

DIN EN 62388

ICS 47.020.70

Ersatz für
DIN EN 62388:2008-09
Siehe Anwendungsbeginn

**Navigations- und Funkkommunikationsgeräte und -systeme für die
Seeschifffahrt –
Radar für Schiffe –
Leistungsanforderungen, Prüfverfahren und geforderte Prüfergebnisse
(IEC 62388:2013);
Englische Fassung EN 62388:2013**

Maritime navigation and radiocommunication equipment and systems –
Shipborne radar –
Performance requirements, methods of testing and required test results
(IEC 62388:2013);
English version EN 62388:2013

Matériels et systèmes de navigation et de radiocommunication maritimes –
Radars de bord –
Exigences de performance, méthodes d'essai et résultats exigés
(CEI 62388:2013);
Version anglaise EN 62388:2013

Gesamtumfang 192 Seiten

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

Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2013-07-31 angenommene Europäische Norm als DIN-Norm ist 2014-04-01.

Für DIN EN 62388:2008-09 besteht eine Übergangsfrist bis 2016-07-31.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 62388:2013-05.

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

Die enthaltene IEC-Publikation wurde vom TC 80 „Maritime navigation and radiocommunication equipment and systems“ erarbeitet.

Das IEC-Komitee hat entschieden, dass der Inhalt dieser Publikation bis zu dem Datum (stability date) unverändert bleiben soll, das auf der IEC-Website unter „<http://webstore.iec.ch>“ zu dieser Publikation angegeben ist. Zu diesem Zeitpunkt wird entsprechend der Entscheidung des Komitees die Publikation

- bestätigt,
- zurückgezogen,
- durch eine Folgeausgabe ersetzt oder
- geändert.

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.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die englische Fassung der EN 62388 veröffentlicht. Zu deren Abschnitt 3, in dem die Begriffe festgelegt werden, 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.

Änderungen

Gegenüber DIN EN 62388:2008-09 wurden folgende Änderungen vorgenommen:

- a) In 6.2 (Aussendungen und Interferenz) erfolgt nun die Verweisung auf den überarbeiteten Anhang B (Unerwünschte Aussendungen von Radarsystemen). Die Maske wurde in Übereinstimmung mit ITU-Anforderungen von einem Abfall von 20 dB/Dekade auf 30 dB/Dekade angepasst, und ein neuer, informativer Anhang J (Interferenz durch Aussendungen in benachbarten Frequenzbändern) wurde hinzugefügt;

- b) Abschnitt 7 (Anzeigedarstellung) wurde vereinfacht (und die bisherigen Anhänge J und K gelöscht), dafür erfolgt in der Norm die Verweisung auf EN 62288, die mit entsprechenden Änderungen ergänzt wurde;
- c) In 9.9.2 (PI-Linien und Positionierung) wurden die Anforderungen an parallele Indexlinien überarbeitet;
- d) In 10.4.4 (Anzeigeausrichtung) wurde eine neue Anzeigeausrichtungsart „stabilisierter Rechte vorausmodus“ hinzugefügt;
- e) In 11.5 (Automatisches Identifizierungssystem) wurden neue Anforderungen und Prüfungen für Typen von AIS Zielen, AIS-Repeaterstationen sowie die Filterung von AIS-Zielen hinzugefügt;
- f) In Abschnitt 12 (Kartenradar) wurde ein neuer Unterabschnitt 12.3 für Anforderungen an ECDIS Backup hinzugefügt;
- g) In Abschnitt 13 (Ergonomische Kriterien) wurde ein neuer Unterabschnitt 13.5 mit Anforderungen an die Rücksetzung auf voreingestellte Werte für ausgewählte Bedienelemente hinzugefügt;
- h) Unterabschnitt 14.3 (Ausgabe-Schnittstelle) wurde zusammen mit dem zugeordneten Anhang H überarbeitet, um die Anforderungen insbesondere im Hinblick auf Schnittstellen zum VDR zu aktualisieren;
- i) Abschnitt 16 (Alerts und Fehler) wurde überarbeitet, um die Anforderungen an das Brücken-Alert-Management zu aktualisieren, und neue Anforderungen wurden für eine Alert-Management-Schnittstelle mit entsprechenden Änderungen in der Norm ergänzt;
- j) In Abschnitt 18 (Geräte-Einarbeitung und -Dokumentation) wurde ein neuer Unterabschnitt 18.3 für Wartungsinformation und Geräteaktualisierung hinzugefügt.

Frühere Ausgaben

DIN IEC 60872: 1989-09
 DIN EN 60936-2: 1990-10
 DIN EN 60872: 1994-01
 DIN EN 60936: 1994-10
 DIN EN 60872-1: 1999-10
 DIN EN 60872-2: 1999-12
 DIN EN 60936-1: 2001-01
 DIN EN 60936-3: 2003-01
 DIN EN 60936-1: 2003-05
 DIN EN 62388: 2008-09

Nationaler Anhang NA (informativ)

3 Begriffe

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.

3.1

aktiviertes AIS-Ziel

(en: activated AIS target)

Ziel, das die automatische oder manuelle Aktivierung eines schlafenden Ziels für die Anzeige zusätzlicher graphisch dargestellter Informationen wiedergibt

Anmerkung 1 zum Begriff: Das Ziel wird durch ein „aktiviertes Ziel“-Symbol einschließlich einem Vektor; dem Kurs und der Rotation oder der Drehrichtungsanzeige (wenn verfügbar) angezeigt, um begonnene Kursänderungen zu kennzeichnen.

3.2

Akquisition eines Radarziels

(en: acquisition of a radar target)

Prozess zur Erfassung eines Ziels und Beginn seiner Verfolgung

3.3

Aktivierung eines AIS-Ziels

(en: activation of an AIS target)

Aktivierung eines schlafenden AIS-Ziels für die Anzeige zusätzlicher graphischer und alphanumerischer Informationen

3.4

akquiriertes Radarziel

(en: acquired radar target)

automatische oder manuelle Akquirierung initiiert die Radarverfolgung

Anmerkung 1 zum Begriff: Vektoren und vorherige Positionen (wenn angegeben) werden angezeigt, wenn die Daten einen stabilen Zustand (nach 1 min) erreicht haben.

3.5

automatisches Identifizierungssystem

AIS

(en: automatic identification system; AIS)

automatisches Identifizierungssystem, das den Anforderungen in der IMO Resolution MSC.74(69), Anhang 3, und IEC 61993-2 entspricht

3.6

AIS-Ziel

(en: AIS target)

von einer AIS-Meldung generiertes Ziel

3.7

zugehöriges Ziel

(en: associated target)

Ziel, welches gleichzeitig ein akquiriertes Radarziel und ein gemeldetes AIS-Ziel mit ähnlichen Parametern darstellt (zum Beispiel Position, Kurs, Geschwindigkeit), die mit einem Zuordnungsverfahren als übereinstimmend erkannt wurden

3.8

Akquirierungs- und Aktivierungszone

(en: acquisition/activation zone)

durch den Bediener festgelegte Zone, in der das System Radarziele automatisch erfasst und gemeldete AIS-Ziele beim Eintritt in die Zone aktiviert

3.9

Azimuthstabilisierung

(en: azimuth-stabilised)

Referenzkursinformation, zum Beispiel die des eigenen Kreiselkompass, wird zur Ausrichtung der Vorauslinie auf der Radaranzeige benutzt, so dass sie auf der Peilskala vom CCRP zum Referenzkurs des eigenen Schiffs zeigt

3.10

kleinster Abstand / kleinste Zeit bis zum Kreuzen des Bugs

BCR/BCT

(en: bow crossing range/bow crossing time; BCR/BCT)

vom Bug des Schiffs aus gesehene Messungen, im Gegensatz zum CCRP

3.11**die vier Haupthimmelsrichtungen (Kompass)**

(en: cardinal points (compass))

0 Grad, 090 Grad, 180 Grad, 270 Grad auf dem Kompass

3.12**konsistenter gemeinsamer Bezugspunkt****CCRP**

(en: consistent common reference point; CCRP)

Ort auf dem eigenen Schiff, auf den alle horizontalen Messungen wie Zielentfernung und -peilung, relativer Kurs, relative Geschwindigkeit, kleinster Passierabstand (CPA), Zeit bis zum kleinsten Passierabstand (TCPA) bezogen sind, in der Regel der Steuerstand auf der Brücke

3.13**kleinster Passierabstand / Zeit bis zum kleinsten Passierabstand****CPA/TCPA**

(en: closest point of approach/time to the closest point of approach; CPA/TCPA)

Entfernung zum kleinsten Passierabstand (CPA) und Zeit bis zum kleinsten Passierabstand (TCPA)

Anmerkung 1 zum Begriff: Grenzwerte werden durch den Bediener gesetzt und sind auf das eigene Schiff bezogen.

3.14**Kurs**

(en: course)

in Grad gegenüber Nord ausgedrückte Richtung, in die sich das Schiff bewegt oder bewegen soll, gewöhnlich von 0 Grad im Norden, dann im Uhrzeigersinn bis 360 Grad

3.15**Kurs über Grund****COG**

(en: course over ground; COG)

an Bord des Schiffs gemessene, in Winkleinheiten zum geographischen Norden ausgedrückte Richtung der Schiffsbewegung relativ zum Boden

3.16**Kurs durch das Wasser****CTW**

(en: course through water; CTW)

durch den Winkel zwischen dem Längengrad durch die Schiffsposition und die Bewegungsrichtung des Schiffs durch das Wasser, in Winkleinheiten zum geographischen Norden ausgedrückte definierte Richtung der Schiffsbewegung durch das Wasser

3.17**Course-Up****C-up**

(en: course-up; C-up)

stabilisierte Sollkursanzeige, in der die Peilskala ausgerichtet werden kann, so dass der Kurs des eigenen Schiffs auf der Peilskala vertikal über dem CCRP liegt

Anmerkung 1 zum Begriff: Die Kurslinie zeigt weiterhin vom CCRP aus den anliegenden Kurs des eigenen Schiffs auf der Peilskala an.

Anmerkung 2 zum Begriff: Wenn der anliegende Kurs des eigenen Schiffs vom Kurs abweicht, dann zeigt die Kurslinie so lange nicht vertikal aufwärts vom CCRP, bis die Peilskala (manuell oder automatisch) zurückgesetzt wird, um die Kursänderung widerzuspiegeln.

3.18**gefährliches Ziel**

(en: dangerous target)

Ziel, dessen vorhergesagte CPA und TCPA die durch den Bediener vorgegebenen Werte verletzen

Anmerkung 1 zum Begriff: Das entsprechende Ziel wird durch ein „Dangerous Target“-Symbol gekennzeichnet.

3.19

Vorgabe

(en: default)

vordefinierte, entweder durch den Anwender oder den Hersteller eingestellte Bedingung

3.20

elektronisches Seekartendarstellungs- und Informationssystem

ECDIS

(en: ECDIS)

elektronisches Karten- und Informationssystem, welches den in der IMO-Resolution MSC.232(82) und in IEC 61174 niedergelegten Anforderungen entspricht

3.21

ECDIS-Basisanzeige

(en: ECDIS display base)

Basisinformationen, die von einer ECDIS-Anzeige nicht gelöscht werden können und die aus Informationen bestehen, die zu jedem Zeitpunkt in allen geographischen Regionen und unter allen Umständen erforderlich sind

Anmerkung 1 zum Begriff: Zur sicheren Navigation werden diese Informationen als nicht ausreichend angesehen.

3.22

ECDIS-Standard-Anzeige

(en: ECDIS standard display)

Basisinformationen, die angezeigt werden, wenn eine Karte zum ersten Mal auf dem ECDIS dargestellt wird

Anmerkung 1 zum Begriff: Der Level der Informationen, die für die Routenplanung oder Routenüberwachung bereitgestellt werden, darf durch den Seefahrer entsprechend dessen Anforderungen geändert werden.

3.23

elektronische Seekarte

ENC

(en: electronic navigational chart; ENC)

hinsichtlich Inhalt, Struktur und Format entsprechend den einschlägigen IHO-Normen standardisierte Datenbasis, die durch eine oder im Auftrag einer Verwaltung veröffentlicht wurde

3.24

elektronisches Positionsbestimmungssystem

EPFS

(en: electronic position fixing system; EPFS)

Positionsbestimmungssystem unter Anwendung elektronischer Mittel

3.25

elektronische Abstands- und Peillinie

ERBL

(en: electronic range and bearing line; ERBL)

elektronische Peillinie mit einem Kennzeichen, das mit dem variablen Abstandskennzeichen kombiniert ist, um Abstand und Peilung vom eigenen Schiff oder zwischen zwei Zielen zu messen

3.26

Gerät im Test

EUT

(en: equipment under test; EUT)

Gerät im Test

3.27**flüchtiger troposphärischer Ausbreitungskanal**

(en: evaporation duct)

niedrig liegender Ausbreitungskanal (eine Änderung in der Luftdichte), der die Radarenergie so einfasst, dass sie sich nahe der Meeresoberfläche ausbreitet

Anmerkung 1 zum Begriff: Ein „duct“ kann Reichweiten der Radarzielerkennung ausweiten oder einschränken.

3.28**Sperrgebiet**

(en: exclusion zone)

Gebiet, für das die automatische Erfassung zur Zielverfolgung ausgenommen und/oder die automatische Aktivierung schlafender AIS-Ziele unterdrückt sein kann

3.29**Grundstabilisierung**

(en: ground stabilisation)

Anzeigemodus, bei dem Geschwindigkeits- und Kursinformation auf den Grund bezogen sind, wobei sie grundbezogene Eingabedaten oder ein EPFS als Referenz nutzen

3.30**anliegender Kurs**

(en: heading)

in horizontaler Richtung in Winkleinheiten ausgedrückter Winkel gegenüber Nord, in die der Bug eines Schiffs in jedem Moment tatsächlich zeigt

3.31**Kurslinie**

(en: heading line)

graphische Linie, ausgehend von einem einheitlichen gemeinsamen Bezugspunkt hin zur Peilskala, um den anliegenden Kurs des Schiffs in einem Radarbild darzustellen

3.32**Rechtvorausmodus****H UP**

(en: head-up; H UP)

Darstellungsart, in der ein anliegender Kurs des eigenen Schiffs nach oben, in Richtung der Spitze der Peilskala, gerichtet ist

Anmerkung 1 zum Begriff: Im Rechtvorausmodus zeigt die Spitze der Peilskala einen relativen Kurs von 000 an.

Anmerkung 2 zum Begriff: Radarechos werden entsprechend ihrer gemessenen Entfernungen angezeigt und bewegen sich mit relativen Zielspuren in einer Richtung relativ zum anliegenden Kurs des eigenen Schiffs.

3.33**stabilisierter Rechtvorausmodus****STAB H UP**

(en: head-up stabilised; STAB H UP)

stabilisierter Rechtvorausmodus, wobei der Kurs des eigenen Schiffs nach oben in Richtung der Sollkurs-stabilisierten Spitze der Peilskala gerichtet ist

Anmerkung 1 zum Begriff: Die Spitze der Peilskala zeigt den wahren anliegenden Kurs des Schiffs gegenüber Nord.

Anmerkung 2 zum Begriff: Radarechos und verfolgte Ziele werden in ihren gemessenen Entfernungen angezeigt und bewegen sich in einer Richtung relativ zum anliegenden Kurs des eigenen Schiffs.

3.34

Hochgeschwindigkeitsfahrzeug HSC

(en: high speed craft; HSC)

Wasserfahrzeuge, die der Definition für Hochgeschwindigkeitsfahrzeuge nach SOLAS entsprechen

3.35

Bildzeichen

(en: icon)

Graphik, die eine Möglichkeit zur Steuerung einer Funktion bereitstellt oder kennzeichnet

3.36

Integriertes Navigationssystem INS

(en: integrated navigation system; INS)

Navigationssystem, welches den in der IMO-Resolution MSC.252(82) und IEC 61924-2 niedergelegten Anforderungen entspricht

3.37

Latenzzeit

(en: latency)

Verzögerung zwischen den aktuell durch das Gerät empfangenen Daten und der Darstellung oder Anwendung dieser Daten

3.38

verlorenes AIS-Ziel

(en: lost AIS target)

Zielsymbol, das die letzte gültige Position eines AIS-Ziels oder dessen letzte gekoppelte Position (DR) darstellt, bevor dessen Daten verloren gingen

Anmerkung 1 zum Begriff: Das Ziel wird durch ein „lost AIS target“-Symbol angezeigt.

3.39

verlorenes verfolgtes Ziel

(en: lost tracked target)

verfolgtes Ziel, für das wegen schwacher, gestörter oder unklarer Signale keine Zielinformation mehr verfügbar ist

Anmerkung 1 zum Begriff: Das Ziel wird durch ein „lost tracked radar target“-Symbol an seiner zuletzt bekannten oder gekoppelten Position angezeigt.

3.40

Karten/Navigationsleitlinien

(en: maps; navigation lines)

durch den Anwender definierte oder erzeugte Linien, um für die Navigation wichtige Verkehrstrennungsgebiete oder Grenzen eines Bereichs anzuzeigen

3.41

Menü

(en: menu)

Bereich einer Anzeige, welcher der interaktiven Anzeige und dem Betrieb eines strukturierten Menüs zur Auswahl oder zur Parameter-, Daten- oder Befehlseingabe zugeordnet ist

Anmerkung 1 zum Begriff: Wenn ausgewählt, dann ersetzt das Anzeigemenü normalerweise Teile der oder die ganze Datenanzeige.

3.42**Navigationssituation**

(en: navigation situation)

breite und allgemeine Beschreibung der Navigationsart, die geplant ist oder gerade ausgeführt wird, zum Beispiel: offenes Meer, Küste, äußere Anfahrt, eingeschränkte Fahrtgebiete, Sperrung, Anlegen/Manövrieren

3.43**nichtflüchtiger und übertragbarer Speicher**

(en: non-volatile and transferable memory)

Speicher, der seine Daten behält, wenn er nicht mit Energie versorgt und von einem Gerät oder Modul getrennt und an ein anderes Gerät oder Modul angeschlossen wird

3.44**Norden oben****N-up**

(en: north-up; N-up)

Azimuth-stabilisierte Darstellung, wobei der Norden auf der Kompasskala fest vertikal oberhalb des CCRP fixiert bleibt

Anmerkung 1 zum Begriff: Die Kurslinie zeigt vom CCRP zum auf das eigene Schiff bezogenen Kurs auf der Kursskala, und die Peilung eines jeden Ziels wird von Norden gemessen. Solch eine Peilung wird gewöhnlich als eine wahre Peilung bezeichnet, wenn die Referenzkurseingabe von einem Kompass kommt, der auf den geographischen Norden abgeglichen ist.

3.45**betrieblicher Anzeigebereich**

(en: operational display area)

Anzeigebereich zur graphischen Präsentation elektronischer Karten- und Radarinformationen, ohne den Anwenderdialogbereich

Anmerkung 1 zum Begriff: Auf der Kartenanzeige ist das der Bereich der Kartendarstellung.

Anmerkung 2 zum Begriff: Auf der Radaranzeige ist das der Bereich des Radarbildes.

3.46**Betriebsart**

(en: operational mode)

Primärfunktion der durch den Anwender ausgewählten Darstellung für den Arbeitsauftrag oder die Navigationssituation, zum Beispiel Radar, Karte, Schiffsführung

3.47**Letzte Positionen**

(en: past positions)

Markierungen der letzten Positionen eines verfolgten oder angezeigten Ziels und des eigenen Schiffs mit gleichen zeitlichen Abständen

Anmerkung 1 zum Begriff: Die Spur der letzten Positionen kann relativ oder wahr sein und lässt sich auf verfolgte Radarziele oder AIS-Ziele anwenden.

3.48**Darstellungsart**

(en: presentation mode)

Ergebnis der Kombination der durch Anwender ausgewählten Parameter, welche die Anzeige von Informationen beeinflusst, zum Beispiel, Sollkurs Orientierung, Bewegung, Stabilisierung, Karten-Projektion

3.49**geschütztes Menü**

(en: protected menu)

Menü, das nicht einfach durch den Anwender zugänglich ist, der Zugang kann zum Beispiel mit Password oder einem Schalter geschehen

3.50

Radar

(en: radar)

radio detection and ranging Funksystem, das die Bestimmung von Abstand und Richtung eines reflektierenden Gegenstands vom aussendenden Gerät erlaubt

3.51

Radarbake

(en: radar beacon)

Navigationshilfe, die auf die Radarübertragung durch die Erzeugung eines Radarsignals zur Identifikation ihrer Position und Identität antwortet

3.52

Radarquerschnitt

RCS

(en: radar cross-section; RCS)

bestimmt die Leistungsdichte, die von einem Ziel für ein bestimmtes Leistungsdichte-Ereignis zum Radar zurückkommt

3.53

Radarerkennung Fehlalarm

(en: radar detection false alarm)

Wahrscheinlichkeit eines Radar-Fehlalarms, der die Wahrscheinlichkeit darstellt, dass Störungen den Erkennungs-Schwellwert übersteigen und als Ziel genannt werden, wenn nur Störungen vorhanden sind

3.54

Radaranzeige

(en: radar display)

Modul eines Radarsystems, das aus der Hardware für die Darstellung besteht

3.55

Radarecho

(en: radar echo)

durch ein Ziel zu einer Radarantenne reflektiertes Signal, das im Radarvideo und im Radarbild erscheint

3.56

Radarbild

(en: radar image)

Draufsicht des Radarvideos in Bereich und Richtung

3.57

Radardarstellung

(en: radar presentation)

Anzeige eines Radarbildes, zusammen mit zugehöriger alphanumerischer und graphischer Information

3.58

Radarsystem

(en: radar system)

gesamter Inhalt und Funktionalität eines Systems, welches zur Erfüllung der Anforderungen dieser Testnorm notwendig ist

3.59

Radarziel

(en: radar target)

fester oder beweglicher Gegenstand, der durch ein Radarsystem erkannt oder erkennbar ist und für den aufeinanderfolgende Radarmessungen von Entfernung und Richtung eine Bewegung festlegen

Anmerkung 1 zum Begriff: Ein Radarziel wird durch vom Radarsensor (Transceiver) bereitgestellte Videosignale abgeleitet und erscheint im Radarbild.

3.60**Radarbild**

(en: radar video)

durch einen Radarempfänger als Ergebnis reflektierter Radarechos generiertes Signal

3.61**Radarzielverstärker**

(en: radar target enhancer)

elektronischer Radarreflektor, an dessen Ausgang ohne eine Verarbeitung, außer Begrenzung, eine Verstärkung des empfangenen Radarimpulses entsteht

3.62**Bereichsverzögerungsindex**

(en: range index delay)

Verzögerung zu Beginn einer Radardarstellung, um den Inhalt des Nahbereichsradarsignals wirksam zu unterdrücken und die lineare Darstellung zu verzerren

3.63**Drehgeschwindigkeit****ROT**

(en: rate of turn; ROT)

Kursänderung je Zeiteinheit

3.64**Referenzziel**

(en: reference target)

Symbol zur Kennzeichnung, dass das assoziierte unbewegliche verfolgte Ziel (zum Beispiel ein Navigationszeichen) als eine auf den Grund stabilisierte Geschwindigkeitsreferenz benutzt wird

3.65**relative Peilung**

(en: relative bearing)

Richtung einer Zielposition vom CCRP des eigenen Schiffs, ausgedrückt als Winkelabweichung zum Kurs des eigenen Schiffs

3.66**relativer Kurs**

(en: relative course)

Bewegungsrichtung eines Ziels relativ zum Kurs (Peilung) des eigenen Schiffs

3.67**relative Bewegung****RM**

(en: relative motion; RM)

Anzeige, auf der die Position des eigenen Schiffs fest bleibt und sich alle Ziele relativ zum eigenen Schiff bewegen

Anmerkung 1 zum Begriff: Es ist die Kombination von relativem Kurs und relativer Geschwindigkeit.

3.68**relative Geschwindigkeit**

(en: relative speed)

Geschwindigkeit eines Ziels, relativ zu den Geschwindigkeitsdaten des eigenen Schiffs

3.69**relativer Richtungsvektor**

(en: relative vector)

vorhergesagte Bewegung eines Ziels, relativ zur Bewegung des eigenen Schiffs

3.70

Such- und Rettungstransponder SART

(en: search and rescue transponder; SART)
Radarantwortsender für den Betrieb im 9-GHz-Band

3.71

Geschwindigkeits- und Distanzmessgerät SDME

(en: speed and distance measuring equipment; SDME)
Geschwindigkeits- und Distanzmessgerät, welches den in der IMO-Resolution MSC. 96(72) niedergelegten Anforderungen entspricht

3.72

Seegang

(en: sea state)
Zustand des Meeres aufgrund des Umgebungswetters, ausgedrückt als Seegang Stärke 0 für flache Verhältnisse mit minimalem Wind bis Stärke 8 für sehr raue Meeresbedingungen

3.73

ausgewähltes Ziel

(en: selected target)
manuell ausgewähltes Ziel zur Anzeige von detaillierter alphanumerischer Information in einem separaten Anzeigebereich

Anmerkung 1 zum Begriff: Das Ziel wird durch ein „selected Target“-Symbol dargestellt.

3.74

schlafendes AIS-Ziel

(en: sleeping AIS target)
Ziel, welches das Vorhandensein und die Orientierung eines mit AIS ausgerüsteten Schiffs an einem bestimmten Ort anzeigt

Anmerkung 1 zum Begriff: Das Ziel wird durch ein „sleeping target“-Symbol dargestellt.

Anmerkung 2 zum Begriff: Es werden keine weiteren Informationen angezeigt, bis das Ziel aktiviert ist.

3.75

Meeresstabilisierung

(en: sea stabilisation)
Anzeigebetriebsart, bei der Geschwindigkeits- und Kursinformation auf das Meer bezogen sind, unter Anwendung von Kompass oder Gleichwertigem und einer Wassergeschwindigkeitslogeingabe als Referenz

3.76

Schutz des menschlichen Lebens auf See SOLAS

(en: safety of life at sea; SOLAS)
Internationales Übereinkommen zum Schutz des menschlichen Lebens auf See, angenommen durch die Internationale Konferenz zur Sicherheit des Lebens auf See, die durch die International Maritime Organization (IMO) in 1974 ausgerichtet wurde

3.77

Fahrt (oder Geschwindigkeit) über Grund SOG

(en: speed over ground; SOG)
an Bord des Schiffs relativ zum Grund gemessene Geschwindigkeit

3.78**Geschwindigkeit im Wasser****STW**

(en: speed through water; STW)

Geschwindigkeit des Schiffs relativ zur Wasseroberfläche

3.79**Standardanzeige**

ECDIS-Standardanzeige

(en: standard display; ECDIS standard display)

Level an Information, der gezeigt werden soll, wenn eine Karte zum ersten Mal auf einem ECDIS oder ECS angezeigt wird

Anmerkung 1 zum Begriff: Der Level an Information, der für Routenplanung und -überwachung bereitgestellt wird, kann durch den Seemann entsprechend seinen Anforderungen abgeändert werden.

3.80**Dauerzustandsverfolgung**

(en: steady state tracking)

Zielverfolgung bei stetiger Bewegung:

- nach Beendigung des Erfassungsvorgangs oder
- ohne ein Manöver des Ziels oder des eigenen Schiffs oder
- ohne Ziel-Tausch oder Störung

3.81**Achterlinie**

(en: stern line)

graphische Linie vom einheitlichen gemeinsamen Bezugspunkt zur Peilskala mit einer zur Kurslinie entgegengesetzten Peilung

3.82**Ziel-Tausch**

(en: target swap)

Situation, in welcher die eingehenden Radardaten eines verfolgten Ziels inkorrekt einem anderen verfolgten Ziel oder einem nicht verfolgten Radarecho zugeordnet werden

3.83**vorhergesagte Zielbewegung**

(en: target's predicted motion)

Vorhersage eines auf der gegenwärtigen Bewegung basierenden zukünftigen Zielkurses und einer zukünftigen Geschwindigkeit, bestimmt durch vorangegangene Messungen von Entfernung und Peilung auf dem Radar

3.84**Zielverfolgung****TT**

(en: target tracking; TT)

Computerprozess zur Beobachtung der sequentiellen Positionsänderungen in der Position eines Radarziels, um seine Bewegung festzulegen

Anmerkung 1 zum Begriff: Ein solches Ziel ist ein verfolgtes Ziel.

3.85**Arbeitsauftrag**

(en: task at hand)

besondere Aktivität, die durch den Anwender ausgeführt wird, zum Beispiel Kollisionsvermeidung, Routenplanung, Routenüberwachung, Vermeidung von Grundberührung

3.86

Testziel

(en: test target)

für Testanforderungen benutztes Radarziel mit bekannten Charakteristika

3.87

Spuren

(en: trails)

in Form eines Nachglühens angezeigte Spuren von Radarzielen

Anmerkung 1 zum Begriff: Spuren können wahr oder relativ sein.

Anmerkung 2 zum Begriff: Relative Spuren werden wie in relativer Bewegung dargestellt.

Anmerkung 3 zum Begriff: Wahre Spuren werden wie in wahrer Bewegung dargestellt.

3.88

Versuchsmanöver

(en: trial manoeuvre)

Gelegenheit zur graphischen Simulation, um dem Anwender zu helfen, ein vorgeschlagenes Steuer- und Kollisionsvermeidungsmanöver durch Anzeige des vorhergesagten Zustands von zumindest allen akquirierten oder aktivierten Zielen als Resultat des simulierten Manövers des eigenen Schiffs auszuführen

3.89

wahre Peilung

(en: true bearing)

vom CCRP des eigenen Schiffs oder von einer anderen Zielposition ausgehende, als Winkelabweichung vom geographischen Norden ausgedrückte Richtung eines Ziels

3.90

wahrer Kurs

(en: true course)

als Winkelabweichung vom geographischen Norden ausgedrückte relative Bewegungsrichtung eines Ziels zum Grund oder zum Meer

3.91

wahre Bewegung

TM

(en: true motion; TM)

Kombination von wahrem Kurs und wahrer Geschwindigkeit

Anmerkung 1 zum Begriff: Anzeige, nach der sich das eigene Schiff mit seiner wahren Bewegung bewegt.

Anmerkung 2 zum Begriff: Ein kontinuierlich aktualisierter Positionsbericht ist nicht erforderlich.

3.92

wahre Geschwindigkeit

(en: true speed)

Geschwindigkeit eines Ziels relativ zum Meeresboden oder zur Meeresoberfläche

3.93

wahrer Richtungsvektor

(en: true vector)

Richtungsvektor, der die vorhergesagte wahre Bewegung eines Ziels darstellt und den Kurs und die Geschwindigkeit mit Referenz zum Meeresboden oder zur Meeresoberfläche anzeigt

3.94

Anwender-konfigurierte Darstellung

(en: user configured presentation)

durch den Anwender auftragsgemäß konfigurierte Darstellung

Anmerkung 1 zum Begriff: Die Darstellung kann Radar- und/oder Karteninformation in Kombination mit anderen navigations- oder schiffsbezogenen Daten enthalten.

3.95

Anwender-definiert

(en: user-defined)

Ergebnis einer Funktion oder ausgewählter bzw. anwenderdefinierter Parameter innerhalb der Vorgaben für spezielle Geräte

3.96

Anwenderdialogbereich

(en: user dialogue area)

der interaktiven Darstellung zugeordneter Anzeigebereich, der aus Datenfeldern und/oder Menüs zur Auswahl betrieblicher Parameter, zur Eingabe von Daten und Kommandos hauptsächlich in alphanumerischer Form besteht

3.97

Reisedatenrecorder

VDR

(en: voyage data recorder; VDR)

Reisedatenrecorder, der den Anforderungen durch IMO-Resolution MSC.333(90) und IEC 61996-1 entspricht

– Leerseite –

Maritime navigation and radiocommunication equipment and systems –
Shipborne radar –
Performance requirements, methods of testing and required test results
(IEC 62388:2013)

Matériels et systèmes de navigation et de
radiocommunication maritimes –
Radars de bord –
Exigences de performance, méthodes
d'essai et résultats exigés
(CEI 62388:2013)

Navigations- und
Funkkommunikationsgeräte und -systeme
für die Seeschifffahrt –
Radar für Schiffe –
Leistungsanforderungen, Prüfverfahren
und geforderte Prüfergebnisse
(IEC 62388:2013)

This European Standard was approved by CENELEC on 2013-07-31. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CENELEC members are the national electrotechnical committees of Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

CENELEC

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 80/696/FDIS, future edition 2 of IEC 62388, prepared by IEC TC 80 "Maritime navigation and radiocommunication equipment and systems" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62388:2013.

The following dates are fixed:

- | | | |
|--|-------|------------|
| – latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2014-04-30 |
| – latest date by which the national standards conflicting with the document have to be withdrawn | (dow) | 2016-07-31 |

This document supersedes EN 62388:2008.

EN 62388:2013 includes the following significant technical changes with respect to EN 62388:2008:

In 6.2 (Transmission and interference) reference is now made to a revised Annex B (Unwanted emissions) where the mask has been tightened from 20 dB/decade to 30 dB/decade in line with ITU requirements and a new informative Annex J has been added concerning interference from emissions in adjacent frequency bands;

Clause 7 (Display presentation) has been simplified (and the previous Annexes J and K deleted) with reference made instead to EN 62288 with associated changes throughout the standard;

In 9.9.2 (PI lines and positioning) the requirements for parallel index lines have been revised;

In 10.4.4 (Display orientation) a new mode of display orientation "head-up stabilised" has been added;

In 11.5 (Automatic Identification System) new requirements and tests have been added for types of AIS targets, AIS repeater stations and filtering of AIS targets;

In Clause 12 (Chart radar) a new subclause 12.3 has been added for ECDIS backup requirements;

In Clause 13 (Ergonomic criteria) a new subclause 13.5 has been added giving requirements for default control settings;

14.3 (Output interfacing) has been revised together with the associated Annex H to update the requirements particularly with regard to interfaces to the VDR;

Clause 16 (Alerts and failures) has been revised to update the requirements to align with bridge alert management and new requirements added for an alert management interface with associated changes throughout the standard;

In Clause 18 (Equipment familiarisation and documentation) a new subclause 18.3 has been added for maintenance information and equipment update.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62388:2013 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 standards indicated:

IEC 62616	NOTE	Harmonised as EN 62616.
ISO 9000	NOTE	Harmonised as EN ISO 9000.
ISO 9241-8	NOTE	Harmonised as EN ISO 9241-8.
ISO 9241-12	NOTE	Harmonised as EN ISO 9241-12.

CONTENTS

1	Scope	13
2	Normative references	13
3	Terms and definitions	14
4	General.....	26
4.1	Overview.....	26
4.2	Purpose	27
4.3	Application of these standards.....	27
4.4	Equipment categories.....	28
4.5	Establishing equipment type and status	28
4.6	Conditions of measurement and related definitions.....	29
4.7	Quality requirements	29
5	Tests	29
5.1	Test sites and simulation	29
5.1.1	Environmental and RF testing	29
5.1.2	Over-sea radar performance tests	29
5.1.3	Test targets and target simulation for performance tests.....	30
5.2	Test terminology and format	30
5.2.1	General	30
5.2.2	Test requirement terminology.....	30
5.2.3	Testing method terminology	31
6	Radar performance.....	31
6.1	General.....	31
6.2	Transmission and interference	31
6.2.1	Transmission frequency	31
6.2.2	Interference	32
6.3	Performance optimisation and monitoring.....	32
6.3.1	General	32
6.3.2	Optimum performance.....	32
6.4	Gain and anti-clutter functions	33
6.4.1	General	33
6.4.2	Gain function	33
6.4.3	Manual and automatic sea anti-clutter	33
6.4.4	Rain anti-clutter	34
6.5	Signal processing	34
6.5.1	General	34
6.5.2	Target enhancement.....	34
6.5.3	Radar signal correlation	35
6.5.4	Signal processing and radar image latency.....	35
6.5.5	Second-time-around echoes.....	35
6.5.6	Transmission format	36
6.5.7	Picture update	36
6.5.8	Additional processing.....	36
6.5.9	Signal processing description.....	36
6.6	Operation with SARTs, target enhancers (RTEs) and beacons.....	37
6.6.1	General	37

6.6.2	Radar beacons, SARTs and enhancers	37
6.7	Minimum range and range compensation	37
6.7.1	General	37
6.7.2	Range compensation	38
6.7.3	Minimum range	38
6.8	Range and bearing discrimination	39
6.8.1	General	39
6.8.2	Measurement conditions	39
6.8.3	Range discrimination.....	39
6.8.4	Bearing discrimination.....	39
6.8.5	Fundamental radar accuracy	40
6.9	Target detection performance assessment	40
6.9.1	General	40
6.9.2	Range of first detection in minimal clutter	41
6.9.3	Assessment of target detection with clutter	43
6.9.4	Radar performance documentation	48
6.10	Radar antenna (including pitch and roll)	49
6.10.1	General	49
6.10.2	Vertical radiation pattern/pitch and roll.....	49
6.10.3	Antenna horizontal pattern	50
6.10.4	Antenna side lobes	50
6.11	Radar availability – Standby and transmit.....	51
6.11.1	Requirements	51
6.11.2	Methods of test and required results.....	51
7	Display presentation	51
7.1	General.....	51
7.1.1	Requirements	51
7.1.2	Methods of test and required results.....	52
7.2	Linearity and index delay	52
7.2.1	Requirements	52
7.2.2	Methods of test and required results.....	52
7.3	Use and discrimination of colour	52
7.3.1	Requirements	52
7.3.2	Methods of test and required results.....	52
8	CCRP and own ship.....	52
8.1	Consistent common reference point (CCRP).....	52
8.1.1	CCRP	52
8.1.2	CCRP position	53
8.1.3	Measurements	53
8.1.4	Antenna offset	53
8.2	Own ship.....	54
8.2.1	General	54
8.2.2	Own ship's outline and minimised symbol	54
8.2.3	Heading line	54
8.2.4	Stern line.....	55
9	Navigation tools.....	55
9.1	General.....	55

9.2	Units of measurement.....	55
9.2.1	Requirements	55
9.2.2	Methods of test and required results.....	55
9.3	Presentation.....	56
9.3.1	Requirements	56
9.3.2	Methods of test and required results.....	56
9.4	Display range scales	56
9.4.1	Mandatory range scales	56
9.5	Variable range marker (VRM)	56
9.5.1	General	56
9.5.2	VRM measurements.....	57
9.6	Electronic bearing line (EBL)	58
9.6.1	General	58
9.6.2	EBL measurements.....	58
9.6.3	EBL origin position.....	58
9.7	Cursor.....	59
9.7.1	General	59
9.7.2	Cursor measurement	59
9.7.3	Selection by cursor	59
9.8	Offset measurement of range and bearing.....	60
9.8.1	General	60
9.8.2	Electronic range and bearing line (ERBL)	60
9.9	Parallel index lines (PI).....	61
9.9.1	General	61
9.9.2	PI lines and positioning	61
9.10	Bearing scale	62
9.10.1	General	62
9.10.2	Bearing scale presentation.....	62
9.11	Range rings.....	63
9.11.1	General	63
9.11.2	Range ring presentation and measurement.....	63
9.12	Radar maps	63
9.12.1	General	63
9.12.2	Map functions and display simple user-defined maps.....	64
9.12.3	Map memory and transfer	64
9.12.4	Map presentation properties.....	64
9.13	Navigation routes	65
9.13.1	General	65
9.13.2	Route display and monitoring	65
10	Orientation, motion and stabilisation	66
10.1	General.....	66
10.2	Azimuth orientation.....	66
10.2.1	Accuracy of alignment.....	66
10.2.2	Heading readout and reference	67
10.2.3	Azimuth stabilisation update.....	68
10.3	Motion and orientation modes	68
10.3.1	General	68
10.3.2	True and relative motion	68

10.4	Off-centring	68
10.4.1	General	68
10.4.2	Manual and automatic off-centring	68
10.4.3	Automatic reset	69
10.4.4	Display orientation	69
10.5	Ground and sea stabilisation	70
10.5.1	Mode and source	70
10.5.2	Ground stabilisation	71
10.5.3	Sea stabilisation	71
11	Aids for collision avoidance	72
11.1	General	72
11.2	Target trails and past positions	72
11.2.1	General	72
11.2.2	Time and plot requirements	72
11.2.3	Trails/past position availability	73
11.3	Target tracking (TT)	74
11.3.1	General	74
11.3.2	Presentation of targets	74
11.3.3	Tracking calculations	74
11.3.4	Target tracking availability	75
11.3.5	Classification and tracked target capacity	75
11.3.6	Manual acquisition	76
11.3.7	Automatic acquisition	77
11.3.8	Motion trend	77
11.3.9	Visibility of 50 %	77
11.3.10	Tracking algorithm	77
11.3.11	Target swap	78
11.3.12	Cease tracking	78
11.3.13	Target tracking scenarios	78
11.3.14	Target motion and tracking accuracy	78
11.3.15	Tracker range and bearing accuracy	87
11.3.16	Reference target	88
11.4	Tracking limitations	88
11.4.1	Tracking warnings	88
11.4.2	Documentation	89
11.4.3	Requirements	89
11.4.4	Methods of test and required results	89
11.5	Automatic identification system	89
11.5.1	General	89
11.5.2	AIS targets and data report capacity	89
11.5.3	AIS target filtering	91
11.5.4	Activation and deactivation of AIS targets	91
11.5.5	AIS functionality and presentation	92
11.6	Radar and AIS target data	94
11.6.1	Requirements	94
11.6.2	Methods of test and required results	94
11.6.3	Bow crossing range and time (BCR/BCT)	95
11.7	Operational target alerts	95

11.7.1	CPA and TCPA	95
11.7.2	New target warning	96
11.7.3	Lost tracked radar target	96
11.7.4	Lost AIS target criteria	97
11.8	Target association	98
11.8.1	General	98
11.8.2	Association and priority	98
11.9	Trial manoeuvre	102
11.9.1	General	102
11.9.2	Trial functions	102
12	Chart radar (optional classification)	103
12.1	General requirements	103
12.1.1	General	103
12.1.2	Chart operation and source	103
12.1.3	Chart elements and availability	104
12.1.4	Chart reference	105
12.1.5	Primary chart information set	105
12.1.6	Chart stabilisation and chart redraw	106
12.1.7	Chart position and latency	107
12.1.8	Matching and adjustment	107
12.1.9	Chart symbols, colours, and size	108
12.1.10	Chart display size	109
12.1.11	Chart alerts and indications	109
12.1.12	Chart malfunction	110
12.1.13	Chart radar malfunction	110
12.2	Additional requirements for standalone radar with chart facilities	110
12.2.1	General	110
12.2.2	Provision and updating of chart information	110
12.2.3	Content and structure of chart data	110
12.3	Additional requirements for ECDIS back-up (optional)	111
12.3.1	General	111
12.3.2	Requirements	111
12.3.3	Test Methods and required results	111
13	Ergonomic criteria (control functions and display)	111
13.1	General	111
13.2	Operational controls	111
13.2.1	Requirements	111
13.2.2	Methods of test and required results	112
13.3	Primary controls	112
13.3.1	Requirements	112
13.3.2	Methods of test and required results	112
13.4	Control properties	113
13.4.1	Requirements	113
13.4.2	Methods of test and required results	113
13.5	Default control setting and saved user control settings	113
13.5.1	Requirements	113
13.5.2	Test methods and required results	114
14	Interfacing	115

14.1	General	115
14.2	Input interfacing	115
14.2.1	Input data	115
14.2.2	Input quality, integrity and latency	116
14.3	Output interfacing	116
14.3.1	Output format	116
14.3.2	Output target data	116
14.3.3	VDR interface	117
15	Design, servicing and installation	118
15.1	General	118
15.2	Fault diagnosis and servicing	118
15.2.1	Requirements	118
15.2.2	Methods of test and required results	119
15.3	Display design	119
15.3.1	Requirements	119
15.3.2	Methods of test and required results	119
15.4	Transceiver design	119
15.4.1	General	119
15.4.2	Sector blanking	120
15.5	Antenna design	120
15.5.1	Requirements	120
15.5.2	Methods of test and required results	120
15.6	Inter-switched and multiple radars	121
15.6.1	General	121
15.6.2	System safeguards	121
15.6.3	Combining radar	121
15.6.4	Multiple radar system status	122
15.7	Multiple operational displays	122
15.7.1	Additional information and conformity	122
15.7.2	Requirements	122
15.7.3	Methods of test and required results	123
15.8	Safety – antenna and radiation	123
15.8.1	General	123
15.8.2	Antenna radiation and rotation	123
15.8.3	Microwave radiation levels	123
16	Alerts and failures	124
16.1	General	124
16.1.1	Priority of alerts	124
16.1.2	Alerts and indications	124
16.1.3	Alarm contact outputs	124
16.1.4	Alert management interface	124
16.1.5	Unacknowledged warnings	125
16.1.6	Unacknowledged alarms	126
16.1.7	Remote acknowledgement and silencing of alerts	126
16.1.8	Picture freeze	127
16.1.9	Sensor failure alert	127
16.2	Backup and fallback arrangements	127
16.2.1	Requirements	127

16.2.2	Failure of heading information (azimuth stabilisation).....	127
16.2.3	Failure of speed through the water information	128
16.2.4	Failure of course and speed over ground information	128
16.2.5	Failure of position input information.....	128
16.2.6	Failure of radar video input information	129
16.2.7	Failure of AIS input information	129
16.2.8	Failure of an integrated or networked system.....	129
17	Environmental testing	129
17.1	General	129
17.2	Testing to IEC 60945	130
17.2.1	Requirements	130
17.2.2	Methods of test and required results.....	130
17.3	Additional environmental tests	130
17.3.1	General	130
17.3.2	Antenna shock test	130
18	Equipment familiarisation and documentation.....	131
18.1	Familiarisation simulator.....	131
18.1.1	General	131
18.1.2	Requirements	131
18.1.3	Methods of test and required results.....	131
18.2	Instructions and documentation	132
18.2.1	General	132
18.2.2	Documentation	132
18.2.3	Operating instructions	132
18.3	Radar system installation.....	133
18.3.1	Requirements	133
18.3.2	Methods of test and required results.....	133
18.4	Maintenance information for equipment update	134
18.4.1	Requirements	134
18.4.2	Methods of test and required results.....	134
Annex A (informative)	Guidelines for radar functionality on navigation displays	135
Annex B (normative)	Unwanted emissions of radar systems	136
Annex C (informative)	Radar target size (RCS) and detection range calculations	141
Annex D (informative)	Factors that influence target detection	145
Annex E (normative)	Sensor errors	154
Annex F (informative)	Target scenario simulator/reported target simulator	156
Annex G (informative)	Tracked and reported target states	157
Annex H (normative)	IEC 61162 sentence formats.....	158
Annex I (normative)	Radar control function/indication grouping	167
Annex J (informative)	Interference to shipborne radar from emissions in adjacent frequency bands.....	171
Bibliography		174
Annex ZA (normative)	Normative references to international publications with their corresponding European publications.....	175

Figure 1 – Reduction of range to first detection due to rain at S-band	44
--	----

Figure 2 – Reduction of range to first detection due to rain at X-band.....	44
Figure 3 – TT scenario 1	80
Figure 4 – TT scenario 2	82
Figure 5 – TT scenario 3	83
Figure 6 – TT scenario 4	84
Figure 7 – TT scenario 5	85
Figure B.1 – B ₄₀ falls within the allocated band	139
Figure B.2 – B ₄₀ falls outside the allocated band.....	140
Figure C.1 – Enhancement by reflection (dB) over free-space (9,41 GHz)	144
Figure C.2 – Enhancement by reflection (dB) over free-space (3,05 GHz)	144
Figure D.1 – Effect of sea spikes on target detection	147
Figure D.2 – Multi-path plots for S-band	149
Figure D.3 – Multi-path plot for X-band	149
Figure G.1 – Tracked target states	157
Figure G.2 – AIS target state.....	157
Table 1 – Performance requirements for categories of ship/craft for SOLAS V.....	28
Table 2 – Range of first detection in clutter-free conditions	41
Table 3 – X-band pass/fail assessment criteria	47
Table 4 – S-band pass/fail assessment criteria	47
Table 5 – Pass/fail assessment	48
Table 6 – Douglas sea state parameters	48
Table 7 – Main horizontal beam pattern.....	50
Table 8 – Effective side-lobes	51
Table 9 – Features and colours to be used for radar maps.....	65
Table 10 – Tracked target capacity (subset of Table 1).....	76
Table 11 – Typical tracked target accuracy (95 % probability figures).....	79
Table 12 – TT scenario 1, with sensor errors applied	80
Table 13 – TT scenario 1, times of measurement task	80
Table 14 – TT scenario 1, accuracies after 1 min and 3 min (all $\pm$ values)	81
Table 15 – TT scenario 2, own ship turning through $\pm 180^\circ$	81
Table 16 – TT scenario 3, initial target data	83
Table 17 – TT scenario 4, initial target data for fast targets (standard speed ships).....	83
Table 18 – TT scenario 4, initial target data for fast targets (HSC)	84
Table 19 – TT scenario 5: initial target data for standard craft.....	85
Table 20 – TT scenario 5: initial target data for collision scenario for HSC	85
Table 21 – Measurement points and results at 3 min and 6 min for HSC	86
Table 22 – Measurement points and results at 11 min and 14 min for HSC.....	86
Table 23 – Measurement points and results at 3 min and 6 min for standard craft	86
Table 24 – Measurement points and results at 11 min and 14 min for standard craft.....	87
Table 25 – Measurement of tracked target accuracy	87
Table 26 – AIS display capacity (subset of Table 1).....	90

Table 27 – AIS reporting rates	97
Table 28 – Association scenario 1, initial TT and AIS target position and data.....	99
Table 29 – Association scenario 1, AIS target data for diverging and converging tracks	100
Table 30 – Association scenario 2, initial TT and AIS target position and data.....	100
Table 31 – Association scenario 2, AIS target data for changing speed.....	101
Table 32 – Association scenario 3, TT and AIS target start position and data	101
Table 33 – Association scenario 4, initial TT and AIS target position and data.....	102
Table 34 – Association scenario 4, TT and AIS target with the same course and speed.....	102
Table 35 – Control settings configured in response to ‘Default’ selection.....	114
Table 36 – Antenna shock test severity (half sine pulse).....	131
Table B.1 – Measurement frequency ranges.....	137
Table D.1 – Spread of RCS values for typical ships	146
Table D.2 – S-band performance predictions for ranges of 0,2, 0,4, 0,7 NM	148
Table D.3 – X-band performance predictions for ranges of 0,2, 0,7 NM	148
Table D.4 – Parameters for attenuation in uniform rain conditions.....	149
Table D.5 – Typical values for attenuation and backscatter in uniform rain conditions	150
Table D.6 – Additional radar system parameters (X/S-band)	150
Table D.7 – Target size, height and RCS values.....	150
Table D.8 – S-band radar parameters (LP)	152
Table D.9 – X-band radar parameters (LP)	153
Table H.1 – Mandatory IEC 61162-1 sentences	158
Table H.2 – Optional IEC 61162-3 messages	159
Table H.3 – Description of terms	160
Table H.4 – Header format (1 of 2).....	161
Table H.5 – Package data format.....	163
Table I.1 – Top-level grouping of data and control functions for radar applications	167
Table I.2 – Icons for common function controls (1 of 2).....	168

MARITIME NAVIGATION AND RADIOCOMMUNICATION EQUIPMENT AND SYSTEMS –

Shipborne radar – 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 not inferior to those adopted by the IMO in Resolution MSC.192(79).

(MSC.192/2) The radar installation, in addition to meeting the general requirements as set out in resolution A.694(17) and the related standard IEC 60945, should comply with the performance standards of MSC.192(79). When a requirement of this standard is different from IEC 60945, the requirement in this standard takes precedence.

2 Normative references

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

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

IEC 61162 (all parts), *Maritime navigation and radiocommunication equipment and systems – Digital interfaces*

IEC 61174, *Maritime navigation and radiocommunication equipment and systems – Electronic chart display and information systems (ECDIS) – Operational and performance requirements, methods of testing and required test results*

IEC 61924-2:2012, *Maritime navigation and radiocommunication equipment and systems – Part 2 Modular Structure for INS - Operational and performance requirements, methods of testing and required test results*

IEC 61996-1:2012, *Maritime navigation and radiocommunication equipment and systems – Shipborne voyage data recorder (VDR) – Part 1: Voyage data recorder (VDR) - 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 results*

ITU-R Recommendation M.628, *Technical characteristics for search and rescue radar transponders*

ITU-R Recommendation M.824, *Technical parameters of radar beacons (racons)*

ITU-R Recommendation M.1176, *Technical parameters of radar target enhancers*

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

IHO S-52 Annex A, *IHO ECDIS Presentation Library*

IMO Resolution A.424(XI), *Performance standards for Gyro-compasses*

IMO Resolution A.694(17), *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids*

IMO Resolution A.821(19), *Performance standards for Gyro-compasses for High-Speed Craft*

IMO Resolution MSC.96(72), *Amendments to IMO Resolution A.824(19), Performance standards for devices to indicate speed and distance*

IMO Resolution MSC.116(73), *Performance standards for marine transmitting heading devices (THDs)*

IMO Resolution MSC.191(79), *Performance standards for the presentation of navigation-related information on shipborne navigational displays*

IMO Resolution MSC.192(79), *Revised performance standards for radar equipment*

IMO Resolution MSC.232(82), *Revised performance standards for electronic chart display and information systems (ECDIS)*

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

IMO MSC.1/Circ.1389, *Guidance on procedures for updating shipborne navigation and communication equipment*

VESA-2007-5:2007, *Industry standards and guidelines for computer display monitor timing (DMT)*

DDWG DVI:1999, *Digital Visual Interface (DVI) Revision 1.0, Digital Display Working Group (DDWG)*

3 Terms and definitions

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

3.1

activated AIS target

target representing the automatic or manual activation of a sleeping target for the display of additional graphically presented information

Note 1 to entry: *The target is displayed by an “activated target” symbol including a vector; the heading; and the ROT or direction of turn indication (if available) to indicate initiated course changes.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.2

acquisition of a radar target

process of acquiring a target and initiating its tracking

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.3

activation of an AIS target

activation of a sleeping AIS target for the display of additional graphical and alphanumerical information

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.4

acquired radar target

automatic or manual acquisition initiates radar tracking

Note 1 to entry: *Vectors and past positions (if provided) are displayed when data has achieved a steady state condition (after 1 min).*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.5

automatic identification system

AIS

Automatic Identification System which complies with the requirements of IMO resolution MSC.74(69) Annex 3 and IEC 61993-2

3.6

AIS target

target generated from an AIS message

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – deleted referral to other targets]

3.7

associated target

target simultaneously representing a tracked target and a reported AIS target having similar parameters (for example position, course, speed) which comply with an association algorithm

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – deleted examples]

3.8

acquisition/activation zone

zone set up by the operator in which the system should automatically acquire radar targets and activate reported AIS targets when entering the zone

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.9

azimuth-stabilised

heading reference input, for example own ship's gyro, is used to orientate the heading line on the radar display so that it points from the CCRP to own ship's referenced heading on the bearing scale

3.10

bow crossing range/bow crossing time

BCR/BCT

measurements presented as from the bow of the ship as opposed to the CCRP

3.11

cardinal points (compass)

0, 090, 180, 270 compass points

3.12

consistent common reference point CCRP

location on own ship, to which all horizontal measurements such as target range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA) are referenced, typically the conning position of the bridge

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.13

closest point of approach/time to the closest point of approach CPA/TCPA

distance to the closest point of approach (CPA) and time to the closest point of approach (TCPA)

Note 1 to entry: *Limits are set by the operator and are related to own ship.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.14

course

direction in which the ship is moving or intended to move, expressed in degrees from North, usually from 000° at north, then in a clockwise direction through 360°

3.15

course over ground COG

direction of the ship's movement relative to the earth, measured on board the ship, expressed in angular units from true north

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.16

course through water CTW

direction of the ship's movement through the water, defined by the angle between the meridian through its position and the direction of the ship's movement through the water, expressed in angular units from true north

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.17

course-up C-up

azimuth-stabilised display in which the bearing scale can be orientated so that own ship's course on the bearing scale is vertically above the CCRP

Note 1 to entry: The heading line will continue to point from the CCRP to own ship's referenced heading on the bearing scale.

Note 2 to entry: If own ship's heading differs from the course, then the heading line will not point vertically upwards from the CCRP until the bearing scale is reset (manually or automatically) to reflect the course alteration.

3.18

dangerous target

target whose predicted CPA and TCPA are violating the values as preset by the operator

Note 1 to entry: *The respective target is marked by a "dangerous target" symbol.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.19

default

predefined condition set either by the user or the equipment manufacturer

3.20

ECDIS

electronic chart display and information system, which complies with IMO resolution MSC.232(82) and IEC 61174

3.21

ECDIS display base

level of information which cannot be removed from the ECDIS display, consisting of information which is required at all times in all geographic areas and all circumstances

Note 1 to entry: *It is not intended to be sufficient for safe navigation.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.22

ECDIS standard display

level of information that should be shown when a chart is first displayed on ECDIS

Note 1 to entry: *The level of the information it provides for route planning or route monitoring may be modified by the mariner according to the mariner's needs.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.23

electronic navigational chart

ENC

database standardised as to content, structure and format according to relevant IHO standards and issued by, or on the authority of, a Government

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.24

electronic position fixing system

EPFS

position fixing system using electronic means

3.25

electronic range and bearing line

ERBL

electronic bearing line carrying a marker, which is combined with the variable range marker, used to measure range and bearing from own ship or between two objects

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added "variable"]

3.26

EUT

equipment under test

equipment (devices, appliances and systems) subjected to tests

3.27

evaporation duct

low lying duct (a change in air density) that traps the radar energy so that it propagates close to the sea surface

Note 1 to entry: *Ducting may enhance or reduce radar target detection ranges.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.28

exclusion zone

area which may exclude the automatic acquisition for target tracking and/or may suppress the automatic activation of sleeping AIS targets

3.29

ground stabilisation

display mode in which speed and course information are referred to the ground, using ground track input data, or EPFS as reference

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, see "Stabilization modes"]

3.30

heading

horizontal direction that the bow of a ship is pointing expressed as an angular displacement from north

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.31

heading line

graphic line on a radar presentation drawn from the consistent common reference point to the bearing scale to indicate the heading of the ship

3.32

head-up

H UP

presentation mode in which own ship's heading is oriented "up" toward the top of the bearing scale

Note 1 to entry: In head-up, the top of the bearing scale shows ships relative heading, 000 degrees.

Note 2 to entry: Radar echoes are shown at their measured distances and moving in a direction relative to own ship's heading with relative Target trails.

3.33

head-up stabilised

STAB H UP

azimuth stabilised head-up presentation mode in which own ship's heading is azimuth stabilised "up" toward the top of the bearing scale

Note 1 to entry: The top of the bearing scale shows the ship's true heading degrees from North.

Note 2 to entry: Radar echoes and tracked targets are shown at their measured distances and moving in a direction relative to own ship's heading.

3.34

high speed craft

HSC

vessels which comply with the definition in SOLAS for high speed craft

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.35

icon

graphic that provides or signifies a control function capability

3.36

integrated navigation system

INS

navigation system which complies with the requirements of IMO resolution MSC.252(82) and IEC 61924-2

3.37

latency

delay between actual data received by the equipment and the presentation or use of that data

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – specified the equipment and use]

3.38

lost AIS target

target symbol representing the last valid position of an AIS target before the reception of its data was lost, or its last dead-reckoned (DR) position

Note 1 to entry: *The target is displayed by a “lost AIS target” symbol.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – specified position and added Note 1 to entry]

3.39

lost tracked target

target information is no longer available due to poor, lost or obscured signals

Note 1 to entry: *The target is displayed by a “lost tracked radar target” symbol at its last known or dead-reckoned position.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.40

maps

navigation lines

operator defined or created lines to indicate channels, traffic separation schemes or borders of any area important for navigation

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.41

menu

area of display that is allocated to the interactive display and operation of a structured menu for the selection and entry of operational parameters, data and commands

Note 1 to entry: The menu display, when selected, is typically replacing parts of, or the whole, data display.

3.42

navigation situation

broad and general description of the type of navigation that is planned or being conducted, for example open ocean, coastal, approach, confined waters, restricted, docking/manoeuvring

3.43

non-volatile and transferable memory

memory which retains its data when it is not provided with power and removed from one equipment or module, and fitted to another equipment or module

3.44
north-up
N-up

azimuth-stabilised presentation in which north on the bearing scale remains fixed vertically above the CCRP

Note 1 to entry: The heading line points from the CCRP to own ship's referenced heading on the bearing scale, and the bearing of any target on the display is measured from north. Such a bearing is commonly referred to as a true bearing when the heading reference input comes from a gyro aligned with true north.

3.45
operational display area

area of the display used to graphically present chart and radar information, excluding the user dialogue area

Note 1 to entry: *On the chart display this is the area of the chart presentation.*

Note 2 to entry: *On the radar display this is the area encompassing the radar image.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 and 2 to entry]

3.46
operational mode

primary function of the presentation selected by the user, for the task at hand or navigation situation, for example radar, chart, conning

3.47
past positions

equally time-spaced past position marks of a tracked or reported target and own ship

Note 1 to entry: *The past positions' track may be either relative or true, and may apply to tracked radar targets or AIS targets.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.48
presentation mode

result of the combination of user selected parameters that affect the display of information, for example azimuth orientation, motion, stabilisation, chart projection

3.49
protected menu

one which is not easily accessed by the user and access may be, for example by a password or a switch

3.50
radar

radio direction and ranging

radio frequency system that allows the determination of distance and direction of reflecting objects and of transmitting devices

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.51
radar beacon

navigation aid which responds to the radar transmission by generating a radar signal to identify its position and identity

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.52

radar cross-section

RCS

determines the power density returned to the radar for a particular power density incident on a target

3.53

radar detection false alarm

probability of a radar false alarm represents the probability that noise will cross the detection threshold and be called a target when only noise is present

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.54

radar display

module of a radar system, consisting of the presentation hardware

3.55

radar echo

signal reflected by a target to a radar antenna that appears in the radar video signal and radar image

3.56

radar image

plan view of the radar video in range and bearing

3.57

radar presentation

display of a radar image together with related alpha-numeric and graphical information

3.58

radar system

entire content and functionality of a system necessary to meet the requirements of this test standard

3.59

radar target

object, fixed or moving, which is detected or detectable by a radar system and has a motion determined by successive radar measurements of range and bearing

Note 1 to entry: A radar target is derived from video signals provided by the radar sensor (transceiver) and which appears in the radar image.

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – specified detectability and added Note 1 to entry]

3.60

radar video

signal produced by a radar receiver as a result of radar echoes returned

3.61

radar target enhancer

electronic radar reflector, the output of which is an amplified version of the received radar pulse without any form of processing except limiting

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.62

range index delay

delay provided at the start of a radar presentation causing the near range radar signal contents to effectively be suppressed and distorting the linear plan presentation

3.63

rate of turn

ROT

change of heading per time unit

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.64

reference target

symbol indicating that the associated tracked stationary target (for example a navigational mark) is used as a speed reference for the ground stabilisation

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.65

relative bearing

direction of a target's position from own ship's CCRP expressed as an angular displacement from own ship's heading

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added CCRP]

3.66

relative course

direction of motion of a target relative to own ship's direction (bearing)

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.67

relative motion

RM

combination of relative course and relative speed

Note 1 to entry: On the display the position of own ship remains fixed, and all targets move relative to own ship.

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2 – added Note 1 to entry]

3.68

relative speed

speed of a target relative to own ship's speed data

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.69

relative vector

predicted movement of a target relative to own ship's motion

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, see "Vector modes"]

3.70

SART

search and rescue transponder

radar transponder capable of operating in the 9 GHz band

3.71

speed and distance measuring equipment

SDME

speed and distance measuring equipment which complies with IMO Resolution MSC.96(72)

3.72

sea state

status of the sea condition due to the weather environment, expressed as a sea state 0 for flat conditions with minimal wind, to sea state 8 for very rough sea conditions

3.73

selected target

manually selected target for the display of detailed alphanumeric information in a separate data display area

Note 1 to entry: *The target is displayed by a "selected target" symbol.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.74

sleeping AIS target

target indicating the presence and orientation of a vessel equipped with AIS in a certain location

Note 1 to entry: *The target is displayed by a "sleeping target" symbol.*

Note 2 to entry: *No additional information is presented until the target is activated.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 and 2 to entry]

3.75

sea stabilisation

display mode in which speed and course information are referred to the sea, using gyro or equivalent and water speed log input as reference

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, see "Stabilization modes"]

3.76

safety of life at sea

SOLAS

International Convention for the Safety of Life at Sea adopted by the International Conference on Safety of Life at Sea convened by the International Maritime Organization (IMO) in 1974

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added adoption]

3.77

speed over ground

SOG

speed of the ship relative to the earth, measured on board of the ship

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.78

speed through water

STW

speed of the ship relative to the water surface

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.79

standard display

ECDIS standard display

level of information that should be shown when a chart is first displayed on ECDIS or ECS

Note 1 to entry: *The level of the information it provides for route planning or route monitoring may be modified by the mariner according to the mariner's needs.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added ECS and Note 1 to entry]

3.80

steady state tracking

tracking a target, proceeding at steady motion:

- *after completion of the acquisition process, or*
- *without a manoeuvre of target or own ship, or*
- *without target swap or any disturbance*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.81

stern line

graphic line drawn from the consistent common reference point to the bearing scale, on a reciprocal bearing to the heading line

3.82

target swap

situation in which the incoming radar data for a tracked target becomes incorrectly associated with another tracked target or a non-tracked radar echo

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.83

target's predicted motion

prediction of a target's future course and speed based on its present motion as determined by past measurements of its range and bearing on the radar

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.84

target tracking

TT

computer process of observing the sequential changes in the position of a radar target in order to establish its motion

Note 1 to entry: *Such a target is a Tracked Target.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.85

task at hand

specific activity being performed by the user, for example collision avoidance, route planning, route monitoring, grounding avoidance

3.86

test target

radar target of known characteristics used for test requirement

3.87

trails

tracks displayed by the radar echoes of targets in the form of an afterglow

Note 1 to entry: *Trails may be true or relative.*

Note 2 to entry: Relative trails are as they would be presented in relative motion.

Note 3 to entry: True trails are as they would be presented in true motion.

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Notes 1, 2 and 3 to entry]

3.88

trial manoeuvre

graphical simulation facility used to assist the operator to perform a proposed manoeuvre for navigation and collision avoidance purposes, by displaying the predicted future status of at least all acquired or activated targets as a result of own ship's simulated manoeuvres

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.89

true bearing

direction of a target from own ship's CCRP or from another target's position, expressed as an angular displacement from true north

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added CCRP]

3.90

true course

direction of motion relative to ground or to sea, of a target expressed as an angular displacement from north

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.91

true motion

TM

combination of true course and true speed

Note 1 to entry: On the display own ship moves with its own true motion.

Note 2 to entry: A continuously updated position report is not required.

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2 – added Note 1 and Note 2 to entry]

3.92

true speed

speed of a target relative to ground, or to sea

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.93

true vector

vector representing the predicted true motion of a target, showing course and speed with reference to the ground or sea

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, see "Vector modes"]

3.94

user configured presentation

display presentation configured by the user for a specific task at hand

Note 1 to entry: *The presentation may include radar and/or chart information, in combination with other navigation or ship related data.*

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2, modified – added Note 1 to entry]

3.95

user-defined

result of a function or parameter selected or defined by the user within the confines of specific equipment

3.96

user dialogue area

area of the display consisting of data fields and/or menus that is allocated to the interactive presentation and entry or selection of operational parameters, data and commands mainly in alphanumeric form

[SOURCE: IMO Resolution MSC.192(79):2004, Appendix 2]

3.97

VDR

voyage data recorder

voyage data recorder which complies with the requirements of IMO resolution MSC.333(90) and IEC 61996-1.

4 General

4.1 Overview

(MSC.192/5) *The design and performance of the radar should be based on user requirements and up-to-date navigational technology. It should provide effective target detection within the safety-relevant environment surrounding own ship and should permit fast and easy situation evaluation.*

(MSC.192/1) *The radar equipment should assist in safe navigation and in avoiding collision by providing an indication, in relation to own ship, of the position of other surface craft, obstructions and hazards, navigation objects and shorelines. For this purpose, radar should provide the integration and display of radar video, target tracking information, positional data derived from own ship's position (EPFS) and geo-referenced data.*

The integration and display of AIS information should be provided to complement radar. The capability of displaying selected parts of Electronic Navigation Charts (ENC) and other vector chart information may also be provided to aid navigation and for position monitoring. Radar is a technology that should be applied together with other sensor information applicable for the task in hand.

Radar is a system and its performance is a factor of all of its component parts. The type test includes the radar sensor, ancillary units and display, complete with its processing and presentation display. All of these component parts contribute to the requirements and approval to these radar standards. Other navigational systems and equipment that provide radar and/or target tracking functions, complies with the relevant clauses of this standard according to the guidelines in Annex A. A navigation display or INS may be approved as part of a radar system when tested with the specific radar sensor and relevant ancillary units. Where the intended application for a navigation system is for collision avoidance, as a minimum requirement, the radar image is always presented, together with the relevant functionality and performance as described in Annex A.

4.2 Purpose

(MSC.192/1) *The radar combined with other sensor, or reported information (for example AIS), should improve the safety of navigation by assisting in the efficient navigation of ships and protection of the environment by satisfying the following functional requirements:*

- *in coastal navigation and harbour approaches, by giving a clear indication of land and other fixed hazards;*
- *as a means to provide an enhanced traffic image and improved situation awareness;*
- *in a ship-to-ship mode for aiding collision avoidance of both detected and reported hazards;*
- *in the detection of small floating and fixed hazards, for collision avoidance and the safety of own ship; and*
- *in the detection of floating and fixed aids to navigation.*

4.3 Application of these standards

(MSC.192/2) *The Performance Standards defined by MSC.192(79) shall apply to all shipborne radar installations used in any configuration mandated by SOLAS independent of the type of ship, frequency band in use and the type of display, providing that no special requirements are specified in Table 1 and that additional requirements for specific classes of ship (in accordance with SOLAS Chapters V and X) are met.*

(MSC.192/2) *Close interaction between different navigation equipment and systems makes it essential to consider this standard in association with other relevant IMO and IEC standards.*

This standard applies to radar systems, navigation systems and navigation equipment which have the task of target detection and collision avoidance. Any equipment which combines these tasks and meets all of the requirements in this standard is regarded as a radar system. In support of the Collision Regulations, all available means shall be used to enhance the role of radar for safe navigation and collision avoidance. The usage of other sensors should, where practical, observe the requirements of the standards associated with those sensors. This standard also provides guidelines and requirements for radar functionality on all navigational displays supporting the tasks of target detection, collision avoidance, general navigation and position referencing on the bridge of a ship.

The successful integration of radar with AIS, charts, databases and other sensors demands that the radar equipment is correctly set up with special attention to the critical alignment of heading(s), system index delay(s), CCRP offsets and gyro. Failure to align these parameters may cause unacceptable registration with other information and may detract from the purpose of integration. This standard has mandated requirements to provide for these alignments.

NOTE Radar systems carried on SOLAS ships have traditionally used non-coherent modulation derived from magnetron transmitters which produce narrow high power pulses together with mechanically rotating antennas. New technology radars are becoming available which use coherent modulation, for example pulse compression, and may use electronically steerable antennas. All tests (or their equivalent) in this standard apply to both non-coherent and coherent radar systems and different types of antennas. At the present time X-band radar systems are required to remain compatible with radar beacons, SARTs and radar enhancers which are designed to operate with conventional non-coherent pulse systems, S-band systems are not limited by this restriction.

4.4 Equipment categories

This standard covers the testing of all SOLAS shipborne radar equipment. Individual equipment may be tested for a specific category of vessel. Table 1 provides a summary of the categories and basic differential capabilities for each category further specified in 11.5.2 and Table 26. The category should be indicated on the type label of the main radar electronics unit and on the related test certificate. Equipment approved for high speed applications should include a suffix H (for example CAT 1H) and equipment approved with a chart option should include a suffix C (for example CAT 1HC).

(MSC.192/5.3.1.1) *Recognising the high relative speeds possible between own ship and target, the equipment should be specified and approved as being suitable for classes of ship having normal (≤ 30 kn) or high (> 30 kn) own ship speeds (100 kn and 140 kn relative speeds respectively).*

The additional characteristics for equipment qualified to be approved for HSC and/or for chart radar are identified in this standard. For example, HSC equipment should be compatible with own ship speeds of up to 70 kn, should be capable of tracking targets with a 140 kn relative speed and should operate between latitudes of 70° N and 70° S.

A chart radar should conform to all the requirements of Clause 12 in this standard. References are made to IEC 61174 (ECDIS) for specific and standalone chart functionality.

Table 1 – Performance requirements for categories of ship/craft for SOLAS V

	Category of ship/craft		
	CAT 3	CAT 2	CAT 1
Size of ship/craft	<500 gross tonnage	500 gross tonnage to <10 000 gross tonnage and HSC <10 000 gross tonnage	All ships/craft $\geq 10\,000$ gross tonnage
Minimum operational display area diameter	180 mm	250 mm	320 mm
Auto acquisition of targets	–	–	Yes
Minimum <u>acquired</u> radar target capacity	20	30	40
Minimum <u>activated</u> AIS target capacity	20	30	40
Minimum <u>sleeping</u> AIS target capacity	100	150	200
Minimum total AIS target and reports capacity	120	180	240
Trial manoeuvre	–	–	Yes
NOTE The minimum display area requirement in the first edition of this standard has been removed as it is not a requirement of the display standards given in Resolution MSC.191(79).			

4.5 Establishing equipment type and status

The manufacturer shall state the intended system content and the category of equipment under test (EUT). Specific requirements, which shall include intended equipment category, are listed below:

- high speed or normal speed;
- frequency band (X-band and/or S-band) and operational frequency limits;
- declaration of any novel processing, new technology or additional functionality which requires alternative testing or claims equivalency to the requirements;
- list all variants (up-mast/down-mast, split processor/displays, chart option, etc.);

- identification of all antennas available with the radar. The smallest antenna (or its properties) shall be used for all relevant performance testing. Environmental testing (vibration and shock) shall use the largest antenna available;
- all ancillary units (inter-switching, buffer amplifiers, etc.);
- units intended for protected (from the weather) or exposed (to the weather) application;
- the intended separation (cable, network or transmission line/feeder) between units. When equipment with separate transmitter and antenna is tested in accordance with this standard, the transmitter/receiver shall be connected to the antenna by a 20 m (minimum) of feeder. The display shall be connected to other units by 65 m of cable. Where equipment is type tested, in which the transmitter and receiver are always installed within the antenna/pedestal combination, the 20 m of antenna feeder shall be omitted. Where necessary, the manufacturer shall supply the appropriate cable and antenna feeder. The manufacturer, or its representative, may propose to the test authority for consideration, a greater distance by which units of the equipment may be separated and still comply with the requirements of this standard. The actual distance requested and tested shall be recorded;
- power supply requirements and declared nominal voltage/frequency of operation. The supply voltage applied to the equipment during the tests shall be the nominal voltage, and alternating current (a.c.) supplies shall be at nominal frequency unless specified otherwise;
- intended equipment configuration(s), either as standalone or as part of a system;
- the manufacturer's code numbers for each piece of equipment and its ancillaries;
- familiarisation documentation or media;
- evidence of sea trials as required by 6.9.3.

4.6 Conditions of measurement and related definitions

All the general requirements of IEC 60945 shall be carried out on the same type of EUT to verify whether the EUT meets these technical requirements. The equipment shall comply with those requirements of IEC 60945 appropriate to its category, i.e. 'protected' (from the weather) or 'exposed' (to the weather). Accordingly, the manufacturer shall declare which equipment or units are intended to be 'protected' or 'exposed'. The manufacturer shall declare any 'preconditioning' required before environmental checks.

4.7 Quality requirements

The equipment and documentation shall be developed, produced and written in accordance with a recognised quality procedure, for example ISO 9000 or an equivalent recognised quality standard.

5 Tests

5.1 Test sites and simulation

5.1.1 Environmental and RF testing

Testing for general, environmental and radio frequency measurements shall be conducted in a test house, or location, accepted by the test authority and by competent persons familiar with the radar application.

5.1.2 Over-sea radar performance tests

Many of the tests may be conducted on land at a test site accepted by the test authority. Specific testing shall be required over sea and these may be shore based or at sea on a test ship.

Radar performance tests will normally be carried out at test sites selected by the type test authority. These test sites shall provide an over water test range with test targets and the features required for

specified tests. The operational performance testing in this standard shall be conducted with a nominal antenna height of 15 m.

The manufacturer shall, unless otherwise agreed, set up the equipment and ensure that it is operating normally before type testing commences.

The value of radar as a secondary position source is based on independence from GNSS. Tests of detection, resolution, and tracking shall exclude connection of any GNSS position and timing interfaces to the radar system during those tests. If a GNSS receiver is integrated into the radar system, it shall be deactivated during these tests.

5.1.3 Test targets and target simulation for performance tests

Standard targets used for the radar performance measurement and assessment are described in the relevant tests.

The target scenario simulator provides test scenarios to assess the tracking performance of the EUT, in accordance with Annex F.

The reported target simulator provides the test scenario for testing the AIS target functions and for target association, in accordance with Annex F.

Simulators used for testing shall be suitably calibrated or verified before use for measurement.

5.2 Test terminology and format

5.2.1 General

For each test subject, there is a requirement subclause (for example referenced to (MSC.192/clause) and a corresponding compliance subclause, which includes a test method and the required result.

5.2.2 Test requirement terminology

For the purposes of this standard, the following test terminology shall apply:

- *performance check* – reconfiguration of the EUT and checking by non-quantitative visual checks that the system is still operative for the purposes of IEC 60945. This shall include the operation of basic functionality to confirm normal operation;
- *performance test* – for the radar EUT, shall be of an identical standard to that used in the performance check for the purposes of IEC 60945, with the addition of a specified test as described in Clause 16;
- *clear indication or visibility of test targets* – visible for at least 8 out of 10 of the antenna scans, or an indication of 5 out of 10 with past positions, synthetic afterglow and trails facility switched off;
- *simple operator action* – procedure achieved by no more than two hard-key or soft-key actions, excluding any necessary cursor movements, or by voice actuation using programmed codes or equivalent alternative means;
- *single operator action* – the use of a single hardware key or, the use of the cursor to select a single display icon or window followed by the operation of a key;
- *dedicated control function* – the use of a dedicated single hardware key or, the use of the cursor to select a single dedicated display icon or window followed by the operation of a key;
- *momentary control function* – the use of a dedicated single hardware key or, the use of the cursor to select a single dedicated display icon or window followed by the operation of a key. The control function shall only operate while the key is pushed;

- *readily available* – applies to information or to a function for the selected application, which is available in a top level menu and accessed directly from a screen function or icon, or by a dedicated control;
- *permanent indication* – applies to a status indication permanently or persistently available (as appropriate) and visible at any time that the equipment is operational;
- *protected menu* – is one which is not easily accessed by the user and protected for example, by a password, internal switch or hardware link;
- *means* – “a means to” do something is equivalent to “a method of” something, for example “a means to measure between two points” is the same as “a method of measuring”.

5.2.3 Testing method terminology

Testing method terminology is derived from ISO 9241-12 and for application to this radar standard, terms are defined as:

- *measurement* – refers to measurement or calculation of a variable concerning the presentation of information, accuracy, or the equipment performance;
- *observation* – means to examine or inspect the equipment to confirm that a particular observable condition has been met. Observations can be made by anyone who has the necessary skill to systematically check the presentation of information and make the determination;
- *document inspection* – means to confirm by inspection that any relevant documented information, facility or function is compliant with the requirement;
- *analytical evaluation* – requires the informed judgement of equipment performance from a study of observations or measurements by an expert, a suitably qualified person who has the necessary skill and experience to judge the relevant property in the relevant subject. The method is typically used for the evaluation of properties which can be judged only in the context of other information or knowledge.

6 Radar performance

6.1 General

The performance test shall include measurement of the transmission frequency spectrum, familiarisation of the controls and signal processing functions, followed by minimum range, discrimination and accuracy measurements. The performance assessment in an over-sea environment shall exercise the signal processing and associated control functions. During this assessment, the test authority shall familiarise themselves with the gain and anti-clutter functions. Detection performance testing is provided in 6.9.

NOTE Radar provides the primary means to detect surface hazards for safe navigation and therefore the detection of surface hazards is a primary element in the task of collision avoidance. The performance requirements address the fundamental radar transmission, detection and signal processing capability of the radar system.

6.2 Transmission and interference

6.2.1 Transmission frequency

6.2.1.1 Requirements

(MSC.192/5.1.1) *The radar shall transmit within the confines of the ITU allocated bands for maritime radar and meet the requirements of the radio regulations and applicable ITU-R recommendations.*

(MSC.192/5.1.2) *Radar systems of both X-band and S-band are covered in these performance standards:*

- *X-band (9,2-9,5 GHz) for high discrimination, good sensitivity and tracking performance; and*

- *S-band (2,9-3,1 GHz) to ensure that target detection and tracking capabilities are maintained in varying and adverse conditions of fog, rain and sea clutter.*

The frequency band selected shall be indicated.

6.2.1.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by measurement and analytical evaluation that the EUT meets the results required by the method described in Annex B of this standard. The test authority shall record the transmitted frequency or frequencies;
- b) confirm by observation that there is an indication of the selected frequency band in use.

6.2.2 Interference

6.2.2.1 Requirements

(MSC.192/5.1.3) *The radar shall be capable of operating satisfactorily in typical interference conditions as encountered in a normal marine radar environment.*

6.2.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by analytical evaluation that the radar system has a method to substantially reduce interference from other approved marine radar transmitting in the frequency bands allocated to marine radar;
- b) confirm by analytical evaluation that the radar system can transmit in the vicinity of other approved marine radar systems without causing significant interference or significant degradation in performance.

NOTE Radar detection performance specified in this standard may be degraded by third party interference, possibly by equipment other than marine radar, see Annex J.

6.3 Performance optimisation and monitoring

6.3.1 General

The radar system shall provide the means to optimise detection performance and to identify a significant drop in performance, as tested in 6.3.2.

6.3.2 Optimum performance

6.3.2.1 Requirements

(MSC.192/5.7.1) *Means shall be available to ensure that the radar system is operating at the best performance. Where applicable to the radar technology, manual tuning shall be provided and additionally, automatic tuning may be provided.*

(MSC.192/5.7.2) *An indication shall be provided, in the absence of targets, to ensure that the system is operating at the optimum performance.*

(MSC.192/5.7.3) *Means shall be available (automatically or by manual operation) and while the equipment is operational, to determine a significant drop in system performance relative to a calibrated standard established at the time of installation.*

6.3.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that the operation of the tuning function (or equivalent as applicable to the technology) is effective. The user manual shall describe how optimum performance is maintained;
- b) confirm by observation there is a manual or automatic means to indicate that the radar system is operating at the optimum performance, even in the absence of targets, for example with the provision of a tuning indicator;
- c) if automatic tuning is provided, confirm by analytical evaluation that it is not inferior to the performance achieved with manual tuning;
- d) confirm by observation, that an indication is provided to the operator when the overall performance reduction is reduced by 10 dB using an attenuator or equivalent means. An up-mast system may be accepted by analogy with a down-mast system, given an equivalent implementation and equipment design.

6.4 Gain and anti-clutter functions

6.4.1 General

This standard specifies control functions associated with processing or controlling the radar signals. If alternative means to achieve equivalent functionality is provided, the manufacturer shall identify the means and shall demonstrate equivalence, supported by the relevant user documentation and to the satisfaction of the test authority.

(MSC.192/5.3.2.1) *Means shall be provided, as far as is possible for the adequate reduction of unwanted echoes, including sea clutter, rain and other forms of precipitation, clouds, sandstorms and interference from other radars.*

Conformance with these requirements is addressed in 6.4.2 to 6.5.8 and the operation of functions is assessed in 6.9.

6.4.2 Gain function

6.4.2.1 Requirements

(MSC.192/5.3.2.2) *A gain control function shall be provided to set the system gain or signal threshold level. A permanent indication of the gain level or setting of the signal threshold shall be given.*

6.4.2.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that there is a permanent indication of the gain level;
- b) confirm by observation that the control function is directly accessible;
- c) confirm by observation on a 24 NM range scale that the gain control varies from a minimum level where only the highest signal levels are presented to a maximum level providing visible receiver noise;
- d) confirm by observation that, if a preset gain adjustment is provided for installation or maintenance use, it is located in a set-up menu protected from user access as described in the equipment manual.

6.4.3 Manual and automatic sea anti-clutter

6.4.3.1 Requirements

(MSC.192/5.3.2.3) *Effective manual and automatic anti-clutter sea functions shall be provided.*

(MSC.192/5.3.2.4) *A combination of automatic and manual anti-clutter sea functions is permitted.*

(MSC.192/5.3.2.5) *There shall be a clear and permanent indication of the status for gain and all anti-clutter sea control functions.*

6.4.3.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation that both “manual sea” and “automatic sea” functions are provided;
- b) confirm by document inspection that the user manual describes any installation and operational adjustments associated with these functions and any performance limitations associated with their use;
- c) confirm by document inspection that the user manual describes the operation of the manual and automatic anti-clutter sea control functions, including any advantages and limitations;
- d) confirm by observation that the status and level of the functions are permanently indicated.

6.4.4 Rain anti-clutter

6.4.4.1 Requirements

An effective manual means of suppressing rain clutter shall be provided. Automatic rejection of rain clutter may also be provided. There shall be a clear and permanent indication of the status of the anti-clutter rain function.

6.4.4.2 Methods of test and required results

The methods of test and the required results are as follows:

- a) confirm by observation the availability and operation of the rain anti-clutter control functions;
- b) confirm by observation that the status and level of the rain anti-clutter function is permanently indicated;
- c) confirm by document inspection that the user manual describes the use of the manual rain anti-clutter control (and automatic where provided), together with any performance limitations associated with its use.

6.5 Signal processing

6.5.1 General

Signal processing functions serve to improve target visibility and detection performance.

6.5.2 Target enhancement

6.5.2.1 Requirements

(MSC.192/5.3.1.3.2) *The radar system shall provide the means to enhance the visibility of targets in adverse clutter conditions at close range.*

(MSC.192/5.3.3.1) *Means shall be available to enhance target visibility on the display.* If selectable, the target enhance status shall be indicated and the user manual shall describe the operation and principles of the target enhance functions.

The function to enhance the visibility of targets at close ranges may use other processing techniques than those for standard navigation purposes.

6.5.2.2 Methods of test and required results

The methods of test and the required results are as follows: