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Ships and marine technology — Terms, abbreviations, graphical symbols and concepts on navigation

Navires et technologie maritime — Termes, abréviations, symboles graphiques et concepts relatifs à la navigation

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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Ships and marine technology — Terms, abbreviations, graphical symbols and concepts on navigation

1 Scope

This International Standard contains terms, abbreviations and graphical symbols, which are to be used in maritime navigation on board ships. The application of abbreviations is useful, but they should not be used in mathematical formulae. Symbols for use in mathematical formulae are mentioned, if necessary.

Navigation is the process of position finding as well as planning, recording and controlling the movement of a craft or vehicle from one place to another.

2 Normative references

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

ISO 31-1, *Quantities and units — Part 1: Space and time*

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

IEC 60872-2, *Maritime navigation and radiocommunication equipment and systems — Radar plotting aids — Part 2: Automatic tracking aids (ATA) — Methods of testing and required test results*

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

IEC 60936-1, *Maritime navigation and radiocommunication equipment and systems — Radar — Part 1: Shipborne radar — Performance requirements — Methods of testing and required test results*

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

3 Special units in maritime navigation

Item No.	Name of unit	International symbol for unit	Definition, conversion factors and remarks
3.1 Unit of length			
3.1.1	nautical mile	NM in charts: M*	1 NM = 1 852 m. The nautical mile is not an SI-unit. This definition was adopted by the First International Hydrographic Conference in 1929 (see ISO 31-1).
3.1.2	cable, cable length	cbl	One-tenth of a nautical mile.
3.2 Unit of velocity and speed			
	knot, knots	kn	$1\text{kn} = 1\ \frac{\text{NM}}{\text{h}} = 0{,}514\quad 444\text{m/s}$ (see ISO 31-1 and Chart INT 1) Velocity is a vector quantity, whereas speed is a scalar having magnitude only.
3.3 Unit of angle			
3.3.1	degree	°	$1° = \frac{\pi}{180}\ \text{rad}$
3.3.2	minute	'	$1' = \frac{1°}{60}$ (see ISO 31-1) In maritime navigation, angles should be specified in degrees, minutes and decimals of minutes (example: write 17° 40,25' not 17° 40' 15").
* Symbol M is to be used in Charts according to the "Chart Specifications of the IHO" which came into force at the XIIth International Hydrographic Conference 1982 in Monaco.			

4 Reference directions

4.1 North directions

North directions are horizontal reference directions.

Item No.	Name of the term	Abbreviation	Definition, remarks
4.1.1	true north	TN	Northerly direction of the meridian (see 9.1.12).
4.1.2	magnetic north	MN	Northerly direction of the horizontal component of the earth's magnetic field (see 14.2).
4.1.3	compass north	CN	Northerly direction of the needle or zero-index of a magnetic compass.
4.1.4	gyro north	GyN	Northerly direction indicated by the gyro-compass.

4.2 Dead ahead direction

Dead ahead direction is the direction ahead of the ship's fore-and-aft line.

5 Course, heading, track, speed

5.1 Course, heading

Course (CSE) and heading (HDG) are angles, measured in the horizontal plane from one of the reference directions specified in Clause 4, counted clockwise from 000° through < 360°, written as three-digit numbers. In radar navigation, the abbreviations CRS for course and HDG for heading are preferred.

Item No.	Name of the term	Abbre-viation	Definition, remarks
5.1.1	true course, course to steer	TC T CRS CTS	The direction, in which the ship is intended to be steered, defined by the angle between the meridian through its position and the fore-and-aft line of the ship, expressed in angular units from true north (000°).
5.1.2	true heading	TH T HDG	Actual direction in which the longitudinal axis of the ship is pointed, defined by the angle between the meridian through its position and the fore-and-aft line of the ship, expressed in angular units from true north (000°).
5.1.3	magnetic course	MC M CRS	The direction, in which the ship is intended to be steered, defined by the angle between the magnetic meridian (see 14.4) through its position and the fore-and-aft line of the ship, expressed in angular units from magnetic north (000°).
5.1.4	magnetic heading	MH M HDG	Actual direction in which the longitudinal axis of the ship is pointed, defined by the angle between the magnetic meridian through its position and the fore-and-aft line of the ship, expressed in angular units from magnetic north (000°).
5.1.5	compass course	CC C CRS	The direction, in which the ship is intended to be steered, defined by the angle between compass north (see 4.1.3) and the fore-and-aft line of the ship, expressed in angular units from compass north (000°).
5.1.6	compass heading	CH C HDG	Actual direction in which the longitudinal axis of the ship is pointed, defined by the angle between compass north and the fore-and-aft line of the ship, expressed in angular units from compass north (000°).
5.1.7	gyro course	GyC Gy CRS	The direction, in which the ship is intended to be steered, defined by the angle between gyro north (see 4.1.4) and the fore-and-aft line of the ship, expressed in angular units from gyro north (000°).
5.1.8	gyro heading	GyH GY HDG	Actual direction in which the longitudinal axis of the ship is pointed, defined by the angle between gyro north and the fore-and-aft line of the ship, expressed in angular units from gyro north (000°).
5.1.9	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.

Item No.	Name of the term	Abbre-viation	Definition, remarks
5.1.10	course of advance, course to make good	COA	Direction from the ship's last fix (see 9.2.5) to the next estimated position (see 9.2.3), expressed in angular units from true north.
5.1.11	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.
5.1.12	course made good	CMG	Rhumb-line direction (see 9.2.11) between two fixes (see 9.2.5).

5.2 Track

The term “track” is used

a) as the path of voyage over the ground (ground track) or through the water (water track) as plotted in the chart, expressed in angular units from true north (000°) clockwise through $< 360°$; must distinguish rhumb-line track (see 9.2.11) and great-circle track (see 9.2.9),

b) as the path of radar-targets on a plan position indicator (see 15.4).

Item No.	Name of the term	Abbre-viation	Definition, remarks
5.2.1	intended water track	WT	Intended path of the ship's movement through the water.
5.2.2	water track	WAT TRK	Actual path of the ship's movement through the water.
5.2.3	intended ground track	GT	Intended path of the ship's movement over the ground.
5.2.4	ground track	GND TRK	Actual path of the ship's movement relative to the earth.
5.2.5	track made good	TMG	Track between two fixes (see 9.2.5).

5.3 Speed

Item No.	Name of the term	Abbre-viation	Definition, remarks
5.3.1	speed	SPD	Own ship's speed in dead ahead direction (see 4.2) produced by machine or sail.
5.3.2	speed through the water	STW	Speed of the ship relative to the water surface.
5.3.3	speed of advance, speed to make good	SOA	Estimated speed of the ship relative to the earth.
5.3.4	speed over the ground	SOG	Speed of the ship relative to the earth, measured on board the ship.
5.3.5	speed made good	SMG	Speed of the ship between two fixes.

6 Bearings

Bearing (BRG) is an angle measured in the horizontal plane from one of the reference directions specified in Clause 4, measured clockwise from 000° through 360° written as three-digit numbers. In radar navigation, the abbreviation BRG for bearing is preferred.

Item No.	Name of the term	Abbre-viation	Definition, remarks
6.1	true bearing	TB T BRG	Angular distance from true north (000°) to the object, the direction of the electronic bearing line (see 15.2.4) on a plan postition indicator (PPI).
6.2	magnetic bearing	MB	Angular distance from magnetic north (000°) to the object.
6.3	compass bearing	CB	Angular distance from compass north (000°) to the object.
6.4	gyro bearing	GyB Gy BRG	Angular distance from gyro north (000°) to the object, the direction of the electronic bearing line (see 15.2.4) on a plan postition indicator (PPI).
6.5	relative bearing	RB R BRG	Angular distance from the ship's dead ahead direction (see 4.2) to the object, on a plan position indicator from the heading line (see 15.2.3) to the electronic bearing line (see 15.2.4). With the addition "right" (starboard) or "left" (port), semicircle counting from 000° through 180° is allowed.

7 Corrections

The numerical value of a correction is the best estimate which can be made of the difference between the true and the measured value of a parameter. The sign is such that a correction which is to be added to an observed reading is taken as positive.

Item No.	Name of the term	Abbre-viation	Definition, remarks
7.1	magnetic variation	MAG VAR	Angle between the geographic and the magnetic meridians (see 9.1.12 and 14.4) at any place of the earth, also called magnetic declination, from true north to magnetic north eastwards named E (sign plus), westwards named W (sign minus).
7.2	deviation	DEV	Angle between the magnetic meridian (see 14.4) and the axis of a compass card, expressed in degrees east or west to indicate the direction in which the northern end of the compass card is offset from magnetic north when it is disturbed by local attraction, from magnetic north to compass north eastwards named E (sign plus), westwards named W (sign minus).
7.3	total compass error correction	CE	Sum of variation and deviation. Angle between true north and compass north, from true north eastwards named E (sign plus), westwards named W (sign minus).

Item No.	Name of the term	Abbre-viation	Definition, remarks
7.4	speed error correction	δ_{Gy}*	Correction of the gyro heading error, which depends on position, speed and course of the ship; sign plus when the ship moves southwards, sign minus when the ship moves northwards.
7.5	gyro error correction	GyE	Correction of all errors (including speed error) of a gyro compass. Angle between true north and gyro north, from true north eastwards with sign plus, error low, westwards with sign minus, error high.
7.6	gyro-R		Correction of the measured error of a gyro compass indication without speed error (gyro residual aberration).
7.7	gyro-A		Correction of the constant part of gyro-R; mean value of measured gyro-R values.
7.8	leeway angle		Angular difference between the course through water and course to steer (CTW – TC).
7.9	drift angle		Angular difference between the course of advance or course over ground and course through water (COA – CTW or COG – CTW).
7.10	leeway and drift angle		Angular difference between the course of advance or course over ground and course to steer (COA – TC or COG – TC); sum of leeway angle and drift angle.
7.11	conversion angle	u *	Angular difference at a point between the rhumb line and a great circle (see 9.2.11 and 9.2.9) from that point to another point on the earth's surface.

* Formula symbol.

8 Influence of wind and current

8.1 Wind

Wind direction is the direction where the movement of the air comes from. The vector of this movement is in the opposite direction of the wind direction. For instance, the movement of the air is in the direction of 270° (direction of the vector in weather charts) in the case of an east wind.

Item No.	Name of the term	Definition, remarks
8.1.1	true wind	Velocity of the air (speed and direction) relative to a fixed point on the earth.
8.1.2	speed wind	Velocity of the air only caused by the ship's motion relative to the earth; (direction against course over ground).
8.1.3	apparent wind, relative wind	Velocity of the air relative to the moving ship; the vector of apparent wind or relative wind (wind feeling on board) minus the vector of speed wind is equal to the vector of true wind.

8.2 Leeway and drift triangle

See Figure 1.

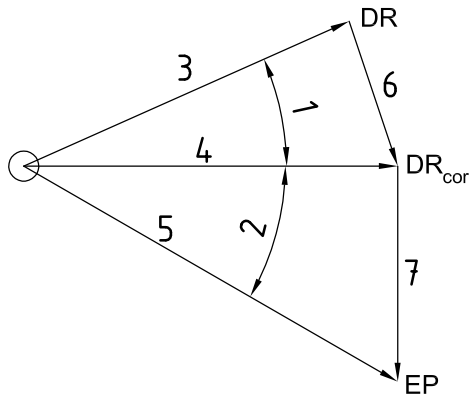

Figure 1

Key

⊕ last fix (see 9.2.5)

1 leeway angle (see 7.8)
2 drift angle (see 7.9)
3 own ship's velocity (see 8.2.1)
4 intended water track (see 5.2.1 and 8.2.3)
5 intended ground track (see 5.2.3 and 8.2.5)
6 leeway vector (see 8.2.2)
7 drift vector (see 8.2.4)
DR dead reckoning position (see 9.2.1)
DR$_{cor}$ corrected dead reckoning position (sea position) (see 9.2.2)
EP estimated position (see 9.2.3)

Item No.	Name of term	Definition of the vector	Item No.	Magnitude of vector	Abbre-viation	Item No.	Direction of vector	Abbre-viation
8.2.1	own ship's velocity	own ship's velocity	8.2.1.1	speed (5.3.1)	SPD	8.2.1.2	course to steer (5.1.1)	CTS TC
8.2.2	leeway vector	ship's velocity due to influence of wind	8.2.2.1	leeway drift		8.2.2.2	leeway set	
8.2.3	intended water track	ship's velocity relative to the water	8.2.3.1	speed through water (5.3.2)	STW	8.2.3.2	course through water (5.1.9)	CTW
8.2.4	drift vector	horizontal velocity of the water surface	8.2.4.1	drift		8.2.4.2	set	
8.2.5	intended ground track	ship's velocity relative to the earth	8.2.5.1	speed of advance (5.3.3)	SOA	8.2.5.2	course of advance (5.1.10)	COA

9 Geographical coordinates, positions, lines, graphical symbols

9.1 Geographical coordinates

Item No.	Name of the term	Abbre-viation	Definition, remarks
9.1.1	geodetic datum		A set of parameters specifying the reference coordinate system used for geodetic control in the calculation of coordinates of points on the earth.
9.1.2	World Geodetic System	WGS	A global geodetic reference system developed by the USA for satellite position fixing and recommended by the IHO for hydrographic and cartographic use.
9.1.3	latitude, geographic latitude	φ LAT	Angular distance from the equator (00°) measured northwards or southwards through 90° and labelled N or S to indicate the direction of measurement.
9.1.4	longitude, geographic longitude	λ LON	Angle at the pole between the prime meridian (000°) (see 9.1.13) and the meridian of a point on the earth, measured eastwards or westwards from the prime meridian through 180° and labelled E or W to indicate the direction of measurement*.
9.1.5	geodetic latitude		Angular distance between the plane of the geodetic equator and the normal to a station on the earth ellipsoid, measured from the equator (00°) northwards or southwards through 90° and labelled N or S.
9.1.6	geodetic longitude		Angle between the plane of the geodetic prime meridian (000°) and the plane of the station's geodetic meridian, measured eastwards or westwards from the prime meridian through 180° and labelled E or W*.
9.1.7	geocentric latitude		Angle at the centre of the reference ellipsoid between the plane of the equator (9.2.8) and the radius vector to a point on the ellipsoid, measured from the equator (00°) northwards or southwards through 90° and labelled N or S.
9.1.8	geocentric longitude		Angle between the plane of the geocentric prime meridian (000°) and the plane of the station's geocentric meridian, measured eastwards or westwards from the prime meridian through 180° and labelled E or W*.
9.1.9	astronomical latitude		Angular distance between the plane of the celestial equator (00°) and the plumb line through the station, measured northwards or southwards through 90° and labelled N or S.
9.1.10	astronomical longitude		Angle between the plane of the prime meridian and the plane of the station's celestial meridian (see 12.2.8), measured eastwards or westwards, from the prime meridian through 180° and labelled E or W.

* The planes of geographic, geodetic and geocentric meridians are identical.