



Rules for the Classification of Ships Operating in Polar Waters and Icebreakers

January 2021

**Rule Note
NR527 DT R04 E**

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GENERAL CONDITIONS

1. INDEPENDENCE OF THE SOCIETY AND APPLICABLE TERMS

- 1.1 The Society shall remain at all times an independent contractor and neither the Society nor any of its officers, employees, servants, agents or subcontractors shall be or act as an employee, servant or agent of any other party hereto in the performance of the Services.
- 1.2 The operations of the Society in providing its Services are exclusively conducted by way of random inspections and do not, in any circumstances, involve monitoring or exhaustive verification.
- 1.3 The Society acts as a services provider. This cannot be construed as an obligation bearing on the Society to obtain a result or as a warranty. The Society is not and may not be considered as an underwriter, broker in Unit's sale or chartering, expert in Unit's valuation, consulting engineer, controller, naval architect, designer, manufacturer, shipbuilder, repair or conversion yard, charterer or shipowner; none of them above listed being relieved of any of their expressed or implied obligations as a result of the interventions of the Society.
- 1.4 The Society only is qualified to apply and interpret its Rules.
- 1.5 The Client acknowledges the latest versions of the Conditions and of the applicable Rules applying to the Services' performance.
- 1.6 Unless an express written agreement is made between the Parties on the applicable Rules, the applicable Rules shall be the Rules applicable at the time of entering into the relevant contract for the performance of the Services.
- 1.7 The Services' performance is solely based on the Conditions. No other terms shall apply whether express or implied.

2. DEFINITIONS

- 2.1 "Certificate(s)" means classification or statutory certificates, attestations and reports following the Society's intervention.
- 2.2 "Certification" means the activity of certification in application of national and international regulations or standards, in particular by delegation from different governments that can result in the issuance of a Certificate.
- 2.3 "Classification" means the classification of a Unit that can result or not in the issuance of a classification Certificate with reference to the Rules. Classification is an appraisalment given by the Society to the Client, at a certain date, following surveys by its surveyors on the level of compliance of the Unit to the Society's Rules or to the documents of reference for the Services provided. They cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.
- 2.4 "Client" means the Party and/or its representative requesting the Services.
- 2.5 "Conditions" means the terms and conditions set out in the present document.
- 2.6 "Industry Practice" means international maritime and/or offshore industry practices.
- 2.7 "Intellectual Property" means all patents, rights to inventions, utility models, copyright and related rights, trade marks, logos, service marks, trade dress, business and domain names, rights in trade dress or get-up, rights in goodwill or to sue for passing off, unfair competition rights, rights in designs, rights in computer software, database rights, topography rights, moral rights, rights in confidential information (including know-how and trade secrets), methods and protocols for Services, and any other intellectual property rights, in each case whether capable of registration, registered or unregistered and including all applications for and renewals, reversions or extensions of such rights, and all similar or equivalent rights or forms of protection in any part of the world.
- 2.8 "Parties" means the Society and Client together.
- 2.9 "Party" means the Society or the Client.
- 2.10 "Register" means the public electronic register of ships updated regularly by the Society.
- 2.11 "Rules" means the Society's classification rules and other documents. The Society's Rules take into account at the date of their preparation the state of currently available and proven technical minimum requirements but are not a standard or a code of construction neither a guide for maintenance, a safety handbook or a guide of professional practices, all of which are assumed to be known in detail and carefully followed at all times by the Client.
- 2.12 "Services" means the services set out in clauses 2.2 and 2.3 but also other services related to Classification and Certification such as, but not limited to: ship and company safety management certification, ship and port security certification, maritime labour certification, training activities, all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board. The Services are carried out by the Society according to the applicable referential and to the Bureau Veritas' Code of Ethics. The Society shall perform the Services according to the applicable national and international standards and Industry Practice and always on the assumption that the Client is aware of such standards and Industry Practice.
- 2.13 "Society" means the classification society 'Bureau Veritas Marine & Offshore SAS', a company organized and existing under the laws of France, registered in Nanterre under number 821 131 844, or any other legal entity of Bureau Veritas Group as may be specified in the relevant contract, and whose main activities are Classification and Certification of ships or offshore units.
- 2.14 "Unit" means any ship or vessel or offshore unit or structure of any type or part of it or system whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.

3. SCOPE AND PERFORMANCE

- 3.1 Subject to the Services requested and always by reference to the Rules, the Society shall:
- review the construction arrangements of the Unit as shown on the documents provided by the Client;
 - conduct the Unit surveys at the place of the Unit construction;
 - class the Unit and enter the Unit's class in the Society's Register;
 - survey the Unit periodically in service to note whether the requirements for the maintenance of class are met.
- The Client shall inform the Society without delay of any circumstances which may cause any changes on the conducted surveys or Services.
- 3.2 The Society will not:
- declare the acceptance or commissioning of a Unit, nor its construction in conformity with its design, such activities remaining under the exclusive responsibility of the Unit's owner or builder;
 - engage in any work relating to the design, construction, production or repair checks, neither in the operation of the Unit or the Unit's trade, neither in any advisory services, and cannot be held liable on those accounts.

4. RESERVATION CLAUSE

- 4.1 The Client shall always: (i) maintain the Unit in good condition after surveys; (ii) present the Unit for surveys; and (iii) inform the Society in due time of any circumstances that may affect the given appraisalment of the Unit or cause to modify the scope of the Services.
- 4.2 Certificates are only valid if issued by the Society.
- 4.3 The Society has entire control over the Certificates issued and may at any time withdraw a Certificate at its entire discretion including, but not limited to, in the following situations: where the Client fails to comply in due time with instructions of the Society or where the Client fails to pay in accordance with clause 6.2 hereunder.
- 4.4 The Society may at times and at its sole discretion give an opinion on a design or any technical element that would 'in principle' be acceptable to the Society. This opinion shall not presume on the final issuance of any Certificate or on its content in the event of the actual issuance of a Certificate. This opinion shall only be an appraisal made by the Society which shall not be held liable for it.

5. ACCESS AND SAFETY

- 5.1 The Client shall give to the Society all access and information necessary for the efficient performance of the requested Services. The Client shall be the sole responsible for the conditions of presentation of the Unit for tests, trials and surveys and the conditions under which tests and trials are carried out. Any information, drawing, etc. required for the performance of the Services must be made available in due time.
- 5.2 The Client shall notify the Society of any relevant safety issue and shall take all necessary safety-related measures to ensure a safe work environment for the Society or any of its officers, employees, servants, agents or subcontractors and shall comply with all applicable safety regulations.

6. PAYMENT OF INVOICES

- 6.1 The provision of the Services by the Society, whether complete or not, involve, for the part carried out, the payment of fees thirty (30) days upon issuance of the invoice.

6.2 Without prejudice to any other rights hereunder, in case of Client's payment default, the Society shall be entitled to charge, in addition to the amount not properly paid, interests equal to twelve (12) months LIBOR plus two (2) per cent as of due date calculated on the number of days such payment is delinquent. The Society shall also have the right to withhold Certificates and other documents and/or to suspend or revoke the validity of Certificates.

- 6.3 In case of dispute on the invoice amount, the undisputed portion of the invoice shall be paid and an explanation on the dispute shall accompany payment so that action can be taken to solve the dispute.

7. LIABILITY

- 7.1 The Society bears no liability for consequential loss. For the purpose of this clause consequential loss shall include, without limitation:
- Indirect or consequential loss;
 - Any loss and/or deferral of production, loss of product, loss of use, loss of bargain, loss of revenue, loss of profit or anticipated profit, loss of business and business interruption, in each case whether direct or indirect.
- The Client shall defend, release, save, indemnify, defend and hold harmless the Society from the Client's own consequential loss regardless of cause.
- 7.2 Except in case of wilful misconduct of the Society, death or bodily injury caused by the Society's negligence and any other liability that could not be, by law, limited, the Society's maximum liability towards the Client is limited to one hundred and fifty per-cents (150%) of the price paid by the Client to the Society for the Services having caused the damage. This limit applies to any liability of whatsoever nature and howsoever arising, including fault by the Society, breach of contract, breach of warranty, tort, strict liability, breach of statute.
- 7.3 All claims shall be presented to the Society in writing within three (3) months of the completion of Services' performance or (if later) the date when the events which are relied on were first discovered by the Client. Any claim not so presented as defined above shall be deemed waived and absolutely time barred.

8. INDEMNITY CLAUSE

- 8.1 The Client shall defend, release, save, indemnify and hold harmless the Society from and against any and all claims, demands, lawsuits or actions for damages, including legal fees, for harm or loss to persons and/or property tangible, intangible or otherwise which may be brought against the Society, incidental to, arising out of or in connection with the performance of the Services (including for damages arising out of or in connection with opinions delivered according to clause 4.4 above) except for those claims caused solely and completely by the gross negligence of the Society, its officers, employees, servants, agents or subcontractors.

9. TERMINATION

- 9.1 The Parties shall have the right to terminate the Services (and the relevant contract) for convenience after giving the other Party thirty (30) days' written notice, and without prejudice to clause 6 above.
- 9.2 In such a case, the Classification granted to the concerned Unit and the previously issued Certificates shall remain valid until the date of effect of the termination notice issued, subject to compliance with clause 4.1 and 6 above.
- 9.3 In the event where, in the reasonable opinion of the Society, the Client is in breach, or is suspected to be in breach of clause 16 of the Conditions, the Society shall have the right to terminate the Services (and the relevant contracts associated) with immediate effect.

10. FORCE MAJEURE

- 10.1 Neither Party shall be responsible or liable for any failure to fulfil any term or provision of the Conditions if and to the extent that fulfilment has been delayed or temporarily prevented by a force majeure occurrence without the fault or negligence of the Party affected and which, by the exercise of reasonable diligence, the said Party is unable to provide against.
- 10.2 For the purpose of this clause, force majeure shall mean any circumstance not being within a Party's reasonable control including, but not limited to: acts of God, natural disasters, epidemics or pandemics, wars, terrorist attacks, riots, sabotages, impositions of sanctions, embargoes, nuclear, chemical or biological contaminations, laws or action taken by a government or public authority, quotas or prohibition, expropriations, destructions of the worksite, explosions, fires, accidents, any labour or trade disputes, strikes or lockouts.

11. CONFIDENTIALITY

- 11.1 The documents and data provided to or prepared by the Society in performing the Services, and the information made available to the Society, are treated as confidential except where the information:
- is properly and lawfully in the possession of the Society;
 - is already in possession of the public or has entered the public domain, otherwise than through a breach of this obligation;
 - is acquired or received independently from a third party that has the right to disseminate such information;
 - is required to be disclosed under applicable law or by a governmental order, decree, regulation or rule or by a stock exchange authority (provided that the receiving Party shall make all reasonable efforts to give prompt written notice to the disclosing Party prior to such disclosure).
- 11.2 The Parties shall use the confidential information exclusively within the framework of their activity underlying these Conditions.
- 11.3 Confidential information shall only be provided to third parties with the prior written consent of the other Party. However, such prior consent shall not be required when the Society provides the confidential information to a subsidiary.
- 11.4 Without prejudice to sub-clause 11.1, the Society shall have the right to disclose the confidential information if required to do so under regulations of the International Association of Classifications Societies (IACS) or any statutory obligations.

12. INTELLECTUAL PROPERTY

- 12.1 Each Party exclusively owns all rights to its Intellectual Property created before or after the commencement date of the Conditions and whether or not associated with any contract between the Parties.
- 12.2 The Intellectual Property developed by the Society for the performance of the Services including, but not limited to drawings, calculations, and reports shall remain the exclusive property of the Society.

13. ASSIGNMENT

- 13.1 The contract resulting from to these Conditions cannot be assigned or transferred by any means by a Party to any third party without the prior written consent of the other Party.
- 13.2 The Society shall however have the right to assign or transfer by any means the said contract to a subsidiary of the Bureau Veritas Group.

14. SEVERABILITY

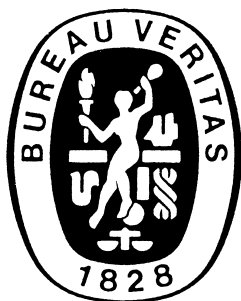
- 14.1 Invalidity of one or more provisions does not affect the remaining provisions.
- 14.2 Definitions herein take precedence over other definitions which may appear in other documents issued by the Society.
- 14.3 In case of doubt as to the interpretation of the Conditions, the English text shall prevail.

15. GOVERNING LAW AND DISPUTE RESOLUTION

- 15.1 These Conditions shall be construed and governed by the laws of England and Wales.
- 15.2 The Parties shall make every effort to settle any dispute amicably and in good faith by way of negotiation within thirty (30) days from the date of receipt by either one of the Parties of a written notice of such a dispute.
- 15.3 Failing that, the dispute shall finally be settled under the Rules of Arbitration of the Maritime Arbitration Chamber of Paris ("CAMP"), which rules are deemed to be incorporated by reference into this clause. The number of arbitrators shall be three (3). The place of arbitration shall be Paris (France). The Parties agree to keep the arbitration proceedings confidential.

16. PROFESSIONAL ETHICS

- 16.1 Each Party shall conduct all activities in compliance with all laws, statutes, rules, economic and trade sanctions (including but not limited to UN sanctions and EU sanctions) and regulations applicable to such Party including but not limited to: child labour, forced labour, collective bargaining, discrimination, abuse, working hours and minimum wages, anti-bribery, anti-corruption, copyright and trademark protection, personal data protection (<https://personal.dataprotection.bureauveritas.com/privacypolicy>).
- Each of the Parties warrants that neither it, nor its affiliates, has made or will make, with respect to the matters provided for hereunder, any offer, payment, gift or authorization of the payment of any money, directly or indirectly, to or for the use or benefit of any official or employee of the government, political party, official or candidate.
- 16.2 In addition, the Client shall act consistently with the Bureau Veritas' Code of Ethics. <https://group.bureauveritas.com/group/corporate-social-responsibility>



RULE NOTE NR 527

NR 527

Rules for the Classification of Ships Operating in Polar Waters and Icebreakers

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SECTION 3	MACHINERY REQUIREMENTS FOR POLAR CLASS AND ICEBREAKER SHIPS
SECTION 4	SHIPS OPERATING IN POLAR WATERS (POLAR CAT)
APPENDIX 1	POLAR WATER OPERATIONAL MANUAL (PWOM)

January 2021

Unless otherwise specified, these rules apply to ships for which contracts are signed after January, 1st 2021. The Society may refer to the contents hereof before January, 1st 2021, as and when deemed necessary or appropriate.

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SECTION 1

GENERAL

1 General

1.1 Application

1.1.1 This Rule Note applies to ships constructed of steel and intended for navigation in ice-infested polar waters, including icebreakers. This Rule Note gives the requirements for the assignment of:

- one of the additional class notations **POLAR CLASS**
- one of the service notations **Icebreaker**
- one of the additional service features **POLAR CAT**.

The requirements of this Rule Note apply in addition to the applicable requirements of NR467 Rules for the Classification of Steel Ships (hereinafter referred to as the Rules for Steel Ships).

1.1.2 Selection of an additional class notation **POLAR CLASS** or a service notation **Icebreaker**

It is the responsibility of the Owner to select an appropriate additional class notation **POLAR CLASS** or an appropriate service notation **Icebreaker**. The ice descriptions given in Tab 2 and Tab 3 are intended to guide Owners, Designers

and Administrations in selecting an appropriate additional class notation **POLAR CLASS** or an appropriate service notation **Icebreaker** to match the requirements for the ships with its intended voyages or services.

Note 1: Complementary information may be found in NI543 Ice Reinforcement Selection in Different World Navigation Areas concerning the choice of the appropriate notation in function of the area of navigation and the period of the year.

1.1.3 Selection of an additional service feature **POLAR CAT**

For ships intended for navigation in polar waters and subject to the provisions as defined in SOLAS Chapter XIV, one of the following additional service features, as defined in [4], is to be assigned and selected according to the ship categories of the IMO International Code for Ships Operating in Polar Waters (Polar Code):

- **POLAR CAT-A** for category A ship
- **POLAR CAT-B** for category B ship
- **POLAR CAT-C** for category C ship.

Figure 1 : Antarctic area

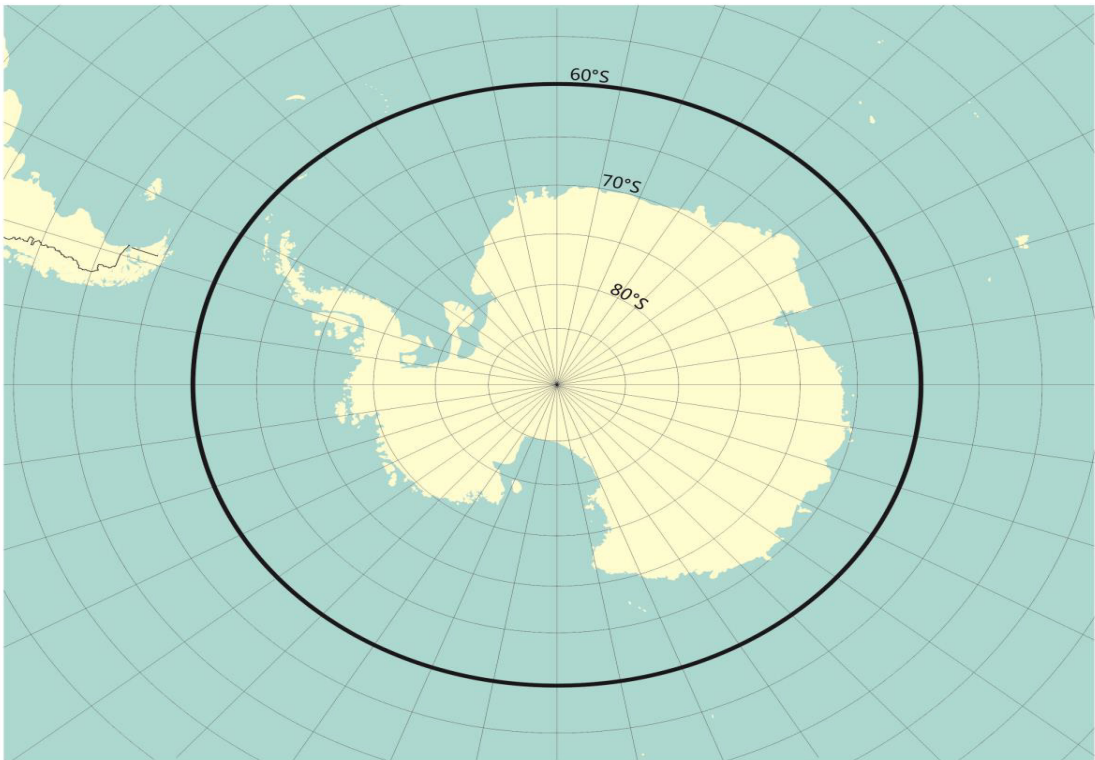


Figure 2 : Arctic waters



Polar waters means Arctic waters and/or the Antarctic area. Fig 1 and Fig 2 are given for illustrative purposes only.

Antarctic area means the sea area south of latitude 60° S.

Arctic waters means those waters which are located

- a) north of a line from the latitude 58°00'.0 N and longitude 042°00'.0 W
- b) to latitude 64°37'.0 N, longitude 039°27'.0 W
- c) and thence by a rhumb line to latitude 67°03'.9 N, longitude 026°33'.4 W
- d) and thence by a rhumb line to the latitude 70°49'.56 N and longitude 008°59'.61 W (Sørkapp, Jan Mayen)
- e) and by the southern shore of Jan Mayen to 73°31'.6 N and 019°01'.0 E by the Island of Bjørnøya,
- f) and thence by a great circle line to the latitude 68°38'.29 N and longitude 043°23'.08 E (Cap Kanin Nos)
- g) and hence by the northern shore of the Asian Continent eastward to the Bering Strait
- h) and thence from the Bering Strait westward to latitude 60° N as far as Il'pyrskiy
- i) and following the 60th North parallel eastward as far as and including Etolin Strait
- j) and thence by the northern shore of the North American continent as far south as latitude 60° N

- k) and thence eastward along parallel of latitude 60° N, to longitude 056°37'.1 W
- l) and thence to the latitude 58°00'.0 N, longitude 042°00'.0 W.

1.1.4 Definition of Icebreaker

“Icebreaker” refers to any ship having an operational profile that includes escort or ice management functions, having powering and dimensions that allow it to undertake aggressive operations in ice-covered waters.

1.1.5 According to the notation, the functions of the ship and its equipment, the following Sections apply:

- Sec 2: structural requirements for additional class notations **POLAR CLASS** and service notations **Icebreaker**
- Sec 3: machinery requirements for additional class notations **POLAR CLASS** and service notations **Icebreaker**
- Sec 4: requirements for additional service features **POLAR CAT.**

1.1.6 Restrictions

If hull and machinery are constructed such as to comply with the requirements of different additional class notations **POLAR CLASS**, then both the hull and the machinery are to be assigned the lower of these additional class notations in the Certificate of Classification. Compliance of hull or machinery with the requirements of a higher additional class notation **POLAR CLASS** is also to be indicated in the Annex to the Certificate of Classification.

The same principle applies to ships having a service notation **Icebreaker**.

1.2 Additional requirement

1.2.1 Ships with additional class notation POLAR CLASS or service notation Icebreaker

Ships complying with the requirements of this Rule Note in order to be assigned one of the additional class notations **POLAR CLASS** or one of the service notations **Icebreaker** are also to comply with the requirements for the assignment of the additional class notation **COLD (H t_{DH}, E t_{DE})** (see Pt E, Ch 10, Sec 11 of the Rules for Steel Ships).

Note 1: Ships with the additional class notation **POLAR CLASS 6** or **POLAR CLASS 7** and not intended to operate in low air temperature may be exempted of the additional class notation **COLD (H t_{DH}, E t_{DE})**.

1.2.2 Ships with additional service feature POLAR CAT

Ships complying with the requirements of this Rule Note in order to be assigned one of the additional service feature **POLAR CAT** and intended to operate in low air temperature, as defined in Sec 4, [1.2.1], are also to comply with the requirements for the assignment of the additional class notation **COLD (H t_{DH}, E t_{DE})**, where the temperatures t_{DH} and t_{DE} are as defined in Sec 4, [1.2.4]. The requirements for the additional class notation **COLD (H t_{DH}, E t_{DE})** are given in Pt E, Ch 10, Sec 11 of the Rules for Steel Ships.

1.3 Ice waterlines

1.3.1 Upper ice waterline

The upper ice waterline (UIWL) is defined by the maximum draughts fore, amidships and aft, in ice navigation.

1.3.2 Lower ice waterline

The lower ice waterline (LIWL) is defined by the minimum draughts fore, amidships and aft, in ice navigation.

The lower ice waterline is to be determined with due regard to the ship's ice-going capability in the ballast loading conditions. The propeller is to be fully submerged at the lower ice waterline.

1.3.3 Information to be submitted

UIWL and LIWL upon which the design of the ship is based are to be specified by the Designer in the plans submitted for approval to the Society and are to be stated on the Certificate of Classification.

1.4 Bow form

1.4.1 Bows with vertical sides and bulbous bows are to be avoided for ships having one of the additional class notations **POLAR CLASS 1** to **POLAR CLASS 5**.

For ships having the additional class notation **POLAR CLASS 6** or **POLAR CLASS 7** and a bow with vertical sides or a bulbous bow, the operational limitations are to be explicitly stated on the Certificate of Classification (e.g. restricted from intentional ramming).

1.5 Shallow water

1.5.1 Shallow water may be considered as less than 2 metres keel clearance.

1.6 Output of propulsion machinery

1.6.1 Scope

The minimum engine output requirement given in [1.6.2] is only applicable to ships having one of the service notations **Icebreaker**.

1.6.2 Minimum propulsion machinery output

The design engine output, which is the maximum output the propulsion machinery can continuously deliver to the propeller, is not to be less than the value given in Tab 1 for the corresponding service notation.

Table 1 : Minimum engine output

Service notation	Minimum engine output (kW)
Icebreaker 1	44000
Icebreaker 2	22000
Icebreaker 3	11000
Icebreaker 4	6000
Icebreaker 5 Icebreaker 6 Icebreaker 7	no minimum engine output

Note 1: For ships having the propulsion power determined by model tests or by full scale measurements, lower values of minimum engine output may be accepted, on a case-by-case basis.

2 Additional class notations POLAR CLASS

2.1 Scope

2.1.1 Ships having one of the additional class notations **POLAR CLASS** are to have the hull form and the propulsion power such that the ship can operate independently at continuous speed in the representative ice conditions described in Tab 2.

For ships not designed to operate independently in ice, such operational intent or limitations are to be explicitly stated on the Certificate of Classification.

Ramming is to be avoided for ships with one of the additional class notations **POLAR CLASS**.

3 Service notations Icebreaker

3.1 Scope

3.1.1 Ships having one of the service notations **Icebreaker** are intended to sail without icebreaker assistance up to the continuous ice conditions described in Tab 2.

Ships with one of the service notations **Icebreaker 1** to **Icebreaker 4** can perform unlimited ramming.

Ships with one of the service notations **Icebreaker 5** to **Icebreaker 7** can exceptionally perform ramming but this is not to be repeated if the ice does not fail at the first attempt.

4 Additional service features POLAR CAT

4.1 Scope

4.1.1 The additional service features **POLAR CAT** are defined as follows:

- **POLAR CAT-A** is assigned to ships designed for operation in polar waters in at least medium first-year ice, which may include old ice inclusions

- **POLAR CAT-B** is assigned to ships designed for operation in polar waters in at least thin first-year ice, which may include old ice inclusions, but in ice conditions less severe than for **POLAR CAT-A**
- **POLAR CAT-C** is assigned to ships designed to operate in open water or ice conditions less severe than those included in **POLAR CAT-A** or **POLAR CAT-B**.

4.1.2 The allowed additional service features **POLAR CAT** are given in Tab 3 with respect to the ice classes or the service notations **Icebreaker** assigned to the ships.

Table 2 : POLAR CLASS and Icebreaker description

POLAR CLASS or Icebreaker	Operations	Ice description (1)	Typical range of ice thickness (m) (2)
1	year-round	all polar waters	3,0 - 4,0
2	year-round	moderate multi-year ice	2,5 - 3,0
3	year-round	second-year ice which may include multi-year ice inclusions	2,0 - 2,5
4	year-round	thick first-year ice which may include old ice inclusions	1,5 - 2,0
5	year-round	medium first-year ice which may include old ice inclusions	1,0 - 1,5
6	summer/ autumn	medium first-year ice which may include old ice inclusions	0,7 - 1,0
7	summer/ autumn	thin first-year ice which may include old ice inclusions	0,5 - 0,7
(1) Based on World Meteorological Organization (WMO) Sea Ice Nomenclature			
(2) For POLAR CLASS assuming independent operation in ice concentration (portion of sea covered by the ice, expressed in tenths) of less than 6/10 and for Icebreaker assuming independent operation in ice concentration of more than 6/10.			

Table 3 : Additional service features POLAR CAT

Ice class or service notation	POLAR CAT-A	POLAR CAT-B	POLAR CAT-C
POLAR CLASS 1, POLAR CLASS 2, POLAR CLASS 3, POLAR CLASS 4, POLAR CLASS 5 Icebreaker 1, Icebreaker 2, Icebreaker 3, Icebreaker 4, Icebreaker 5	X	–	–
POLAR CLASS 6, POLAR CLASS 7 Icebreaker 6, Icebreaker 7	–	X	–
Other or none	–	–	X
Note 1: X : Allowed – : Not allowed.			

SECTION 2

STRUCTURAL REQUIREMENTS FOR POLAR CLASS
AND ICEBREAKER SHIPS

Symbols

L_{ui}	: Rule length, in m, measured horizontally from the fore side of the stem at the intersection with the upper ice waterline (UIWL) to the after side of the rudder post, or the centre of the rudder stock if there is no rudder post. L_{ui} is not to be less than 96%, and need not be greater than 97%, of the extreme length of the upper ice waterline (UIWL) measured horizontally from the fore side of the stem. In ships with unusual stern and bow arrangement the length L_{ui} will be specially considered.	E	: Young's modulus, in N/mm ² , to be taken equal to: • $E = 2,06 \cdot 10^5$ N/mm² for steels in general • $E = 1,95 \cdot 10^5$ N/mm² for stainless steels • $E = 7,00 \cdot 10^4$ N/mm² for aluminium alloys
FE_{ui}	: Fore end, perpendicular to the upper ice waterline (UIWL) at the forward side of the stem	F_{Bow}	: Total glancing impact force in the bow area, in kN, defined in [4.3.5]
AE_{ui}	: Aft end, perpendicular to the upper ice waterline (UIWL) at a distance L_{ui} aft of the fore end	F_{NonBow}	: Total glancing impact force in hull areas other than the bow area, in kN, defined in [4.4.1]
B_{ui}	: Ship moulded breadth, in m, at the upper ice waterline (UIWL)	h_w	: Web height, in mm, of a stiffener (see Fig 9)
Δ_{ui}	: Ship displacement at the upper ice waterline (UIWL), in t. Where multiple waterlines are used for determining the UIWL, the displacement is to be determined from the waterline corresponding to the greatest displacement	ℓ	: Span, in m, of ordinary stiffeners
x	: Distance, in m, from the aft end (AE_{ui}) to the section under consideration	$M_{SW,S}$	: Design still water bending moment, in kN.m, in sagging condition, defined in Pt B, Ch 5, Sec 2, [2.2] of the Rules for Steel Ships. When the ship is always in hogging, $M_{SW,S}$ is to be taken equal to the minimum hogging condition.
x_i	: Distance, in m, from the aft end (AE_{ui}) to the mid-length position of each sub-region of bow area	p_{avg}	: Design ice load average pressure, in kN/m ² , defined in [4.5.1]
b	: b_{Bow} or b_{NonBow} , in m, as appropriate for the area under consideration	p_{Bow}	: Total glancing impact pressure in the bow area, in kN/m ² , defined in [4.3.7]
b_{Bow}	: Height of the design load patch, in m, in the bow area, defined in [4.3.8]	q_{Bow}	: Total glancing impact line load in the bow area, in kN/m, defined in [4.3.6]
b_{NonBow}	: Height of the design load patch, in m, in hull areas other than the bow area, defined in [4.4.4]	q_{NonBow}	: Total glancing impact line load in hull areas other than the bow area, in kN/m, defined in [4.4.3]
b_f	: Flange width, in mm, of a stiffener (see Fig 9)	Q_{SW}	: Design still water shear force, in kN, defined in Pt B, Ch 5, Sec 2, [2.3] of the Rules for Steel Ships
C_{AF}	: Hull area factor, defined in [4.6.1]	R_{eH}	: Minimum yield stress of the material, in N/mm ²
C_{ARi}	: Load patch aspect ratio, defined in [4.3.4]	R_m	: Ultimate minimum tensile strength of the material, in N/mm ² , defined in Pt B, Ch 4, Sec 1, [2.1.1] of the Rules for Steel Ships
C_C	: Crushing failure class factor, defined in [4.2.1]	s	: Spacing, in m, of ordinary stiffeners
C_D	: Load patch dimensions class factor, defined in [4.2.1]	t_C	: Corrosion/abrasion addition, in mm, defined in [3.1]
C_i	: Shape coefficient, defined in [4.3.3]	t_f	: Net flange thickness, in mm, of a stiffener (see Fig 9)
C_F	: Flexural failure class factor, defined in [4.2.1]	t_{net}	: Net plate thickness required to resist ice loads, in mm, defined in [6.2]
C_L	: Longitudinal strength class factor, defined in [4.2.1]	t_p	: Net thickness, in mm, of attached plating of a stiffener (see Fig 9)
C_A	: Displacement class factor, defined in [4.2.1]	t_w	: Net web thickness, in mm, of a stiffener (see Fig 9)
C_{PP}, C_{PM}, C_{PS}	: Peak pressure factors, defined in [4.5.2]	w	: w_{Bow} or w_{NonBow} , in m, as appropriate for the area under consideration
		w_{Bow}	: Width of the design load patch, in m, in the bow area, defined in [4.3.8]

- w_{NonBow}

:

Width of the design load patch, in m, in hull areas other than the bow area, defined in [4.4.4]
- α

:

Upper ice waterline angle, in degree (see Fig 4)
- γ

:

Buttock angle at the upper ice waterline (angle of buttock line measured from horizontal), in degree (see Fig 4)
- β

:

Frame angle, in degree, when the value is unknown, the frame angle may be defined by:
 $\tan \beta = \tan \alpha / \tan \gamma$ (see Fig 4)
- θ

:

Normal frame angle at the upper ice waterline, in m, defined by:
 $\tan \theta = \tan \beta \cdot \cos \alpha$ (see Fig 4).

1 General

1.1 Hull areas

1.1.1 The hull of all ships having an additional class notation **POLAR CLASS** or a service notation **Icebreaker** is divided into areas reflecting the magnitude of the loads that are expected to act upon them.

In the longitudinal direction, there are four regions:

- Bow (B)
- Bow Intermediate (BI)
- Midbody (M)
- Stern (S).

The Bow Intermediate, Midbody and Stern regions are further divided in the vertical direction into:

- Bottom (b)
- Lower (ℓ)
- Icebelt regions (i).

The extent of each hull area is indicated in Fig 1 for **POLAR CLASS** ships, and in Fig 2 for **Icebreaker** ships, where h_i , measured at aft end of Bow region, in m, is given in Tab 1.

1.1.2 The upper ice waterline (UIWL) and the lower ice waterline (LIWL) are defined in Sec 1, [1.3].

Table 1 : Value of h_i for hull area extents

POLAR CLASS or Icebreaker	h_i , in m
1 to 4	1,5
5 to 7	1,0

1.1.3 The boundary between the Bow and Bow Intermediate regions is to be located:

- afterward of the intersection point of the line of the stem and the ship baseline, and
- forward of 0,45 L_{ui} aft of the fore end (FE_{ui}).

1.1.4 The boundary between the bottom and lower regions is to be taken at the point where the shell is inclined 7° from the horizontal plan in any direction, including transversally and longitudinally.

1.1.5 If a ship is intended to operate astern in ice infested polar waters, the aft section of the ship is to be designed using the Bow and Bow Intermediate hull area requirements for the glancing impact scenario only (i.e. excluding the ramming impact scenario).

1.1.6 For ships having one of the service notations **Icebreaker**, the forward boundary of the stern region is to be at least 0,04 L_{ui} forward of the section where the parallel ship side at the upper ice waterline (UIWL) ends.

1.2 Hull shape

1.2.1 For ships having one of the additional class notations **POLAR CLASS** or one of the service notations **Icebreaker**, the maximum values of the angles γ_{stem} and α_{bow} for the bow form (see Fig 3 with B_{ui} evaluated at the midship section) are given as a guidance in Tab 2.

1.2.2 In addition, for ships having one of the service notations **Icebreaker 1** to **Icebreaker 4**, the minimum values of normal frame angle θ (see Fig 4) to be fitted around the whole hull at the upper ice waterline (UIWL) are given as a guidance in Tab 3.

2 Materials and welding

2.1 Material classes and grades

2.1.1 The material grade for hull structure is to be not less than those given in Tab 4 and Tab 5, based on the as-built thickness of the material, the assigned additional class notation **POLAR CLASS** or service notation **Icebreaker**, and the material classes of structural members given in Tab 6.

2.1.2 Material classes specified in Pt B, Ch 4, Sec 1, Tab 3 of the Rules for Steel Ships are applicable to ships having one of the additional class notations **POLAR CLASS** or one of the services notations **Icebreaker**, regardless of the ship length.

In addition, material classes for weather and sea exposed structural members and for members attached to the weather and sea exposed shell plating are given in Tab 6.

Where the material classes in Tab 6 and those in Pt B, Ch 4, Sec 1, Tab 3 of the Rules for Steel Ships differ, the higher material class is to be applied.

2.1.3 Material grades for all plating and attached framing of hull structures and appendages situated below the level of 0,3 m below the lower ice waterline (LIWL), as shown in Fig 5, are to be obtained from Tab 4, based on the material classes for structural members in Tab 6, regardless of the additional class notation **POLAR CLASS** or service notation **Icebreaker** assigned.

Figure 1 : Hull area extents for POLAR CLASS ships

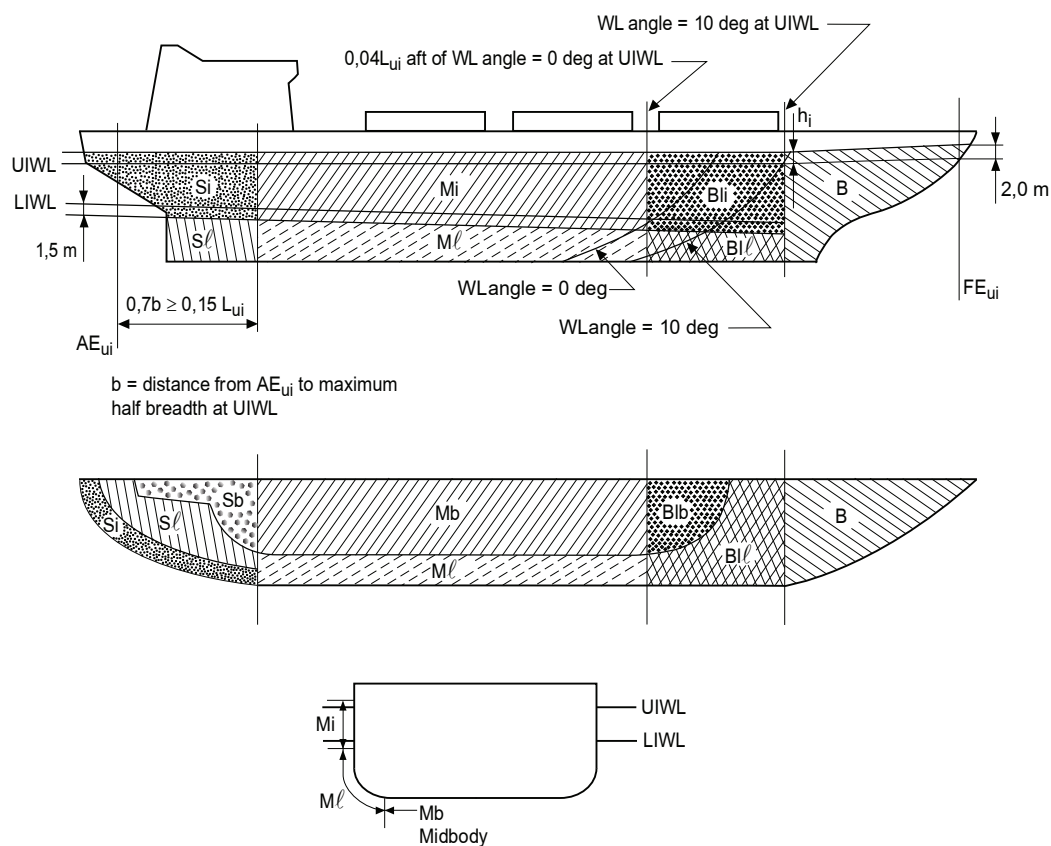


Figure 2 : Hull area extents for Icebreaker ships

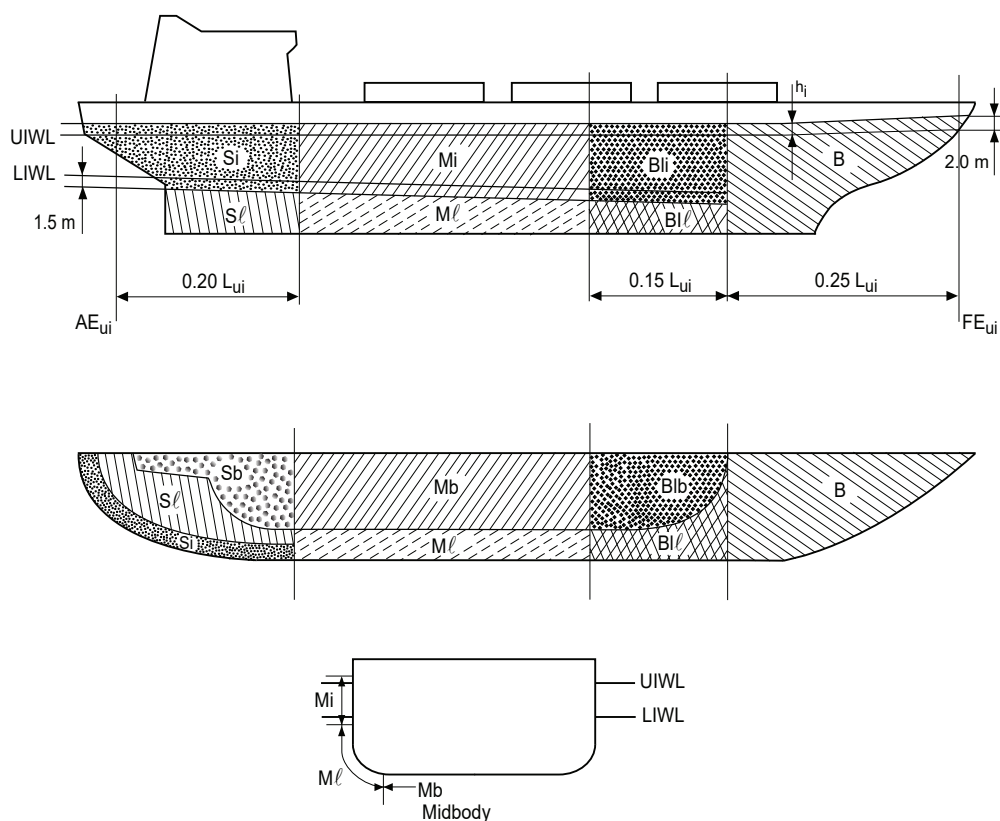


Table 2 : Maximum value of angles γ_{stem} and α_{bow} for the bow form

POLAR CLASS or Icebreaker	1	2	3	4	5	6	7
Buttock angle at the stem γ_{stem} , in degree	25	25	30	30	45	60	70
Waterline angle at the bow α_{bow} , in degree	30	30	30	30	40	40	40

Figure 3 : Definition of angles γ_{stem} and α_{bow}

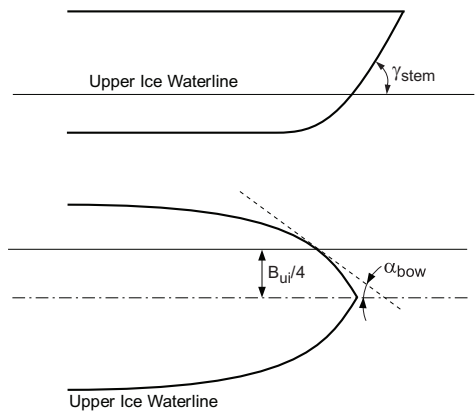


Figure 4 : Definition of hull angles

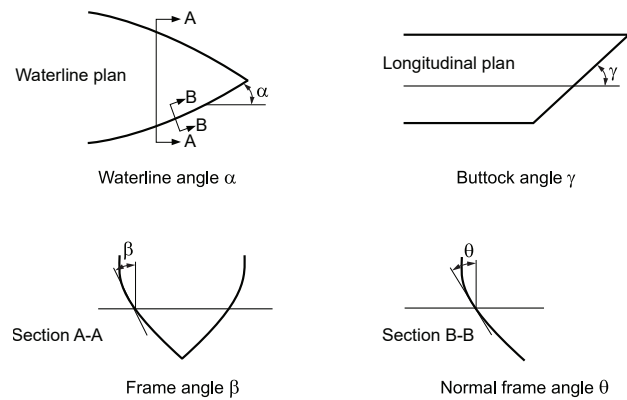


Table 3 : Minimum value of normal frame angle θ at UIWL

Icebreaker 1 to Icebreaker 4	Position on the hull (x/L_{ui})					
	< 0,2	0,2 - 0,4	0,4 - 0,6	0,6 - 0,75	0,75 - 0,9	0,9 - 1,0
Normal frame angle θ , in degree	30	25	15	25	30	40

Table 4 : Material grade requirements for classes I, II and III

As-built thickness t , in mm	Material class I		Material class II		Material class III	
	NSS	HSS	NSS	HSS	NSS	HSS
$t \leq 15$	A	AH	A	AH	A	AH
$15 < t \leq 20$	A	AH	A	AH	B	AH
$20 < t \leq 25$	A	AH	B	AH	D	DH
$25 < t \leq 30$	A	AH	D	DH	D	DH
$30 < t \leq 35$	B	AH	D	DH	E	EH
$35 < t \leq 40$	B	AH	D	DH	E	EH
$40 < t \leq 50$	D	DH	E	EH	E	EH
$50 < t \leq 60$	D	DH	E	EH	F	FH
$60 < t \leq 80$	E	EH	F	FH	F	FH
$80 < t \leq 100$	F	FH	F	FH	F	FH

Note 1: “NSS” and “HSS” mean, respectively: “Normal Strength Steel” and “Higher Strength Steel”.