

## Bearing accuracy

- Chart contour
- Radar contour



The bearing accuracy of marine radars are normally not so high.


- Beam-width distortion, which can be partly eliminated by reduction in gain.
- Heading marker error, which can be determined by various methods.
- Centring error, which can easily be corrected.
- Error due to yawing of own ship.
- Error due to parallax when viewing the display.

La precisione della misurazione dei rilevamenti sul radar non è molto alta.

• La distorsione conseguente alla larghezza del fascio può parzialmente essere eliminata riducendo il Gain.

- L'errore dovuto alla linea di fede può essere determinato con vari metodi.
- L'errore di centramento può essere facilmente eliminato.
- Un errore può essere conseguente alle oscillazioni dei movimenti della nave.
- Un errore può essere conseguente alla parallasse nel guardare lo schermo.

## Bearing accuracy

 Chart contour

 Radar contour



Always read and follow the Radar manufacturer recommendations for use and maintenance of the radar equipment. This will save you time and money and ensure proper use of the equipment.

### Always remember to:

- Adjust the centres correctly.
- Apply the heading marker error if there is one.
- Check the compass readings if the display is unstabilised.
- Reduce the gain, to reduce the beam-width distortion.
- View cursor and bearing scale from the correct position.
- Always use true course as input to a stabilised radar display.

Leggere e seguire le raccomandazioni dei costruttori del radar per l'uso e la manutenzione sempre. Ciò vi preserva tempo e denaro e vi assicura il corretto uso. **Ricordarsi sempre di:**

- 1) Posizionare il centro correttamente.
- 2) Aggiungere l'errore della linea di fede se c'è.
- 3) Confrontare con la bussola se la rappresentazione è instabile.
- 4) Ridurre il **Guadagno** per ridurre la distorsione per la larghezza del fascio.
- 5) Guardare il cursore ed il rilevamento da una posizione corretta.
- 6) Introdurre sempre la rotta vera per stabilizzare l'immagine sullo schermo.

**The learning objective of this section is:**

- **To get familiarised with the IMO resolution A.477 Performance Standards for Radar Equipment.**

Lo scopo di questa lezione è di acquisire familiarità con la Risoluzione A.477 dell'IMO sulle caratteristiche standards degli equipaggiamenti radar.

Si rinvia al testo della soluzione.

**RADAR OBSERVATION & PLOTTING**

RESOLUTION A.477 (XII)

**Adopted on 19 November 1981**

*Agenda item 10(b)*

## **PERFORMANCE STANDARDS FOR RADAR EQUIPMENT**

**THE ASSEMBLY,**

**RECALLING** Article 16(i) of the Convention on the Inter-Governmental Maritime Consultative Organization,

**BEARING IN MIND** the provisions of Regulation 12, Chapter V, of the International Convention of the Safety of Life at Sea, 1974, and the proposed amendments to that regulation,

**RECALLING ALSO** resolution A.222 (VII) by which it adopted performance standards for radar equipment,

**RECOGNIZING** the desirability of making such performance standards compatible with the Performance Standards for Automatic Radar Plotting Aids (ARPA) (resolution A.422 (XII)) and with resolution A.423 (XI) on radar beacons and transponders,

**HAVING CONSIDERED** the recommendation made by the Maritime Safety Committee at its forty-second session,

**1. ADOPTS** the Recommendation on Performance Standards for Radar Equipment set out in the Annex to the present resolution;

**2. RECOMMENDS** Member Governments to ensure that:

(a) Radar equipment installed on or after 1 September 1984 conforms to performance standards not inferior to those specified in the Annex to the present resolution;

(b) Radar equipment installed before 1 September 1984 conforms at least to the performance standards set out in resolution A.222 (VII).

You are expected, as a certified radar operator, to have a good knowledge of the IMO requirements for marine radar.

## ANNEX

RECOMMENDATION ON PERFORMANCE STANDARDS  
FOR RADAR EQUIPMENT

### 1. APPLICATION

1.1 This Recommendation applies to all ship's radar equipment on or after 1 September 1984 in compliance with Regulation 12, Chapter V of the International Convention for the Safety of Life at Sea 1974, as amended

1.2 Radar equipment installed before 1 September 1984 should comply at least with the performance standards recommended in resolution A.222 (VII).

### 2. GENERAL

The radar equipment should provide an indication, in relation to the ship, of the position of other surface craft and obstructions and of buoys, shorelines and navigational marks in a manner, which will assist in navigation and in avoiding collision.

### 3. ALL RADAR INSTALLATIONS

All radar installations should comply with the following minimum requirements.

#### 3.1 Range performance

The operational requirement under normal propagation conditions, when the radar antenna is mounted at height of 15 meters above sea level, is that the equipment should in the absence of clutter give a clear indication of:

##### .1 Coastlines

At 20 nautical miles when the ground rises to 60 meters.

At 7 nautical miles when the ground rises to 6 meters

##### .2 Surface objects

At 7 nautical miles a ship of 5,000 tons gross tonnage, whatever her aspect.

At 3 nautical miles a small vessel of 10 meters in length.

At 2 nautical miles an object such as a navigational buoy having an effective echoing area of approximately 10 square meters.



PERFORMANCE  
STANDARDS FOR  
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## 3.2 Minimum range

The surface objects specified in 3.1.2 should be clearly displayed from a minimum range of 50 meters up to a range of one nautical mile, without changing the setting of controls other than the range selector.

## 3.3 Display

**3.3.1** The equipment should without external magnification provided a relative plan display in the head-up unstabilized mode with an effective diameter of not less than:

- .1 180 millimeters\* on ships of 500 tons gross tonnage and more but less than 1,600 tons gross tonnage;
- .2 250 millimeters\* on ships of 1,600 tons gross tonnage and more but less than 10,000 tons gross tonnage;
- .3 340 millimeters\* in the case of one display and 250 millimeters in the case of the other on ships of 10,000 tons gross tonnage and upwards.

**3.3.2** The equipment should provide one of the two following sets of range scales of display:

- .1) 1.5, 3, 6, 12 and 24 nautical miles and one range scale of not less than 0,5 and not greater than 0,8 nautical miles; or
- .2) 1,2,4,8,16 and 32 nautical miles.

*\*Display diameters of 180, 250 and 340 millimeters correspond respectively to 9,12 and 16 inch cathode ray tubes.*

**3.3.3** Additional range scales may be provided.

**3.3.4** The range scale displayed and the distance between range rings should be clearly indicated at all times.

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## **3.4 Range measurements**

**3.4.1** Fixed electronic range rings should be provided for range measurements as follows:

.1 Where range scales are provided in accordance with 3.3.2.1, on the range scale of between 0.5 and 0.8 nautical miles at least two range rings should be provided and on each of the other range scales six range rings should be provided, or

.2 Where range scales are provided in accordance with 3.3.2.2, four range rings should be provided on each of the range scales.

**3.4.2** A variable electronic range marker should be provided with a numeric readout of range.

**3.4.3** The fixed range rings and the variable range marker should enable the range of an object to be measured with an error not exceeding 1.5 per cent of the maximum range of the scale in use, or 70 meters, whichever is the greater.

**3.4.4** It should be possible to vary the brilliance of the fixed range rings and the variable range marker and to remove them completely from the display.

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## 3.5 Heading indicator

**3.5.1** The heading of the ship should be indicated by a line on the display with a maximum error not greater than plus or minus  $1^\circ$ . The thickness of the displayed heading line should not be greater than  $0.5^\circ$ .

**3.5.2** Provision should be made to switch off the heading indicator by a device which cannot be left in the "heading marker off" position.

## 3.6 Bearing measurement

**3.6.1** Provision should be made to obtain quickly the bearing of any object whose echo appears on the display.

**3.6.2** The means provided for obtaining bearings, should enable the bearing of a target whose echo appears at the edge of the display to be measured with an accuracy of plus or minus  $1^\circ$  or better.

## 3.7 Discrimination

**3.7.1** The equipment should be capable of displaying as separate indications on a range scale of 2 nautical miles, or less two small similar targets at a range of between 50 per cent and 100 per cent of the range scale in use, and not the same azimuth, separated by not more than 50 meters in range.

**3.7.2** The equipment should be capable of displaying as separate indications two small similar targets both situated at the same range between 50 per cent and 100 per cent of the 1.5 or 2 mile range scale, and separated by not more than  $2.5^\circ$  in azimuth.

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### 3.8 Roll or pitch

The performance of the equipment should be such that when the ship is rolling or pitching up to plus or minus 10° the range performance requirements of 3.1 and 3.2 continue to be met.

### 3.9 Scan

The scan should be clockwise, continuous and automatic through 360° of azimuth. The scan rate should be not less than 12 revolutions per minute. The equipment should operate satisfactorily in relative wind speeds of up to 100 knots.

### 3.10 Azimuth stabilization

**3.10.1** Means should be provided to enable the display to be stabilized in azimuth by a transmitting compass. The equipment should be provided with a compass input to enable it to be stabilizing in azimuth. The accuracy of alignment with the compass transmission should be within 0.5° with a compass rotation rate of 2 revolutions per minute.

**3.10.2** The equipment should operate satisfactorily in the unstabilized mode when the compass control is inoperative.

### 3.11 Performance check

Means should be available, while the equipment is used operationally, to determine readily a significant drop in performance relative to a calibration standard established at the time of installation, and to check that the equipment is correctly tuned in the absence of targets.

### 3.12 Anti-clutter devices

Suitable means should be provided for the suppression of unwanted echoes from sea clutter, rain and other forms of precipitation, clouds and sandstorms. It should be possible to adjust manually and continuously the anti-clutter controls. Anti-Clutter controls should be inoperative in the fully anti-clockwise positions. In addition, automatic anti-clutter controls may be provided: however, they must be capable of being switched off.

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## 3.13 Operation

**3.13.1** The equipment should be capable of being switched on and operated from the display position.

**3.13.2** Operational controls should be accessible and easy to identify and use. Where symbols are used they should comply with the recommendations of the organization on symbols for controls on marine navigational radar equipment.

**3.13.3** After switching on from cold the equipment should become fully operational within 4 minutes.

**3.13.4** A standby condition should be provided from which the equipment can be brought to an operational condition within 15 seconds.

## 3.14 Interference

After installation and adjustment on board, the bearing accuracy as prescribed in this Recommendation should be maintained without further adjustment irrespective of the movement of the ship in the earth's magnetic field.

## 3.15 Sea or ground stabilization (true motion display)

**3.15.1** Where sea or ground stabilization is provided the accuracy and discrimination of the display should be at least equivalent to that required by this Recommendation.

**3.15.2** The motion of the trace origin should not, except under manual override conditions, continue to a point beyond 75 per cent of the radius of the display. Automatic resetting may be provided.

## 3.16 Antenna system

The antenna system should be installed in such a manner that the design efficiency of the radar system is not substantially impaired.

## 3.17 Operation with radar beacons

**3.17.1** All radar's operating in the 3-centimeter band should be capable of operating in a horizontally polarized mode.

**3.17.2** It should be possible to switch off those signal-processing facilities, which might prevent a radar beacon from being shown on the radar display.

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