



BSI Standards Publication

**Maritime navigation and radiocommunication
equipment and systems — Track control systems —
Operational and performance requirements,
test methods and required test results**

National foreword

This British Standard is the UK implementation of EN IEC 62065:2025. It is identical to IEC 62065:2025. It supersedes BS EN 62065:2014, which will be withdrawn on 30 November 2028.

The UK participation in its preparation was entrusted to Technical Committee EPL/80, Maritime navigation and radiocommunication equipment and systems.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Amendments/corrigenda issued since publication

Date	Text affected
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English Version

Maritime navigation and radiocommunication equipment and
systems - Track control systems - Operational and performance
requirements, test methods and required test results
(IEC 62065:2025)

Matériels et systèmes de navigation et de
radiocommunication maritimes - Systèmes de contrôle de
route - Exigences opérationnelles et de fonctionnement,
méthodes d'essai et résultats exigibles
(IEC 62065:2025)

Navigations- und Funkkommunikationsgeräte und -systeme
für die Seeschifffahrt - Bahnregelungssysteme - Betriebs-
und Leistungsanforderungen, Prüfverfahren und geforderte
Prüfergebnisse
(IEC 62065:2025)

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

European foreword

The text of document 80/1163/FDIS, future edition 3 of IEC 62065, prepared by TC 80 "Maritime navigation and radiocommunication equipment and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62065:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national (dop) 2026-11-30 level by publication of an identical national standard or by endorsement
- latest date by which the national standards conflicting with the (dow) 2028-11-30 document have to be withdrawn

This document supersedes EN 62065:2014 and all of its amendments and corrigenda (if any).

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The text of the International Standard IEC 62065:2025 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 61023 NOTE Approved as EN 61023

IEC 61108 (series) NOTE Approved as EN IEC 61108 (series)

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60945	-	Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results	EN 60945	-
IEC 61162-1	-	Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 1: Single talker and multiple listeners	EN IEC 61162-1	-
IEC 61162-2	-	Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 2: Single talker and multiple listeners, high-speed transmission	EN IEC 61162-2	-
IEC 61162-450	-	Maritime navigation and radiocommunication equipment and systems - Digital interfaces - Part 450: Multiple talkers and multiple listeners - Ethernet interconnection	EN IEC 61162-450	-
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	EN IEC 62288	-
IEC 62616	-	Maritime navigation and radiocommunication equipment and systems - Bridge navigational watch alarm system (BNWAS)	EN 62616	-
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	EN IEC 62923-1	-
IEC 62923-2	-	Maritime navigation and radiocommunication equipment and systems – Bridge alert management - Part 2: Alert and cluster identifiers and other additional features	EN IEC 62923-2	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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

This third edition cancels and replaces the second edition published in 2014. This edition constitutes a technical revision.

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

- a) 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;

- b) the previous Annex F has been removed as it was outdated and not instrumental in this document;
- c) the requirements in Clause 5 have been further detailed;
- d) the structure of Clause 6 has been updated.

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

Draft	Report on voting
80/1163/FDIS	80/1168/RVD

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

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

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

NOTE The following print types are used in this document: 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).

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

1 Scope

This document specifies the minimum operational and performance requirements, test methods 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.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. 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*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1.1

active track

track activated for track control

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

3.1.2

alarm

high-priority alert

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

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

3.1.3

alert

announcement of abnormal situations and conditions requiring attention

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

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

3.1.4

assisted turn

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

3.1.5

back-up navigator

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

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

3.1.6

back-up navigator call

BNC

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 62923-1:2018, 3.1.18, modified – Notes to entry added.]

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

XTD

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

GC

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

Note 1 to entry: Also called orthodrome.

[SOURCE: ISO 19018:2020, 10.2.9, modified - "also called orthodrome" moved from definition to note to entry.]

3.1.16

heading

HDG

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

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

3.1.17

heading control

control of the ship's heading

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

3.1.18

heading monitor function

monitoring of the actual heading sensor by an independent second source

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

3.1.19

leg

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

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

3.1.20

main conning position

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

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

3.1.21

minimum manoeuvring speed for track control

lowest alongship speed through the water at which the track control system is capable of maintaining its performance within the specified accuracy limits

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

3.1.22

NEXT-waypoint

waypoint following the TO-waypoint

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

3.1.23

override facility

control to perform the override function

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

3.1.24

override function

intentional fast change-over from automatic to temporary manual control

[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

RL

line on the surface of the earth making the same angle with each meridian crossed

3.1.30

ship manoeuvring characteristics

range-of-manoeuve 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

Note 1 to entry: Movement to starboard is indicated by a positive value.

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, modified – Note to entry has been added.]

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, modified – In the definition, the text in upright type has been added.]

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, modified – In the definition, the text in upright type has been added.]

3.1.40**warning**

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

Note 1 to entry: Warnings are presented 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 course of the new leg, taking into consideration the distance required for the ship to build up the necessary rate of turn

[SOURCE: IMO Resolution MSC.74(69), Annex 2, modified – In the definition, the text in upright type has been added.]

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
FU	Follow up
GPS	Global positioning system
INS	Integrated navigation system
NFU	Non-follow up
RMS	Root mean square
ROT	Rate of turn
SDME	Speed and distance measuring equipment
SWH	Significant wave height
TCS	Track control system

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*
 - 1) *heading control;*
 - 2) *along-track speed control (see Annex B).*
- b) Planning the track by waypoints may be performed
 - 1) as part of the track control system; or
 - 2) by importing waypoint- and/or track data.
- c) (A2/2.1) *These IMO Performance Standards are applicable for track control systems working*
 - 1) *at ship's speed from minimum manoeuvring speed up to 30 kn; and*
 - 2) *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, 6.12, 6.16.1)

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

When the EUT contains track control related modes additional to those described in this document, the manufacturer's documentation shall describe these modes.

5.2 Operational requirements

5.2.1 Functionality

5.2.1.1 Track control mode

(See 6.3.1)

(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 the cross-track limit is not exceeded 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 does not 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), and
- *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);

NOTE 4 The maximum difference limit is a user setting that is not required to be set each time track control is started.

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 6.17)

(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 5.4.1.*

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

If the TCS does not include the position monitoring function, the installation manual shall provide instructions to fit equipment with a position monitoring function in compliance with this document.

5.2.1.5 Approaching course change behaviour (~A)

(See 6.7)

A graphical description of the sequences described in this Subclause 5.2.1.5 is given in Annex A (see 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°"

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

"STBD turn from 356° to 012° in 33 s"

5.2.1.6 Course change behaviour (~A)

(See 6.7)

A graphical description of the sequences described in this Subclause 5.2.1.5 is given in Figure A.1.

(A2/5.1.6.1) *In the case of track control by a sequence of waypoints, if the CCW has been acknowledged before wheel-over, a single audible indication representing the Morse letter "C" (i.e. dash dot dash dot) shall be given at the wheel-over-line, unless this audible indication coincides with the audible signal of the CCW for the NEXT-waypoint (see 5.2.1.5).*

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

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

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

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

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

5.2.1.7 Change of waypoints

(See 6.4, 6.8)

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

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

While in track control mode, changes to waypoints other than the TO-waypoint, the FROM-waypoint and the NEXT-waypoint shall only be applied to the active track after the resulting amended route plan has passed the check for plausibility and correctness of geometric properties and the ship's manoeuvrability (e.g. the ship's maximum rate of turn is not exceeded in the route plan).

For temporary track, see 5.2.1.2.

5.2.1.8 Turn performance (~A)

(See 6.3.2)

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

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

within the turning capability of the ship.

5.2.1.9 Adaptation to steering characteristics

(See 6.3.3, 6.3.3.4, 6.12)

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

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

NOTE 1 The minimum adjustments for various weather and speed conditions are defined and covered by the tests for adaptation to speed, currents and sea states in this document (see 6.3.3).

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

- the track control system shall provide an 'accuracy reduced' warning. The alert description text shall provide guidance for decision making; and
- track control shall continue and use the last plausible speed of the ship or a system derived speed. Subsequently, TCS may allow the mariner to set a manual speed. The 'accuracy reduced' warning shall be continued as long as the last plausible speed, a system derived speed or a manual speed is in use. See also 5.2.1.10.

NOTE 2 Examples of system derived speed information are an estimate deduced from continuous observation of shift of positions, or deduced from propeller RPM, etc.

If the mariner has not set a manual speed and a valid speed becomes available, the system shall continue track control using the valid speed information (based on sensor information, see 5.2.1.3) and shall rectify the 'accuracy reduced' warning. See also 5.2.1.10.

5.2.1.10 Permitted tolerance

(See 6.3.3, 6.3.4)

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

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

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

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

5.2.1.11 Override function

(See 6.9.1)

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

5.2.1.12 Heading control mode

(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 5.2.1.14 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 can 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 or 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 has multiple operating modes available, it shall clearly indicate which operating mode is in operation.

The indication shall at least be provided at all workstations 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 in compliance with this document.

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

(See 6.19)

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 can either be a single value or an upper and a lower limit.

- when the ship's actual speed deviates from the pre-planned speed beyond a pre-set limit, an appropriate alert (see Annex B) shall be provided, taking into account the time needed to achieve the new speed setting and the properties of the 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 track control function is intentionally disengaged by the mariner, all active alerts related to track control only shall be terminated.

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

For alerts required by this document, standard alert identifiers shall be as specified in Annex F, Table F.1.

5.2.3.2 Failure or reduction in power supply

(See 6.13.2)

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

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

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

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

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

The installation manual shall contain a description of the available status signal(s) and shall contain an instruction that the equipment needs to be installed in an environment providing the monitoring of at least one status signal that is provided by the equipment, in order to raise an alert on power failure.

5.2.3.3 Position monitoring alert

(See 6.6)

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

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

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

5.2.3.4 Heading monitoring alert

(See 6.10)

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

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

See Annex E.

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

5.2.3.5 Failure and alert status of sensor

(See 6.18.1)

(A2/5.3.4) *In the case of any failure or failure status*, including sensor signals received in simulated, manual and estimated (DR) mode, *received from the position-fixing sensor or the heading sensor in use* and no automatic change-over of the sensor in use occurs:

- *an alert shall be generated at the track control system* as specified in 5.5.2 and 5.5.3; *and*
- *the system shall provide guidance of the user to a safe steering mode* as specified in 5.5.2 and 5.5.3; *and*
- *a back-up navigator call shall be given* as specified in 5.2.3.12 *if an alarm required in 5.5.2 or 5.5.3 is not acknowledged by the officer of the watch within 30 seconds*; *and*
- the alerts in 5.2.3.3 and 5.2.3.4 shall not be raised.

Fall-back procedures consequential to the failure and failure status are stated in 5.5.

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

5.2.3.6 Selection for use of faulty sensor signals

(See 6.5, 6.18.3)

(A2/5.3.5) *It shall not be possible to select any sensor signal tagged with a fault or failure status*, including signals received in simulated, manual and estimated (DR) mode, for track control. The equipment shall indicate the sensor status (see 5.3.2.1 .3).

5.2.3.7 Cross-track alert

(See 6.3.3, 6.13.3)

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

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

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

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

If the EUT includes ECDIS, the cross-track limit for monitoring the TCS performance shall be lower than or equal to the ECDIS cross-track limit for deviation from the planned route (see IEC 61174).

5.2.3.8 Course difference alert

(See 6.13.4)

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

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

5.2.3.9 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 before, but no later than 1 min after 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 2 min after 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 (see 5.2.1.15) or advice to the mariner to switch over to heading control mode or manual mode (see 5.5.1).

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

(See 6.14)

This Subclause 5.2.3.12 applies to alerts associated with BNC in this document.

A graphical description of the sequences described in this Subclause 5.2.3.12 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
- interface using any one of the following interfaces (as appropriate) IEC 61162-1, IEC 61162-2 or IEC 61162-450 and using the ALR sentence (see Clause K.2 and IEC 62616).

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

Where required in this document, BNC shall be activated in accordance with the following:

- if within 30 s of the alarm's sounding the alarm has not been acknowledged and has not been temporarily silenced, and the alarm condition has not been rectified and the alert is not terminated, 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 (either on the EUT or remotely from the CAM system), terminated 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 as described in IEC 62923-1 shall be supported.

5.3 Ergonomic criteria

5.3.1 Operational controls

(See 6.15, 6.9.1, 6.9.2)

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*

If the track control system can be operated with a heading control system (configuration B (see 5.5.1, Figure 1)), changing over from track to heading control shall be possible by a single operator action.

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

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

5.3.2 Presentation of information

5.3.2.1 Continuously displayed information

(See 6.12, 6.16.2)

(A2/6.2.1) *The following information shall be displayed clearly (see 5.1) and continuously; but not necessarily on a single display:*

- .1 *mode of steering* (see 5.2.1.15); for category B systems, an additional "assisted turn" indication shall be provided during course change manoeuvres;
- .2 *sources of actual selected position, heading and speed* in use;
- .3 *status and failure* of selected heading, speed, and position *sensors* in use (see 5.2.3.5) (*if any*);

NOTE 1 The status for heading includes the heading correction status, if available, see 5.4.1 and 5.5.2.

- .4 *track course and actual heading*;

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

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

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

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

NOTE 3 If the TO-waypoint is the last waypoint in the active pre-planned track, the time and distance relate to passing the last waypoint.

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

NOTE 4 If the next leg is a great circle leg, the next track course is the initial course of the great circle.

- .9 *selected track identification*.

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

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

5.3.2.2 Information to be provided on demand

(See 6.16.2)

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

- .1 *a list of pre-planned waypoints including:*
 - *waypoint numbers* or identifiers,
 - *co-ordinates*,
 - *courses and distances between waypoints*,

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

- *turn radius or rates of turn* of the curved track(s) (~A);
- .2 *all user settable track control related limits and other preset control parameters*;
- .3 *geodetic datum* in use.

5.3.2.3 Presentation

(See 6.16.2, 6.3.1)

(A2/6.2.3) *Logically related values, such as:*

- *preset and actual values; or*
- *TO-waypoint data (e.g. time and distance, see 5.3.2.1 .7),*

shall be displayed as pairs or logical groups of data.

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

5.4 Interfacing

5.4.1 Sensors

(See 6.17)

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

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

NOTE 1 It is not necessary for the heading source used for monitoring to be a gyro-compass or equivalent.

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

(A2/7.2) *All connected sensors shall be able to provide status, including failure information.*

If the TCS supports sensors for use for track control that do not provide status or failure information, the TCS shall perform corresponding plausibility checks.

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

NOTE 3 In principle, gyro-compasses provide heading information that is corrected for speed and latitude using the HCR sentence, but if, under some circumstances, that correction has not been applied the TCS will not be informed about the status of the correction. If the status information is not available, TCS performance can be degraded.

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

5.4.2 Standards

(See 6.17)

(A2/7.3) *The track control system shall be capable of digital, serial communication with the ships navigation system and comply with IEC 61162 (any one of the following interfaces may be used (as appropriate): IEC 61162-1, IEC 61162-2 or IEC 61162-450) and Annex K.*

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

5.5 Fall-back arrangements

5.5.1 General

(See 6.18.2)

When the track control function fails, the following requirements in this Subclause 5.5.1 apply.

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

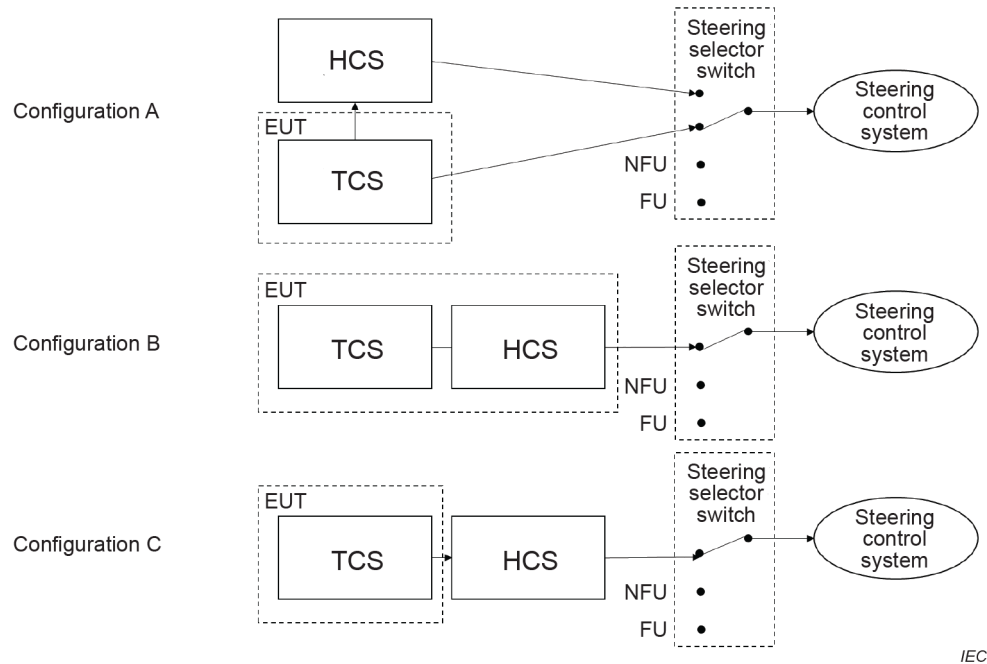


Figure 1 – EUT typical configurations

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 at the moment of fallback 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 HTC and HTD sentences are available in IEC 61162-1.

NOTE 4 Configuration A does not require that a HCS is installed.

Configuration B:

NOTE 5 In configuration B the EUT contains a HCS. The EUT provides a rudder command to the steering control system.

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

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

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

Configurations A, B and C:

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

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

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

See 5.2.3.11 for the 'track control stopped' alert.

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

5.5.2 Failure of position

(See 6.18.3)

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

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

- either track control shall be stopped immediately (see 5.5.1); or
- the track control system shall provide a warning instructing the mariner to change steering mode and shall continue using position dead reckoning. The alert description text shall indicate that dead reckoning is in use for the position and contain guidance either about the available steering modes or about available alternative position sensors. Within 10 min of the failure having been detected, the warning instructing the mariner to change steering mode shall be terminated and track control shall be stopped (see 5.5.1). If a valid position becomes available before track control has been stopped, the system shall continue track control and shall rectify the warning.