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Entwurf

**Navigations- und Funkkommunikationsgeräte und -systeme für die
Seeschifffahrt –
Bahnregelungssysteme –
Betriebs- und Leistungsanforderungen, Prüfverfahren und geforderte
Prüfergebnisse
(IEC 80/682/CDV:2012);
Englische Fassung FprEN 62065:2012**

Maritime navigation and radiocommunication equipment and systems –
Track control systems –
Operational and performance requirements, methods of testing and required test results
(IEC 80/682/CDV:2012);
English version FprEN 62065:2012

Anwendungswarnvermerk

Dieser Norm-Entwurf mit Erscheinungsdatum 2013-08-19 wird der Öffentlichkeit zur Prüfung und
Stellungnahme vorgelegt.

Weil die beabsichtigte Norm von der vorliegenden Fassung abweichen kann, ist die Anwendung dieses
Entwurfes besonders zu vereinbaren.

Stellungnahmen werden erbeten

- vorzugsweise online im Norm-Entwurfs-Portal des DIN unter www.entwuerfe.din.de bzw. für Norm-Entwürfe der DKE auch im Norm-Entwurfs-Portal der DKE unter www.entwuerfe.normenbibliothek.de, sofern dort wiedergegeben;
- oder als Datei per E-Mail an dke@din.de möglichst in Form einer Tabelle. Die Vorlage dieser Tabelle kann im Internet unter www.din.de/stellungnahme oder für Stellungnahmen zu Norm-Entwürfen der DKE unter www.dke.de/stellungnahme abgerufen werden;
- oder in Papierform an die DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (Hausanschrift: Stresemannallee 15, 60596 Frankfurt am Main).

Die Empfänger dieses Norm-Entwurfs werden gebeten, mit ihren Kommentaren jegliche relevanten
Patentrechte, die sie kennen, mitzuteilen und unterstützende Dokumentationen zur Verfügung zu stellen.

Gesamtumfang 108 Seiten

DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE
Normenstelle Schiffs- und Meerestechnik (NSMT) im DIN

Nationales Vorwort

Die englische Originalfassung des europäischen Dokuments FprEN 62065:2012 „Navigations- und Funkkommunikationsgeräte und -systeme für die Seeschifffahrt – Bahnregelungssysteme – Betriebs- und Leistungsanforderungen, Prüfverfahren und geforderte Prüfergebnisse“ (Entwurf in der Umfrage) ist unverändert in diesen Norm-Entwurf übernommen worden.

Die Internationale Elektrotechnische Kommission (IEC) und das Europäische Komitee für Elektrotechnische Normung (CENELEC) haben vereinbart, dass ein auf IEC-Ebene erarbeiteter Entwurf für eine Internationale Norm zeitgleich (parallel) bei IEC und CENELEC zur Umfrage (CDV-Stadium) und Abstimmung als FDIS (en: Final Draft International Standard) bzw. Schluss-Entwurf für eine Europäische Norm gestellt wird, um eine Beschleunigung und Straffung der Normungsarbeit zu erreichen. Dem entsprechend ist das internationale Dokument IEC 80/682/CDV:2012 „Maritime navigation and radiocommunication equipment and systems – Track control systems – Operational and performance requirements, methods of testing and required test results“ unverändert in den Entwurf FprEN 62065:2012 übernommen worden.

Das internationale Dokument wurde vom TC 80 „Maritime navigation and radiocommunication equipment and systems“ der Internationalen Elektrotechnischen Kommission (IEC) erarbeitet.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründen, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Das K 738 hat mit RS_738_2012-0090 beschlossen, dass die Bedingungen des DIN-Präsidialbeschlusses 1/2004 für das vorliegende Normprojekt erfüllt sind.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die englische Fassung der IEC 62065 veröffentlicht. Zu deren Abschnitt 3, der die Abkürzungen und Begriffe festlegt, wurde eine Übersetzung angefertigt und als informativer Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für viele der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Bei der Abstimmung zu dem Europäischen Schluss-Entwurf bei CENELEC und dem Internationalen Schluss-Entwurf bei IEC [Final Draft International Standard (FDIS)] sind jeweils nur „JA/NEIN“-Entscheidungen möglich, wobei „NEIN“-Entscheidungen fundiert begründet werden müssen. Dokumente, die bei CENELEC als Europäische Norm angenommen und ratifiziert werden, sind unverändert als Deutsche Normen zu übernehmen.

Für diesen Norm-Entwurf ist das nationale Arbeitsgremium K 738 „Elektronische Navigationsinstrumente“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (www.dke.de) zuständig.

Es ist vorgesehen, auch bei der entsprechenden zukünftigen Deutschen Norm auf die Deutsche Sprachfassung zu verzichten und diese in der englischsprachigen Fassung zu veröffentlichen.

Für den Fall einer undatierten Verweisung im normativen Text (Verweisung auf eine Norm ohne Angabe des Ausgabedatums und ohne Hinweis auf eine Abschnittsnummer, eine Tabelle, ein Bild usw.) bezieht sich die Verweisung auf die jeweils neueste gültige Ausgabe der in Bezug genommenen Norm.

Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe der Norm.

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Änderungen

Gegenüber DIN EN 62065:2003-06 wurden folgende Änderungen vorgenommen:

- a) Alarmmeldungen und Warnmeldungen wurden an die Anforderungen für das Brücken-Alert-Management angepasst;
- b) Die Anforderungen an das Kategorie B System wurden überarbeitet;
- c) Die Parameter für Schiffsmodelle im Annex I wurden justiert und der Gezeitenstrom wurde modelliert;
- d) Ein neuer Annex K mit Schnittstellenanforderungen wurde hinzugefügt.

Nationaler Anhang NA (informativ)

Begriffe und Abkürzungen

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe.

Die deutschen Übersetzungen haben Empfehlungscharakter und können nur die ungefähre Begrifflichkeit in Deutsch wiedergeben. Unter Experten wird empfohlen, ausschließlich die englischen Fachbegriffe zu verwenden, um die Gefahr von Missverständnissen zu reduzieren.

3 Begriffe

3.1.1

aktive Bahn

(en: active track)

zur Bahnregelung aktivierte Bahn

3.1.2

Alarmmeldung

(en: alarm)

Alert hoher Priorität. Die zugrundeliegende Gegebenheit erfordert unmittelbare Aufmerksamkeit und Maßnahmen der Brückenmannschaft, um die sichere Schiffsführung zu gewährleisten.

3.1.3

Alert

(en: alert)

Bekanntmachung von außergewöhnlichen Situationen und Gegebenheiten, die Aufmerksamkeit erfordern. Alerts werden in vier Prioritäten eingeteilt: Notfallalarmmeldungen, Alarmmeldungen, Warnmeldungen, Vorsichtsmeldungen. Ein Alert stellt Informationen über eine definierte Zustandsänderung zusammen mit Informationen darüber bereit, wie dieses Ereignis in bestimmter Art und Weise dem System und dem Anwender bekanntzumachen ist.

3.1.4

Regelung der Schiffsgeschwindigkeit entlang der Bahn

(en: along track speed control)

Regelung der Schiffsgeschwindigkeit während der Bahnregelung, die auf einer vorausgeplanten Bahn basiert

3.1.5

unterstützte Kursänderung

(en: assisted turn)

Manöver eines Schiffes, mit voreingestelltem Radius oder Drehgeschwindigkeit automatisch geregelt, um näherungsweise einen gekrümmten Bahnabschnitt zu befahren, wobei keine Stützung durch die Schiffsposition ausgeführt wird,

3.1.6**Ersatz-Navigationsoffizier/Ersatznavigator****(en: back-up navigator)**

Eine Einzelperson, üblicherweise ein Offizier, der durch den Kapitän ernannt wurde, auf Rufbereitschaft zu sein, wenn auf der Brücke Unterstützung benötigt wird

3.1.7**Ersatznavigatoralarm****(en: back-up navigator alarm)**

vom TCS automatisch gesendetes Signal, mit dem Unterstützung für die Brücke gerufen wird, wenn es der Wachoffizier versäumt, bestimmte Alarmmeldungen in einem definierten Zeitraum zu bestätigen

3.1.8**einheitliches gemeinsames Bezugssystem****(en: consistent common reference system)**

Teilsystem oder -funktion eines TCS zur Erfassung, Verarbeitung, Speicherung, Überwachung und Verteilung von Daten und Informationen mit dem Zweck, ein einheitliches und verbindliches Bezugssystem für alle weiteren Teilsysteme und nachgeordneten Funktionen innerhalb eines TCS sowie für sonstige angeschlossene Geräte bereitzustellen, falls verfügbar

3.1.9**Kurs****(en: course)**

Für die Seeschifffahrt ist Kurs die horizontale Richtung in die ein Seefahrzeug gesteuert wird oder gesteuert werden soll, ausgedrückt als Winkelabstand von Nord, gewöhnlich 000° für Nord, im Uhrzeigersinn bis 360°.

ANMERKUNG 1 zum Begriff: 360° wird als 000° angezeigt.

3.1.10**Grenzwert für Kursabweichungen****(en: course difference limit)**

maximale Abweichung zwischen Bahnkurs und anliegendem Kurs bevor eine Warnmeldung generiert wird

3.1.11**Bahnabweichung****(en: cross track distance (also known as cross track error))**

senkrechter Abstand eines vordefinierten Punktes auf dem Schiff von der Bahn einschließlich der Richtung (negativ, wenn das Schiff links von der geplanten Bahn ist)

3.1.12**Grenzwert für Bahnabweichungen****(en: cross-track limit)**

maximale Bahnabweichung bevor eine Alarmmeldung generiert wird

3.1.13**gekrümmter Bahnabschnitt****(en: curved track)**

gekrümmter Bahnabschnitt zwischen zwei geraden Bahnabschnitten

3.1.14**Rückfallmaßnahmen****(en: fall-back arrangements)**

automatische Reaktion des TCS unter Verwendung von Daten, Funktion oder Hardware von verminderter Qualität im Vergleich zum Ausgefallenen (z. B. Koppelnavigation für die Positionsbestimmung, Kursregelung bei Ausfall der Bahnregelung)

3.1.15**zuletzt passierter Wegpunkt****(en: FROM-waypoint)**

der zuletzt passierte Wegpunkt

3.1.16

auf dem Großkreis fahren

(en: **great circle sailing**)

auf der Schnittlinie der Erdoberfläche mit einer Ebene fahren, die die Punkte A, B und den Erdmittelpunkt enthält

3.1.17

anliegender Kurs

(en: **heading**)

horizontale Richtung in die der Bug eines Schiffes in jedem Moment tatsächlich zeigt, ausgedrückt in Winkелеinheiten gegenüber einer Bezugsrichtung, gewöhnlich von 000° an der Bezugsrichtung ausgehend im Uhrzeigersinn bis einschließlich 360°

ANMERKUNG 1 zum Begriff: 360° wird als 000° angezeigt.

3.1.18

Kursregelung

(en: **heading control**)

Regelung des anliegenden Kurses

3.1.19

Kursüberwachungsfunktion

(en: **heading monitor function**)

Überwachung des aktiven Kurssensors durch eine unabhängige zweite Quelle

3.1.20

gerader Bahnabschnitt

(en: **leg**)

gerade Linie zwischen zwei Wegpunkten und/oder gekrümmt(en) Bahnabschnitt(en)

3.1.21

Haupt-Steuer- und Kommandoplatz

(en: **main conning position**)

Ort auf der Brücke mit einer für die Führung des Schiffes geeigneten Aussicht, an dem die notwendige Information und Geräte für den wachhabenden Offizier bereitgestellt werden, damit er seine Funktionen auszuführen kann

3.1.22

Mindestgeschwindigkeit zum Manövrieren bei der Bahnregelung

(en: **minimum manoeuvring speed for track control**)

Niedrigste Geschwindigkeit längsschiffs durch das Wasser, bei der die Bahnregelung noch in der Lage ist, ihre Funktionsfähigkeit innerhalb der spezifizierten Genauigkeitsgrenzen aufrechtzuerhalten. Der Wert hängt von der Schiffsgestaltung und Ladung und den gegenwärtigen Umgebungsbedingungen ab.

3.1.23

übernächster zu passierender Wegpunkt

(en: **NEXT-waypoint**)

Wegpunkt, der dem nächsten zu passierenden Wegpunkt folgt

3.1.24

manuelle Eingriffsmöglichkeit

(en: **override facility**)

Bedienelement, um den manuellen Eingriff zu ermöglichen

3.1.25

Eingriffsfunktion

(en: **override function**)

beabsichtigter schneller Wechsel von automatischer zu vorübergehend manueller Steuerung

3.1.26**Positionsüberwachungsfunktion****(en: position monitor function)**

Überwachung des aktiven Positionssensors durch eine unabhängige zweite Quelle

3.1.27**primäres Ortsbestimmungssystem****(en: primary position-fixing system)**

durch die International Maritime Organization (siehe 5.1.1.3) anerkanntes elektronisches Ortsbestimmungssystem (EPFS) das für die Bahnregelung verwendet wird

3.1.28**Kursänderungsradius****(en: radius of turn)**

Radius eines gekrümmten Bahnabschnittes

3.1.29**Kursänderungsgeschwindigkeit (Drehgeschwindigkeit)****(en: rate of turn)**

Kursänderung pro Zeiteinheit

3.1.30**auf der Loxodrome fahren****(en: rhumb line sailing)**

eine Linie auf der Erdoberfläche befahren, die alle Längengrade unter dem gleichen Winkel schneidet

3.1.31**Schiffsmanövrierkenndaten****(en: ship manoeuvring characteristics)**

Definition des durchführbaren Manövrierbereiches des Schiffs (zum Beispiel, maximale Kursänderungsgeschwindigkeit, minimaler Kursänderungsradius, maximale Kursänderungsbeschleunigung und -verzögerung)

3.1.32**einzelner -Bedienschritt****(en: single operator action)**

Vorgang, der durch nicht mehr als eine einzelne Tasten- oder Soft-key-Betätigung oder einen vorgegebenen Sprachbefehl eingeleitet wird, ohne Notwendigkeit von Cursorbewegungen

3.1.33**Geschwindigkeit****(en: speed)**

absoluter Wert der Geschwindigkeit. Kann entweder die Schiffsgeschwindigkeit durch das Wasser sein oder die Geschwindigkeit über Grund sein.

3.1.34**Steuerungsarten Wahlschalter****(en: steering mode selector)**

Schalter zur Auswahl von manuellen Steuerungsarten und automatischen Steuerungseinrichtungen

3.1.35**temporäre Bahn****(en: temporary track)**

Bahn deren Ursprung die aktuelle Schiffsposition ist und die mit der vorausgeplanten Bahn zusammentrifft. Die temporäre Bahn darf temporäre Wegpunkte beinhalten, die als unterschiedlich zu den Wegpunkten der vorausgeplanten Bahn identifiziert werden können.

3.1.36**nächster zu passierender Wegpunkt****(en: TO-waypoint)**

nächster Wegpunkt, dem sich das Schiff nähert

3.1.37

Bahn

(en: track)

beabsichtigter Weg des Schiffs über Grund

3.1.38

Bahnregelung

(en: track control)

Regelung der Schiffsbewegung entlang einer Bahn, wobei die Reglerkorrekturen zum Kompensieren von Wind, Strömung und anderen Einflüssen sich nicht nur auf die Richtung zum nächsten Wegpunkt stützen, sondern auch auf die Bahnabweichung

3.1.39

Bahnkurs

(en: track course)

Richtung von einem Wegpunkt zu nächsten, mit einem konstanten Kurs auf einer Loxodromenbahn und einem variierenden Kurs auf einer Großkreisbahn

3.1.40

Warnmeldung

(en: warning)

Alert für eine Gegebenheit, die sofortige Aufmerksamkeit, aber keine unmittelbaren Maßnahmen der Brückenmannschaft erfordert. Warnmeldungen werden aus Vorsichtsgründen angezeigt, um die Brückenmannschaft auf geänderte Bedingungen aufmerksam zu machen, die keine unmittelbare Gefahr darstellen, aber ohne geeignete Maßnahmen zur Gefahr werden können.

3.1.41

Wegpunkt

(en: waypoint)

Eine geographische Position zusammen mit den zugehörigen Daten

3.1.42

geographischer Ort zum Einleiten eines Kursänderungsmanövers

(en: wheel-over-line)

Linie an der das Schiff einen gekrümmten Bahnabschnitt dergestalt beginnen soll, damit jede Abweichung im Hinblick auf den neuen Kurs eliminiert wird und die benötigte Fahrtstrecke berücksichtigt wird, die das Schiff bis zum Erreichen der erforderlichen Drehrate zurücklegt

3.1.43

Zeitpunkt zum Einleiten eines Kursänderungsmanövers

(en: wheel-over-time)

Zeitpunkt zu dem die Bahnregelung den geplanten Kurswechsel startet

3.2 Abkürzungen

~A	nicht anwendbar für Kategorie-A-Systeme	(en: not applicable for category A systems)
ACCA	Alarmmeldung für gegenwärtige Kursänderung	(en: actual course change alarm)
ACCW	Warnmeldung für gegenwärtige Kursänderung	(en: actual course change warning)
BAM	Brücken-Alert-Management	(en: bridge alert management)
CCRP	einheitlicher gemeinsamer Referenzpunkt	(en: consistent common reference point)
CCRS	einheitliches gemeinsames Bezugssystem	(en: consistent common reference system)
COG	Bewegungsrichtung über Grund	(en: course over ground)
DGPS	Globales Positionsbestimmungssystem (mit Differential(signal))	(en: differential GPS)
DR	Koppelnavigation	(en: dead reckoning)
ECCA	vorzeitige Warnmeldung für nächste Kursänderung	(en: early course change alarm)
ECCW	vorzeitige Warnmeldung für die nächste Kursänderung	(en: early course change warning)

ENC	elektronische Seekarte	(en: electronic navigational chart)
EPFS	elektronisches Positionsbestimmungssystem	(en: electronic position fixing system)
EUT	Gerät im Test	(en: equipment under test)
GC	Großkreis	(en: great circle)
GPS	globales Positionsbestimmungssystem	(en: global positioning system)
INS	integriertes Navigationssystem	(en: integrated navigation system)
NA	(Ersatz-) Navigatoralarm	(en: (back up) navigator alarm)
RL	Loxodrome	(en: rhumb line)
ROT	Kursänderungsgeschwindigkeit (Drehgeschwindigkeit)	(en: rate-of-turn)
SDME	Geschwindigkeits- und Wegstreckenmessgerät	(en: speed and distance measuring equipment)
TCS	Bahnregelungssystem	(en: track control system)
WOT	Zeitpunkt zum Einleiten eine Kursänderungsmanövers	(en: wheel-over time)

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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**

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

This second edition cancels and replaces IEC 62065 published in 2002 and constitutes a technical revision. The major changes are; - alarms and warnings have been brought into line with the requirements for Bridge Alert Management, - requirements for the category B system have been revised, - the parameters of the ship models of annex I have been adjusted to resemble more Newtonian-like behaviour and the tidal current has been modelled, - a new Annex K has been added with interface requirements.

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

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

229

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

232 This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

233 The committee has decided that the contents of this publication will remain unchanged until
234 the stability date¹ indicated on the IEC web site under "<http://webstore.iec.ch>" in the data
235 related to the specific publication. At this date, the publication will be

- 236 • reconfirmed,
237 • withdrawn,
238 • replaced by a revised edition, or
239 • amended.

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¹

The National Committees are requested to note that for this publication the stability date is 2019

**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 Recommendations on Performance Standards for Track Control Systems. In addition it takes into account IMO resolution A.694(17) to which IEC 60945 is associated. When a requirement of this standard is different from IEC 60945, the requirement in this standard shall take precedence. Also it takes into account IMO resolution MSC.302(87) on Bridge Alert Management (BAM).

NOTE All text of this standard 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 referenced documents are indispensable for the application 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 61924-2, Maritime navigation and radiocommunication equipment and systems – Integrated navigation systems (INS) – Operational and performance requirements, methods of testing and required test results

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)

IMO A.694(17), *General requirements for shipborne radio equipment performing part of the GMDSS and for electronic navigational aids*

IMO MSC.74(69) Annex 2, *Recommendations on performance standards for Track control systems*

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

288 3 Definitions and abbreviations

289 For the purposes of this standard, the following definitions and abbreviations apply.

290 3.1 Definitions

291 3.1.1

292 **active track**

293 *track activated for track control*

294 3.1.2

295 **alarm**

296 a high-priority alert. Condition requiring immediate attention and action by the bridge team, to
297 maintain the safe navigation of the ship.

298 3.1.3

299 **alert**

300 announcement of abnormal situations and conditions requiring attention. Alerts are divided in
301 four priorities: emergency alarms, alarms, warnings and cautions. An alert provides
302 information about a defined state change in connection with information about how to
303 announce this event in a defined way to the system and the operator.

304 3.1.4

305 **along track speed control**

306 automatic control of the ship's speed during track control based on a pre-planned track

307 3.1.5

308 **assisted turn**

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

311 3.1.6

312 **back-up navigator**

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

315 3.1.7

316 **back-up navigator alarm**

317 signal automatically sent from the TCS to call assistance to the bridge when the officer of the
318 watch fails to acknowledge certain alarms within a defined time period. Note that the back-up
319 navigator alarm does not represent an alarm as defined in 3.1.2.

320 3.1.8

321 **consistent common reference system**

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

326 3.1.9

327 **course**

328 for marine navigation, course is the horizontal direction in which a vessel is steered or
329 intended to be steered, expressed as angular distance from north, usually 000° at north,
330 clockwise through 360°.

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

332

- 333 **3.1.10**
334 **course difference limit**
335 maximum difference between track course and heading before a warning is activated.
- 336 **3.1.11**
337 **cross track distance (also known as cross track error)**
338 *perpendicular distance of a predefined point on the ship from the track including direction*
339 *(negative if the ship is left of the intended track)*
- 340 **3.1.12**
341 **cross-track limit**
342 *maximum cross track distance before an alarm is activated*
- 343 **3.1.13**
344 **curved track**
345 *non-straight track between two legs*
- 346 **3.1.14**
347 **fall-back arrangements**
348 automatic reaction of the TCS by using data, function or hardware of degraded quality in
349 relation to the failed one, (e.g. dead reckoning for position information, heading control in case
350 of a failure of track control)
- 351 **3.1.15**
352 **FROM-waypoint**
353 *the last passed waypoint*
- 354 **3.1.16**
355 **great circle sailing**
356 sailing on the intersection of the earth surface and a plane containing the points A, B and the
357 centre of the sphere
- 358 **3.1.17**
359 **heading**
360 the horizontal direction in which a ship actually points or heads at any instant, expressed in
361 angular units from a reference direction, usually from 000° at the reference direction
362 clockwise through 360°.
- 363 Note 1 to entry: 360° is indicated as 000°.
- 364 **3.1.18**
365 **heading control**
366 *control of the ship's heading*
- 367 **3.1.19**
368 **heading monitor function**
369 *Monitoring the actual heading sensor by an independent second source*
- 370 **3.1.20**
371 **leg**
372 *straight line between two waypoints and /or curved track(s)*
- 373 **3.1.21**
374 **main conning position**
375 *place on the bridge with a commanding view providing the necessary information and*
376 *equipment for the conning officer to carry out his functions*

- 377 **3.1.22**
378 **minimum manoeuvring speed for track control**
379 lowest fore/aft speed through the water at which the track control system is capable of
380 maintaining its performance within the specified accuracy limits. The value depends on the
381 ship's design and loading and on the present environmental conditions
- 382 **3.1.23**
383 ***NEXT-waypoint***
384 *the waypoint following the TO-waypoint*
- 385 **3.1.24**
386 ***override facility***
387 *a control to perform the override function*
- 388 **3.1.25**
389 ***override function***
390 *an intentional fast change-over from automatic to temporary manual control*
- 391 **3.1.26**
392 ***position monitor function***
393 *monitoring the actual position sensor by an independent second source*
- 394 **3.1.27**
395 **primary position-fixing system**
396 electronic position-fixing system (EPFS) used for track control and approved by the
397 International Maritime Organization (see 5.1.1.3)
- 398 **3.1.28**
399 ***radius of turn***
400 *radius of a curved track*
- 401 **3.1.29**
402 ***rate of turn***
403 *change of heading per time unit*
- 404 **3.1.30**
405 **rhumb line sailing**
406 sailing on a line on the surface of the earth making the same angle with each meridian
407 crossed
- 408 **3.1.31**
409 **ship manoeuvring characteristics**
410 these define the range-of-manoeuve possible for the ship (for example, maximum rate of
411 turn, minimum radius of turn, maximum turn acceleration and deceleration)
- 412 **3.1.32**
413 **single operator action**
414 procedure achieved by no more than one hard-key or soft-key action, excluding any
415 necessary cursor movements, or voice actuation using programmed codes.
- 416 **3.1.33**
417 **speed**
418 the absolute value of velocity. May either be the ship's speed through the water, or the speed
419 made good over the ground
- 420 **3.1.34**
421 **steering mode selector**
422 a switch provided for the selection of manual steering modes and automatic steering devices

423 **3.1.35**
 424 **temporary track**
 425 a track that originates at the current position of the ship and joins the pre-planned track. The
 426 temporary track may include temporary waypoints which can be identified as different from the
 427 waypoints of the pre-planned track

428 **3.1.36**
 429 **TO-waypoint**
 430 *the waypoint which the ship is approaching*

431 **3.1.37**
 432 **track**
 433 *path to be followed over ground*

434 **3.1.38**
 435 **track control**
 436 *control of the ship's movement along a track, where corrections made by the controller to*
 437 *compensate for wind, drift and other influences, are based on the cross track error and not*
 438 *only on the bearing to the destination waypoint (TO-waypoint)*

439 **3.1.39**
 440 **track course**
 441 *the direction from one waypoint to the next, a constant course on a rhumb line track and a*
 442 *varying course on a Great Circle track*

443 **3.1.40**
 444 **warning**
 445 alert for condition requiring immediate attention, but no immediate action by the bridge team.
 446 Warnings are presented for precautionary reasons to make the bridge team aware of changed
 447 conditions which are not immediately hazardous, but may become so if no action is taken

448 **3.1.41**
 449 **waypoint**
 450 a geographic position together with its associated data

451 **3.1.42**
 452 **wheel-over-line**
 453 *the line where the ship has to initiate a curved track to eliminate the effect of any offset with*
 454 *respect to the new course, taking into consideration the distance required for the ship to build*
 455 *up the necessary rate of turn*

456 **3.1.43**
 457 **wheel-over-time**
 458 the point in time where the track control system initiates the planned course change

459 **3.2 Abbreviations**

460	~A	Not applicable for category A systems
461	ACCA	Actual course change alarm
462	ACCW	Actual course change warning
463	BAM	Bridge alert management
464	CCRP	Consistent common reference point
465	CCRS	Consistent common reference system
466	COG	Course over ground
467	DGPS	Differential GPS
468	DR	Dead reckoning

469	ECCA	Early course change alarm
470	ECCW	Early course change warning
471	ENC	Electronic navigational chart
472	EPFS	Electronic position fixing system
473	EUT	Equipment under test
474	GC	Great circle
475	GPS	Global positioning system
476	INS	Integrated navigation system
477	NA	(Back up) Navigator alarm
478	RL	Rhumb line
479	ROT	Rate-of-turn
480	SDME	Speed and distance measuring equipment
481	TCS	Track control system
482	WOT	Wheel-over time

483 **4 Application of this standard**

484 The application of this standard is as follows.

- 485 a) (A2/1) *Track control systems in conjunction with their sources of position, heading and*
 486 *speed information are intended to keep a ship automatically on a pre-planned track over*
 487 *ground under various conditions and within the limits related to the ship's manoeuvrability.*
 488 *A track control system may additionally include or be combined with*
- 489 – *heading control;*
 - 490 – *along-track speed control (see Annex B).*
- 491 b) Planning the track by waypoints may be performed
- 492 – *as part of the track control system, or*
 - 493 – *by importing waypoint or track data.*
- 494 c) The track control system shall ensure the integrity of the geodetic datum, the ship
 495 manoeuvring characteristics and the curved tracks of the imported data.
- 496 d) This standard applies for track control systems which can exchange data with a heading
 497 sensor, speed sensor, EPFS and/or heading controller but excludes waypoint data
 498 exchange.
- 499 e) If a track control system automatically receives additional data, including waypoints, from
 500 other navigational aids, the requirements of IEC 61924-2 for this data exchange shall also
 501 apply.
- 502 f) If a track control system is integrated into an INS, the corresponding requirements of INS
 503 (as defined in IEC 61924-2) shall apply, for example concerning
- 504 – *route planning by waypoints,*
 - 505 – *data transfer of safety-checked waypoints and*
 - 506 – *monitoring of navigational safety for example by charts*
- 507 g) Track control does not necessarily require that ENC or other geographic data such as
 508 shallow area information be taken into consideration by the track control system.
- 509 h) (A2/2.1) *These IMO Performance Standards are applicable for track control systems*
 510 *working*
- 511 – *at ship's speed from minimum manoeuvring speed up to 30 knots; and*
 - 512 – *at ship's maximum rate of turn not greater than 10°/s.*
- 513 i) These performance standards do not apply to High Speed Craft as defined by SOLAS
 514 chapter 10.

- 515 j) (A2/2.2) *Track control systems fitted on ships shall meet all requirements of the IMO*
 516 *Performance Standards (MSC.74(69) Annex 2 Recommendations on Performance*
 517 *Standards for Track Control Systems) relating to straight tracks*
- 518 k) *Systems fitted on ships requiring curved track control shall additionally meet all the*
 519 *requirements relating to curved tracks (category C).*
- 520 l) This standard applies to three categories of track control systems:
- 521 Category A: Single leg track control or multiple leg track control without assisted turns
 522 between legs;
- 523 Category B: Multiple leg track control with assisted turns between legs;
- 524 Category C: Full track control on legs and turns.
- 525 Some requirements contained in this clause cannot be verified by objective measurements.
 526 The manufacturer shall declare that compliance to these requirements is achieved and shall
 527 provide relevant documentation. The declaration(s), documentation and, where necessary, the
 528 equipment shall be checked. The manufacturer shall also declare the general hardware and
 529 functional composition of the equipment and the relevant category of IEC 60945 for each unit.

530 5 Requirements

531 5.1 Operational requirements

532 5.1.1 Functionality

533 5.1.1.1 Track control steering modes

534 (See 6.4.3.2)

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

536 *.1 to a single waypoint; or*

537 *.2 along a track containing a sequence of waypoints*

538 *using rhumb line or great circle sailing.*

539 5.1.1.2 Starting requirements

540 (See 6.4.2.1, 6.4.2.2, 6.4.2.3, 6.4.2.4, 6.4.3.1, 6.4.3.1.7)

541 (A2/5.1.2) *The system shall allow the officer of the watch (user) to start or restart track*
 542 *control only if*

- 543 – the required position, heading and speed sensor data are valid and selected.
- 544 – the pre-planned track has been checked for plausibility and correctness of geometric and
 545 ship dependent limits (see Annex E) before becoming the active track
- 546 and if
- 547 – *the ship's position* relative to the selected track,
- 548 – *the difference between track course and actual heading,*
- 549 – *the ship's manoeuvrability*
- 550 *will result in a safe approach manoeuvre to the track.* A safe approach manoeuvre is a
 551 planned manoeuvre which is within the manoeuvring characteristics of the vessel and which
 552 does not result in an unexpected turning direction.

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

- 554 a) to select the TO-waypoint or a leg on a pre-planned track and to select the maximum
555 allowable difference between the bearing to the TO-waypoint and the actual heading;
556 or
557 b) to define a temporary track to go to the pre-planned track. The temporary track shall
558 meet all ship manoeuvring characteristics which apply to a pre-planned track (~A)

559 5.1.1.3 Primary position-fixing system

560 (See 6.2.2.2)

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

563 5.1.1.4 Position monitoring

564 (See 6.4.5.3)

565 (A2/5.1.4) *The ship's position shall be continuously monitored by a second or additional*
566 *independent position source.* If the ship is fitted with a second EPFS and position is available
567 from this EPFS its position shall be used for position monitoring. Otherwise, estimated
568 position by dead reckoning (DR) as a minimum shall be used as the second position source
569 for position monitoring. The DR position shall be derived from a shipborne heading sensor
570 and a speed and distance measuring equipment (SDME). Means shall be provided to adapt
571 the acceptable deviation to the required steering accuracy. *This monitoring need not be an*
572 *integral part of the track control system.*

573 5.1.1.5 Early course change warning (~A)

574 (See 6.4.5.12)

575 A graphical description of the sequences described here is given in Annex A.

576 (A2/5.1.5) *In the case of track control by a sequence of waypoints, an 'early course change*
577 *warning' shall be given up to 6 min, and no later than 3 min, before the wheel-over time.*

578 If the early course change warning is not acknowledged within 30 s, at the latest 2 min 30 s
579 before the wheel-over-time, the alert priority shall change from warning to alarm.

580 The early course change alarm is defined to be associated with NA activation (see 5.1.3.11).

581 5.1.1.6 Actual course change warning (~A)

582 (See 6.4.5.12)

583 A graphical description of the sequences described here is given in Annex A.

584 (A2/5.1.6.1) *In the case of track control by a sequence of waypoints an actual course*
585 *change warning shall be given at the wheel-over time.*

586 (A2/5.1.6.2) *The system shall provide means for the officer of the watch (user) to*
587 *confirm/acknowledge the actual course change warning.*

588 (A2/5.1.6.3) *With or without the confirmation/acknowledgement, the ship shall follow*
589 *automatically the track.*

590 (A2/5.1.6.4) *If the actual course change warning is not confirmed/acknowledged by the*
591 *officer of the watch (user) within 30 s of wheel-over the alert priority shall change from*
592 *warning to alarm and after another 30 s a back-up navigator alarm shall be given as fully*
593 *described in 5.1.3.11.*

594 5.1.1.7 Change of waypoints

595 (See 6.4.2.2, 6.4.2.3, 6.4.2.4, 6.4.2.5, 6.4.3.1.6, 6.4.3.1.8, 6.4.3.1.9)

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

- 600 a) the pre-planning of the new track is completed; and
601 b) *the starting requirements (5.1.1.2) are fulfilled.*

602 **5.1.1.8 Turn performance (~A)**

603 (See 5.1.1.8)

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

- 606 a) on a preset radius of turn; or
607 b) *on a radius calculated on the base of a preset rate of turn and the planned speed; and*
608 *within the turning capability of the ship.*
609 The planned track shall be checked for plausibility and correctness of geometry and of ship
610 dependent limits before becoming the active track.

611 **5.1.1.9 Adaptation to steering characteristics**

612 (See 6.4.4.1, 6.4.4.3)

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

615 **5.1.1.10 Permitted tolerance**

616 (See 6.4.4.2)

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

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

621 Category B TCS shall comply with the requirements for curved track TCS, except that, after
622 having passed the wheel-over, the actual cross track distance is merely used for monitoring
623 until completion of the automatic course change manoeuvre. Manual or automatic means shall
624 be provided to adapt to variable drift and speed changes during a turn. (e.g. facilitating
625 manual adjustments of rate of turn or radius of turn).

626 **5.1.1.11 Override function**

627 (See 6.4.6.5, 6.4.8)

628 (A2/5.1.11) *A track control system shall be able to accept a signal from the override facilities*
629 *to terminate track control mode and switch to these override facilities. After change-over to*
630 *override, return to track control shall require user intervention (see 5.1.1.2).*

631 **5.1.1.12 Heading control mode**

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

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

636 **5.1.1.13 Manual change over from track control to manual steering**

637 (See 6.4.6.5)

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

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

642 (A2/5.1.13.3) *After change over to manual control, return to automatic control shall require*
643 *operator (user) intervention (see 6.5.5).*

644 **5.1.1.14 Manual change over from track control to heading control**

645 (See 6.4.6.6)

646 This sub-clause only applies if the heading control is included in the track control system.

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

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

650 – *if sailing on a leg, take over the actual heading as the preset heading,*

651 – *if sailing on a curved track, take over the actual heading as the preset heading.*

652 Optionally, if sailing on a curved track, based on an intended operator selection, the heading
653 control system may complete the turn with the track course of the next leg as the preset
654 heading (~A). This selection shall only be available after the turn has started and shall be
655 clearly and unambiguously indicated.

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

657 **5.1.1.15 Steering mode indication**

658 (See 6.4.7.1)

659 (A2/5.1.15) *Adequate indication shall be provided to show which method of steering is in*
660 *operation.* The indication of the steering mode is not required to be an integral part of the
661 track control system, but shall be displayed at any work station of the track control system
662 where the steering mode can be affected.

663 **5.1.1.16 Heading monitoring**

664 (A2/5.1.16) *Heading monitoring shall be provided to monitor the actual heading information*
665 *by independent heading sources. The heading monitor is not required to be an integral part of*
666 *the track control system.*

667 NOTE This is an installation issue which is not covered by this standard.

668 **5.1.1.17 End of track**

669 (See 6.4.5.10)

670 At the end of the pre-planned track, an 'end of track warning' shall be generated.

671 Until the user takes over, the system shall follow the track course of the final leg. As a
672 minimum, the system shall maintain the actual heading.

673 For category A systems, the 'end of track warning' shall be given at the end of each leg.

674 **5.1.2 Accuracy and performance constraint documentation**

675 (See 6.2.2.1)

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

677 .1 *the accuracy of the sensors for position, heading and speed;*

678 .2 *changes of course and speed;*

679 .3 *actual speed through the water; and*

680 .4 *environmental conditions*

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

682 **5.1.3 Alerts**

683 **5.1.3.1 Failure or reduction in power supply**

684 (See 6.4.5.2)

685 (A2/5.3.1) *In case of failure or reduction of power supply to the track control system which*
686 *effects its safe operation, a warning shall be given.*

687 **5.1.3.2 Position monitoring alert**

688 (See 6.4.5.3)

689 (A2/5.3.2) *A warning shall be given when the position monitor detects a deviation between*
690 *the primary and secondary position-fixing system beyond a preset limit. See annex E.*

691 **5.1.3.3 Heading monitoring alert**

692 (See 6.4.5.4)

693 (A2/5.3.3) *A warning shall be given when the heading monitor detects a deviation beyond a*
694 *preset limit. See Annex E.*

695 **5.1.3.4 Failure and alert status of sensor**

696 (See 6.4.5.5)

697 (A2/5.3.4) *In the case of any failure or alert status received from the position-fixing sensor,*
698 *the heading sensor or the speed sensor in use:*

699 .1 *in case of a performance reduction of the track control process an alert of an appropriate*
700 *priority shall be generated at the track control system;*

701 .2 *the system shall automatically provide guidance to the user of a safe steering mode; and*

702 .3 *a back-up navigator alarm shall be given if a failure or alert status of priority alarm is not*
703 *acknowledged by the officer of the watch (user) within 30 s as fully described in 5.1.3.11.*

704 *Fall-back procedures consequential to the failure and alert conditions are stated in 5.5.*

705 **5.1.3.5 Use of faulty signals**

706 (See 6.4.5.6)

707 (A2/5.3.5) *It shall not be possible to select any sensor signal tagged with a fault or alert*
708 *status of priority alarm.*

709 5.1.3.6 Cross track alert

710 (See 6.4.5.7)

711 (A2/5.3.6) *A cross-track alarm, shall be provided when the actual position deviates from the*
712 *track beyond a preset cross-track limit. See Annex E.*

713 Category B and C systems shall monitor the actual position against the curved tracks. If this
714 monitoring and alerting is not done, the system shall be a category A system and track control
715 shall stop at the end of each leg.

716 5.1.3.7 Course difference alert

717 (See 6.4.5.8)

718 (A2/5.3.7) *A warning shall be given if the actual heading of the ship deviates from the track*
719 *course beyond a preset value. The preset course difference limit shall be large enough to*
720 *prevent unnecessary alerts (see Annex E).*

721 5.1.3.8 Low speed alert

722 (See 6.4.5.9)

723 (A2/5.3.8) *If speed through the water in the fore/aft direction is lower than a predefined limit*
724 *necessary for steering the ship under track control (minimum manoeuvring speed for track*
725 *control) a warning shall be given. This alert is not required to be an integral part of the track*
726 *control system.*

727 5.1.3.9 End of track alert

728 (See 6.4.5.10)

729 A warning shall be given between 3 min and 6 min before the last waypoint of the active track
730 is passed. If the end of track warning is not confirmed/acknowledged by the officer of the
731 watch (user) within 30 s the alert priority shall change from warning to alarm. The end of track
732 alarm is defined to be associated with NA activation (see 5.1.3.11).

733 5.1.3.10 Track control stopped alert

734 (See 6.4.5.11)

735 A track control stopped warning shall be given if the system automatically switches over to
736 heading control or is unable to continue operation. If the track control stopped warning is not
737 confirmed/acknowledged by the officer of the watch (user) within 30 s the alert priority shall
738 change from warning to alarm. The track control stopped alarm is defined to be associated
739 with NA activation (see 5.1.3.11).

740 5.1.3.11 Handling of the Back-up Navigator Alarm (NA)

741 (See 6.4.5.13)

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

743 The back-up navigator alarm shall call assistance to the bridge by transfer of the
744 unacknowledged alarm within the track control system to the BNWAS (IEC 62616).

745 For all those unacknowledged alarms, required by this standard to have the NA activation
746 function, the track control system shall generate the back-up navigator alarm output to the
747 BNWAS, i.e. activate the NA signal output. (either by contact closure or equivalent circuit, or
748 an IEC 61162 interface using the ALR sentence).

749 Power failure of track control system shall not activate the NA signal output.

750 The NA shall be activated in accordance with the following:
 751 • If within 30 s of the alarm's occurrence, the alarm has not been acknowledged, or has not
 752 been temporarily silenced, and the alarm condition has not been rectified, then the NA shall be
 753 activated.
 754 • If within 30 s of the alarm's occurrence, the alarm has not been acknowledged, has not been
 755 rectified, but has been temporarily silenced by the operator, then the following will apply:
 756 When the silencing expires, the NA activation shall function as if the alarm condition just
 757 arose, but any further silencing shall not result in further delay of the NA. Note that the
 758 silencing specified here is the temporary silence function which expires, reactivating the
 759 audible announcement, after 30 s.

760 As soon as all of the alarms associated with NA activation are acknowledged or rectified, the
 761 NA shall be deactivated. Note that acknowledgement may occur locally, remotely, or as a
 762 result of turning off the alert generating function (e.g. disabling track control).

763 **5.1.3.12 Remote acknowledgments of alerts**

764 (See 6.4.5.14)

765 Remote temporary silencing and remote acknowledgement shall be possible via alert related
 766 communication described in IEC 61924-2 (see also Annex K).

767 Remote acknowledgement shall only be possible for category B alerts (alerts where no
 768 additional information for decision support is necessary as described in IEC 61924-2).

769 Remote silencing of the relevant audible alarms of the TCS shall be possible at any time.

770 **5.2 Ergonomic criteria**

771 **5.2.1 Operational controls**

772 **5.2.1.1 Controls for track control**

773 (See 6.4.8)

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

- 775 .1 *accept or calculate the course between subsequent waypoints; and*
- 776 .2 *adjust radius or rate of turn, all user settable track control related limits, limits for alerts,*
 777 *functions and other control parameters.*

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

779 NOTE There are restrictions described in 5.1.1.7.

780 **5.2.1.2 Change over controls**

781 (See 6.4.6.5, 6.4.8)

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

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

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

786 *If the track control system can be operated with a heading control system, changing over from*
 787 *track to heading control shall be possible by a single operator action.*

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

789 *The steering mode selector switch or override facility, if installed, shall be located at or in the*
790 *immediate vicinity of the main conning position.*

791 **5.2.2 Presentation of information**

792 **5.2.2.1 Continuously displayed information**

793 (See 6.4.7.1)

794 (A2/6.2.1) *The following information shall be displayed clearly and continuously in the*
795 *vicinity of the main conning position; but not necessarily on a single display:*

796 .1 *mode of steering;* for category B systems, an additional “assisted turn” indication shall be
797 *provided during course change manoeuvres;*

798 .2 *sources of actual selected position, heading and speed;*

799 .3 *status and failure of selected heading, speed, and position sensors (if any) and their*
800 *related monitoring functions;*

801 .4 *track course and actual heading;*

802 .5 *actual position, cross track distance including direction and speed over ground;*

803 .6 *TO-waypoint and NEXT-waypoint;*

804 .7 *time and distance to TO-waypoint;*

805 NOTE In this sub-clause the TO-waypoint means the related wheel-over.

806 .8 *next track course;*

807 .9 *selected track identification.*

808 *Items .4, .5, .7 and .8 shall be displayed numerically.*

809 All displayed information shall conform to the general requirements for displays contained in
810 IEC 62288

811 **5.2.2.2 Information to be provided on demand**

812 (See 6.4.7.2)

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

814 .1 *a list of pre-planned waypoints including*

815 – *waypoint numbers,*

816 – *co-ordinates,*

817 – *courses and distances between waypoints,*

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

819 .2 *all user settable track control related limits and other preset control parameters;*

820 .3 *geodetic datum in use.*

821 The facility to provide the information in .1 is not required to be an integral part of the track
822 control system.

823 **5.2.2.3 Presentation**

824 (See 6.4.7.1)

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

827 5.3 Design and installation

828 The track control system shall be designed, manufactured and installed in accordance with
829 recognized international quality standards, such as ISO 9000.

830 5.4 Interfacing

831 5.4.1 Sensors

832 (See 6.2.2.2)

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

836 NOTE Information flowing within the EUT may contain proprietary data

837 5.4.2 Status information

838 (See 6.4.5.5)

839 (A2/7.2) *All connected sensors shall be able to provide status, including failure information.*
840 The track control system shall check for received status and failure information. If a sensor
841 used for track control does not provide status or failure information, the track control system
842 shall perform corresponding plausibility checks.

843 If a sensor is capable of distributing both processed sensor data and unprocessed sensor
844 data then the status of the processing shall be incorporated in the data communication
845 protocol.(E.g. If the distributed heading is normally corrected for speed/latitude error then the
846 protocol should inform if this being the case or not. See Annex K).

847 5.4.3 Standards

848 (See 6.2.2.2)

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

851 The track control system shall support the IEC 61162 series interfaces as given in Annex K as
852 a minimum. In addition, suitable alternative input or output interfaces may be used.

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

854 5.5 Fall-back arrangements

855 NOTE The associated alerts are stated in 5.1.3.

856 5.5.1 Failure of track control

857 (See 6.4.6.1)

858 If track control fails, a 'track control stopped warning' shall be given.

859 (A2/8.1.1) *If the heading control is installed and is still available then the system shall*
860 *automatically switch over to heading control and*

861 – if sailing on a leg, *take the actual heading as the preset heading for the heading control, or*
862 *a calculated heading in such a way that the actual COG shall be approximately*
863 *maintained,*

864 – if sailing on a curved track, the turn shall be completed and the track course of the next
865 leg shall be taken over as the preset heading (~A).

866 (A2/8.1.2) *If the heading control is not available the rudder angle shall be maintained.* The
867 rudder angle shall be set to a fixed angle in such a way that:

- 868 – if sailing on a leg, the actual heading shall be approximately maintained;
- 869 – if sailing on a curved track, the actual rate of turn shall be approximately maintained (~A).

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

872 **5.5.2 Failure of position sensor**

873 (See 6.4.6.2)

874 Position can be based on single position sensor or optionally can be based on multiple
875 position sensors.

876 If the Track Control System is connected to multiple sensors (not integrated into an INS) an
877 automatic change of sensors shall generate a warning. In this case position information has
878 failed, or is unavailable, when all connected position sensors fail or are unavailable at the
879 same time.

880 If position is based on CCRS position available from the INS and if the INS has reported that
881 the CCRS position has failed integrity check (state failed in NSR sentence from the INS) or
882 has not been possible (state doubtful in NSR sentence from the INS), then this situation shall
883 be treated as if the CCRS position has failed or is unavailable.

884 If position information has failed or is unavailable, then:

- 885 – the position sensor alarm shall be activated;
- 886 – the track control system shall automatically switch to heading control within 10 min of the
887 failure having been detected and a “track control stopped warning” shall be generated.
888 The system shall
 - 889 – if sailing on a leg, take the actual heading as the preset heading;
 - 890 – if sailing on a curved track, complete the turn and take the track course of the next leg
891 as the preset heading (~A).

892 When at position failure condition and not switched to heading control system, then

- 893 – the track control system shall provide the estimated position of the ship by dead reckoning
894 as a minimum and use it for track control;
- 895 – after 1 min or less, another warning shall be activated giving the advice to switch to a valid
896 and available position sensor, heading control or manual steering;
- 897 – even if acknowledged, this warning shall be repeated every 2 min until steering mode has
898 been changed manually or automatically.
- 899 – when a position sensor becomes available before steering mode has been changed
900 manually or automatically, the system may switch automatically back to position sensor
901 information and, in that case, shall generate a warning.

902 The manual or automatic switching of position information shall not generate excessive rudder
903 activities.

904 **5.5.3 Failure of the heading measuring system**

905 (See 6.4.6.3)

906 Heading can be based on single heading sensor or optionally can be based on multiple
907 heading sensors.

908 If the Track Control System is connected to multiple sensors (not integrated into an INS) an
909 automatic change of sensors shall generate a warning. In this case heading information has

910 failed or is unavailable, when all connected heading sensors fail or are unavailable at the
911 same time.

912 If heading is based on CCRS heading available from the INS and if the INS has reported that
913 the CCRS heading has failed integrity check (state failed in NSR sentence from the INS) or
914 has not been possible (state doubtful in NSR sentence from the INS), then this situation shall
915 be treated as if the CCRS heading has failed or is unavailable.

916 If heading information has failed or is unavailable, then:

- 917 – the heading sensor alarm shall be activated;
- 918 – the 'track control stopped' warning shall be activated, giving advice to the user to switch to
919 manual control.
- 920 – (A2/8.2.1) *The actual rudder angle shall be maintained* (i.e. stay in position). The rudder
921 angle shall be set to a fixed angle in such a way that
- 922 – if sailing on a leg, the actual heading shall be approximately maintained;
- 923 – if sailing on a curved track, the actual rate of turn shall be approximately maintained
924 (~A).

925 **5.5.4 Failure of the speed sensor**

926 (See 6.4.6.4)

927 Speed can be based on single speed sensor/source or optionally can be based on multiple
928 speed sensors/sources.

929 If the Track Control System is connected to multiple sensors (not integrated into an INS) an
930 automatic change of sensors shall generate a warning. In this case speed information has
931 failed or is unavailable, when all connected speed sensors fail or are unavailable at the same
932 time.

933 If speed is based on CCRS speed available from the INS and if the INS has reported that the
934 CCRS speed has failed integrity check (state failed in NSR sentence from the INS) or has not
935 been possible (state doubtful in NSR sentence from the INS), then this situation shall be
936 treated as if the CCRS speed has failed or is unavailable.

937 If speed information has failed or is unavailable, then:

- 938 – the speed sensor alarm shall be activated;
- 939 – the track control mode shall continue and use the last plausible speed of the ship, or a
940 system derived speed as fallback information.

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

943 In case of a reduction of the track control performance, the track control system shall
944 additionally provide the following user guidance and alerts:

- 945 – after 1 min, or less, a warning shall be activated giving the advice to switch to a valid,
946 alternative speed information or to change the steering mode.
- 947 – even if acknowledged, this warning shall be repeated every 2 min until a valid, alternative
948 speed information (e.g. system derived speed) has been intentionally selected or steering
949 mode has been changed.

950 When a suited speed sensor becomes available before the steering mode has been changed,
951 the system may automatically switch back to speed sensor information and, in such case,
952 shall generate a warning.

953 The manual or automatic switching of speed information shall not generate excessive rudder
954 activities

955 6 Test requirements and results**956 6.1 General**

957 All tests in this section are intended to be executed in a laboratory environment with a
958 simulator. Additional onboard tests may or may not be required.

959 6.2 General requirements**960 6.2.1 Environmental tests****961 6.2.1.1 General**

962 The EUT shall meet the test requirements of IEC 60945. The equipment shall comply with the
963 requirements of IEC 60945 that are appropriate to its category or alternatively, evidence of
964 prior testing shall be supplied.

965 The manufacturer shall declare which equipment or units are 'protected' or 'exposed'. The
966 manufacturer shall declare any 'preconditioning' required before environmental checks.

967 For the purposes of this standard, the following definitions shall apply for environmental tests:

968 performance check

969 a short functional check to show that the equipment under test is still operational without
970 investigating all details of its functionality, for example power on equipment and activate any
971 function

972 performance test

973 a detailed test of the equipment covering all functions provided. A performance test shall
974 ensure that the full functionality is available under the present environmental conditions,
975 power supply and input/output conditions, for example satisfactorily performing a subset of
976 scenario 3

977 inspection

978 a visual check of the equipment or documentation

979 6.2.1.2 Test site

980 Tests will normally be carried out at test sites, accredited by the type test authority. The
981 manufacturer shall, unless otherwise agreed, set up the equipment and ensure that it is
982 operating normally before type testing commences.

983 6.2.1.3 Identification of the equipment under test (EUT)

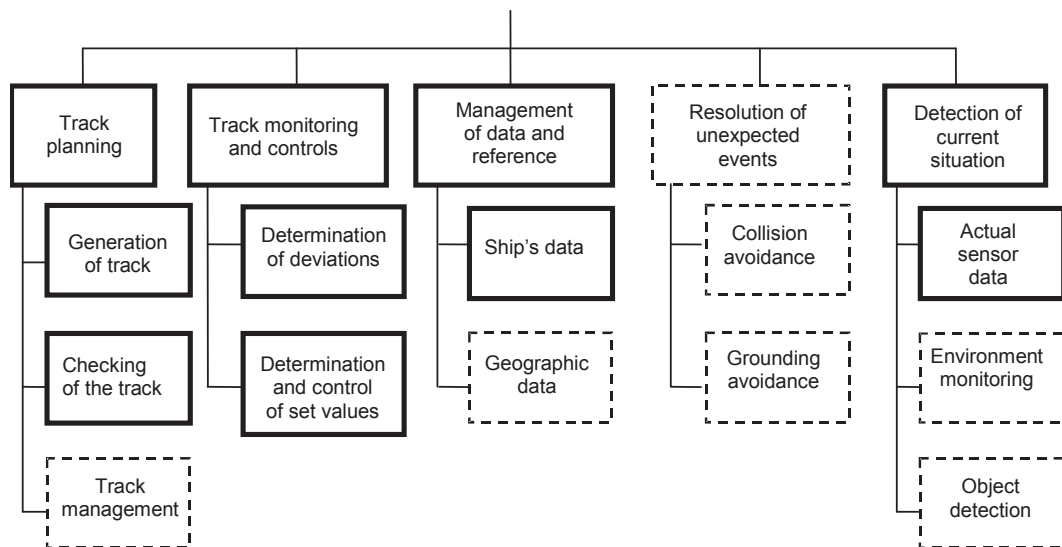
984 The IMO performance standards for track control systems do not require distinct hardware
985 components supporting distinct functions. It is up to the manufacturer to perform the different
986 tasks for track control in possibly different physical and logical parts of its system. This may
987 result in different layout solutions for the

- 988 – physical parts involved,
- 989 – logical parts involved,
- 990 – general data flow between physical and/or logical parts,
- 991 – sensor interfaces,
- 992 – locations of required functions,
- 993 – user access (human machine interface).

994 Therefore, the EUT's special layout and its information flow have to be identified before it can
995 be decided which tests are applicable. Identification should follow a functional approach in
996 steps:

- 997 a) identify functions to perform different tasks of track control;
- 998 b) identify information flow between functions;
- 999 c) identify dependencies between functions (see Annex D);
- 1000 d) identify in which parts of the system the required functions are performed.

1001 Identification of functions can be taken from the functional model of an integrated navigation
1002 system that incorporates track control (track control affected parts in boxes with solid lines),
1003 see Figure 1.



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1004

1005 **Figure 1 – Functional model of track control as part of an integrated navigation system**

1006 The information flow and the resulting dependencies between supported functions can be
1007 identified using the generic data flow diagram of the functional model (Annex F). A general
1008 scheme of the EUT's components should be used to apply functions and their information flow
1009 to physical parts of the system.

1010 **6.2.1.4 Test of optional track control related modes**

1011 All track control related modes offered by the manufacturer shall be exercised.

1012 **6.2.2 Documentation**

1013 **6.2.2.1 Equipment manuals**

1014 (See 5.1.2)

1015 Verify that adequate information is provided to enable suitable qualified members of the ship's
1016 crew to operate and maintain the equipment properly.

1017 **6.2.2.2 Technical documentation for type approval**

1018 (See 5.1.1.3, 5.4.1, 5.4.2)

1019 Manufacturer's documentation shall include: