</sup> at a suitable height and with a safety rail of suitable height.

- (c) Consideration should be given to the compass safety distance as supplied by the manufacturer when positioning equipment units.
- (d) The design of the mounting platform for the antenna and antenna pedestal should take into account the vibration requirements of resolution A.694(17) and furthermore defined by IEC 60945. In addition to vibration, the design of the mounting platform should consider shock and whiplash due to seagoing conditions.

### **7.1 *Interaction with sea and false echoes***

Considerations of interaction with the sea imply that the radar antenna should be only as high as necessary to clear major objects, and as high to be consistent with other requirements regarding acceptable horizon and target detection range. The location of the antenna should minimize sea clutter returns and the-number of multi-path nulls.

### **7.2 *Cables and grounding***

The cables and the grounding should comply with the following:

- (a) Cable screens, especially coaxial cable screens, should be installed in accordance with manufacturer's documentation.
- (b) The cables should be kept as short as possible to minimize attenuation of the signal.
- (c) All cables between antenna and radar system units should be routed as directly as possible, consistent with consideration for other equipment, in order to reduce electromagnetic interference effects.
- (d) Cables should not be installed close to high-power lines, such as radar or radio-transmitter lines.
- (e) Crossing of cables should be done at right angles (90°) to minimize magnetic field coupling.
- (f) All outdoor installed connectors should be waterproof by design to protect against water penetration into the cables.
- (g) Cables and microwave transmission lines should not be exposed to sharp bends.
- (h) Cables and microwave transmission lines should be installed with sufficient physical separation, as defined in the manufacturer's documentation.
- (i) Grounding of equipment units should be carried out according to the manufacturer's documentation.

### **7.3 *Power source***

The radar should be connected to an emergency power source, as required by SOLAS chapter II-1.

#### **7.4 Radar controls and display**

- (a) If the control panel is a separate unit, the functionality of the radar controls should be available for the mariner at all workstations where a radar display is available.
- (b) The orientation of the display unit should be such that the user is looking ahead. The lookout view should not be obscured and the ambient light should cause minimum degradation on the display screen in accordance with MSC/Circ.982.

#### **7.5 Initial installation of radar**

Radar systems are functionally integrated with a number of instruments (refer to resolution MSC.192(79), section 8). As various systems are getting increasingly more integrated and complex, correct system settings are very important.

The following documents should be kept on board of the vessel:

- (a) The installation company should sign an installation report that to the best of their knowledge the installation and setup has been carried out according to the manufactures documentation and to these guidelines.
  - (b) Information about possible performance limitations, including blind sectors, due to the radar system installation that may be of vital importance for mariners and should be stated in this documentation.
  - (c) The setup of interfaces and system parameters (including CCRP position offset) should be carried out in accordance with the manufacturer's documentation. This information should be attached as an annex to the installation report noted under paragraph (a) above.
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