

GREEN / MinPower

Software for Assessment of Minimum Propulsion Power



ClassNK PrimeShip-GREEN/MinPower

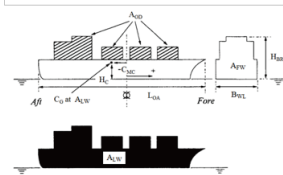
Ver. 2.0

Ship builder's Name	NK Shipbuilding
Ship Number	221
Ship Name	FUE
Type of Ship	Bulk Carrier
Design Conditions	Full/SESD design
Date of Print	2021/10/26 10:06
NK ID	

Analysis option	
Form factor k	<input type="checkbox"/> ITTC 1957
Self propulsion factors	<input type="checkbox"/> Schoenher
	<input type="checkbox"/> Huseas
Added resistance due to wind	<input type="checkbox"/> Results from wind tunnel test
	<input type="checkbox"/> Empirical's formula
	<input type="checkbox"/> Data set (ITTC 7.5-06-01-01.1.F.4)
Added resistance due to waves	<input type="checkbox"/> Task test results
	<input type="checkbox"/> Simplified formula

Hull parameter	
L _{WL}	m 220.00
L _{BP}	m 220.00
B _{WL}	m 32.34
d _{WL}	m 14.00
S	m ² 11700.0
A _{WP}	m ² 500.0
A _{CL}	m ² 2000.0
A _{CS}	m ² 500.0
R _k	m 10.00
H _{max}	m 40.00
C _{WL}	m 8.00
k	0.300
Propeller	D _p m 7.00
	T _p m 0.975
Efficiency	η _p 1.020
etc.	1-c 0.200
Maximum	P _{max} kW 9500
Minimum	N _{min} rpm 88.50

Definition of parameters for configuration of portion of ship



Propeller open-water characteristics (POC)	
J	0.075 0.100 0.200 0.300 0.400 0.500 0.600



Key Features

- ◆ Easy to assess the minimum propulsion power to maintain the manoeuvrability in adverse conditions according to the "minimum propulsion power guidelines"
- ◆ Stand-alone software base on Microsoft Excel
- ◆ User-friendly interface
- ◆ Auto-generation of output results and figures for class approval

This software is intended to conduct assessments of required minimum propulsion power in adverse conditions for bulk carriers, tankers and combination carriers with the size of equal or more than 20,000DWT by means of methods defined in MEPC.1/Circ.850/Rev.3 of IMO "GUIDELINES FOR DETERMINING MINIMUM PROPULSION POWER TO MAINTAIN THE MANOEUVRABILITY OF SHIP IN ADVERSE CONDITIONS".

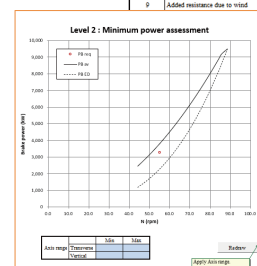
Main Functions

- ◆ Assessment Level2 in the guidelines is available.
- ◆ This assessment procedure is based on the assumption that, if the ship has sufficient installed power to move with a certain advance speed in head waves and wind, the ship will also be able to keep course in waves and wind from any other direction. It is necessary to input self-propulsion factors, aerodynamic resistance, added resistance, etc. for the assessment.
- ◆ Easy to confirm the level of achievement since the assessment is conducted just at the point where the added resistance due to wind and waves is at maximum.

Ship builder's Name		NK Shipbuilding		Ver.		2.0				
Ship Number	221	L _{WL}	L _{BP}	B _{WL}	d _{WL}	S	A _{WP}	A _{CL}	A _{CS}	R _k
Ship Name	FUE	Hull		S _{max} , m ²		Minimum Propulsion Power				
Type of Ship	Bulk Carrier	R _k	C _{WL}	η _p	1-c	η _p	1-c	P _{max}	N _{min}	etc.
Design Conditions	Full/SESD design	Propeller	Wave impedance	External Propulsion of wave	Design	Adv. wind speed	0.000			
Date of Print	2021/10/26 10:11	D _p	T _p	η _p	1-c	P _{max}	N _{min}	etc.	0.000	
NK ID		R _k	C _{WL}	η _p	1-c	P _{max}	N _{min}	etc.	0.000	

Level 2 : Minimum power assessment

Adverse conditions		min	h _w	5.30
1	Significant wave height	(m)	h _w	5.30
2	Peak wave period	(s)	T _p	7.5
3	Wave direction	(deg)	α	0.0
4	Mean wind speed	(m/s)	V _w	20.44
5	Required ship advance speed through the water in wind and wave direction from head to 30 degrees offbow	(m/s)	V ₁₀	1.03
6	Relative wind speed	(m/s)	V _{rel}	2.00
Resistance in adverse conditions		(kN)	R _{ad}	21.47
7	Cable-water resistance	(kN)	R _{cw}	13.66
8	Added rudder resistance	(kN)	R _r	16.74
9	Added resistance due to wind	(kN)	R _w	133.55
0	Added resistance due to waves	(kN)	R _{wv}	377.18



Resistance in adverse conditions		(kN)	T	481.61
	R _{cw}	13.66	J	0.094
	R _r	16.74	N	14.44
	R _w	133.55	K _t	0.0394
	R _{wv}	377.18	P ₁₀	1.031
	R _{ad}	21.47	Q ₁₀	23.94
Total		(kN)	P ₁₀	3773
Target		(kN)	Q ₁₀	658.93
		(kN)	P ₁₀ - P ₁₀	
		(kN)	Q ₁₀ - Q ₁₀	

Structure of the system

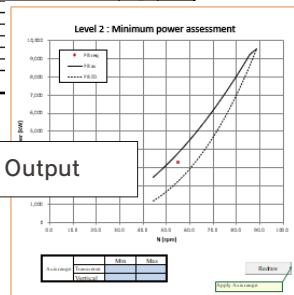
The screenshot shows the software interface with various input fields for ship particulars, analysis options, and self-propulsion factors. A diagram of a ship hull is shown below the input fields, with arrows indicating the flow of data from the input fields to the hull diagram.



Level 2 : Minimum power assessment

Adverse conditions				
1	Equivalent wave height	(m)	H _w	5.70
2	Peak wave period	(s)	T _w	9.7
3	Wave direction	(deg)	α	0.0
4	Mean wind speed	(m/s)	V _m	20.0
5	Required ship advance speed through the water in wind and wave direction stem head to 30 degree off-bow	(m/s)	V ₀	1.07
6	Relative wind speed	(m/s)	V _{rel}	21.47
Resistance in adverse conditions				
7	Calculated resistance	(kN)	R _c	15.06
8	Added hull resistance	(kN)	R _h	19.79
9	Added resistance due to wind	(kN)	R _w	132.70
10	Added resistance due to waves	(kN)	R _{wv}	277.16
Calculation of required brake power and torque in adverse conditions				
11	Required propeller thrust	(kN)	T	882.83
12	Load factor		K _{prop}	1.0000
13	Advanced coefficient		K _{adv}	0.0000
14	Propeller revolution	(rpm)	N	58.84
15	Frangep coefficient		K _f	0.0204
16	Required brake power		P _{req}	
17	Required torque		Q _{req}	
Load diagram corresponding to propeller revolution				
18	Available brake power		P _{avail}	
19	Frangep on load diagram (Minimum torque)		T _{min}	
Adjustment				
20	Adjustment		Adj	
21				

Output



The screenshot shows the software interface with the 'Print for submission' button highlighted. The interface displays the software name and version (Ver. 2.0) and a date (2021/07/13:56).

Input

- ◇ Ship's principal particulars
- ◇ Self-propulsion factors
- ◇ Frontal and side windage area of hull and superstructure
- ◇ Propeller open water characteristics
- ◇ Torque-speed limitation curve of the engine provided by the engine manufacturer
- ◇ Added resistance in short-crested irregular waves, etc.

Analysis options

There are selectable options below.

- ◇ The self-propulsion factors
 - ① Tank test results
 - ② Empirical formula
- ◇ For the added resistance due to wind
 - ① Results from wind tunnel test
 - ② Fujiwara's formula
(ITTC 7.5-04-01-01.1:F.4)
 - ③ ITTC data sets
(ITTC 7.5-04-01-01.1:F.3)
- ◇ For the added resistance due to waves
 - ① Tank test results
 - ② Simplified formula

Output

- ◇ Results of the assessment for submission

PrimeShip-GREEN/MinPower system requirements

Hardware requirement	Software requirements
Print function of Microsoft Windows	OS : Windows 10 (64bit) Office : Microsoft Excel 2016, 2019 (64bit, 32bit)

Contact address : EEDI Section of Hull Department
ClassNK Administration Center Annex

3-3 Kioi-cho, Chiyoda-ku, Tokyo 102-0094, Japan

E-mail: eedi@classnk.or.jp Tel: +81-3-5226-2018 Fax: +81-3-5226-2019