Guidance for Ships for Navigation in Ice

2022. 02.

Machinery Rule Development Team

- Main Amendments -

(1) Effective date : 1 Jul. 2022 (Date of which contracts for construction are signed)

◉ The coefficients for fatigue design of propeller blade have been modified.

Present

CHAPTER 1 STRENGTHENING FOR NAVIGATION IN ICE

Section 6 Propulsion Machinery *(2018)*

606. Design

1. 〈omitted〉

2. Propeller blade

(1) ~ (2) 〈omitted〉

(3) Fatigue design of propeller blade

The fatigue design of the propeller blade is based on an estimated load distribution for the service life of the ship and the S-N curve for the blade material. An equivalent stress that produces the same fatigue damage as the expected load distribution shall be calculated and the acceptability criterion for fatigue should be fulfilled as given in this Section. The equivalent stress is normalized for 10^8 cycles.

For materials having two slope S-N curve (See **Fig 1.13**) fatigue calculations according to this sub-paragraph are not required if the following criterion is fulfilled.

$$\sigma_{\exp} \geq B_1 \cdot \sigma_{ref2}^{B_2} \cdot \log(N_{i\alpha})^{B_3}$$

where, B_1, B_2 and B_3 coefficients for propellers are given in the table below.

Table 1.23 B_1, B_2 and B_3 coefficients

	Open propeller	Ducted propeller
B_1	0.00246	0.00167
B_2	0.947	0.956
B_3	2.101	2.470

(hereafter, omitted)

Amendment

CHAPTER 1 STRENGTHENING FOR NAVIGATION IN ICE

Section 6 Propulsion Machinery *(2018)*

606. Design

1. 〈same as the present〉

2. Propeller blade

(1) ~ (2) 〈same as the present〉

(3) Fatigue design of propeller blade

The fatigue design of the propeller blade is based on an estimated load distribution for the service life of the ship and the S-N curve for the blade material. An equivalent stress that produces the same fatigue damage as the expected load distribution shall be calculated and the acceptability criterion for fatigue should be fulfilled as given in this Section. The equivalent stress is normalized for 10^8 cycles.

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where, B_1, B_2 and B_3 coefficients for propellers are given in the table below.

Table 1.23 B_1, B_2 and B_3 coefficients

	Open propeller	Ducted propeller
B_1	0.00328	0.00223
B_2	1.0076	1.0071
B_3	2.101	2.471

(hereafter, same as the present)

Note

<Guidance for Ships for Navigation in Ice>

(Amendment)Modification of coefficients for fatigue design of propeller blade <application date: the date of contract for construction on or after 1 July 2022>

- Reflects the effect of the change of the safety factor from 1.5 to 1.3 in the equation of the (2) blade stress acceptability criterion.
- Reflects the 5% increase of the value C_1 in Table 1.24.
- Reflects the correction of errors in the calculation formula for calculating the coefficients B_1, B_2, B_3.