



DPC: 24 / 30495458 DC

BSI Group Headquarters

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Interested committees:

Title: BS EN IEC 62065 Maritime navigation and radiocommunication equipment and systems - Track control systems - Operational and performance requirements, methods of testing and required test results

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Responsible Committee Secretary: **Mr Simon Bounds (BSI)**
Direct tel: **0208 996 7281**
E-mail: simon.bounds@bsigroup.com

Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



80/1121/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER: IEC 62065 ED3	
DATE OF CIRCULATION: 2024-06-21	CLOSING DATE FOR COMMENTS: 2024-09-13
SUPERSEDES DOCUMENTS: 80/1087/CD, 80/1111/CC	

IEC TC 80 : MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS	
SECRETARIAT: United Kingdom	SECRETARY: Mr Kim Fisher
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 18	PROPOSED HORIZONTAL STANDARD: ☐ Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.
FUNCTIONS CONCERNED: ☐ EMC ☐ ENVIRONMENT ☐ QUALITY ASSURANCE ☐ SAFETY	

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TITLE:

Maritime navigation and radiocommunication equipment and systems - Track control systems - Operational and performance requirements, methods of testing and required test results

NOTE FROM TC/SC OFFICERS:

This draft has been prepared by WG16 following 80/1111/CC. Clause 6 dealing with tests has been completely revised.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**MARITIME NAVIGATION AND
RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –
TRACK CONTROL SYSTEMS –****Operational and performance requirements,
methods of testing and required test results**

FOREWORD

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International Standard IEC 62065 has been prepared by IEC technical committee 80: Maritime navigation and radiocommunication equipment and systems.

This third edition cancels and replaces the second edition, which has been technically revised.

This edition includes the following significant technical changes with respect to the previous edition:

- alert management has been brought in line with MSC.302(87), IEC 62923-1 and IEC 62923-2, reducing the number of alerts for one situation and improving the information provided by alerts. An overview is provided in Annex F;
- the previous Annex F has been removed as outdated and not instrumental in the standard;
- the structure of Clause 6 has been updated.

260 The text of this International Standard is based on the following documents:

Draft	Report on voting
XX/XX/FDIS	XX/XX/RVD

261
262 Full information on the voting for its approval can be found in the report on voting indicated in
263 the above table.

264 The language used for the development of this International Standard is English.

265 This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in
266 accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available
267 at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are
268 described in greater detail at www.iec.ch/standardsdev/publications.

269 The committee has decided that the contents of this document will remain unchanged until the
270 stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to
271 the specific document. At this date, the document will be

- 272 • reconfirmed,
273 • withdrawn,
274 • replaced by a revised edition, or
275 • amended.

276

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MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS – TRACK CONTROL SYSTEMS –

Operational and performance requirements, methods of testing and required test results

1 Scope

This International Standard specifies the minimum operational and performance requirements, methods of testing and required test results conforming to performance standards adopted by the IMO in resolution MSC.74(69) Annex 2 Recommendation on Performance Standards for Track Control Systems. In addition, it takes into account IMO resolution A.694(17) to which IEC 60945 is associated. It also takes into account IMO resolution MSC.302(87) on bridge alert management (BAM), to which IEC 62923-1 and IEC 62923-2 are associated.

All text of this document that is identical to that in IMO resolution MSC.74(69), Annex 2, is printed in italics and the resolution (abbreviated to – A2) and paragraph numbers are indicated in brackets i.e. (A2/3.3).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

IEC 61162-1, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 1: Single talker and multiple listeners*

IEC 61162-2, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 2: Single talker and multiple listeners, high-speed transmission*

IEC 61162-450, *Maritime navigation and radiocommunication equipment and systems – Digital interfaces – Part 450: Multiple talkers and multiple listeners – Ethernet interconnection*

IEC 62288, *Maritime navigation and radiocommunication equipment and systems – Presentation of navigation-related information on shipborne navigational displays – General requirements, methods of testing and required test results*

IEC 62616, *Maritime navigation and radiocommunication equipment and systems – Bridge navigational watch alarm system (BNWAS)*

IEC 62923-1, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 1: Operational and performance requirements, methods of testing and required test results*

IEC 62923-2, *Maritime navigation and radiocommunication equipment and systems – Bridge alert management – Part 2: Alert and cluster identifiers and other additional features*

321 IMO MSC.74(69) Annex 2, *Recommendation on Performance Standards for Track Control*
322 *Systems*

323 IMO MSC.302(87), *Performance standards for bridge alert management (BAM)*

324 **3 Terms, definitions and abbreviated terms**

325 **3.1 Terms and definitions**

326 For the purposes of this document, the following terms, definitions and abbreviated terms apply.

327 ISO and IEC maintain terminological databases for use in standardization at the following
328 addresses:

- 329 • IEC Electropedia: available at <http://www.electropedia.org/>
- 330 • ISO Online browsing platform: available at <http://www.iso.org/obp>

331 **3.1.1**

332 **active track**

333 *track activated for track control*

334 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

335 **3.1.2**

336 **alarm**

337 **high-priority alert**

338 *condition requiring immediate attention and action by the bridge team, to maintain the safe*
339 *navigation and safe operation of the ship*

340 [SOURCE: IMO Resolution MSC.302(87)]

341 **3.1.3**

342 **alert**

343 *announcement of abnormal situations and conditions requiring attention*

344 Note 1 to entry: *Alerts are divided in four priorities: emergency alarms, alarms, warnings and cautions. An alert*
345 *provides information about a defined state change in connection with information about how to announce this event*
346 *in a defined way to the system and the operator.*

347 [SOURCE: IMO Resolution MSC.302(87)]

348 **3.1.4**

349 **assisted turn**

350 *manoeuvre of a ship automatically controlled by a pre-set radius or rate of turn, but not based*
351 *on the ship's position, to perform an approximation of a curved track*

352 **3.1.5**

353 **back-up navigator**

354 *any individual, generally an officer, who has been designated by the ships master to be on call*
355 *if assistance is needed on the bridge*

356 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

357 **3.1.6**

358 **back-up navigator call**

359 **BNC**

360 *signal automatically sent to the BNWAS to call assistance to the bridge*

3.1.7
consistent common reference system
CCRS

sub-system or function for acquisition, processing, storage, surveillance and distribution of data and information providing identical and obligatory reference to sub-systems and subsequent functions and to other connected equipment, if available

3.1.8
CAM system
combined functionality of CAM and CAM-HMI

Note 1 to entry: CAM means the functionality for the management of the presentation of alerts on the CAM-HMI, the communication of alert states between CAM-HMI and navigational systems and sensors

Note 2 to entry: CAM-HMI means the human machine interface for centralized presentation and handling of alerts on the bridge

[SOURCE: IEC 62923-1]

3.1.9
course

horizontal direction in which a vessel is steered or intended to be steered, expressed as angular distance from north, usually 000° at north, clockwise through 360°

Note 1 to entry: 360° is indicated as 000°.

3.1.10
course difference limit

maximum difference between track course and heading before a warning is activated

3.1.11
cross-track distance
perpendicular distance of the ship from the track

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.12
cross-track limit
maximum cross-track distance before an alarm is activated

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.13
curved track
non-straight track between two straight legs

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.14
FROM-waypoint
last passed waypoint

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.15
great circle
intersection of a sphere on the earth and a plane through its centre

Note 1 to entry: Also called orthodrome.

403 [SOURCE: ISO 19018]

404 **3.1.16**

405 **heading**

406 *direction in which the bow of a ship is pointing expressed as an angular displacement from*
407 *north*

408 [SOURCE: IMO Resolution MSC.191(79)]

409 **3.1.17**

410 **heading control**

411 *control of the ship's heading*

412 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

413 **3.1.18**

414 **heading monitor function**

415 *monitoring of the actual heading sensor by an independent second source*

416 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

417 **3.1.19**

418 **leg**

419 *straight line between two waypoints and/or curved track(s)*

420 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

421 **3.1.20**

422 **main conning position**

423 *place on the bridge with a commanding view providing the necessary information and equipment*
424 *for the conning officer to carry out his functions*

425 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

426 **3.1.21**

427 **minimum manoeuvring speed for track control**

428 *lowest fore/aft speed through the water at which the track control system is capable of*
429 *maintaining its performance within the specified accuracy limits*

430 Note 1 to entry: The value depends on the ship's design and loading and on the present environmental conditions.

431 **3.1.22**

432 **NEXT-waypoint**

433 *waypoint following the TO-waypoint*

434 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

435 **3.1.23**

436 **override facility**

437 *control to perform the override function*

438 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

439 **3.1.24**

440 **override function**

441 *intentional fast change-over from automatic to temporary manual control*

442 [SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.25**position monitor function***monitoring of the actual position sensor by an independent second source*

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.26**primary position-fixing system***electronic position-fixing system (EPFS) used for track control***3.1.27****radius of turn***radius of a curved track*

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.28**rate of turn***change of heading per time unit*

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.29**rhumb line***line on the surface of the earth making the same angle with each meridian crossed***3.1.30****ship manoeuvring characteristics***range-of-manoeuvre possible for the ship*

Note 1 to entry: Examples of the range-of-manoevres are: maximum rate of turn, minimum radius of turn, maximum turn acceleration and deceleration.

3.1.31**single operator action***procedure achieved by no more than one hard-key or soft-key action, excluding any necessary cursor movements, or voice actuation using programmed codes*

[SOURCE: IMO Resolution MSC.252(83)]

3.1.32**speed***absolute value of velocity*

Note 1 to entry: May either be the ship's speed through the water, or the speed made good over the ground.

3.1.33**surge***alongship component of ship motion***3.1.34****sway***athwartships component of ship motion (positive to starboard)***3.1.35****temporary track***track that originates at the current position of the ship and joins the pre-planned track*

Note 1 to entry: The temporary track may include temporary waypoints which can be identified as different from the waypoints of the pre-planned track.

3.1.36**TO-waypoint**

waypoint which the ship is approaching

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.37**track**

path to be followed over ground

Note 1 to entry: Also called route.

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.38**track control****TC**

control of the ship's movement along a track, where corrections made by the controller to compensate for wind, drift and other influences, are based on the cross-track distance and not only on the bearing to the TO-waypoint

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.39**track course**

direction from one waypoint to the next, a constant course on a rhumb line track and a varying course on a great circle track

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.40**warning**

condition requiring immediate attention, but no immediate action by the bridge team

Note 1 to entry: Warnings are resented for precautionary reasons to make the bridge team aware of changed conditions which are not immediately hazardous, but may become so if no action is taken.

[SOURCE: IMO Resolution MSC.302(87)]

3.1.41**waypoint****WP**

geographic position on a route

3.1.42**wheel-over-line****WOL**

line where the ship has to initiate a curved track to eliminate the effect of any offset with respect to the new course, taking into consideration the distance required for the ship to build up the necessary rate of turn and the prevailing weather, speed and loading conditions

[SOURCE: IMO Resolution MSC.74(69), Annex 2]

3.1.43**wheel-over-time****WOT**

point in time when the track control system initiates the course change

3.1.44**yaw**

rate of turn (positive to starboard)

3.2 Abbreviated terms

~A	Not applicable for category A systems
BAM	Bridge alert management
BNWAS	Bridge navigational watch alarm system
CAM	Central alert management
CCA	Course change alarm
CCW	course change warning
COG	Course over ground
DGPS	Differential GPS
DR	Dead reckoning
ECDIS	Electronic chart display and information system
EPFS	Electronic position fixing system
EUT	Equipment under test
GC	Great circle
GPS	Global positioning system
HCS	Heading control system
HDG	Heading
INS	Integrated navigation system
RL	Rhumb line
RMS	Root mean square
ROT	Rate of turn
SDME	Speed and distance measuring equipment
SWH	Significant wave height
TCS	Track control system
XTD	Cross-track distance

4 Application of this document

The application of this document is as follows.

- a) (A2/1) *Track control systems in conjunction with their sources of position, heading and speed information are intended to keep a ship automatically on a pre-planned track over ground under various conditions and within the limits related to the ship's manoeuvrability. A track control system may additionally include or be combined with for example but not limited to*
 - *heading control;*
 - *along-track speed control (see Annex B).*
- b) Planning the track by waypoints may be performed
 - as part of the track control system; or
 - by importing waypoint- and/or track data.
- c) (A2/2.1) *These IMO Performance Standards are applicable for track control systems working*
 - *at ship's speed from minimum manoeuvring speed up to 30 kn; and*
 - *at ship's maximum rate of turn not greater than 10°/s.*
- d) This document applies to three categories of track control systems:
 - Category A: Single leg track control or multiple leg track control without assisted turns between legs;

Category B: Multiple leg track control with assisted turns between legs;

Category C: Full track control on legs and turns.

e) (A2/2.2) *Track control systems fitted on ships shall meet all requirements of the IMO Performance Standards (MSC.74(69) Annex 2 Recommendation on Performance Standards for Track Control Systems) relating to straight tracks as described in this document. Systems fitted on ships requiring curved track control shall additionally meet all the requirements relating to curved tracks, described as category C in this document.*

f) In this document, the ship models are for ships that use a conventional propeller propulsion system in conjunction with a single rudder or multiple parallel operated rudders (see Annex I).

5 Requirements

5.1 General

(See 6.1.1, 6.16)

The track control system shall comply with the applicable requirements of IEC 60945 and IEC 62288.

5.2 Operational requirements

5.2.1 Functionality

5.2.1.1 Track control mode

(See 6.3.1, 6.16.1)

(A2/5.1.1) *A track control system shall be able to steer the ship from its position*

.1 to a single waypoint; or

.2 along a track containing a sequence of waypoints

using rhumb line legs and great circle legs, as pre-planned by the user, and shall ensure that ship's position and actual heading do not deviate from the pre-planned track beyond preset limits in 6.3 under the scenarios defined in Annex G.

5.2.1.2 Starting requirements

(See 6.4)

(A2/5.1.2) *The system shall allow the officer of the watch (user) to start or restart track control or replace the active track with a new track during track control only if*

NOTE 1 For changes to the active track, see 5.2.1.7.

- position, heading and speed sensor data in use are valid,
- the pre-planned track has passed the check for plausibility and correctness of geometric properties and ship's manoeuvrability (e.g. the ship's maximum rate of turn is not exceeded in the route plan) before becoming the active track,

NOTE 2 The track control system is not required to check the pre-planned route for dangers in nautical charts. and if:

- *the ship's position* relative to the selected track (see recommendation in Table E.1, row 3),
- *the difference between track course and actual heading* (see recommendation in Table E.1, row 4),
- *the ship's manoeuvrability* (e.g. the ship's maximum rate of turn is not exceeded by the approach manoeuvre)

NOTE 3 The maximum rate of turn can be configurable at installation and/or dynamically determined.

will result in a safe approach manoeuvre to the track. A safe approach manoeuvre is within the manoeuvring characteristics of the vessel and does not result in an unexpected turning direction.

For this purpose, the system shall allow the user at least one of the following options:

- a) to select or confirm the TO-waypoint or a leg on a pre-planned track and to select the limit for the maximum difference between the track course and the actual heading (see recommendation in Table E.1, row 4);
- or
- b) to use a temporary track to go to the pre-planned track. The TCS shall graphically present the temporary track. The temporary track shall meet all ship manoeuvring characteristics which apply to a pre-planned track (~A). When track control is active on a temporary track, it shall not be possible for the user to change the properties of the temporary track.

5.2.1.3 Primary position-fixing system, heading and speed

(See 6.5)

(A2/5.1.3) The primary position-fixing system used for track control shall be an electronic position-fixing system (EPFS) approved by the International Maritime Organization. See also 5.5.1.

Position, heading and speed can each be based on a single sensor/source or optionally from multiple sensors/sources.

5.2.1.4 Position monitoring

(See 6.6)

(A2/5.1.4) The ship's position shall be continuously monitored by a second or additional independent position source. If the ship is fitted with a second EPFS and position is available from this EPFS its position shall be used for position monitoring. Otherwise, estimated position by dead reckoning (DR) as a minimum shall be used as the second position source for position monitoring. The DR position shall be derived from a shipborne heading sensor and a speed and distance measuring equipment (SDME). See 5.2.3.3. This monitoring need not be an integral part of the track control system.

5.2.1.5 Approaching course change behaviour (~A)

(See 6.7)

A graphical description of the sequences described here is given in Figure A.1.

(A2/5.1.5) In the case of track control by a sequence of waypoints, an early course change indication shall be given by a category B warning (CCW) at a user-selectable time no earlier than 5 min, but no later than 1 min before the wheel-over line. Acknowledgement shall rectify the CCW.'

When, due to quick succession of legs, a CCW for the wheel over line of the NEXT-waypoint would be required before the wheel over line of the TO-waypoint, the CCW for the NEXT-waypoint shall be delayed until the wheel over line of TO-waypoint.

Information for decision making in the alert description text shall at least contain the direction of the upcoming turn (STBD/PORT) and the planned course over ground. Optionally the actual time to wheel-over may be added and shall be kept up-to-date.

EXAMPLEs of information for decision making in a course change alert:

"Ship turns to STBD to 012°"

"STBD turn to 012°"

660 "In 33 s ship turns to STBD from 356° to 012°"

661 "In 33 s STBD turn from 356° to 012°"

662 **5.2.1.6 Course change behaviour (~A)**

663 (See 6.7)

664 A graphical description of the sequences described here is given in Figure A.1.

665 (A2/5.1.6.1) *In the case of track control by a sequence of waypoints, if the CCW has been*
666 *acknowledged before wheel-over, a single audible indication representing the Morse letter "C"*
667 *(i.e. dash dot dash dot) shall be given at the wheel-over line, unless this audible indication*
668 *coincides with the audible signal of the CCW for the NEXT-waypoint (see 5.1.1.5).*

669 (A2/5.1.6.1) *In the case of track control by a sequence of waypoints, a category B alarm (CCA)*
670 *shall be given as escalation of an unacknowledged CCW at the wheel-over line.*

671 (A2/5.1.6.2) *The system shall provide means for the officer of the watch to confirm the course*
672 *change at wheel-over by acknowledging the CCA. Acknowledgement shall rectify the CCA.*

673 (A2/5.1.6.3) *With or without the confirmation (acknowledgement of the CCW or CCA), the ship*
674 *shall follow automatically the track.*

675 (A2/5.1.6.4) *If the actual course change alarm is not confirmed (CCA not acknowledged) by*
676 *the officer of the watch within 30 s of wheel-over, a back-up navigator call (BNC) shall be given.*
677 *When the BNC has been sent, it shall be removed when the mariner:*

- 678 • acknowledges the CCA; or
- 679 • intentionally disengages track control by selecting a different steering control mode.

680 **5.2.1.7 Change of waypoints**

681 (See 6.4, 6.8)

682 (A2/5.1.7) *In the case of track control by a pre-planned sequence of waypoints, it shall not be*
683 *possible to modify the TO-waypoint, the FROM-waypoint and (~A) the NEXT-waypoint of the*
684 *active track and their relevant associated waypoint data while in the track control mode without*
685 *creating a new track and until:*

- 686 a) *the pre-planning of the new (modified) track is completed;*
- 687 *and*
- 688 b) *the starting requirements (5.2.1.2) are fulfilled.*

689 This also applies to other waypoints than the TO-, FROM and (~A) NEXT waypoint of the active
690 track.

691 For temporary track, see 5.2.1.2.

692 **5.2.1.8 Turn performance (~A)**

693 (See 6.3.2)

694 (A2/5.1.8) *The track control system shall enable the ship to sail from one leg to another by*
695 *turns based:*

- 696 a) *on a preset turn radius;*
- 697 *or*
- 698 b) *on a radius calculated on the base of a preset rate of turn and the planned speed;*
- 699 *and*

700 *within the turning capability of the ship.*

701 **5.2.1.9 Adaptation to steering characteristics**

702 (See 6.3.3, 6.12)

703 (A2/5.1.9) *The track control system shall be capable of manual or automatic adjustment to*
704 *different steering characteristics of the ship under various weather, current, speed and loading*
705 *conditions.*

706 The user manual shall contain information on the facilities for adjustment to weather, current,
707 speed and loading conditions.

708 NOTE The minimum adjustments for various weather and speed conditions are defined and covered by the tests
709 for adaptation to speed, currents and sea states in this document (see 6.3.3).

710 While track control is active, and no valid speed information remains in use (see 5.2.1.3 and
711 5.2.3.5) by the track control function, or optional integrity and plausibility checks are in use and
712 the speed becomes marked as not passing these checks, then:

- 713 • the track control system shall provide a 'accuracy reduced' warning. The alert description
714 text shall provide guidance for decision making; and
- 715 • track control shall continue and use the last plausible speed of the ship or a system derived
716 speed. Subsequently, TCS may allow the mariner to set a manual speed.

717 NOTE Examples of system derived speed information are an estimate deducted from continuous observation of
718 shift of positions, or deducted from propeller RPM etc.

719 If a valid speed becomes available, the system shall continue track control using the valid speed
720 information (based on sensor information, see 5.2.1.3) and shall rectify the 'performance
721 reduced' warning. See also 5.2.1.10.

722 **5.2.1.10 Permitted tolerance**

723 (See 6.3.4)

724 (A2/5.1.10) *Means shall be incorporated to prevent unnecessary activation of the rudder due*
725 *to normal yaw or sway motion, sensor data resolution and statistically scattered position errors.*

726 A change of position, heading and/or speed sensors in use shall not generate excessive rudder
727 activities.

728 The quality of the track control shall be so that overshoot, oscillation and constant track
729 deviation are within tolerable limits (see 6.3) both for straight and curved tracks.

730 Category B TCS shall comply with the requirements for curved track TCS, except that, after
731 having passed the wheel-over, the actual cross-track distance is merely used for monitoring
732 until completion of the automatic course change manoeuvre. Manual or automatic means shall
733 be provided to compensate for variable drift and speed changes during a turn (e.g. facilitating
734 manual adjustments of rate of turn or radius of turn). The manual adjustments shall not influence
735 the following turns.

736 **5.2.1.11 Override function**

737 (See 6.9.1)

738 (A2/5.1.11) *A track control system shall be able to accept a signal from the override facilities*
739 *to terminate track control mode and switch to these override facilities. After change-over to*
740 *override, return to track control shall require user intervention (see 5.2.1.2).*

741 **5.2.1.12 Heading control mode**

742 (See 6.9.1)

(A2/5.1.12) *A track control system may be operated in heading control mode. In this case, the performance standards of heading control systems are to be applied.*

NOTE The IMO performance standards for heading control are given in IMO resolution MSC.64(67) annex 3 and these are incorporated into ISO 11674.

5.2.1.13 Manual change over from track control to manual steering

(See 6.9.1)

(A2/5.1.13.1) *Change over from track control to manual steering shall be possible at any rudder angle.*

(A2/5.1.13.2) *Change over from track control to manual steering shall be possible under any conditions, including any failure in the track control system.*

(A2/5.1.13.3) *After change over to manual steering, return to automatic track control shall require operator (user) intervention (see 5.2.1.2).*

5.2.1.14 Manual change over from track control to heading control

(See 6.9.2)

This subclause only applies if the heading control is included in the track control system.

(A2/5.1.14.1) *Any change over from track control to heading control shall be possible under all conditions of normal operation.*

(A2/5.1.14.2) To maintain the course, *the heading control system shall:*

- if sailing on a leg, *take over the actual heading as the preset heading,*
- (~A) if sailing on a curved track, *take over the actual heading as the preset heading.*

(~A) If sailing on a curved track, the system may provide the additional option, based on an intended operator selection, to complete the turn with the track course of the next leg as the preset heading for the heading control system. This operator selection shall only be available after the turn has started and shall be clearly and unambiguously indicated.

(A2/5.1.14.3) *Any switching back to track control shall require operator (user) intervention (see 5.2.1.2).*

5.2.1.15 Steering mode indication

(See 6.16.2)

(A2/5.1.15) *Adequate indication shall be provided to show which method of steering is in operation.*

If HCS is an integral part of the TCS, the TCS shall at least indicate if the TCS, HCS or a manual/external mode is in operation. If HCS is not an integral part of the TCS, the TCS shall at least indicate if the TCS or a manual/external mode is in operation.

When the TCS is activated and has multiple internal modes available, it shall clearly indicate which internal mode is in operation.

The indication shall at least be provided at all locations where the steering mode can be changed in the TCS.

5.2.1.16 Heading monitoring

(See 6.10)

(A2/5.1.16) *Heading monitoring shall be provided to monitor the actual heading information by independent heading sources. The heading monitor is not required to be an integral part of the track control system. See 5.2.3.4 for the alerts based on the heading monitoring.*

If the TCS does not include the heading monitoring function, the installation manual shall provide instructions to fit equipment with a heading monitoring function.

5.2.1.17 End of pre-planned track

(See 6.11)

At the end of the pre-planned track, until the user takes over, the system shall continue in track control mode extending the final leg.

See also 5.2.3.10.

5.2.1.18 Control of pre-planned speed by TCS

This requirement applies when a track control system includes along track speed control.

When along track speed control is operated in automatic speed control mode based on a pre-planned route:

- when the pre-planned speed changes at a waypoint, the alert descriptive text of the associated course change alert (see 5.2.1.5) shall include the new pre-planned speed;

NOTE The pre-planned speed could either be a single value or an upper and a lower limit.

- when the actual ship's speed deviates from the pre-planned speed beyond a pre-set limit, an appropriate alert shall be provided, taking into account the time needed to achieve the new speed setting and properties of speed sensors.

5.2.2 Accuracy and performance constraint documentation

(See 6.12)

(A2/5.2.1) *A short qualitative description of the effect of:*

- .1 the accuracy of the sensors for position, heading and speed;*
- .2 changes of course and speed;*
- .3 actual speed through the water; and*
- .4 environmental conditions*

on the track control system shall be provided to the user in appropriate documentation.

For category B TCS, the user manual shall describe:

- the difference between control during straight legs and assisted turns; and
- the transition from assisted turns to a straight leg, including the principles used to manoeuvre to the straight leg.

5.2.3 Alerts

5.2.3.1 General

(See 6.13.1)

The equipment shall comply with IEC 62923-1 and IEC 62923-2.

When the automatic track control function is intentionally disengaged by the mariner, all active alerts related to track control only shall be terminated.

820 NOTE For example, the heading monitoring and its alerts may remain active if they are also part of an active function
821 other than track control.

822 For alerts required by this document, standard alert identifiers are specified in Annex F,
823 Table F.1.

824 **5.2.3.2 Failure or reduction in power supply**

825 (See 6.13.2)

826 (A2/5.3.1) *In case of failure or reduction of power supply to the track control system which*
827 *effects its safe operation, an alert or status signal shall be given as follows.*

828 If track control is active and the TCS has multiple power inputs, and remains in safe operation
829 after failure of one power input due to the presence of another power input, the TCS shall on
830 failure of one power input raise a 'power fail' caution, see Table F.1 for details.

831 If track control is active, in case of total power input failure to the TCS, where the TCS remains
832 able to raise an alert, it shall either raise a 'power fail' warning (if track control continues) or a
833 'track control stopped' alert (if track control is automatically stopped), see Table F.1 for details.

834 In case of total power failure of the TCS, where the TCS is no longer able to raise an alert, the
835 TCS shall provide a status signal, either:

- 836 • by normally closed contact; or
- 837 • by ceasing transmission of the HBT sentence which, without total power failure, shall be
838 transmitted with a frequency of at least 1 Hz to enable external equipment to raise an alert
839 within 3 s.

840 The installation manual shall contain a description of the available status signal(s) and a
841 requirement for external equipment to monitor at least one status signal and provide an alert
842 when power failure occurs. The installation manual shall contain an instruction that the
843 equipment needs to be installed in an environment providing the monitoring of at least one
844 status signal provided by the system and an alert on power failure.

845 **5.2.3.3 Position monitoring alert**

846 (See 6.6)

847 (A2/5.3.2) A 'doubtful position' warning shall *be given when the position monitor detects a*
848 *deviation beyond a preset limit* for the difference between the primary position source and the
849 position source used for monitoring or when position monitoring becomes impossible, see
850 5.2.1.4. See Annex E.

851 The preset limit shall be user selectable, and cover at least the range of 0,01 NM to 1 NM (or
852 the equivalent in other units).

853 NOTE Although the detection function is called "position monitor", a functional title is required by IEC 62923-1, such
854 as 'doubtful position'. The alert description text is available to describe the consequences of the problem and/or how
855 to deal with the situation.

856 **5.2.3.4 Heading monitoring alert**

857 (See 6.10)

858 (A2/5.3.3) A 'doubtful heading' warning shall *be given when the heading monitor detects a*
859 *deviation beyond a preset limit* or when heading monitoring becomes impossible, see 5.2.1.16.
860 There shall be a user selectable limit for raising the alert covering at least the range of:

- 861 – 1° to 15° for comparison between gyro compasses or equivalent; and/or
- 862 – 5° to 90° for comparison between gyro compasses or equivalent with a magnetic compass.

863 See Annex E.

864 NOTE Although the detection function is called "heading monitor", a functional title is required by IEC 62923-1,
865 such as 'doubtful heading'. The alert description text is available to describe the consequences of the problem and/or
866 how to deal with the situation.

867 **5.2.3.5 Failure and alert status of sensor**

868 (See 6.18.1)

869 *(A2/5.3.4) In the case of any failure or failure status received from the position-fixing sensor or*
870 *the heading sensor in use and no automatic change-over of the sensor in use occurs:*

- 871 1) *an alert shall be generated at the track control system as specified in 5.6.2 and 5.6.3; and*
872 2) *the system shall provide guidance of the user to a safe steering mode as specified in 5.6.2*
873 *and 5.6.3; and*
874 3) *a back-up navigator call shall be given if an alarm required in 5.6.2 or 5.6.3 is not*
875 *acknowledged by the officer of the watch within 30 seconds as specified in 5.2.3.12; and*
876 4) *the alerts in 5.2.3.3 and 5.2.3.4 shall not be raised.*

877 *Fall-back procedures consequential to the failure and failure status are stated in 5.6.*

878 In the case of any failure or failure status received from the speed sensor in use and no
879 automatic change-over of the sensor in use occurs, 5.2.1.9 applies.

880 **5.2.3.6 Selection for use of faulty sensor signals**

881 (See 6.5)

882 *(A2/5.3.5) It shall not be possible to select any sensor signal tagged with a fault or invalid*
883 *status, including signals received in simulated, manual and estimated (DR) mode, for automatic*
884 *track control. The equipment shall indicate the sensor status.*

885 **5.2.3.7 Cross-track alert**

886 (See 6.13.3)

887 *(A2/5.3.6) A 'cross track' alarm shall be provided when the actual position deviates from the*
888 *track beyond a preset cross track limit. This shall be a user selectable limit covering at least*
889 *the range of 0,01 NM to 1 NM (or the equivalent in other units) for raising the alert. See Annex E.*

890 NOTE 1 This cross-track limit, to monitor the TCS performance, is a different limit than the user-specified distance
891 from the route used for the check of safety contour, prohibited areas, geographic areas for which special conditions
892 exist and navigational hazards in IEC 61174.

893 NOTE 2 This cross-track limit, to monitor the TCS performance, can be the same or a different limit than the ECDIS
894 cross-track limit for deviation from the planned route in IEC 61174.

895 The cross-track limit for monitoring the TCS performance should be lower than or equal to the
896 ECDIS cross-track limit for deviation from the planned route (see IEC 61174).

897 **5.2.3.8 Course difference alert**

898 (See 6.13.4)

899 *(A2/5.3.7) A 'course difference' warning shall be given if the actual heading of the ship*
900 *deviates from the track course beyond a preset value. The preset course difference limit shall*
901 *be a user selectable limit covering at least the range of 5° to 45° for raising the alert (see*
902 *Annex E).*

903 NOTE This makes the mariner aware of an increasing steering angle in order to encourage the mariner to evaluate
904 the ship's behaviour, e.g. in traffic or in respect to the environmental circumstances. The alert description text is
905 available to describe the consequences of the problem and/or how to deal with the situation.

5.2.3.9 Low speed alert

(See 6.13.5)

(A2/5.3.8) *If speed through the water in the fore/aft direction is lower than a predefined limit necessary for steering the ship under track control (minimum manoeuvring speed for track control) a 'Low speed' warning shall be given.*

NOTE The alert description text can be used to describe the consequences of the problem and/or how to deal with the situation.

5.2.3.10 End of track alert

(See 6.11)

In the case of track control by a sequence of waypoints, an 'end of track' warning shall be given at a user-selectable time no earlier than 5 min, but no later than 1 min before the last waypoint. The acknowledgement of the warning shall rectify the warning. (~A)

NOTE 1 The alert description text can be used to describe the behaviour of the TCS after passing the last waypoint and/or how to deal with the situation.

When, due to quick succession of legs, an 'end of track' warning would be required before the wheel over line of the penultimate waypoint of the pre-planned track, the 'end of track' warning shall be delayed until the wheel over line of the penultimate waypoint of the pre-planned track. (~A)

If the 'end of track' warning is not acknowledged, the alert priority shall be escalated from warning to alarm at the last waypoint. (~A)

For category A systems, the 'end of track' warning shall be given at the end of each leg, and if not acknowledged, the alert priority shall be escalated from warning to alarm within 1 min.

NOTE 2 The alert description text can be used to describe the behaviour of the TCS after passing the end of the leg and/or how to deal with the situation.

The 'end of track' alarm is associated with BNC activation (see 5.2.3.12).

5.2.3.11 Track control stopped alert

(See 6.13.6)

A 'track control stopped' warning shall be given if the system automatically switches over to heading control mode. If the 'track control stopped' warning is not acknowledged within 30 s the warning shall escalate to alarm.

A 'track control stopped' alarm shall be given if the system automatically stops track control and does not automatically switch to heading control.

The 'track control stopped' alert title or alert description text shall, if practicable, include the automatically selected mode or advice to the mariner to switch over to heading control mode or manual mode (see 5.6.1).

The 'track control stopped' alarm is associated with BNC activation (see 5.2.3.12).

The acknowledgement of the 'track control stopped' alert shall rectify the alert.

5.2.3.12 Handling of the Back-up Navigator Call (BNC)

(See 6.14)

This clause applies to alerts associated with BNC in this document.

A graphical description of the sequences described here is given in Figure A.2.

Activation of BNC shall use the emergency call function of the BNWAS (see IEC 62616) by applying at least one of the following means:

- contact closure or equivalent circuit; or
- IEC 61162 interface using the ALR sentence (see Annex K.2 and IEC 62616).

Power failure of track control system shall not activate the BNC.

BNC shall be activated in accordance with the following:

- if within 30 s of the alarm's occurrence, the alarm has not been acknowledged and has not been temporarily silenced, and the alarm condition has not been rectified, then the BNC shall be activated;
- if within 30 s of the alarm's occurrence, the alarm has not been acknowledged and has not been rectified, but has been temporarily silenced by the operator, then the following will apply:

When the silencing expires, the BNC activation shall function as if the alarm condition just arose, but any further silencing shall not result in further delay of the BNC. Note that the silencing specified here is the temporary silence function which expires, reactivating the audible announcement, after 30 s.

As soon as all of the alarms associated with BNC activation are acknowledged or rectified, the BNC shall be deactivated.

5.2.3.13 Remote acknowledgments of alerts

(See 6.13.1)

Remote temporary silencing and remote acknowledgement shall be possible as described in IEC 62923-1.

5.3 Ergonomic criteria

5.3.1 Operational controls

(See 6.15)

5.3.1.1 Controls for track control

(A2/6.1.1) *Means shall be provided to:*

- .1 accept or calculate the course between subsequent waypoints; and*
- .2 adjust radius or rate of turn, all user settable track control related limits, limits for alert functions and other control parameters.*

Means may include but are not limited to a keyboard, knob or input at a screen.

NOTE There are restrictions described in 5.2.1.7.

5.3.1.2 Change over controls

(A2/6.1.2.1) *Track control to manual control*

Changing over from track control to manual steering shall be possible by a single operator action.

(A2/6.1.2.2) *Track control to heading control*

984 *If the track control system can be operated with a heading control system (configuration B (see*
 985 *5.6.1 Figure 1)), changing over from track to heading control shall be possible by a single*
 986 *operator action.*

987 (A2/6.1.2.3) *Location of change over controls*

988 The installation manual shall contain instructions that *the steering mode selector switch or*
 989 *override facility, if installed, shall be located at or in the immediate vicinity of the main conning*
 990 *position.*

991 **5.3.2 Presentation of information**

992 **5.3.2.1 Continuously displayed information**

993 (See 6.12, 6.16.2)

994 (A2/6.2.1) *The following information shall be displayed clearly and continuously; but not*
 995 *necessarily on a single display:*

996 .1 *mode of steering* (see 5.2.1.15); for category B systems, an additional “assisted turn”
 997 *indication shall be provided during course change manoeuvres;*

998 .2 *sources of actual selected position, heading and speed;*

999 .3 *status and failure of selected heading, speed, and position sensors in use (see 5.2.3.5) (if*
 1000 *any);*

1001 NOTE 1 The status for heading includes the heading correction status, if available, see 5.5.2.

1002 .4 *track course and actual heading;*

1003 NOTE 2 For a great circle the track course depends on the ship's position.

1004 .5 *actual position, cross-track distance* including direction (port/starboard) *and speed over*
 1005 *ground;*

1006 .6 *TO-waypoint and NEXT-waypoint;*

1007 .7 *time and distance* related to the wheel-over of the *TO-waypoint;*

1008 NOTE 3 In the case the TO-waypoint is the last waypoint in the active pre-planned track, the time and distance
 1009 relates to passing the last waypoint.

1010 .8 *next track course* (i.e. the course of the next leg); *and*

1011 NOTE 4 In case the next leg is a great circle leg, the next track course is the initial course of the great circle.

1012 .9 *selected track identification.*

1013 *Items .4, .5 (except direction), .7 and .8 shall be displayed numerically.*

1014 The installation manual shall contain instruction to install the TCS so that the presentation of
 1015 the required information is in the vicinity of the main conning position.

1016 **5.3.2.2 Information to be provided on demand**

1017 (See 6.16)

1018 (A2/6.2.2) *The following information shall be provided at least on demand:*

1019 .1 *a list of pre-planned waypoints including:*

1020 – *waypoint numbers or identifiers,*

1021 – *co-ordinates,*

1022 – *courses and distances between waypoints,*

1023 NOTE Distances are approximately from wheel-over point to wheel-over point along the curved track (since
 1024 accurate values are ship dependent, see IEC 61174).

1025 – *turn radius or rates of turn* of the curved track(s) (~A);

- 1026 .2 *all user settable track control related limits and other preset control parameters;*
1027 .3 *geodetic datum in use.*

1028 **5.3.2.3 Presentation**

1029 (See 6.16)

1030 (A2/6.2.3) *Logically related values such as preset and actual values shall be displayed as a*
1031 *pair of data.*

1032 If the TCS is capable of graphically presenting the ship's position relative to the pre-planned
1033 track, the graphical presentation shall be consistent with the numerical information.

1034 **5.4 Design and Installation**

1035 The track control system should be designed, manufactured and installed in accordance with
1036 recognized international quality standards, such as ISO 9000. See also SOLAS 1974 V/18.5
1037 and IEC 60945 Software.

1038 **5.5 Interfacing**

1039 **5.5.1 Sensors**

1040 (See 6.5, 6.17)

1041 (A2/7.1) *The track control system (TCS) shall be connected to position, heading and speed*
1042 *sensors which meet the standards of the International Maritime Organization.* For track control
1043 *the heading measurement system shall be a gyro-compass or equivalent.*

1044 The installation manual shall include instructions that the TCS is to be connected to a gyro
1045 compass or equivalent that meets the standards of the International Maritime Organization and
1046 that the TCS has to be connected to sensors for position and speed that meet the standards of
1047 the International Maritime Organization.

1048 NOTE 1 The heading source used for monitoring need not be a gyro-compass or equivalent.

1049 NOTE 2 Information flowing within the EUT can use proprietary interfaces and contain proprietary data.

1050 **5.5.2 Status information**

1051 (See 6.17, 6.18.1)

1052 (A2/7.2) *All connected sensors shall be able to provide status, including failure information.*
1053 *The track control system shall check for received status and failure information.*

1054 TCS may support a legacy gyro compass to be used for track control which does not provide
1055 status or failure information on the application of the speed and latitude correction, in which
1056 case the track control system shall perform corresponding plausibility checks (see 5.3.2.1 .3).

1057 NOTE In principle, gyro compasses provide heading information that is corrected for speed and latitude using the
1058 HCR sentence, but under some circumstances that correction may not have been applied. TCS may not be informed
1059 about the status of the correction. If the status information is not available, TCS performance may be degraded.

1060 If the HCR sentence is received from the heading measurement system, the track control
1061 system shall indicate the correction status (see 5.3.2.1 .3).

1062 **5.5.3 Standards**

1063 (See 6.17)

1064 (A2/7.3) *The track control system shall be capable of digital, serial communication with the*
1065 *ships navigation system and comply with the IEC 61162 series and Annex K.*

The manufacturer shall specify which IEC 61162 part each physical interface supports.

5.6 Fall-back arrangements

5.6.1 General

(See 6.18.2)

When the track control function fails, the following requirements apply.

Figure 1 illustrates the typical TCS configurations relating to the fall-back requirements.

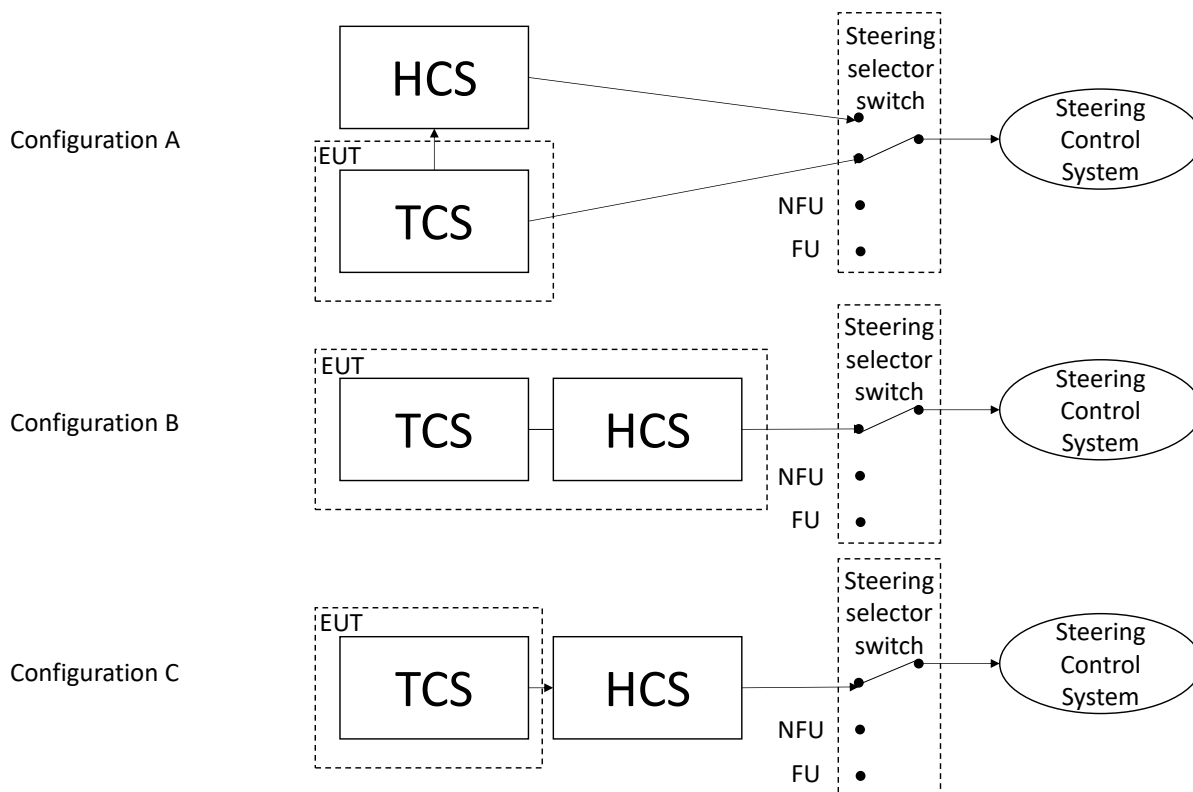


Figure 1 – EUT typical configurations

Configurations A and C:

NOTE 1 In configurations A and C, the EUT does not contain a HCS. In configuration A, TCS provides a rudder command to the steering control system. In configuration C, TCS provides a heading to steer to the HCS.

(A2/8.1.1) If the system does not include a heading control mode, then the system shall transmit the HTC sentence to command the heading control system to automatically switch over to heading control mode and:

- if sailing on a leg, the HTC sentence shall include a command to *take the actual heading as the preset heading for the heading control*, or a command to take the calculated heading available at the moment of TCS failure, so that the actual COG is approximately maintained;
- if sailing on a curved track, the HTC sentence shall include a command to take the track course of the next leg as the preset heading, so that the pre-planned course change manoeuvre is approximately completed (~A).

NOTE 2 Approximately indicates that the heading is no longer corrected for any errors in relation to the planned track.

NOTE 3 Configuration A does not require that a HCS is installed.

Configuration B:

1090 NOTE 4 In configuration B the EUT contains a HCS. The EUT provides a rudder command to the steering control
1091 system.

1092 (A2/8.1.1) *If the system includes a heading control mode which is still available then the*
1093 *system shall automatically switch over to heading control and:*

- 1094 – if sailing on a leg, *take the actual heading as the preset heading for the heading control*, or
1095 a calculated heading available at the moment of TCS failure, so that the actual COG is
1096 approximately maintained;
- 1097 – if sailing on a curved track, the track course of the next leg shall be taken over as the preset
1098 heading so that the pre-planned course change manoeuvre is approximately completed
1099 (~A).

1100 NOTE 5 HTC and HTD sentences are available in IEC 61162-1.

1101 NOTE 6 Approximately indicates that the heading is no longer corrected for any errors in relation to the planned
1102 track.

1103 Configurations A, B and C:

1104 (A2/8.1.2) The installation manual of the TCS shall include an instruction to install the TCS in
1105 combination with the steering control system so that in the event of failure of the TCS, *if the*
1106 *heading control is not available, the rudder angle shall be maintained* so that:

- 1107 – if sailing on a leg, the actual heading is approximately maintained;
- 1108 – if sailing on a curved track, the actual rate of turn is approximately maintained (~A).

1109 NOTE 7 Approximately indicates that the rudder angle is no longer corrected for any errors in relation to the planned
1110 track or the commanded heading.

1111 See 5.2.3.11 for the track control stopped alert.

1112 For advice on failure of track control mode when dual controllers are installed, see Annex C.

1113 **5.6.2 Failure of position**

1114 (See 6.18.3)

1115 NOTE Integrity and plausibility checks may be available to the TCS, e.g. from an INS using the NSR sentence.

1116 While track control is active, and no valid position remains in use (see 5.2.1.3 and 5.2.3.5) by
1117 the track control function, or optional integrity and plausibility checks are in use and the position
1118 becomes marked as not passing these checks, then:

- 1119 • either track control shall be stopped immediately (see 5.6.1); or
- 1120 • the track control system shall provide a warning instructing the mariner to change steering
1121 mode and shall continue using position dead reckoning. The alert description text shall
1122 indicate that dead reckoning is in use for the position and contain guidance either about the
1123 available steering modes or about available alternative position sensors. Within 10 min of
1124 the failure having been detected track control shall be stopped (see 5.6.1). If a valid position
1125 becomes available before track control has been stopped, the system shall continue track
1126 control and shall rectify the warning.

1127 **5.6.3 Failure of the heading**

1128 (See 6.18.4)

1129 NOTE 1 The requirements in (A2/8.2) for the actual rudder angle to be maintained on failure of the heading
1130 measuring system and associated alarms are covered by 5.6 and 5.2.3.

1131 NOTE 2 Plausibility checks may be available to the TCS, e.g. from an INS using the NSR sentence.

1132 While track control is active, and no valid heading remains in use (see 5.2.1.3 and 5.2.3.5) by
1133 the track control function, or optional integrity and plausibility checks are in use and the heading
1134 becomes marked as not passing these checks, then:

- either track control shall be stopped immediately (see 5.6.1); or
- the track control system shall provide an alarm instructing the mariner to change steering mode and shall continue to use the heading updated using other information such as rate of turn or speed components. The alert description text shall indicate that a calculated heading is in use and contain guidance either about the available steering modes or about available alternative heading sensors. Within 1 min of the failure having been detected track control shall be stopped (see 5.6.1). If a valid heading becomes available before track control has been stopped, the system shall continue track control and shall rectify the alarm.

6 Methods of test and required test results

6.1 General

6.1.1 General, safety and environmental tests

(See 5.1)

Confirm compliance with IEC 60945 by inspection of documented evidence.

For the purposes of this document, the following tests and checks shall be used for environmental tests:

- performance check: short functional check to show that the equipment under test is still operational without investigating all details of its functionality, for example power on equipment and activate a function.
- performance test: detailed test of the equipment covering all functions provided. A performance test shall ensure that the full functionality is available under the present environmental conditions, power supply and input/output conditions, for example satisfactorily performing a subset of scenario 3.
- inspection: visual check of the equipment or documentation.

6.1.2 Identification of the equipment under test (EUT)

The manufacturer shall declare the supported equipment category (see 4) and configuration (see 5.6.1). The manufacturer shall provide sufficient information and documentation for the equipment to be understood and operated.

The manufacturer shall declare if heading and/or position monitoring is an integral part of the equipment.

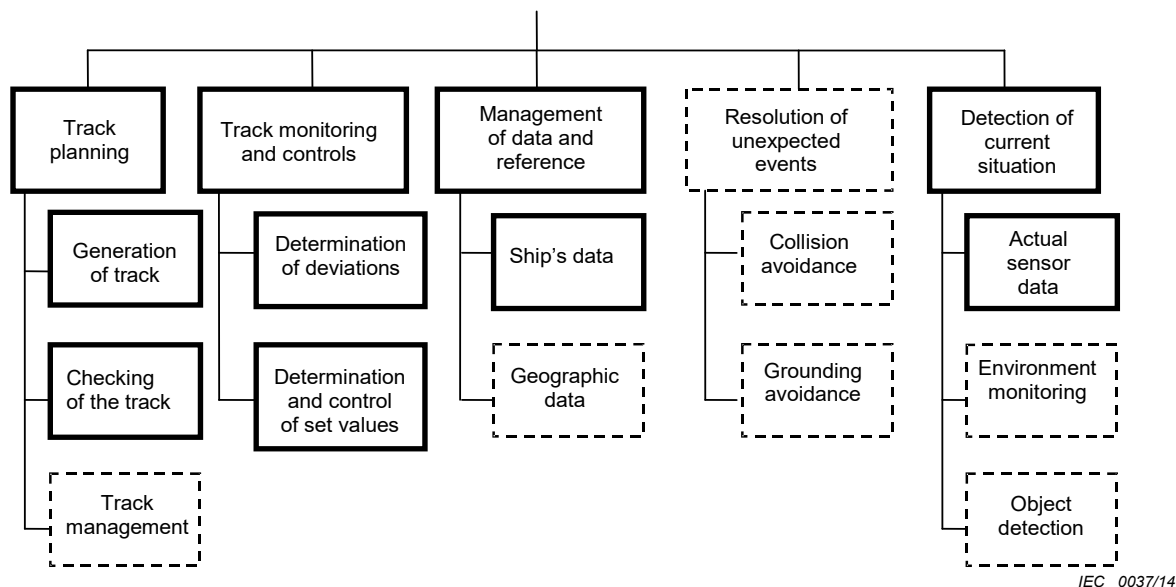
The IMO performance standards for track control systems do not require distinct hardware components supporting distinct functions. This may result in different layout solutions for the:

- physical parts involved;
- logical parts involved;
- general data flow between physical and/or logical parts;
- sensor interfaces;
- locations of required functions;
- user access (human machine interface).

Therefore, the EUT's special layout and its information flow shall be identified. Identification should follow a functional approach in steps:

- a) identify functions to perform different tasks of track control;
- b) identify information flow between functions;
- c) identify dependencies between functions (see Annex D);
- d) identify in which parts of the system the required functions are performed.

1178 Identification of functions can be taken from the functional model of an integrated navigation
 1179 system that incorporates track control (track control affected parts in boxes with solid lines),
 1180 see Figure 2.



1181

1182 **Figure 2 – Functional model of track control as part of an integrated navigation system**

1183 A general scheme of the EUT's components should be used to apply functions and their
 1184 information flow to physical parts of the system.

1185 6.1.3 Execution of operational tests

1186 All tests concerning curved tracks:

- 1187 • shall be executed with systems able to perform full track control on these track segments
 1188 (category C);
- 1189 • shall be executed with systems able to perform an approximation by means of an assisted
 1190 turn on these track segments (category B);
- 1191 • shall not be executed with systems without curved track control (category A). In these cases
 1192 course changes to follow the scenarios specified within this standard shall be performed
 1193 using means according to the manufacturer's documentation.

1194 6.2 Test setup

1195 6.2.1 General

1196 All tests in this clause are intended to be executed in a laboratory environment with a simulator.

1197 Prepare the test setup (see Figure 3) including the necessary simulator and install the interfaces
 1198 to the EUT. Verify that the 3 ship classes described below (see 6.2.2) are available in the
 1199 simulator. Prepare the scenarios by loading the test tracks into the planning system which is
 1200 used by the EUT.