Propulsion

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Project ID **ZERO**
Description **TWIN PROP**
File name **ZERO 3 2100_fiksni PD 1.hcnc**

Analysis parameters

Hull-propulsor interaction			**System analysis**		
Technique:	**[Calc]**	**Prediction**	Cavitation criteria:		**5% cav line**
Prediction:		**Holtrop**	Analysis type:		**Free run**
Reference ship:			CPP method:		
Max prop diam:		**2300,0 mm**	Engine RPM:		
Corrections			Mass multiplier:		
Viscous scale corr:	**[On]**	**Standard**	RPM constraint:		
Rudder location:		**Behind propeller**	Limit [RPM/s]:		
Friction line:		**ITTC-57**	**Water properties**		
Hull form factor:		**1,345**	Water type:		**Salt**
Corr allowance:		**ITTC-78 (v2008)**	Density:		**1026,00 kg/m3**
Roughness [mm]:	**[Off]**	**0,00**	Viscosity:		**1,18920e-6 m2/s**
Ducted prop corr:	**[Off]**				
Tunnel stern corr:	**[Off]**				
Effective diam:					
Recess depth:					

Prediction method check [Holtrop]

Parameters	FN [design]	CP	LWL/BWL	BWL/T
Value	**0,23**	**0,64**	**4,77**	**2,61**
Range	**0,06··0,80**	**0,55··0,85**	**3,90··14,90**	**2,10··4,00**

Prediction results [System]

	HULL-PROPULSOR				ENGINE			
SPEED [kt]	PETOTAL [kW]	WFT	THD	EFFR	RPMENG [RPM]	PBENG [kW]	FUEL [L/h]	LOADENG [%]
3,00	**6,8**	**0,0480**	**0,0564**	**0,9827**	**192**	**5,5**	**---**	**3,6**
3,50	**10,2**	**0,0477**	**0,0564**	**0,9827**	**221**	**8,4**	**---**	**5,4**
4,00	**14,6**	**0,0475**	**0,0564**	**0,9827**	**250**	**11,9**	**---**	**7,7**
4,50	**20,0**	**0,0473**	**0,0564**	**0,9827**	**279**	**16,4**	**---**	**10,6**
5,00	**26,6**	**0,0471**	**0,0564**	**0,9827**	**308**	**21,7**	**---**	**14,0**
6,00	**44,0**	**0,0468**	**0,0564**	**0,9827**	**366**	**35,9**	**---**	**23,1**
7,00	**68,1**	**0,0466**	**0,0564**	**0,9827**	**424**	**55,3**	**---**	**35,7**
8,00	**101,2**	**0,0464**	**0,0564**	**0,9827**	**484**	**82,3**	**---**	**53,1**
9,00	**147,7**	**0,0462**	**0,0564**	**0,9827**	**548**	**120,3**	**---**	**77,6**
+ 9,50 +	**178,1**	**0,0462**	**0,0564**	**0,9827**	**582**	**145,3**	**---**	**93,8**

	POWER DELIVERY							
SPEED [kt]	RPMPROP [RPM]	QPROP [kN·m]	QENG [kN·m]	PDPROP [kW]	PSPROP [kW]	PSTOTAL [kW]	PBTOTAL [kW]	TRANSP
3,00	**55**	**0,88**	**0,25**	**5,2**	**5,3**	**10,7**	**11,0**	**906,7**
3,50	**63**	**1,17**	**0,33**	**7,9**	**8,1**	**16,3**	**16,8**	**693,9**
4,00	**71**	**1,47**	**0,42**	**11,2**	**11,6**	**23,2**	**23,9**	**557,6**
4,50	**80**	**1,81**	**0,52**	**15,4**	**15,9**	**31,8**	**32,7**	**457,5**
5,00	**88**	**2,18**	**0,62**	**20,5**	**21,1**	**42,2**	**43,5**	**382,8**
6,00	**105**	**3,03**	**0,87**	**33,7**	**34,8**	**69,6**	**71,7**	**278,6**
7,00	**121**	**4,03**	**1,15**	**52,1**	**53,7**	**107,4**	**110,7**	**210,6**
8,00	**138**	**5,25**	**1,50**	**77,4**	**79,8**	**159,7**	**164,6**	**161,8**
9,00	**157**	**6,78**	**1,94**	**113,2**	**116,7**	**233,5**	**240,7**	**124,5**
+ 9,50 +	**166**	**7,72**	**2,20**	**136,7**	**141,0**	**281,9**	**290,6**	**108,8**

	EFFICIENCY				THRUST	
SPEED [kt]	EFFO	EFFG	EFFOA	MERIT	THRPROP [kN]	DELTHR [kN]
3,00	**0,6744**	**0,9700**	**0,6372**	**0,37233**	**2,34**	**4,41**
3,50	**0,6622**	**0,9700**	**0,6255**	**0,35478**	**3,00**	**5,66**
4,00	**0,6649**	**0,9700**	**0,6279**	**0,3483**	**3,75**	**7,07**
4,50	**0,6669**	**0,9700**	**0,6297**	**0,34322**	**4,58**	**8,64**
5,00	**0,6685**	**0,9700**	**0,6311**	**0,33881**	**5,48**	**10,35**
6,00	**0,6706**	**0,9700**	**0,6329**	**0,33242**	**7,56**	**14,26**
7,00	**0,6718**	**0,9700**	**0,6339**	**0,32848**	**10,01**	**18,90**
8,00	**0,6720**	**0,9700**	**0,6339**	**0,32788**	**13,03**	**24,59**
9,00	**0,6710**	**0,9700**	**0,6328**	**0,33141**	**16,91**	**31,91**
+ 9,50 +	**0,6698**	**0,9700**	**0,6317**	**0,33492**	**19,31**	**36,44**

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Prediction results [Propulsor]

	PROPULSOR COEFS								
SPEED [kt]	JH	KTH	KQ	KTJ2	KQJ3	CTH	CP	RNPROP	
3,00	**0,7638**	**0,1396**	**0,02517**	**0,23937**	**0,056487**	**0,60955**	**0,91971**	**1,82e6**	
3,50	**0,7746**	**0,1353**	**0,02518**	**0,22544**	**0,054183**	**0,57408**	**0,8822**	**2,09e6**	
4,00	**0,7833**	**0,1322**	**0,02479**	**0,2155**	**0,051582**	**0,54877**	**0,83985**	**2,37e6**	
4,50	**0,7901**	**0,1298**	**0,02448**	**0,20802**	**0,049642**	**0,52971**	**0,80826**	**2,65e6**	
5,00	**0,7959**	**0,1278**	**0,02421**	**0,20174**	**0,048029**	**0,51373**	**0,782**	**2,92e6**	
6,00	**0,8043**	**0,1248**	**0,02382**	**0,19296**	**0,045793**	**0,49137**	**0,74559**	**3,47e6**	
7,00	**0,8094**	**0,1230**	**0,02358**	**0,18776**	**0,044479**	**0,47812**	**0,72419**	**4,03e6**	
8,00	**0,8102**	**0,1227**	**0,02355**	**0,18697**	**0,04428**	**0,47611**	**0,72096**	**4,60e6**	
9,00	**0,8056**	**0,1244**	**0,02376**	**0,19162**	**0,045452**	**0,48795**	**0,74005**	**5,21e6**	
+ 9,50 +	**0,8010**	**0,1260**	**0,02398**	**0,19636**	**0,046655**	**0,50002**	**0,75963**	**5,52e6**	

	CAVITATION								
SPEED [kt]	SIGMAV	SIGMAN	SIGMA07R	TIPSPEED [m/s]	MINBAR	PRESS [kPa]	CAVAVG [%]	CAVMAX [%]	PITCHFC [mm]
3,00	**89,98**	**52,50**	**9,69**	**6,04**	**0,108**	**2,25**	**2,0**	**2,0**	**1819,5**
3,50	**66,07**	**39,65**	**7,29**	**6,95**	**0,115**	**2,89**	**2,0**	**2,0**	**1833,8**
4,00	**50,56**	**31,02**	**5,69**	**7,86**	**0,122**	**3,61**	**2,0**	**2,0**	**1846,0**
4,50	**39,93**	**24,93**	**4,57**	**8,77**	**0,130**	**4,41**	**2,0**	**2,0**	**1855,6**
5,00	**32,33**	**20,48**	**3,74**	**9,67**	**0,137**	**5,28**	**2,0**	**2,0**	**1863,9**
6,00	**22,44**	**14,52**	**2,65**	**11,49**	**0,153**	**7,27**	**2,0**	**2,0**	**1875,8**
7,00	**16,48**	**10,80**	**1,97**	**13,33**	**0,170**	**9,64**	**2,0**	**2,0**	**1883,1**
8,00	**12,61**	**8,28**	**1,51**	**15,22**	**0,189**	**12,54**	**2,0**	**2,0**	**1884,2**
9,00	**9,96**	**6,46**	**1,18**	**17,22**	**0,215**	**16,27**	**2,0**	**2,5**	**1877,7**
+ 9,50 +	**8,94**	**5,74**	**1,05**	**18,28**	**0,230**	**18,58**	**2,4**	**3,0**	**1871,1**

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Hull data

General				Planing		
Configuration:		**Monohull**		*Proj chine length:*		***0,000 m***
Chine type:		**Round/multiple**		*Proj bottom area:*		***0,0 m2***
Length on WL:		**45,750 m**		*LCG fwd TR:*	*[XCG/LP 0,000]*	***0,000 m***
Max beam on WL:	[LWL/BWL 4,766]	**9,600 m**		*VCG below WL:*		***0,000 m***
Max molded draft:	[BWL/T 2,607]	**3,682 m**		*Aft station (fwd TR):*		***0,000 m***
Displacement:	[CB 0,398]	**660,00 t**		*Deadrise:*		***0,00 deg***
Wetted surface:	[CS 2,897]	**497,0 m2**		*Chine beam:*		***0,000 m***
ITTC-78 (CT)				*Chine ht below WL:*		***0,000 m***
LCB fwd TR:	[XCB/LWL 0,494]	**22,593 m**		*Fwd station (fwd TR):*		***0,000 m***
LCF fwd TR:	[XCF/LWL 0,461]	**21,100 m**		*Deadrise:*		***0,00 deg***
Max section area:	[CX 0,625]	**22,1 m2**		*Chine beam:*		***0,000 m***
Waterplane area:	[CWP 0,765]	**336,0 m2**		*Chine ht below WL:*		***0,000 m***
Bulb section area:		**0,0 m2**		*Propulsor type:*		***Propeller***
Bulb ctr below WL:		**0,000 m**		*Max prop diameter:*		***2300,0 mm***
Bulb nose fwd TR:		**0,000 m**		*Shaft angle to WL:*		***4,00 deg***
Imm transom area:	[ATR/AX 0,000]	**0,0 m2**		*Position fwd TR:*		***0,000 m***
Transom beam WL:	[BTR/BWL 0,000]	**0,000 m**		*Position below WL:*		***0,000 m***
Transom immersion:	[TTR/T 0,000]	**0,000 m**		*Transom lift device:*		***Flap***
Half entrance angle:		**20,60 deg**		*Device count:*		***0***
Bow shape factor:	[BTK flow]	**-1,0**		*Span:*		***0,000 m***
Stern shape factor:	[WL flow]	**1,0**		*Chord length:*		***0,000 m***
				Deflection angle:		***0,00 deg***
				Tow point fwd TR:		***0,000 m***
				Tow point below WL:		***0,000 m***

Propulsor data

Propulsor				Propeller options	
Count:		**2**		Oblique angle corr:	**On**
Propulsor type:		**Propeller series**		Shaft angle to WL:	**4,00 deg**
Propeller type:		**FPP**		Added rise of run:	**0,10 deg**
Propeller series:		**B Series**		Propeller cup:	**0,0 mm**
Propeller sizing:		**By power**		KTKQ corrections:	**Custom**
Reference prop:				Scale correction:	**Full ITTC**
Blade count:		**3**		KT multiplier:	**0,970**
Expanded area ratio:		**0,3000**	**[Size]**	KQ multiplier:	**1,030**
Propeller diameter:		**2100,0 mm**	**[Keep]**	Blade T/C [0.7R]:	**0,11**
Propeller mean pitch:	[P/D 1,0000]	**2100,0 mm**	**[Keep]**	Roughness:	**0,20 mm**
Hub immersion:		**1,7 mm**		Cav breakdown:	**On**
Engine/gear				**Design condition**	
Drive line:		**Standard**		Max prop diam:	**2300,0 mm**
Gear input:		**Single engine**		Design speed:	**9,50 kt**
Engine data:		**Generic DC motor**		Reference power:	**155,0 kW**
Rated RPM:		**600 RPM**		Design point:	**1,000**
Rated power:		**155,0 kW**		Reference RPM:	**600,0**
Gear efficiency:		**0,970**		Design point:	**1,000**
Load correction:		**Off**			
Gear ratio:		**3,500**	**[Keep]**		
Shaft efficiency:		**0,970**			

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Symbols and values

SPEED =	Vessel speed
PETOTAL =	Total vessel effective power
WFT =	Taylor wake fraction coefficient
THD =	Thrust deduction coefficient
EFFR =	Relative-rotative efficiency
RPMENG =	Engine RPM
PBENG =	Brake power per engine
FUEL =	Fuel rate per engine
LOADENG =	Percentage of engine max available power at given RPM
RPMPROP =	Propulsor RPM
QPROP =	Propulsor open water torque
QENG =	Engine torque
PDPROP =	Delivered power per propulsor
PSPROP =	Shaft power per propulsor
PSTOTAL =	Total vessel shaft power
PBTOTAL =	Total vessel brake power
TRANSP =	Transport factor
EFFO =	Propulsor open-water efficiency
EFFG =	Gear efficiency (load corrected)
EFFOA =	Overall propulsion efficiency [=PETOTAL/PSTOTAL]
MERIT =	Propulsor merit coefficient
THRPROP =	Open-water thrust per propulsor
DELTHR =	Total vessel delivered thrust
JH =	Propulsor advance coefficient
KTH =	Propulsor thrust coefficient [horizontal, if in oblique flow]
KQ =	Propulsor torque coefficient
KTJ2 =	Propulsor thrust loading ratio
KQJ3 =	Propulsor torque loading ratio
CTH =	Horizontal component of bare-hull resistance coefficient
CP =	Propulsor thrust loading coefficient
RNPROP =	Propeller Reynolds number at 0.7R
SIGMAV =	Cavitation number of propeller by vessel speed
SIGMAN =	Cavitation number of propeller by RPM
SIGMA07R =	Cavitation number of blade section at 0.7R
TIPSPEED =	Propeller circumferential tip speed
MINBAR =	Minimum expanded blade area ratio recommended by selected cavitation criteria
PRESS =	Average propeller loading pressure
CAVAVG =	Average predicted back cavitation percentage
CAVMAX =	Peak predicted back cavitation percentage [if in oblique flow]
PITCHFC =	Minimum recommended pitch to avoid face cavitation
+ =	Design speed indicator
* =	Exceeds recommended parameter limit
! =	Exceeds recommended cavitation criteria [warning]
!! =	Substantially exceeds recommended cavitation criteria [critical]
!!! =	Thrust breakdown is indicated [severe]
--- =	Insignificant or not applicable