Development of Guidelines for Navigating Ice-covered Seas in Russian Territorial Waters

Development Department

1. INTRODUCTION

With the steep rise in global demand for energy these days and the relaxation in climatic conditions in cold regions due to global warming, there has been an increase in the development of the rich underground resources of ice-covered seas in the Sakhalin region and the Russian territorial waters of the Arctic Ocean. An increase in the number of ships navigating these ice-covered seas is also anticipated because of the increased economic growth accompanying the development of resources and thriving conditions that go together with such development. Moreover, the use of the Arctic Ocean as a regular international trade route between the East and the West is coming closer to reality because of the effects of global warming. In reality, the distance between Japan and Europe becomes shorter if the route through the Arctic Ocean is used. For instance, the distance of 11200 nautical miles for the voyage between Yokohama and Rotterdam through the Suez Canal is shortened by 40 % to 6500 nautical miles if the Northern Sea route is used. Moreover, oil is being shipped throughout the year from December 2008 from Sakhalin 2, which is a Sakhalin project. Shipment of LNG has also started from March 2009 and shipping operations between Sakhalin and Japan has increased substantially.

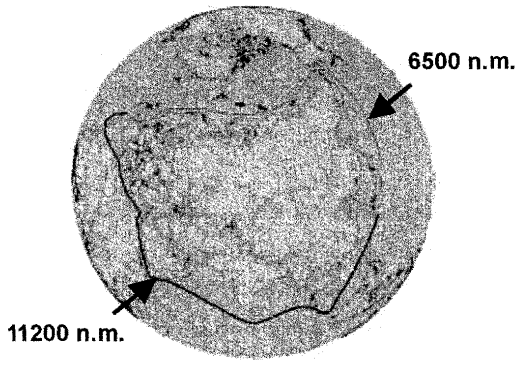

Figure 1 Comparison of Japan-Europe routes

Under such conditions, there arose a need for formulating guidelines that summarized the agenda to be considered for ships navigating ice-covered seas such as the Arctic Ocean and the Sea of Okhotsk.

Generally, for ships navigating ice-covered seas, low temperature measures (anti-icing, anti-freezing, de-icing measures) and environmental protection measures are necessary for machinery and equipment. Measures are also necessary to reinforce the structural strength of the hull and to enhance the performance of propulsion machinery to cope with contact of the ship with ice. The guidelines and rules listed below have been prepared and standardized internationally because of these measures, and are now recognized standards.

(1) IMO: MSC/Circ.1056 and MEPC/Circ.399
"GUIDELINES FOR SHIPS OPERATING IN ARCTIC ICE-COVERED WATERS" (adopted in October and December, 2002)

(2) IACS: Unified Requirements (UR) I1, I2 and I3 (established in August 2006): Rules for structural requirements of hull and machinery according to IMO Guidelines

(3) NK: Rules for the Survey and Construction of Steel Ships Part I (established September 2007): Rules based on the requirements of IACS UR I1, I2, and I3, and the Finnish-Swedish Ice Class Rules

(4) Other classification society rules and guidelines

Independent rules and guidelines exist for ice-covered seas under the jurisdiction of ports, or countries such as Russia, Finland, Sweden, and Canada. During design and operation of ships navigating such waters, care is required to adhere to the regulatory controls of the jurisdictional port or country, and the associated supporting system besides complying with the rules mentioned above. For instance, it is well known that a ship intending to navigate the Sakhalin route and the Northern Sea route where are resource-rich has to obtain permission from the Russian government. Certificates issued by an organization recognized by the Russian government are also necessary.

In view of this background, ClassNK has prepared the "Guidelines for Navigating Ice-covered Seas in Russian Territorial Waters" mainly for ships that navigate these waters. This document summarizes requirements and necessary procedures of the Russian government, and standard design specifications such as low-temperature measures and anti-freezing measures necessary for ships navigating ice-covered seas (generally sea areas where temperature is low), referring to the requirements of the IMO Guidelines.

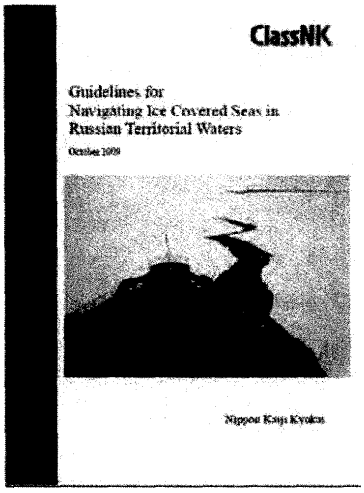

Figure 2 Guidelines for Navigating Ice-covered Seas in Russian Territorial Waters

2. Overview of "Guidelines for Navigating Ice-covered Seas in Russian Territorial Waters"

These guidelines give information such as the structure and equipment required to be provided on ships navigating Russian territorial waters and procedures for acquiring permission from the Russian government to navigate these waters. This is a technical document prepared for ship operators and designers of ships intended to navigate Russian territorial waters. The guidelines contain the following chapters:

Chapter 1	General
Chapter 2	Hull structures and equipment
Chapter 3	Machinery and electrical installations
Chapter 4	Fire detection and extinguishing systems, escape measures, life-saving appliances and navigational equipment
Chapter 5	Operation
Chapter 6	Procedures for navigating ice-covered seas in Russian territorial waters
References	

Chapters in the guidelines include the following: General items related to assumed routes and definition of terms in Chapter 1; Summary of requirements related to structure and equipment in Chapters 2 to 4; Requirements related to operation in Chapter 5; Information on procedures required for ships to navigate Russian territorial waters in Chapter 6. Overviews of each chapter in these guidelines are given below.

3. Overview of chapters in the guidelines

3.1 "Chapter 1 General"

Two routes are assumed in these guidelines: the Northern Sea route and the Sakhalin route. (Fig. 3 and Fig. 4)

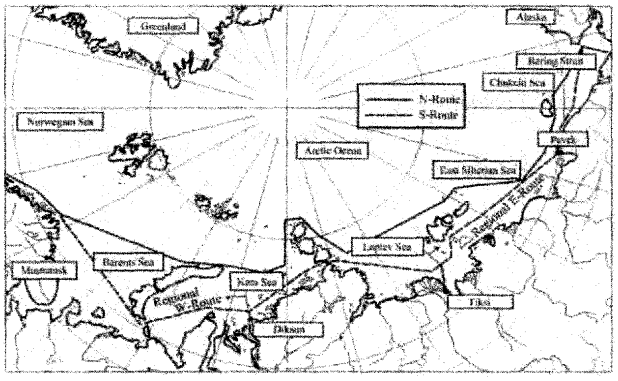

Figure 3 Example of a Northern Sea route

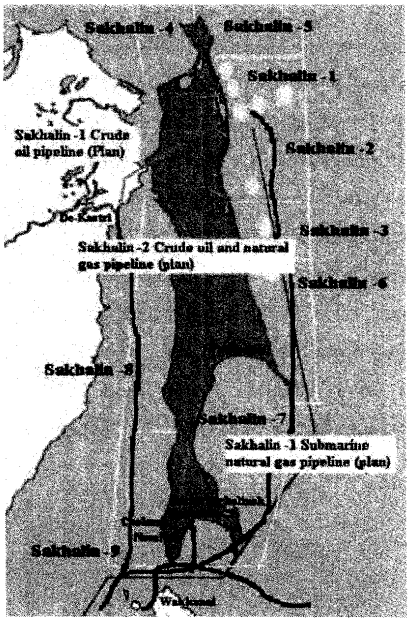

Figure 4 Sakhalin and route around Sakhalin

Ships operating in Russian territorial waters are required to possess the Ice Class or notation equivalent to Ice Class as specified in the rules of the Russian Maritime Register of Shipping (RS – Russian classification society), according to the Russian government. The approximate correspondence between the Ice Class specified in the RS rules, and the Polar Class and Ice Class defined in these guidelines is shown in Table 1.

Table 1 Equivalence with Ice Class of the Russian Maritime Register of Shipping

RS Ice Class	Polar Class	Ice Class
—	*PC*1	—
*Arc*9	*PC*2	—
*Arc*8	*PC*3	—
*Arc*7	*PC*4	—
*Arc*6	*PC*5	—
*Arc*5	*PC*6	*IA Super*
*Arc*4	*PC*7	*IA*
*Ice*3	—	*IB*
*Ice*2	—	*IC*
*Ice*1	—	*ID*

These guidelines are meant for ships that satisfy the requirements of normal ships, such as those complying with the MARPOL Convention. Therefore, items to be complied with related to the handling of wastes according to the MARPOL Convention are not mentioned here. The disposal of waste is regulated in principle, since the Arctic Ocean is a special area according to the MARPOL Convention. Moreover, bilge containing oil cannot be discharged into these waters. If oil in the bilge is completely removed by appropriate processing, bilge can be discharged into the Arctic Ocean.

The definitions in these guidelines are established referring to Part I of the Rules for the Survey and Construction of Steel Ships, the IMO Guidelines, and so on.

The definition of design temperature to decide the grade of material of the hull structure matches that of IACS UR S6. The design temperature of material used in equipment other than the hull structure was taken as the design temperature of material of hull structure based on design records. The design temperature of material used in ships operating in the Arctic Ocean was taken as -20 °C and below based on the requirements of the Russian government. The design temperature of machinery and equipment (temperature for low temperature measures such as anti-freezing and work confirmation) has to be assumed as the actual temperature, which is lower than the statistical average of the lowest mean daily air temperature generally defined as the design temperature of the material. According to reports by a Russian research organization, the mean temperature of air for the coldest five-day period is recommended as the standard temperature. The organization reports that this standard is 10 °C lower than the statistical average of the lowest mean daily air temperature, and this point has been noted for reference.

3.2 "Chapter 2 Hull structures and equipment"

This chapter gives requirements for hull structure and hull equipment related to measures such as anti-freezing, anti-icing and de-icing measures, referring to the IMO Guidelines, requirements of the Russian government, rules and technical guidelines of other classification societies, equipment in ships that have actually plied in these areas, and so on.

(1) Bow form

The bulbous bow, which is effective in reducing wave-making resistance, cannot be used in principle in ships navigating the Arctic Ocean, where the ship is expected to operate while crushing the ice. However, a bulbous bow may be used if the ship can navigate astern in ice-covered seas. If the bulbous bow has no effect on the navigation of the ship in ice, and if this is verified by model tests, then navigation of the ship with bulbous bow may be allowed in Sakhalin territorial waters.

(2) Arrangement of oil tanks such as fuel oil tanks

More stringent restrictions than those in the MARPOL Convention are given for arrangement of fuel oil tanks based on the rules of the Russian government.

(3) Anti-freezing measures for ballast tanks

If the whole or a part of a ballast tank or a fresh water tank is above the lower ice waterline, the liquid in the tanks is likely to cool down and freeze because of the open air at low temperature. If the liquid in the tank freezes, the tank may expand or negative internal pressure may occur during deballasting, and the structure may be damaged. To prevent such damage, anti-freezing measures must be adopted for tanks exposed to outside air at low temperatures. Methods such as installation of heating equipment and convection of liquid by air bubbles have been specified as anti-freezing measures referring to rules and guidance of major classification societies such as LR and DNV, and also referring to design records until now.

(4) Bilge tanks

For design purpose, measures must be adopted for disposal of bilges and wastes generated during a 30-day period, according to the requirements of the Russian government.

(5) Bridge structure

In principle, the bridge shall be a fully enclosed structure (no direct access to and from exposed parts from the bridge) similar to the treatment of bridges by LR and DNV, referring to the design records until now. For ships navigating the Sakhalin territorial waters, if the exposed parts of the bridge wing are appropriately protected from ice, then a non-fully enclosed type bridge structure may be allowed by the Russian government, as stated in the guidelines.

(6) Deck equipment

Requirements related to anti-icing measures, anti-freezing

measures and de-icing measures are given for deck equipment such as handrails, gangways, and mooring equipment, referring to design records and rules and guidelines of other classification societies.

3.3 "Chapter 3 Machinery and electrical installations"

This chapter describes requirements related to machinery and electrical installations in ships navigating ice-covered seas, referring to IMO Guidelines, rules of the Russian government and technical guidelines of other ships.

(1) General

Main requirements related to machinery and electrical installations are described below.

(a) The normal practice is to install covers on various machinery and equipment as a measure against icing. However, if the cover is made of plastic material such as FRP, there is a possibility that the cover may be damaged when ice adhering to the cover is hammered to remove it. To avoid such situations, materials that are highly resistant to mechanical damage are specified for covers with a high probability of damage due to hammering to remove ice.

(b) Materials resistant to low temperatures are specified for machinery and equipment, even if a compartment has heating equipment. Low temperature may occur in such compartments because of a breakdown of the heating equipment.

(2) Machinery

(a) The guidelines state that the main propulsion machinery of a ship navigating the Arctic Ocean should be designed such that when damage occurs due to collision with ice, the damage to the system is limited only to those components of the main propulsion machinery which can be easily repaired or replaced.

(b) Stainless steel or high-strength bronze is specified as the material to be used in propeller blades in accordance with the rules of the Russian government and limited to ships navigating the Arctic Ocean.

(c) Deck equipment

Deck equipment with movable parts and hydraulic valves are to be provided with heating jackets as shown in Fig. 5 to prevent freezing and icing. Such heating jackets make it difficult for icing to occur; and moreover, even if icing does occur, it can be removed easily by hammering. Anti-freezing measures and anti-icing measures have been described referring to guidelines such as LR Guidelines and design records.

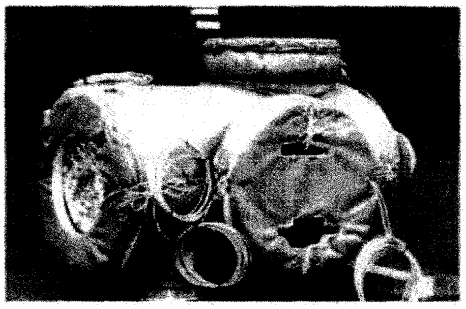

Figure 5 Heating jacket

3.4 "Chapter 4 Fire detection and extinguishing systems, escape measures, life-saving appliances and navigational equipment"

This chapter describes requirements related to fire detection and extinguishing systems, escape measures, life-saving appliances, and navigational equipment in ships navigating ice-covered seas.

In principle, all systems should be provided with appropriate measures such as anti-icing, freezing and de-icing measures so that these systems can be used normally in low temperature environments.

Group survival kits and personal survival kits including a whistle for notifying the location and protective gear for hands and feet are needed as life-saving appliances, depending on conditions such as route and period of navigation for ships navigating the Arctic Ocean, based on the IMO Guidelines.

3.5 "Chapter 5 Operation"

This Chapter describes the operating requirements for navigating the ice-covered seas in the Russian territorial waters referring mainly to the requirements of the Russian government and the IMO Guidelines.

The Master or Master's representative of the ship navigating the Arctic Ocean during a period when ice forms must have experience in navigating ice-covered seas, and must be capable of navigating the ship supported by icebreakers. If the said person does not have such experience, two pilots shall be provided to steer the ship in these waters.

If the navigation is to be supported by icebreakers, an application requesting icebreaker support shall be submitted in advance to an office of the Marine Operations Headquarters approved by the Russian government that has jurisdiction over the area in which the ship is to navigate. The requirements related to necessary procedures for requesting icebreaker support are described in "Chapter 6 Procedures for navigating ice-covered seas in Russian territorial waters."

Moreover, ships navigating ice-covered seas shall be provided with operating and training manuals for navigating ice-covered

seas for all ice navigators on board the ship. In addition to operating manuals for navigating normal routes, manuals for navigating ice-covered seas shall also be included. These requirements are based on the IMO Guidelines.

3.6 "Chapter 6 Procedures for navigating ice-covered seas in Russian territorial waters"

For ships intending to navigate Russian territorial waters, permission is required to be taken from the Russian government or an organization approved by the Russian government to navigate Russian territorial waters. An application for icebreaker support also needs to be made. This chapter gives information related to procedures required for navigating Russian territorial waters, referring to the requirements of the Russian government.

More specifically, procedures to obtain permission from the Administration of the Northern Sea Route (ANSR) are necessary for ships intending to navigate the Northern Sea Route. Procedures for applying to the Marine Operations Headquarters (these are private companies certified by the Russian government to control and support Northern Sea Route ships) are necessary for icebreaker support and for making requests for ice pilots. Sometimes there may be a recommendation to apply to the Central Marine Research and Design Institute (CNIIMF) for the issue of Ice Certificate certifying that the ship has a capability to navigate the Russian territorial waters. Except for the application to ANSR, similar procedures are necessary for ships intending to navigate the Sakhalin territorial waters.

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The flow of procedures navigating Russian territorial waters is shown in Fig. 6.

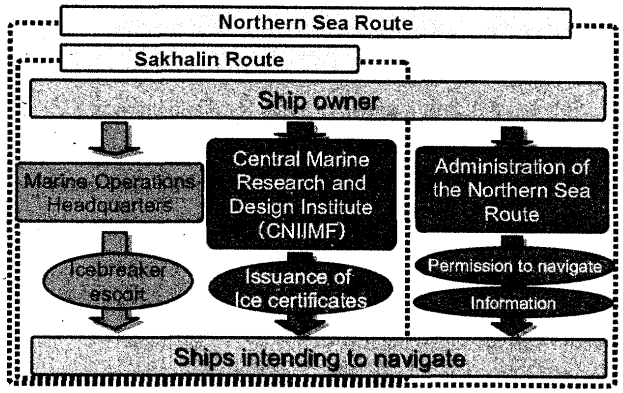

Figure 6 Procedures for navigating Russian territorial waters

3.7 "References"

The addresses of organizations such as the Administration of the Northern Sea Route and the Marine Operations Headquarters required for procedures for navigating Russian territorial waters and the relevant rules used as reference in the development of these guidelines are listed here for reference.

4. CONCLUSIONS

It would be our great pleasure if these guidelines could assist in the design and operation of ships intended to navigate the Russian territorial waters of the Arctic Ocean and the Sea of Okhotsk, especially Sakhalin.

These guidelines are intended mainly to give reference information on navigating Russian territorial waters. Readers should note that matters relating particularly to the Russian government must be finally confirmed from the Russian government and associated organizations.

Acknowledgements

The authors are grateful to ship owners, shipbuilders and personnel from universities for their cooperation in the preparation and review of these guidelines.

REFERENCES

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