

INTERNATIONAL STANDARD

**ISO
7463**

First edition
1990-09-15

Shipbuilding and marine structures — Symbols for computer applications



Reference number
ISO 7463 : 1990 (E)



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Contents

	Page
Foreword	iii
1 Scope	1
2 Normative reference	1
3 Derivation of symbols	1
4 Standard symbols	2
Annex A — Tables of Roman character set symbols	3
A.1 General	3
A.2 Geometry of ship and propeller	7
A.3 Resistance and propulsion	12
A.4 Seakeeping and manoeuvrability	20
A.5 Strength of structures	25
A.6 Vibration	28
A.7 Notes	29

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Case postale 56 • CH-1211 Genève 20 • Switzerland

Printed in Switzerland

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.

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.

International Standard ISO 7463 was prepared by Technical Committee ISO/TC 8, *Shipbuilding and marine structures*.

Annex A forms an integral part of this International Standard.

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Shipbuilding and marine structures — Symbols for computer applications

1 Scope

This International Standard specifies symbols for dimensional quantities used in shipbuilding and related branches of marine technology for use in computer applications where the available character set is restricted. The symbols are capable of being represented using the 26 alphabetic and 10 numeric characters of the standard FORTRAN character set (see ISO 1539) and are also within the scope of International Alphabet No. 2 (AI2) of the International Telecommunication Union.

Examples of application of the symbols may be as names of variables in computer programs and as abbreviations in output listings.

This International Standard specifies the symbols to be used but does not attempt to provide definitions for the quantities represented. The notes and formulae in the columns headed "Explanation" in the tables of symbols presented in annex A are provided as guidance to the application of the symbol. The use of standard symbols does not absolve authors from the need to define the quantities concerned.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 1539 : 1980, *Programming Languages—FORTRAN*.

3 Derivation of symbols

3.1 Origin

The symbols are based on a list approved by the International Towing Tank Conference (ITTC), Ottawa, 1975, and a related list produced by the International Ship Structures Congress (ISSC), in 1974. In the few instances where it has been necessary to remove incompatibilities between the two lists, preference has been given to the ITTC symbols for subjects A.1 and A.4 and to the ISSC symbols for subjects A.5 and A.6 (see annex A).

3.2 General principles

The following general principles have been applied in assembling the symbols.

- a) Only those alphabetic and numeric characters which are common to the character sets in clause 1 are used in the construction of symbols.
- b) No distinction is made between upper and lower case alphabetic characters.
- c) Punctuation and other special characters are not used.
- d) Every symbol begins with an alphabetic character.
- e) No symbol contains more than five characters, including subscripts.
- f) Symbols which are frequently used are kept as short as possible, consistent with the avoidance of ambiguity.
- g) The same symbol is not used to represent different quantities within closely related areas of application.

Where practicable, the symbols for the restricted character set are related to the symbols commonly used for the quantities concerned as adopted by the ITTC and ISSC. The following conventions are employed.

- a) Where the usual symbol incorporates a Greek letter, the name of the character is spelled out, sometimes in abbreviated form.
- b) Subscripts and indices are suffixed to the main symbol on the same line and without spacing or parenthesis.
- c) The Froude "circular" symbols are represented by the prefix CIRC.
- d) The suffix M or S may be added to any symbol to distinguish between the values for model or ship respectively.

Consistency with established symbols is considered more important than compatibility with the FORTRAN convention which reserves names beginning with I, J, K, L, M and N for integer variables. It is therefore suggested that programmers should prefix symbols which conflict with the convention with a suitable character.

In maintaining the relationship with established symbols it has been necessary to make use of both the alphabetic character O and the numeric 0 (zero). It is therefore necessary to ensure that printers used for output in which the symbols appear make a clear distinction between the forms of these two characters.

4 Standard symbols

The symbols are presented in annex A which forms an integral part of this International Standard. They are grouped under the following subject headings:

- A.1 General
- A.2 Geometry of ship and propeller
- A.3 Resistance and propulsion
- A.4 Seakeeping and manoeuvrability
- A.5 Strength of structures
- A.6 Vibration

The first column in the tables gives the Restricted Character Set symbol (R.C.S.).

The second column, under the heading "Usual symbol", gives the symbol approved by the International Towing Tank Conference or the International Ship Structures Congress for use in ordinary letter-press work. In some instances an alternative is included. The English name of a Greek letter is given in parenthesis at its first occurrence.

The third column gives the name or descriptive title of the quantity represented by the symbol.

Where clarification is considered necessary this is given under the heading "Explanation" in the fourth column.

For further clarification, the dimensions of the quantity are stated in the final column.

Within the subject headings the quantities are arranged in alphabetical order of the usual symbol, the Greek alphabet following the Roman.

Annex A (normative)

Tables of Roman character set symbols

NOTE — Symbols are classified by subject; they are arranged alphabetically within a given classification.

A.1 General

R.C.S. symbol	Usual symbol	Title	Explanation	Dimensions
ACC	a	Linear acceleration	dv/dt	LT^{-2}
A	A	Area in general		L^2
AT	A_T	Cross-sectional area of an experiment tank or tunnel		L^2
B	B	Breadth in general		L
CO	c	Velocity of sound		LT^{-1}
VWG	c_G	Group velocity of waves		LT^{-1}
C	C	Coefficient		—
D	D, d	Diameter in general		L
E	E	Energy in general		$L^2 MT^{-2}$
FC	f	Friction coefficient	Ratio of tangential force to normal force between two sliding bodies or planes	—
F	F	Force in general		LMT^{-2}
CQF	F	Entrainment factor	$\frac{1}{U_\delta} dQ/dx$	—
G	g	Acceleration due to gravity		LT^{-2}
DE	h	Depth in general		L
H	h	Head, pressure, in general	Height of column of liquid of specified density supported	L
HBL	H	Boundary layer shape parameter	δ^*/θ	—
HT	H	Total head, Bernoulli	$h + p/w + q/w$	L
HQF	H_E	Entrainment shape parameter	$(\delta - \delta^*)/\theta$	—
HK	k	Roughness height or magnitude	Roughness height often expressed as some form of average	L
SK	K_s	Sand roughness	Mean diameter of the equivalent sand grains covering a surface	L
L	L	Length in general		L
LW	L_w, λ (lambda)	Wavelength	From crest to crest	L
MA	m	Mass		M
M	M	Moment in general		$L^2 MT^{-2}$

R.C.S. symbol	Usual symbol	Title	Explanation	Dimensions
N	n	Rate of revolution		REVS.T ⁻¹
PR	p	Pressure intensity	Force per unit area	L ⁻¹ MT ⁻²
PRC	p_c	Pressure in a cavity		L ⁻¹ MT ⁻²
PRV	p_v	Vapour pressure of water		L ⁻¹ MT ⁻²
PRU	p_u	Ambient pressure in undisturbed flow		L ⁻¹ MT ⁻²
P	P	Power in general	E/t	L ² MT ⁻³
PRD	q	Dynamic pressure	$\frac{1}{2}\rho U^2$	L ⁻¹ MT ⁻²
QF	Q	Rate of flow	Volume of fluid per unit time	L ³ T ⁻¹
QF	Q	Entrainment	$\int_0^\delta \bar{U} dy$	L ² T ⁻¹
RD	r, R	Radius in general		L
RDC	R_c	Radius of curvature		L
RDH	R_H	Radius, hydraulic	Area of section divided by wetted perimeter	L
SP	s	Length along path		L
TI	t	Time in general		T
TEM	t°	Temperature in general		—
TC	T	Period of time for a complete cycle		T
UFL	u	Velocity fluctuations in boundary layer	$\frac{1}{T} \int_0^T u dt = 0$	LT ⁻¹
UTAU	u_τ	Shear (friction) velocity	$U_\delta \sqrt{C_\tau/2} = \sqrt{\tau_w/\rho}$	LT ⁻¹
UFLM	$\bar{u}$	Mean of velocity fluctuations		LT ⁻¹
UFLS	u'	Standard deviation of root mean square value of velocity fluctuations	$u'^2 = \frac{1}{T} \int_0^T u^2 dt$	LT ⁻¹
UL	U_δ	Velocity at the edge of the boundary layer at $y = \delta$		LT ⁻¹
UM	$\bar{U}$	Time mean of velocity in boundary layer	$\frac{1}{T} \int_0^T U dt$	LT ⁻¹
UMPR	$\bar{U}_p$	Velocity change in boundary layer due to pressure gradient		LT ⁻¹
UMK	$\bar{U}_R$	Velocity defect in boundary layer due to roughness		LT ⁻¹
VX, VY, VZ	u, v, w	Velocity components in direction of x, y, z axes		LT ⁻¹
U, V	U, V	Linear velocity	ds/dt	LT ⁻¹
VOL	V	Volume in general		L ³

R.C.S. symbol	Usual symbol	Title	Explanation	Dimensions
WPVOL	w	Weight density	ρg	$L^{-2} MT^{-2}$
WT	W	Weight in general		LMT^{-2}
X, Y, Z	x, y, z	Body axes and Cartesian coordinates	Right hand orthogonal system of axes fixed in the body. The x -axis is forward and parallel to the reference or base line used to determine the body shape. For dynamic considerations the origin should be at the centre of gravity of the body and the z -axis vertically upwards. The y -axis is to port.	L
X0, Y0, Z0	x_0, y_0, z_0	Fixed axes and corresponding Cartesian coordinates	Right hand orthogonal system of axes nominally fixed in relation to the earth; the positive z -axis is vertically upwards, and the x -axis lies in the general direction of initial motion	L
CTHEX	α (alpha)	Coefficient of thermal expansion (linear)	Elongation per unit length per degree change in temperature	—
ACCA	α	Angular acceleration	$d\omega/dt$	T^{-2}
SPECG	γ (gamma)	Specific gravity	Weight of a substance divided by the weight of an equal volume of distilled water at 4 °C	—
ADEX	γ	Adiabatic exponent		—
GAM	γ	Vortex density	Strength per length or per area of vortex distribution	—
CIR	Γ (capital gamma)	Circulation	$\oint V ds$ along a closed line	$L^2 T^{-1}$
DLTB	δ (delta)	Thickness of a boundary layer in general		L
CDAM	δ	Damping coefficient	When F is a function of time given by $F(t) = Ae^{-\delta t} \sin \left\{ \frac{2(t-t_0)}{T} \right\}$	—
DLTB	δ^*, δ_1	Displacement thickness of boundary layer	$\int_0^\delta \left\{ 1 - \frac{\bar{U}}{U_\delta} \right\} dy$	L
TETM	θ (theta)	Momentum thickness	$\int_0^\delta \frac{\bar{U}}{U_\delta} \left(1 - \frac{\bar{U}}{U_\delta} \right) dy$	L
TETE	θ^*	Energy thickness	$\int_0^\delta \frac{\bar{U}}{U_\delta} \left(1 - \frac{\bar{U}^2}{U_\delta^2} \right) dy$	L
TETP	θ	Angle of pitch or trim (Positive bow down)		—
CAP	κ (kappa)	Coefficient of kinematic capillarity	σ/ρ	$L^3 T^{-2}$
MU	μ (mu)	Coefficient of dynamic viscosity	Shear stress per unit velocity gradient	$L^{-1} MT^{-1}$
NU	ν (nu)	Coefficient of kinematic viscosity	μ/ρ	$L^2 T^{-1}$
RHO	ρ (rho)	Mass density	Mass per unit volume	ML^{-3}

R.C.S. symbol	Usual symbol	Title	Explanation	Dimensions
RHOP	ρ_P	Propeller mass density	Propeller mass per unit volume	ML^{-3}
CAPC	σ (sigma)	Capillarity constant	Surface tension per unit length	MT^{-2}
TAUW	τ_W (tau)	Hydrodynamic shear stress at a wall		$L^{-1} MT^{-2}$
POTF	ϕ (phi)	Potential function, such as velocity potential		$L^2 T^{-1}$
PHIR	ϕ	Angle of roll, heel or list (Positive starboard side down)		—
PHI	ϕ	Phase difference		—
PHI0	ϕ_0	Phase angle, according to $\cos(\omega t + \phi_0)$		—
STRF	ψ (psi)	Stream function	$\psi = \text{constant}$ is the equation of a stream line	$L^3 T^{-1}$
PSIY	ψ	Angle of yaw, heading or course (Positive bow to port)		—
OMG	ω (omega)	Angular velocity or circular frequency	Angle per unit time	T^{-1}
OMG0	ω_0	Natural circular frequency		T^{-1}

A.2 Geometry of ship and propeller

R.C.S. symbol	Usual symbol	Title	Explanation	Dimensions
ABL	A_{BL}	Area of ram bow in longitudinal plane	The area of the ram projected on the middle line plane forward of the fore perpendicular	L^2
ABT	A_{BT}	Area of transverse cross-section of a bulbous bow (full area port and starboard)	The cross-sectional area at the fore perpendicular. Where the waterlines are rounded so as to terminate on the fore perpendicular, A_{BT} is measured by continuing the area curve forward to the perpendicular, ignoring the final rounding ¹⁾	L^2
AD	A_D	Developed blade area	Developed blade area of a screw propeller outside the boss or hub	L^2
AE	A_E	Expanded blade area	Expanded blade area of a screw propeller outside the boss or hub	L^2
AM	A_M	Area, midship section	Midway between fore and aft perpendiculars	L^2
AO	A_O	Disc area	$\pi D^2/4$	L^2
AP	A_P	Projected blade area	Projected blade area of a screw propeller outside the boss or hub	L^2
AR	A_R	Area of rudder		L^2
ATR	A_T	Area of transom (full area port and starboard)	Cross-sectional area of transom stern below the load waterline	L^2
AV	A_V	Area exposed to wind	Projected area of portion of ship above waterline	L^2
AW	A_W	Area, waterplane		L^2
AX	A_X	Area, maximum transverse section		L^2
XAB	$\overline{AB}$	Longitudinal centre of buoyancy from aft perpendicular ²⁾	Distance of centre of buoyancy from aft perpendicular	L
XAF	$\overline{AF}$	Distance of centre of flotation from aft perpendicular ²⁾		L
XAG	$\overline{AG}$	Longitudinal centre of gravity from aft perpendicular ²⁾	Distance of centre of gravity from aft perpendicular	L
BF	b	Span of an aerofoil or hydrofoil	Tip to tip or support to tip when cantilevered	L
B	B	Beam or breadth, moulded, of ship		L
B	B	Position of centre of buoyancy on drawing		—
CIRCB	$\textcircled{B}$	R.E. Froude's breadth coefficient	$B/\nabla^{1/3}$	—
ZBM	$\overline{BM}$	Metacentre above centre of buoyancy ²⁾	Distance from the centre of buoyancy B to the transverse metacentre M	L
ZBML	$\overline{BM}_L$	Longitudinal metacentre of buoyancy ²⁾		L
BWL	B_{WL}	Breadth on waterline		L
CH	c	Chord length of an aerofoil or hydrofoil		L

1) See A.7, note 1.

2) See A.7, note 2.