ITTC 호(4)

(ITTC mbols)

수조시험연구회(KTTC)

국제수조회의(International Towing Tank Conference)에서는 오래전부터 기호 및 용어위원회(Symbols & Terminology Group)를 구성하여 ITTC 표준기호를 작성해 왔다.

19차 ITTC('90.9. 스페인)에서 채택된 "ITTC 표준기호"는 3가지 주제－General Mechanics, Ships in General, Special Craft－로 분류되어 왔다. 본 내용에서는 이러한 표준기호를 나누어 소개하고자 한다(참고문헌 : "Standard Symbols and Terminology", 19TH ITTC, Sept. 1990, Madrid, Spain).

SECTION 2 SHIPS IN GENERAL

2.1 GEOMETRY AND HYDROSTATICS

2.1.1 Hull Geometry

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
A_{BL}	ABL	Area of ram bow in longitudinal plane	The area of the ram projected on the middle line plane forward of the fore perpendicular(*)	㎡
A_{BT}	ABT	Area of transverse corss－section of a bulbous bow (full area port and starboard)	The corss sectional area at the fore perpendicular. Where the water lines are rounded so as to terminate on the forward perpendicular A_{BT} is measured by continuing the area curve forward to the perpendicular, ignoring the final rounding(*).	㎡
A_M	AM	Area, midship section	Midway between fore and aft perpendiculars	㎡

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
A_T	ATR	Area of transom (full area port and starboard)	Cross-sectional area of transom stern below the load waterline	m^2
A_V	AV	Area exposed to wind	Area of portion of ship above waterline projected normally to the direction of relative wind.	m^2
A_W	AW	Area waterplane		m^2
A_{WA}	AWA	Waterplane area aft of midship		m^2
A_{WF}	AWF	Waterplane area forward of midship		m^2
A_X	AX	Area, maximum transverse section		m^2
B	BX	Beam or breadth molded of ship		m
Ⓑ	CIRCB	R.E. Froude's breadth coefficient	$\frac{B}{\nabla^{\frac{1}{3}}}$	1
C_B, δ	CB	Block coefficient	$\frac{\nabla}{LBT}$	1
C_{IL}	CWIL	Coefficient of inertia of waterplane, longitudinal	$12\frac{I_L}{BL^3}$	1
C_{IT}	CWIT	Coefficient of inertia of waterplane, transverse	$12\frac{I_T}{B^3L}$	1
C_M, β	CM	Midship section coefficient (midway between forward and aft perpendiculars)	$\frac{A_M}{BT}$	1
C_P, Φ	CP	Longitudinal prismatic coefficient	$\frac{\nabla}{A_XL}$ or $\frac{\nabla}{A_ML}$	1
C_{pa}, Φ_A	CPA	Prismatic coefficient, afterbody.	$\frac{\nabla(\text{afterbody})}{\frac{1}{2}A_XL}$ or $\frac{\nabla(\text{afterbody})}{\frac{1}{2}A_ML}$	1
C_{PE}, Φ_E	CPE	Prismatic coefficient, entrance.	$\frac{\nabla(\text{entrance})}{A_XL_E}$ or $\frac{\nabla(\text{entrance})}{A_ML_E}$	1
C_{PF}, Φ_F	CPF	Prismatic coefficient, forebody.	$\frac{\nabla(\text{forebody})}{\frac{1}{2}A_XL}$ or $\frac{\nabla(\text{forebody})}{\frac{1}{2}A_ML}$	1
C_{PR}, Φ_R	CPR	(*2) Prismatic coefficient, run	$\frac{\nabla(\text{run})}{A_XL_r}$ or $\frac{\nabla(\text{run})}{A_ML_r}$	1

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
C_S	CS	Wetted surface coefficient	$\frac{S}{\sqrt{(\nabla L)^{\frac{1}{2}}}}$	1
C_{VP}, Φ_v	CVP	Prismatic coefficient vertical	$\frac{\nabla}{A_W T}$	1
C_{WA}	CWA	Aft water plane area coefficient	$\frac{A_{WA}}{\frac{1}{2}BL}$	1
C_{WF}	CWF	Forward water plane area coefficient	$\frac{A_{WF}}{\frac{1}{2}BL}$	1
C_{WP}, α	CWP	Designed load waterline coefficient	$\frac{A_W}{LB}$	1
C_X	CX	Maximum transverse section coefficient	$\frac{A_X}{BT}$ where B and T are measured at the position of maximum area.	1
C_∇	CVOL	Volumetric coefficient	$\frac{\nabla}{L^3}$	1
D	DEP	Depth, molded of a ship hull		m
f_{BL}	CABL	Area coefficient for ram bow	$\frac{A_{BL}}{LT}$	1
f_{BT}	CABT	Taylor sectional area coefficient for bulbous bow	$\frac{A_{BT}}{A_X}$	1
f_T	CATR	Sectional area coefficient for transom stern	$\frac{A_T}{A_X}$	1
i_E	ENTA	Angle of entrance, half	Angle of waterline at the bow with reference to centerplane, neglecting local shape at stern.	1
i_R	RUNA	Angle of run, half	Angle of waterline at the stern with reference to the center-plane, neglecting local shape of stern frame.	1
I_L	IL	Longitudinal moment of inertia of waterplane	About transverse axis through center of floatation.	m^4
I_T	IT	Transverse moment of inertia of waterplane	About longitudinal axis through center of floatation.	m^4
L	L	Length of ship	Reference length of ship (generally between the perpendiculars).	m

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
L_E	ENTL	Length of entrance	From the forward perpendicular to the forward end of parallel middle body, or minimum section.	m
L_{OA}	LOA	Length, overall		m
L_{OS}	LOS	Overall submerged length		m
L_P	LP	Length of parallel middle body.	Length of constant transverse section.	m
L_{pp}	LPP	Length between perpendiculars		m
L_R	RUNL	Length of run	From section of maximum area or after end of parallel middle body to waterline termination or other designated point.	m
L_{WL}	LWL	Length of waterline.		m
Ⓜ	CIRCM	R.E. Froude's length coefficient, or length−displacement ratio.	$\frac{L}{\nabla^{\frac{1}{3}}}$	1
S	S	Watted surface		m^2
Ⓢ	CIRCS	R.E. Froude's wetted surface coefficient	$\frac{S}{\nabla^{\frac{2}{3}}}$	1
t	TT	Taylor tangent of the area curve.	The intercept of the tangent to the sectional area curve at the bow on the midship ordinate expressed as a ratio of the midship ordinate expressed as a ratio of the midship ordinate.	1
T	T	Draft molded, of ship		m
T_A	TA	Draft at aft perpendicular.		m
T_F	TF	Draft at forward perpendicular		m
T_M	TM	Draft at midship		m
Ⓣ	CIRCT	R.E. Froude's draft coefficient	$\frac{T}{\nabla^{\frac{1}{3}}}$	1
△, V	DISV	Displacement volume	$\frac{\Delta}{\rho g}$	m^3

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
μ	MUVOL	Volumetric permeability	The ratio of the volume of water entering a compartment to the volume of the compartment	1

2.1.2 Propulsor Geometry

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
A_D	AD	Developed blade area	Developed area of a screw of a screw propeller outside the boss or hub.	m^2
A_E	AE	Expanded blade area	Expanded blade area of a screw propeller outside the boss or hub.	m^2
A_O	AO	Disc Area	$\frac{\pi D^2}{4}$	m^2
A_P	AP	Projected blade area	Projected blade area of a screw propeller outside the boss or hub.	m^2
$\overline{C}$	CHM	Mean chord length	The expanded or developed area of a propeller blade divided by the span from the hub to the tip.	m
d	DH	Boss or hub diameter		m
D	DP	Propeller diameter		m
G_Z	GAP	Gap between the propeller blades	$\frac{2\pi r \sin\phi}{Z}$	m
h_o	HO	Immersion	The depth of submergence of the propeller measured vertically from the shaft axis to the free surface.	m
i_G	RAKG	Rake	The displacement from the propeller plane to the generator line in the direction of the shaft axis. Aft displacement is considerate positive rake.	m
I_S	RAKS	Axial displacement, skew-induced	The axial displacement of a blade section which occurs when the propeller is skewed. Aft displacement is considered.	m
i_T	RAKT	Axial displacement, total	The axial displacement of the blade reference line from the propeller plane. Positive direction is aft. $i_G + i_S$	m

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
P	PP	Propeller pitch in general		m
R	RD	Propeller radius		m
t_0	TO	Thickness on axis of propeller blade.	Thickness of propeller blade as extended down to propeller axis.	m
X_p	XP	Longitudinal propeller position.	Distance of propeller center forward of the after perpendicular.	m
Y_p	YP	Lateral propeller position	Transverse distance of propeller center from middle line (wings screw).	m
Z	NPB	Number of propeller blades.		m
Z_p	ZP	Vertical propeller position	Height of propeller center above base line.	m
Φ	PHIP	Pitch angle of screw propeller.	$arctg(\frac{\rho}{2\pi R})$	1
Φ_F	PHIF	Pitch angle of screw propeller measured to the face line.		1
θ_s	TETS	Skew angle	The angular displacement about the shaft axis of the reference point of any blade section relative to the generator line measured in the plane of rotation. It is positive when opposite to the direction of ahead rotation.	1
θ	RAKA	Angle of rake		1
θ_{EXT}	TEMX	Skew angle extent	The difference between maximum and minimum local skew angle.	

2.1.3 Appendage Geometry

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
A_B	AB	bow hydroplanes area		m^2
A_C	AC	Area under cut−up		m^2
A_F	AF	Flap area		m^2
A_R	ARUD	Rudder area	Area of the rudder, including flap	m^2
A_{RF}	ARF	Area of the fixed part of rudder		m^2
A_{RP}	ARP	Area of rudder in the propeller race.		m^2

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
A_{RT}	ART	Total rudder area	$A_R + A_{RF}$	m²
A_S	AS	Stern hydroplanes area		m²
A_{SK}	ASK	Skeg area		m²
S	SF	Span of an aerofoil or a hydrofoil	Tip to tip or support to tip when cantilevered	m
c	CH	Chord length of an aerofoil or a hydrofoil		m
$\bar{c}$	CHM	Average chord length	$\frac{A_{RT}}{S}$	m
c_r	CHR	Chord length at the root		m
c_t	CHT	Chord length at the tip		m
f	FM	Camber of an aerofoil or a hydrofoil	Maximum separation of median and nose−tail line	m
t	TMAX	Maximum thickness of an aerofoil or a hydrofoil	Measured normal to mean line	m
A_{BK}	ABK	Wetted surface area of bilge keels		m²
δ_B	DLTBH	Bow hydroplane angle (*)		1
δ_S	DLTSH	Stern hydroplane angle(*)		1
δ_R	DLTR	Rudder angle (*)		1
δ_{RF}	DLTRF	Rudder−flap angle (*)		1
δ_F	DLTF	Stabilizer fin angle		1
β	BETA	Stabilizer fin depression angle	Angle between horizontal plane and plane of stabilizer fin. Positive when giving positive roll moment	1
γ	TAPER	Rudder taper	$\frac{C_t}{C_r}$	1
Λ	LAM	Rudder aspect ratio	$\frac{S^2}{A_{RT}}$	1
$\overline{AB}$	XAB	Longitudinal center of buoyancy from aft perpendicular (*).	Distance of center of buoyancy from aft perpendicular	m
$\overline{AF}$	XAF	Distance of center of flotation from after perpendicular (*).		m
$\overline{AG}$	XAG	Longitudinal center of gravity from aft perpendicular (*).	Distance of center of gravity from aft perpendicular	m

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
B		Position of center of buoyancy.		
$\overline{BM}$	ZBM	Transverse metacenter above center of buoyancy (*)	Distance from the center of buoyancy B to the transverse metacenter M $\overline{KM} - \overline{KB}$	m
$\overline{BM_L}$	ZBML	Longitudinal metacenter above center of buoyancy (*)	$\overline{KM_L} - \overline{KB}$	
F		Position of center of flotation (centroid of water plane)		
F	FREB	Freeboard	From the freeboard markings to the freeboard deck, according to official rules.	m
$\overline{FB}$	XFB	Longitudinal center of buoyancy from forward perpendicular (*)	Distance of center of buoyancy from forward perpendicular	m
$\overline{FG}$	XFG	Longitudinal center of gravity from forward perpendicular (*)	Distance of center of gravity from forward perpendicular.	m
G		Position of center of gravity.		
$\overline{GM}$	GM	Transverse metacentric height (*)	Distance of center of gravity G to the metacenter M $\overline{KM} - \overline{KG}$	m
$\overline{GM_L}$	GML	Longitudinal center of metacentric height	Distance from the center of gravity G to the longitudinal metacenter M_L $KM_L - KG$	m
$\overline{KA}$	ZKA	Assumed center of gravity above molded base or keel	Distance from the assumed center of gravity A to the molded base or keel K	
$\overline{KB}$	ZKB	Center of buoyancy above molded base or keel (*)	Distance from the center of buoyancy B to the molded base or keel K	m

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
$\overline{KM}$	ZKM	Transverse Longitudinal metacenter above molded base or keel (*)	Distance from the transverse metacenter M to the molded base or keel K.	m
$\overline{KM_L}$	ZKML	Longitudinal metacenter above molded base or keel (*)	id longitudinal M_L	m
M		Position of transverse metacenter		
M_L		Position of longitudinal metacenter		
M_S	MS	Moment of ship stability in general	$\Delta\overline{GZ}$ (other moments such as those of capsizing, heeling, etc. will be represented by M_s with additional subscripts as appropriate.)	NM
$\triangle$	DISP	Displacement force (buoyancy)	$\rho g \nabla$	N
∇, V	DISV	Displacement volume	$\frac{\triangle}{\rho g}$	m^3
δ	D (prefix to other symbol).	Finite increment in…		
$\overline{AG_T}$	YAG	Transverse distance from assumed center of gravity G		m
$\overline{AF_V}$	ZAG	Vertical distance from assumed center of gravity A, to actual center of gravity G		m
AP		Aft perpendicular		
$\overline{AZ}$	YAZ	Righting arm based on horizontal distance from assumed center of gravity A, to Z		m
C_{MTL}	CMTL	Longitudinal trimming coefficient	$\frac{BM_L}{\overline{L}}$ or trimming moment are divided by trim	1
b		Mean center of floatation of added buoyant layer		

Standard Symbol	Computer Symbol	Name of Concept	Definition or Explanation	SI Unit
$\overline{FF}$	XFF	Longitudinal center of floatation from forward perpendicular	Distance of center of floatation from forward perpendicular	m
FP		Forward perpendicular		
g		Center of gravity of an added or removed weight (mass)		
$\overline{GZ}$	GZ	Righting arm or lever	$\overline{AZ} - \overline{AG_V}\sin\Phi - \overline{AG_T}\sin\phi$	m
$\overline{KG}$	ZKG	Center of gravity above molded base or keel	Distance from center of gravity G to the molded base or keel K	m
$\overline{Kg}$	ZKAG	Vertical center of gravity of added or removed weight above molded base or keel.	Distance from center of gravity, g, to the molded base or keel K	m
I	XTA	Longitudinal trimming arm.	$x_{cb} - x_{cg}$	m
m	MA	Ship mass	$\frac{w}{g}$	kg
M_{TC}	MTC	Moment to trim one centimeter	$\frac{C_{MTL}}{100}$	Nm/cm
M_{TM}	MTM	Moment to trim one meter	$\triangle C_{MTL}$	Nm/m
t	YHA	Transverse heeling arm		m
X_{cb}	XACB	Longitudinal mean center of floatation of added buoyant layer	Longitudinal distance from a midship to the center of the added buoyant layer	m
X_{CB}	XCB	Longitudinal center of buoyancy	Longitudinal distance from a midship to the center of buoyancy, B	m
X_{CF}	XCF	Longitudinal center of flotation	Longitudinal distance from a midship to the center of flotation, F	m
X_{cg}	XACG	Longitudinal center of gravity of added weight (mass)	Longitudinal distance from a midship to the center of gravity, g, of an added or removed weight(mass)	m
X_{CG}	XCG	longitudinal center of gravity	Longitudinal distance from a midship to the center of gravity, G	m
T_{rim}	TR	Trim	$T_A - T_F$	m
δT_{rim}	DTR	Change in trim		m
δT_{PS}	DTPS	Parallel sinkage	Added weight in tons divided by tons per unit immersion	m
W	WT	Displacement weight, ship weight	mg	N