INTERNATIONAL MARITIME ORGANIZATION

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UNIFIED INTERPRETATION TO PROVISIONS OF IMO SAFETY, SECURITY, AND ENVIRONMENT-RELATED CONVENTIONS

Proposal for a unified interpretation relating to the ice accretion and the intact and damage stability under the Polar Code

Submitted by IACS

SUMMARY

Executive summary:	This document proposes a unified interpretation to clarify the requirements in the Polar Code for the ice accretion and its application for the intact and damage stability calculations
Strategic direction, if applicable:	6
Output:	6.1
Action to be taken:	Paragraph 14
Related documents:	None

Background

1 Regulations 4.3.1 and 4.3.2 of part I-A of the Polar Code address stability in the intact and damage conditions.

2 Ships, which have to comply with the probabilistic damage stability under SOLAS ("SOLAS damage"), do so by assuming three draughts and associated vertical centres of gravity (VCGs). The calculations are performed and a limiting GM (or VCG) curve is generated. All conditions, which are contained in the approved stability manual, are then checked against the limiting curve to ensure compliance. Equally, if the master of the ship loads the ship in a condition which is not in the stability manual, the master should check that the calculation results are on the safe side of the limiting curve.

3 If a ship has an ice class notation, then there should be at least one departure/arrival condition which includes the ice accretion in the stability book. Therefore, this condition is also to be checked against the SOLAS damage stability curve.

4 The Polar Code has two requirements: the ice accretion is considered for the intact stability (regulation 4.3.1 of part 1-A of the Polar Code) and calculated for the additional damage stability ("POLAR damage") (regulation 4.3.2 of part 1-A of the Polar Code).

5 For ships which have to meet the SOLAS probabilistic damage stability requirements, the method of calculating POLAR damage stability is carried out by applying additional damage cases to the three SOLAS initial loading conditions defined, using draught and VCG/GM. The ship has to remain afloat after the damage (s_i=1 for all conditions used to calculate the attained index A) for the damage compliance. As a consequence of carrying out the POLAR damage stability assessment, it is possible that the limiting curve created from the SOLAS probabilistic damage stability assessment might change, thus creating a combined SOLAS/POLAR limiting curve.

6 If the damage stability from other instruments (deterministic-based damage, such as in MARPOL or the IGC and IBC Codes, etc.) is applicable, then the ship has to comply with the residual stability requirements from the appropriate instrument with extents of the damage applied as defined under the Polar Code for each loading condition of the ship.

Discussion

7 As a result of IACS members work on behalf of a number of flag Administrations, a number of questions have arisen:

.1 Do the intact loading conditions with the ice accretion (as required by the Polar Code) have to meet the combined SOLAS/POLAR limiting curve or only a limiting curve generated from the intact stability requirements?

.2 For ships where probabilistic damage is calculated, should the three initial loading conditions used to calculate the POLAR limiting curve include ice accretion, or only some of them (e.g. deepest load draft), or none of these?

.3 For ships which have to comply with other IMO instruments (i.e. those that do not require probabilistic damage stability calculations), does the ice accretion have to be taken into account when calculating the damage stability?

.4 How should damage cases, which are formed when the vertical extent is adjacent to the baseline, be dealt with? That is, the transverse extent of the hull surface (offset by 760 mm, measured normal to the hull) means that for some ship arrangements it is possible to generate damages going to the centreline. This question is posed on the proviso that the vertical damage extent is only allowed to be placed in a vertical location and not in a tangential direction to the hull surface.

8 In an attempt to address these issues, IACS has drafted a unified interpretation as contained in the annex.

9 While developing the draft unified interpretation, IACS considered that the choice of GM for calculating the probabilistic stability was that of designers. The maximum draft, which any ship can sail at, is the one corresponding to the minimum-assigned freeboard. The minimum freeboard should be maintained, even with the ice accretion.

10 It was also understood that any actual load conditions should fall on the safe side of any limiting curve created from the probabilistic or intact stability calculations.

11 Further, IACS understands that IMO has a general policy of not considering two incidents at the same time and thus it could be argued that the ice accretion and the ice damage would not occur simultaneously. However, it was also noted that in order to increase the safety of ships operating in the polar regions, the requirements of the Polar Code were developed to supplement existing IMO instruments.

12 Therefore, IACS considered that the ice accretion should be considered when calculating deterministic damage stability (e.g. MARPOL, the IGC Code, etc.), with the exception of that required by the International Convention on Load Lines, which is based on a theoretical condition and not on the actual condition.

13 IACS discussed the extent of damage assumed in the Polar Code and concluded that although the centreline should not be crossed in the mid-ship region where there was a lot of shape (e.g. at the bow), it was possible that the damage extent would cross the centreline. The draft unified interpretation contains diagrams to illustrate this point.

Action requested of the Sub-Committee

14 The Sub-Committee is invited to consider the information provided, specifically the discussion in paragraphs 7 to 13 and the draft unified interpretation in the annex, and take action, as appropriate.

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ANNEX

DRAFT UNIFIED INTERPRETATION ON THE ICE ACCRETION AND THE INTACT AND DAMAGE STABILITY

Interpretation of regulations 4.3.1 and 4.3.2 of part 1-A of the Polar Code – consideration of the ice accretion in the intact and damage stability calculations

Regulations 4.3.1 and 4.3.2 of part I-A of the Polar Code read as follows:

"4.3.1 Stability in intact conditions

4.3.1.1 In order to comply with the functional requirement of paragraph 4.2.1, for ships operating in areas and during periods where ice accretion is likely to occur, the following icing allowance shall be made in the stability calculations:

.1 30 kg/m^2 on exposed weather decks and gangways;

.2 7.5 kg/m^2 for the projected lateral area of each side of the ship above the water plane; and

.3 the projected lateral area of discontinuous surfaces of rail, sundry booms, spars (except masts) and rigging of ships having no sails and the projected lateral area of other small objects shall be computed by increasing the total projected area of continuous surfaces by 5% and the static moments of this area by 10%.

4.3.1.2 Ships operating in areas and during periods where ice accretion is likely to occur shall be:

.1 designed to minimize the accretion of ice; and

.2 equipped with such means for removing ice as the Administration may require; for example, electrical and pneumatic devices, and/or special tools such as axes or wooden clubs for removing ice from bulwarks, rails and erections.

4.3.1.3 Information on the icing allowance included in the stability calculations shall be given in the PWOM.

4.3.1.4 Ice accretion shall be monitored and appropriate measures taken to ensure that the ice accretion does not exceed the values given in the PWOM."

and

"4.3.2 Stability in damaged conditions

4.3.2.1 In order to comply with the functional requirements of paragraph 4.2.2, ships of categories A and B, constructed on or after 1 January 2017, shall be able to withstand flooding resulting from hull penetration due to ice impact. The residual stability following ice damage shall be such that the factor s_i, as defined in SOLAS regulations II-1/7-2.2 and II-1/7-2.3, is equal to one for all loading conditions used to calculate the attained subdivision index in SOLAS regulation II-1/7. However, for cargo ships that comply with subdivision and damage stability regulations in another instrument developed by the Organization, as provided by SOLAS regulation II-1/4.1, the residual stability criteria of that instrument shall be met for each loading condition.

4.3.2.2 The ice damage extents to be assumed when demonstrating compliance with paragraph 4.3.2.1 shall be such that:

.1 the longitudinal extent is 4.5% of the upper ice waterline length if centred forward of the maximum breadth on the upper ice waterline, and 1.5% of upper ice waterline length otherwise, and shall be assumed at any longitudinal position along the ship's length;

.2 the transverse penetration extent is 760 mm, measured normal to the shell over the full extent of the damage; and

.3 the vertical extent is the lesser of 20% of the upper ice waterline draught or the longitudinal extent, and shall be assumed at any vertical position between the keel and 120% of the upper ice waterline draught."

Interpretations

Interpretation 1

The loading conditions, including the ice accretion, should meet both, the intact and damage stability requirements, i.e. the combined SOLAS/POLAR limiting curve.

Interpretation 2

The choice of GM to calculate the SOLAS probabilistic damage should rest with the designer. The chosen GM need not include the ice accretion.

The maximum draught used (ds) should be that corresponding to the full load condition. A ship should not exceed the maximum load line draught, even with the ice accretion.

The deepest draught and the light service draught taken for the Polar Code damage stability calculation should correspond with the permissible draught range assigned for the polar operation.

Interpretation 3

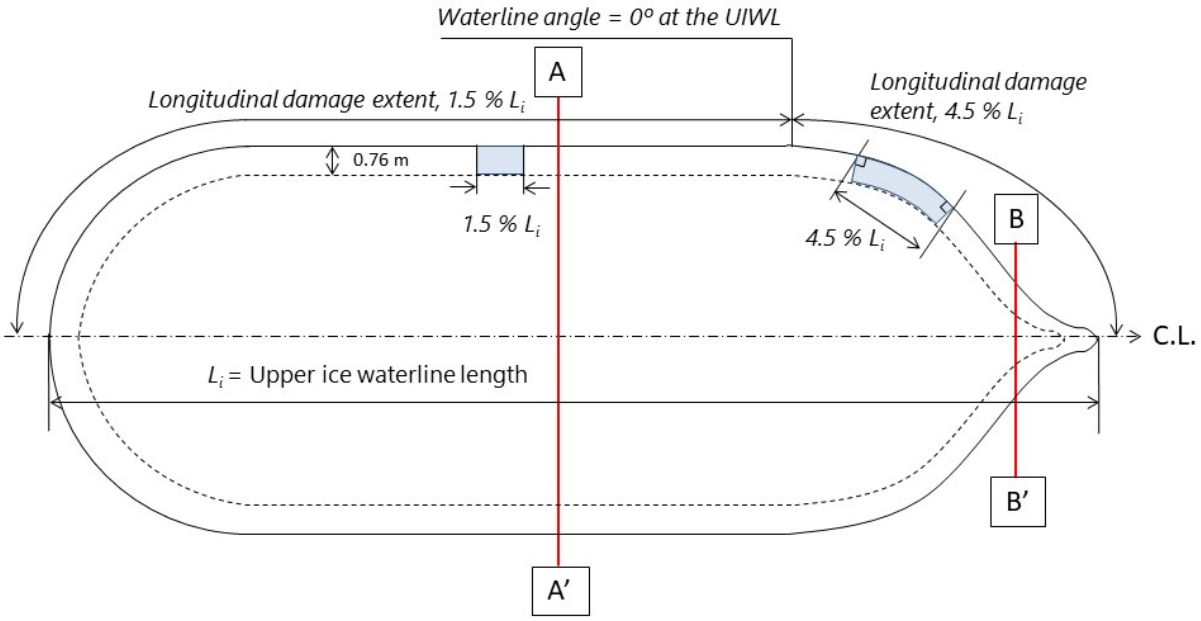
For ships, which have to comply with other IMO instruments (i.e. do not have to calculate probabilistic damage stability), ice accretion should be taken into consideration when calculating deterministic damage stability. With regard to regulation 27 of the international Load Line Convention, 1966 as amended by the 1988 Protocol thereto, ice accretion should not be applied.

Interpretation 4

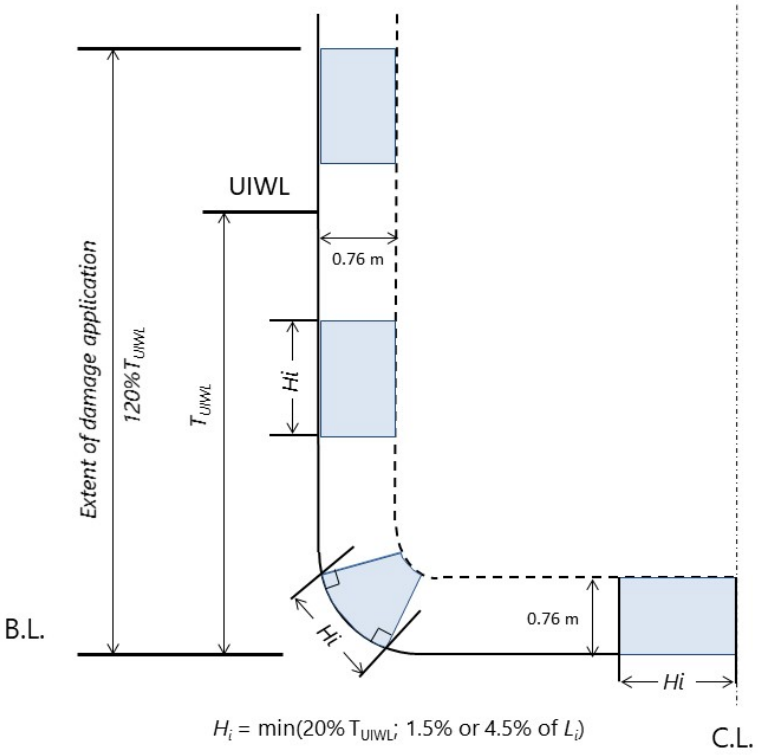
The transverse damage penetration extent of 760 mm, measured normal to the shell, should not be limited by the centreline of the ship where the centreline is less than 760 mm from the shell (see section B-B).

Lesser damages should be considered where these result in a more severe condition.

The following diagrams are provided for clarification:



Section A-A'



H_i = min(20% T_{UIWL}; 1.5% or 4.5% of L_i)