INTERNATIONAL STANDARD

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Maritime navigation and radiocommunication equipment and systems – Radar plotting aids –

Part 2: Automatic tracking aids (ATA) – Methods of testing and required test results

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For graphical symbols, and letter symbols and signs approved by the IEC for general use, readers are referred to publications IEC 60027: *Letter symbols to be used in electrical technology*, IEC 60417: *Graphical symbols for use on equipment. Index, survey and compilation of the single sheets* and IEC 60617: *Graphical symbols for diagrams*.

* See web site address on title page.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – RADAR PLOTTING AIDS –

Part 2: Automatic tracking aids (ATA) – Methods of testing and required test results

FOREWORD

1) The IEC (International Electrotechnical Commission) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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6) Attention is drawn to the possibility that some of the elements of this International Standard may be the subject of patent rights. The IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60872-2 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems. The IEC 60872 series, of which this is part 2, replaces IEC 60872 published in 1987 and amendment 1 (1991) and reflects the new requirements of the International Maritime Organization (IMO).

The text of this standard is based on the following documents:

FDIS	Report on voting
80/195/FDIS	80/220/RVD

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

Annexes A, B, C, D and E form an integral part of this standard.

A bilingual version of this standard may be issued at a later date.

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – RADAR PLOTTING AIDS –

Part 2: Automatic tracking aids (ATA) – Methods of testing and required test results

1 Scope

This International Standard specifies the minimum performance requirements, technical characteristics, methods of testing and test results for equipment that complies with performance standards not inferior to those adopted by the International Maritime Organisation (IMO) – resolution MSC.64(67) Annex 4.

This standard takes account of IMO resolution A.694 and is associated with IEC 60945.

When a requirement in this standard is different from IEC 60945, the requirement in this standard shall take precedence.

Equipment intended for use on high speed craft (HSC) shall additionally satisfy the requirements of the HSC scenarios as defined in IEC 60936-2, annex D.

All texts of this standard, the wording of which is identical to that in IMO Resolution MSC.64(67) Annex 4, are printed in *italics* and the resolution and paragraph numbers are indicated in brackets.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 60872. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this part of IEC 60872 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60872-1:1998, *Maritime navigation and radiocommunication equipment and systems – Radar plotting aids – Part 1: Automatic radar plotting aids (ARPA) – Methods of testing and required test results*

IEC 60872-3, *Maritime navigation and radiocommunication equipment and systems – Radar plotting aids – Part 3: Electronic plotting aid (EPA) – Methods of testing and required test results* [1]

IEC 60936-1, *Maritime navigation and radiocommunication equipment and systems – Radar – Part 1: Shipborne radar – Methods of testing and required test results* [1]

IEC 60936-2:1998, *Maritime navigation and radiocommunication equipment and systems – Radar – Part 2: Shipborne radar for high speed craft (HSC) – Methods of testing and required test results*

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1) To be published.

IEC 60945:1996, *Maritime navigation and radiocommunication equipment and systems – General requirements – Methods of testing and required test results*

IEC 61162, — *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*

ISO 9000, — *Quality management and quality assurance standards*

IMO Resolution A.694:1991, *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system and for electronic navigational aids*

IMO Resolution A.820:1995, *Performance standards for navigational radar equipment for high-speed craft*

IMO Resolution A.823:1995, *Performance standards for automatic radar plotting aids (ARPAs)*

IMO Resolution A.824:1995, *Performance standards for devices to indicate speed and distance*

IMO MSC.64(67):1996, *Annex 4 – Performance standards for radar equipment*

IHO S-52:1996, *Specifications for chart content and display aspects of ECDIS*

3 Performance requirements

NOTE – The following requirements are from IMO MSC.64(67) Appendix 1 of Annex 4.

3.1 (MSC.64(67)/1) **Introduction**

3.1.1 (MSC.64(67)/1.1) "*Auto tracking* aid" (ATA) shall, *in order to improve the standard of collision avoidance at sea:*

.1 reduce the workload of observers by enabling them to obtain information about automatically plotted targets so that they can perform as well with several separate targets as they can by manually plotting a single target;

.2 provide continuous, accurate and rapid situation evaluation.

3.1.2 The radar facilities provided by an ATA display shall comply with those clauses of IMO Resolution MSC.64(67) annex 4 or A.820 appropriate to its mode of use.

3.1.3 (MSC.64(67)/Annex 4/1) *In addition to the general requirements contained in resolution A.694(17),* ATA shall *comply with the following minimum requirements.*

3.1.4 Where an ATA display is intended for use as the master display of a complete radar system, the system shall comply with IEC 60936-1. For high speed craft (HSC) ATA, the relevant clauses of IEC 60936-2 shall apply.

3.1.5 Where an ATA display is intended for use as a slave display of a complete radar system it shall comply with the relevant clauses of IEC 60936-1, where applicable to such a display. For HSC ATA the relevant clauses of IEC 60936-2 apply. In addition, the ATA display shall be capable of presenting readily, without significant degradation, the signals shown on the master display.

3.1.6 Additional ARPA facilities, not mandated in this ATA standard, shall comply with IEC 60872-1.

3.1.7 Quality assurance

The ATA shall be designed, produced and documented by companies complying with ISO 9000, as applicable.

3.2 (MSC.64(67)/2) Definitions

Definitions of terms used in these performance standards are given in annex A.

3.3 (MSC.64(67)/3) Performance standards

3.3.1 (MSC.64(67)/3.1) Detection

Where a separate facility is provided for detection of targets, other than by the radar observer, it shall *have a performance not inferior to that which could be obtained by the use of the radar display.*

3.3.2 (MSC.64(67)/3.2) Acquisition

3.3.2.1 (MSC.64(67)/3.2.1) *There* shall *be a facility to provide for manual acquisition* with the relevant symbol (see symbol 1 of annex E) *and cancellation for relative speeds up to 100 knots.*

3.3.2.2 (MSC.64(67)/3.2.2) Manual acquisition shall have a performance not inferior to that which could be obtained by the user of the radar display.

3.3.3 (MSC.64(67)/3.3) Tracking

3.3.3.1 (MSC.64(67)/3.3.1) *The "auto tracking* aid" shall *be able to automatically track, process, simultaneously display and continuously update the information on at least 10 targets*. A target being acquired and tracked during the initial stage shall be shown by a symbol (see symbol 3 of annex E) within 3 s. Targets being tracked when tracking is in steady state shall be shown by symbols 4A or 4B and 5 of annex E within 20 scans.

3.3.3.2 (MSC.64(67)/3.3.2) *The "auto tracking* aid" shall *continue to track an acquired target which is clearly distinguishable on the display for* any *5 out of 10 consecutive scans, provided the target is not subject to target swop.*

3.3.3.3 (MSC.64(67)/3.3.3) *The possibility of tracking errors, including target swop,* shall *be minimised by "auto tracking* aid" *design. A qualitative description of the effects of error sources on the automatic tracking and corresponding errors* shall *be provided to the user, including the effects of low signal-to-noise and low signal-to-clutter ratios caused by sea returns, rain, snow, low clouds and non-synchronous emissions*. Such descriptions shall be in the operating manual.

3.3.3.4 Automatically applied "target identities" shall not be re-used until, as a minimum, the number assigned equals the maximum number of tracked targets.

3.3.3.5 The ATA shall continuously track a manoeuvring target.

3.3.4 (MSC.64(67)/3.4) Display

3.3.4.1 (MSC.64(67)/3.4.1) *The display may be a separate or integral part of the ship's radar. However the "auto tracking* aid" *display* shall *include all the data required to be provided by a radar display in accordance with the performance standards for navigational radar equipment.*

3.3.4.2 (MSC.64(67)/3.4.2) *The design* shall *be such that any malfunction of "auto tracking* aid" *parts producing data additional to information to be produced by the radar as required by the performance standards for navigational equipment* shall *not affect the integrity of the basic radar presentation.*

The equipment shall be regarded as complying with the above if the design is such that, where practicable, normal performance of the radar system in accordance with IEC 60936-1 or IEC 60936-2 will not be affected by malfunction of any ATA subsystem that is not an essential part of the radar.

3.3.4.3 (MSC.64(67)/3.4.3) *The "auto tracking* aid" *facilities* shall *be available on at least 3, 6 and 12 nautical mile range scales, and there* shall *be a positive indication of the range scale in use.*

3.3.4.4 (MSC.64(67)/3.4.4) "*Auto tracking* aid" *facilities may also be provided on other range scales.* The methods of operation which are provided shall be clearly described in the manufacturer's manual.

3.3.4.5 (MSC.64(67)/3.4.5) *The "auto tracking* aid" shall *be capable of operating with a relative motion display with "north-up" and "course-up" azimuth stabilization. In addition, the "auto tracking* aid*" may also provide for a true motion display. If true motion is provided, the operator* shall *be able to select for his display either true or relative motion. There* shall *be a positive indication of the display mode and orientation in use.*

3.3.4.6 (MSC.64(67)/3.4.6) *The course and speed information generated by the "auto tracking* aid" *for acquired targets* shall *be displayed in a vector or graphic form which clearly indicates the target's predicted motion with the relevant symbols* (see symbols 4A or 4B or 5 of annex E). *In this regard:*

.1 *"auto tracking* aid" *presenting predicted information in vector form only* shall *have the option of both true and relative vectors. There* shall *be an indication of the vector mode selected and if "true" is selected, there* shall *be a display of whether it is stabilized with reference to sea or ground;*

.2 *an "auto tracking* aid*" which is capable of presenting target course and speed information in graphic form* shall *also, on request, provide the target's true and/or relative vector;*

.3 *vectors displayed* shall *be time-adjustable;*

.4 *a positive indication of the time-scale of the vector in use* shall *be given; and*

.5 *if stationary targets are being used for ground referencing then this shall be indicated with the relevant symbols* (see symbol 13 of annex E). *In this mode, relative vectors including those of the targets used for ground referencing* shall *be displayed when requested.*

3.3.4.7 (MSC.64(67)/3.4.7) *The "auto tracking* aid" *information* shall *not obscure the visibility of radar targets. The display of "auto tracking* aid" *data* (vector, graphic and associated symbol) shall *be under the control of the radar observer. It* shall *be possible to cancel the display of unwanted "auto tracking* aid" *data within 3 s* of command.

3.3.4.8 (MSC.64(67)/3.4.8) *Means* shall *be provided to adjust independently the brilliance of the "auto tracking* aid" *data and radar data, including complete extinction of the "auto tracking* aid" *data.*

3.3.4.9 (MSC.64(67)/3.4.9) *The method of presentation* shall *ensure that the "auto tracking* aid*" data is clearly visible in general to more than one observer in the conditions of light normally experienced on the bridge of a ship by day and by night. Screening may be provided to shade the display from sunlight but not to the extent that it will impair the observer's ability to maintain a proper look-out. Facilities to adjust the brightness* shall *be provided.*

3.3.4.10 (MSC.64(67)/3.4.10) *Provisions* shall *be made to obtain quickly the range and bearing of any object which appears on the "auto tracking* aid*" display.* The accuracy for this data shall be as stated in IMO MSC.64(67) annex 4.

3.3.4.11 (MSC.64(67)/3.4.11) *The "auto tracking* aid*"* shall *present in a period of not more than 1 min an indication of the target's motion trend and display within 3 min the targets predicted motion in accordance with* 3.3.4.6, 3.3.6, 3.3.7.2 and 3.3.7.3.

3.3.4.12 (MSC.64(67)/3.4.12) *After changing range scales on which the "auto tracking* aid*" facilities are available or* on *resetting the display, full plotting information* shall *be displayed within a period of time not exceeding one scan* of 360°.

3.3.5 (MSC.64(67)/3.5) **Operational warnings**

3.3.5.1 (MSC.64(67)/3.5.1) *The "auto tracking* aid*"* shall *have the capability to warn the observer with a visual and audible signal of any distinguishable target which closes to a range or transits a zone chosen by the observer. The target causing the warning* shall *be clearly indicated with the relevant symbols* (see annex E) *on the display.*

A simple guard zone (3.3.5.2) is required.

3.3.5.2 Guard zone

A target entering the zone shall initiate an audible and visual alarm. The visual alarm being symbol 7 of annex E. After acknowledgement the symbol may cease to flash and shall remain until outside the zone.

3.3.5.3 The methods of operation which are provided shall be clearly described in the manufacturer's operation manual.

3.3.5.4 (MSC.64(67)/3.5.2) *The "auto tracking* aid*"* shall *have the capability to warn the observer with a visual and audible signal of any tracked target which is predicted to close within a minimum range and time chosen by the observer. The target causing the warning* shall *be clearly indicated with the relevant symbols* (see symbol 8 of annex E) *on the display.*

3.3.5.5 (MSC.64(67)/3.5.3) *The "auto tracking* aid*"* shall *clearly indicate if a tracked target is lost, other than out of range, and the target's last tracked position shall be clearly indicated on the display* (see symbol 9 of annex E).

3.3.5.6 (MSC.64(67)/3.5.4) *It* shall *be possible for the observer to activate or de-activate the audible warning capability.*

3.3.6 (MSC.64(67)/3.6) **Alphanumeric *data requirements***

3.3.6.1 (MSC.64(67)/3.6.1) *The observer* shall *be able to select any tracked target to obtain data. Targets selected* shall *be marked with the relevant symbol* (see symbol 12 of annex E) *on the radar display. If data is required for more than one target at the same time each symbol* shall *be separately identified, for example with a number adjacent to the symbol.*

3.3.6.2 (MSC.64(67)/3.6.2) *The following data for each selected target* shall *be clearly and unambiguously identified and displayed immediately and simultaneously in alphanumeric form outside the radar area:*

.1 present range of the target;

.2 present bearing of the target;

.3 predicted target range at the closest point of approach (CPA);

.4 predicted time to CPA (TCPA);

If the CPA has passed, it shall be indicated by a TCPA with a negative (–) sign.

.5 calculated true course of the target;

.6 calculated true speed of the target.

3.3.6.3 (MSC.64(67)/3.6.3) *The display of* 3.3.6.2.5 and 3.3.6.2.6 shall *include an identification of whether the data uses sea or ground reference.*

3.3.6.4 (MSC.64(67)/3.6.4) *When data for several targets is displayed, not less than two items* shall *be displayed simultaneously for each target selected. If the items of data are displayed in pairs for each target the groupings* shall *be* 3.3.6.2.1 with 3.3.6.2.2; 3.3.6.2.3 with 3.3.6.2.4; and, 3.3.6.2.5 with 3.3.6.2.6.

3.3.7 (MSC.64(67)/3.7) **Accuracy**

3.3.7.1 (MSC.64(67)/3.7.1) *The "auto tracking* aid*"* shall *provide accuracies not less than those given in* 3.3.7.2 and 3.3.7.3 *for the four scenarios defined in annex 2* (see annex B). *With the sensor errors specified in annex 3* (see annex C), *the values given relate to the best possible manual plotting performance under environmental conditions of ± 10 degrees of roll.*

3.3.7.2 (MSC.64(67)/3.7.2) *An "auto tracking* aid*"* shall *present within 1 min of steady state tracking the relative motion trend of a target with the following accuracy values (95 % probability values).*

Data / *Scenario*	***Relative course*** *(degrees)*	***Relative speed*** *(knots)*	***CPA*** *(nautical miles)*
1	*11*	*2,8*	*1,6*
2	*7*	*0,6*	---
3	*14*	*2,2*	*1,8*
4	*15*	*1,5*	*2,0*

Note 1 – In steady state tracking both own and target ship follow straight line course at constant speed.

Note 2 – Probability values are the same as confidence levels.

NOTE – In the above table, the values are plus (+) and minus (–).

3.3.7.3 (MSC.64(67)/3.7.3) *An "auto tracking* aid*"* shall *present within 3 min of steady state tracking the motion of a target with the following accuracy values (95 % probability values).*

Data / *Scenario*	***Relative course*** *(degrees)*	***Relative speed*** *(knots)*	***CPA*** *(nautical miles)*	***TCPA*** *(min)*	***True course*** *(degrees)*	***True speed*** *(knots)*
1	*3,0*	*0,8*	*0,5*	*1,0*	*7,4*	*1,2*
2	*2,3*	*0,3*	---	---	*2,8*	*0,8*
3	*4,4*	*0,9*	*0,7*	*1,0*	*3,3*	*1,0*
4	*4,6*	*0,8*	*0,7*	*1,0*	*2,6*	*1,2*

NOTE – In the above table, the values are plus (+) and minus (–).

3.3.7.4 (MSC.64(67)/3.7.4) *When a tracked target, or own ship, has completed a manoeuvre, the system* shall *present in a period of not more than 1 min an indication of the target's motion trend and display within 3 min the target's predicted motion, in accordance with* 3.3.4.6, 3.3.6, 3.3.7.2 and 3.3.7.3. *In this context, a "manoeuvre of own ship"* shall *be deemed to consist of an alteration of course of ± 45° in 1 min.*

3.3.7.5 (MSC.64(67)/3.7.5) *The "auto tracking* aid*"* shall *be designed in such a manner that under the most favourable conditions of own ship motion the error contribution from the "auto tracking* aid*"* shall *remain insignificant compared to the errors associated with the input sensors, for the scenarios of annex 2* (see annex B).

3.3.8 (MSC.64(67)/3.8) **Connections with other equipment**

3.3.8.1 (MSC.64(67)/3.8.1) *The "auto tracking* aid*"* shall *not degrade the performance of any equipment providing sensor inputs. The connection of the "auto tracking* aid*" to any other equipment* shall *not degrade the performance of that equipment. This requirement* shall *be met whether the "auto tracking* aid*" is operating or not. Additionally the "auto tracking* aid*"* shall *be designed to comply with this requirement under fault conditions as far as is practicable.*

3.3.8.2 The ATA shall provide an indication when any input from an external sensor is absent. The ATA shall also repeat any alarm or status messages concerning the quality or source of the input data from its external sensors which may influence its operation.

3.3.8.3 Information exchange between the ATA and other equipment, shall be in accordance with IEC 61162. As far as possible, such an interface shall not degrade the ATA performance by normal or abnormal behaviour of the interface nor of the signals on it.

3.3.8.4 If no suitable IEC 61162 interface is available, another appropriate interface may be used.

3.3.9 (MSC.64(67)/3.9) **Performance tests and warnings**

3.3.9.1 (MSC.64(67)/3.9.1) *The "auto tracking* aid*"* shall *provide suitable warnings of "auto tracking* aid*" malfunction to enable the observer to monitor the proper operation of the system. Additionally, test programmes* shall *be available so that the overall performance of "auto tracking* aid*" can be assessed periodically against a known solution. When a test programme is being executed the relevant test symbols* (see symbol 11A or B of annex E) shall *be displayed.*

3.3.9.2 The test scenario may be shown on a synthetic or live picture. For a synthetic picture symbol 11A of annex E shall be used, and for a live picture symbol 11B of annex E shall be used.

3.3.10 (MSC.64(67)/3.10) **Sea and ground stabilization**

3.3.10.1 (MSC.64(67)/3.10.1) *Log and speed indicators providing inputs to "auto tracking* aid*" equipment* shall *be capable of providing the ship's speed through the water in the fore and aft direction.*

3.3.10.2 (MSC.64(67)/3.10.2) *If a ground stabilized input is also available from the log* (dual axis)*, or from an electronic position-fixing system* (if the speed measurement accuracy is in accordance with the requirements of IMO resolution A.824) *or from tracked stationary targets, then the type of input in use* shall *be displayed.*

3.3.11 (MSC.64(67)/3.11) **Equipment connected to "auto tracking aid"**