Amendments for Guidance for Ships for Navigation in Ice

- Main Amendments -

(1) Effective date : 1 Jul. 2020 (Date of which the contract for construction is signed)

◉ The design requirements of propulsion shafting for Ice class ID have been newly added.

Present

CHAPTER 1 STRENGTHENING FOR NAVIGATION IN ICE

Section 6 Propulsion Machinery *(2018)*

601. ~ 602. <omitted>

603. Design ice conditions

In estimating the ice loads of the propeller for Ice classes, different types of operation as given in **Table 1.15** were taken into account. For the estimation of design ice loads, a maximum ice block size is determined. The maximum design ice block entering the propeller is a rectangular ice block with the dimensions $H_{ice} \cdot 2H_{ice} \cdot 3H_{ice}$. The thickness of the ice block (H_{ice}) is given in **Table 1.16**.

Table 1.15 <omitted>

Table 1.16 The thickness of the ice block (H_{ice})

Ice class	IA Super	IA	IB	IC	ID
Thickness of the design maximum ice block entering the propeller (H_{ice})	1.75 m	1.5 m	1.2 m	1.0 m	1.0 m

604. <omitted>

Amendment

CHAPTER 1 STRENGTHENING FOR NAVIGATION IN ICE

Section 6 Propulsion Machinery *(2018)*

601. ~ 602. <same as the present>

603. Design ice conditions

In estimating the ice loads of the propeller for Ice classes, different types of operation as given in **Table 1.15** were taken into account. For the estimation of design ice loads, a maximum ice block size is determined. The maximum design ice block entering the propeller is a rectangular ice block with the dimensions $H_{ice} \cdot 2H_{ice} \cdot 3H_{ice}$. The thickness of the ice block (H_{ice}) is given in **Table 1.16**.

Table 1.15 <same as the present

Table 1.16 The thickness of the ice block (H_{ice})

Ice class	IA Super	IA	IB	IC
Thickness of the design maximum ice block entering the propeller (H_{ice})	1.75 m	1.5 m	1.2 m	1.0 m

604. <same as the present>

Reason

<Guidance for Ships for Navigation in Ice>

(Amendment)

- newly added the design requirements of propulsion shafting for Ice class ID <application date: the date of contract for construction on or after 1 July 2020>

- delete ice block thickness of Ice class ID so that 608. Design of propulsion shafting for Ice class ID is newly introduced.

Present

605. Design loads

1. ~ 3. <omitted>

4. Design loads on propeller blades

F_b is the maximum force experienced during the ship's service life that bends a propeller blade backwards when the propeller mills an ice block while rotating ahead. F_f is the maximum force experienced during the ship's service life that bends a propeller blade forwards when the propeller mills an ice block while rotating ahead. F_b and F_f originate from different propeller/ice interaction phenomena, not acting simultaneously. Hence they are to be applied to one blade separately.

(1) ~ (8) <omitted>

(9) Number of ice loads

The number of load cycles per propeller blade in the load spectrum is to be determined according to the formula:

$$N_{ice} = k_1 \cdot k_2 \cdot k_3 \cdot N_{class} n,$$

where,

Reference number of loads for Ice classes N_{class}

Class	IA Super	IA	IB	IC	ID
impacts for the ship's service life /n	$9 \cdot 10^6$	$6 \cdot 10^6$	$3.4 \cdot 10^6$	$2.1 \cdot 10^6$	$2.1 \cdot 10^6$

(hereafter, omitted)

Amendment

605. Design loads

1. ~ 3. <same as the present>

4. Design loads on propeller blades

F_b is the maximum force experienced during the ship's service life that bends a propeller blade backwards when the propeller mills an ice block while rotating ahead. F_f is the maximum force experienced during the ship's service life that bends a propeller blade forwards when the propeller mills an ice block while rotating ahead. F_b and F_f originate from different propeller/ice interaction phenomena, not acting simultaneously. Hence they are to be applied to one blade separately.

(1) ~ (8) <same as the present>

(9) Number of ice loads

The number of load cycles per propeller blade in the load spectrum is to be determined according to the formula:

$$N_{ice} = k_1 \cdot k_2 \cdot k_3 \cdot N_{class} n,$$

where,

Reference number of loads for Ice classes N_{class}

Class	IA Super	IA	IB	IC
impacts for the ship's service life /n	$9 \cdot 10^6$	$6 \cdot 10^6$	$3.4 \cdot 10^6$	$2.1 \cdot 10^6$

(hereafter, same as the present Rules)

Reason

- delete number of loads of Ice class ID so that 608. Design of propulsion shafting for Ice class ID is newly introduced.

Present	Amendment	Reason
608. <new>	**608. Design of propulsion shafting for Ice class ID *(2020)***	- newly added the design of propulsion shafting for Ice class ID

1. Application

This regulation applies to the design of propulsion shafting for ships with Ice class ID. However, some or all of propulsion shaft design for Ice class IC in this section may be applied.

2. Propeller shaft and stern tube shaft

The diameter of propeller shaft and stern tube shaft is not to be less than 5% increased from the shaft diameter calculated in accordance with **Pt 5, Ch 3, 204.** of the Rules for the Classification of Steel Ships.

3. Thickness of Propeller Blade

(1) The thickness of propeller blade is not to be less than 8% increased from the blade thickness calculated in accordance with **Pt 5, Ch 3, 303. of the Rules for the Classification of Steel Ships**.

(2) The thickness of propeller blades at a radius of $0.95R$ $t_{0.95}$ is not to be less than that obtained from the following formula.

$$t_{0.95} = 0.14(t+57)\sqrt[3]{\frac{430}{T}}$$

$t_{0.95}$: Thickness of propeller blade at a radius of $0.95R$ (mm)

t : Thickness at the root of propeller blade in accordance with **Pt 5, Ch 3, 303. of Rules for the Classification of Steel Ships** (solid propeller: $0.25R$, controllable pitch propeller: $0.35R$) (mm)

T : Specified minimum tensile strength of propeller material ($\mathrm{N/mm^2}$)

Present	Amendment	Reason
(hereafter, omitted)	**4. Fitting of propeller** Where the propeller is force-fitted to the propeller shaft without the use of a key, the calculations for pull-up length and pull-up load in accordance with **Pt 5, Ch 3, 305. 2** (C) **of the Guidance Relating to the Rules for the Classification of Steel Ships** is to be carried out using F_V' of the following formula in lieu of F_V. $F_V' = F_V + 0.15\frac{2cQ}{D_s}$ (hereafter, same as the present Rules)	