CIRCULAR LETTER

No. 314-47-1249c dated 24.07.2019

Re:

amendments to the Rules for the Classification and Construction of Sea-Going Ships, ND. No. 2-020101-114-E

Item(s) of supervision:

ships of ice classes

Entry-into-force date: Valid till: Validity period extended till:

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Number of pages: 1+9

Appendices:

Appendix 1: information on amendments introduced by the Circular Letter
Appendix 2: text of amendments to Part II "Hull"

Director General Konstantin G. Palnikov

Text of CL:

We hereby inform that the Rules for the Classification and Construction of Sea-Going Ships shall be amended as specified in the Appendices to the Circular Letter.

It is necessary to do the following:

1. Familiarize the RS surveyors and interested organizations in the area of the RS Branch Offices' activity with the content of the Circular Letter.
2. Apply provisions of the Circular Letter during the RS practical activity.

List of the amended and/or introduced paras/chapters/sections:

Part II: Table 1.1.4.3, paras 3.10.1.1.4, 3.10.1.2.1, 3.10.1.2.2, Table 3.10.1.2.2, paras 3.10.1.2.3, 3.10.1.3.2, 3.10.2.6.1, 3.10.2.6.2, 3.10.3.1, 3.10.3.2.1, 3.10.3.3.1, 3.10.3.4.1, 3.10.3.4.2, 3.10.3.8, 3.10.4.1, 3.10.4.10.1, 3.10.4.10.2, 3.10.4.11.3, 3.10.4.11.4, 3.10.4.11.5, 3.10.4.11.6, 3.10.4.11.7, 3.10.4.11.8, 3.10.4.11.9

Person in charge: Irina A. Surikova 314 +7 (812) 312-85-72

"Thesis" System No. 19-165413
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RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2019,
ND No. 2-020101-114-E

PART II. HULL

1 DESIGN PRINCIPLES

1.1 GENERAL

1 Table 1.1.4.3. Value of upper yield stress “390” is replaced by “≥ 390”.

3 REQUIREMENTS FOR STRUCTURES OF SHIPS OF SPECIAL DESIGN

3.10 STRENGTHENING OF ICE CLASS SHIPS AND ICEBREAKERS

2 Para 3.10.1.1.4 is deleted.

3 Para 3.10.1.2.1. Captions to the figs. 3.10.1.2-1 – 3.10.1.2-4 are replaced by the following text:

“Fig. 3.10.1.2.1-1. \( \alpha \) – slope of design ice waterline at the section considered, in deg.”;
“Fig. 3.10.1.2.1-2. \( \beta \) – slope of frame on the level of design ice waterline at the section considered, in deg.”;
“Fig. 3.10.1.2.1-3. \( \alpha_0 \) – slope of design ice waterline at the fore perpendicular, in deg.;
1 – shell plating; 2 – stem.”;
“Fig. 3.10.1.2.1-4. \( \varphi \) – slope of stem on the level of design ice waterline, in deg.”.

4 Para 3.10.1.2.2. The first sentence is replaced by the following text:

“3.10.1.2.2 The hull configuration parameters of ice class ships are recommended to be within the limits stated in Table 3.10.1.2.2.”.

5 Table 3.10.1.2.2. In the last column ice class Ice1 is deleted.

6 Para 3.10.1.2.3. The first two sentences is replaced by the following text:

“3.10.1.2.3. Hull configuration parameters of icebreakers.
For icebreakers, at 0–0.25\( L \) from the area of fore perpendicular within service draughts, straight and convex waterlines shall be used. The recommended entrance angles for above waterlines \( \alpha_0 \) are within the limits of \( \alpha_0 = 22° \div 30° \).”.

7 Para 3.10.1.3.2 is supplemented by the following paragraph:

“For calculation procedures of this Chapter ice loadline shall be taken as the design ice waterline, unless stated otherwise.”.

8 Para 3.10.2.6.1. The second and the third sentences are deleted.
9 \textbf{Para 3.10.2.6.2.} The first sentence is replaced by the following:

"3.10.2.6.2 A combined stem with bar welded thereto (Fig. 3.10.2.6.2-1, a), or a plate stem (Fig. 3.10.2.6.2-1, b) may be used."

10 \textbf{Para 3.10.3.1} is supplemented by the following paragraph:

"At the fore part with slope of design ice waterline $\alpha > 3^\circ$, for ice class ships with bulbous bows, and when $\beta \leq 5$, the ice load parameters shall be determined in compliance with 3.10.3.8.".

11 \textbf{Para 3.10.3.2.1.} The definition of factor $v_m$ in the explication to Formula (3.10.3.2.1) is replaced by the following text:

"$v_m =$ value of the shape factor $v$, which is the maximum one for the region, as determined at sections within $x = 0; 0,025L; 0,05L; 0,075L; 0,1L$, etc. from the forward perpendicular (as far as Ice1, Ice2 and Ice3 ice class ships are concerned, design sections where $x \leq 0,58b$, shall only be considered; for $b$, refer to Fig. 3.10.1.3.2) at the design ice waterline. The value shall be determined by the following formulæ:

for ships and icebreakers with the hull shape compliant with the provisions of 3.10.1.2.2 and 3.10.1.2.3

$v = \left(0,278 + 0,18 \frac{x}{L}\right) \cdot 4^{\frac{\alpha^2}{\beta}}$ at $\frac{x}{L} \leq 0,25$;

$v = \left(0,343 - 0,08 \frac{x}{L}\right) \cdot 4^{\frac{\alpha^2}{\beta}}$ at $\frac{x}{L} > 0,25$;

for other ships and icebreakers

$v = f_v\left(0,9 + 0,3 \frac{x}{L} + 0,005\alpha - 0,0015\beta'\right)$

where $L =$ length at design ice waterline;

$x =$ distance between the considered section and the forward perpendicular, in $m$;  

$\alpha =$ angle of design waterline inclination which shall be measured in accordance with Figs. 3.10.1.2-1 and 3.10.1.2-3 (where $x = 0$), in deg.;

$\beta =$ angle of frame inclination at design ice waterline on the considered section which shall be measured in accordance with Fig. 3.10.1.2-1, in deg.; where the frame is concave, in case of Arc4, Arc5, Arc6, Arc7, Arc8, Arc9 ice class ships, $\beta$ shall be chosen as a minimum angle, which is measured at service waterlines;

$\beta' = \arctg(tg\beta \cos \alpha) =$ side inclination angle with regard to normal, deg.;

$f_v = \frac{(\sin \alpha \cos \beta)^{0.54}}{(\cos \beta)^{0.37}(\sin \beta)^{0.23}}$.

12 \textbf{Para 3.10.3.3.1.} The definition of factor $u_m$ in the explication to Formula (3.10.3.3.1) is replaced by the following text:

"$u_m =$ maximum value of the shape factor $u$ for the region, as determined at sections within $x = 0; 0,025L; 0,05L; 0,075L; 0,1L$, etc. from forward perpendicular (as far as Ice1, Ice2 and Ice3 ice class ships are concerned, sections where $x \leq 0,58b$ shall only be considered; for $b$, refer to Fig. 3.10.1.3.2) at the design ice waterline. The value shall be determined by the following formulæ:

for ships and icebreakers with the hull shape compliant with the provisions of 3.10.1.2.2 and 3.10.1.2.3

$u = k_B \left(0,635 + 0,61 \frac{x}{L}\right) \cdot \sqrt{\frac{\alpha}{\beta}}$ at $\frac{x}{L} \leq 0,25$;

$u = k_B \left(0,862 - 0,30 \frac{x}{L}\right) \cdot \sqrt{\frac{\alpha}{\beta}}$ at $\frac{x}{L} > 0,25$;

for other ships and icebreakers

$u = f_u\left(0,72 + \frac{x}{L} + 0,001\alpha - 0,013\frac{x}{L}\beta'\right)$

where $L, x, \alpha, \beta, \beta' \ldots$ refer to 3.10.3.2.1;
\[ k_B = \begin{cases} 
1 & \text{at } \beta \geq 7^\circ \\
1.15 - 0.15 \frac{\beta}{7} & \text{at } \beta < 7^\circ 
\end{cases} \]

\[ f_u = \frac{(\sin \alpha \cos \beta)^{0.58}}{(\cos \beta)^{0.33}(\sin \beta)^{0.5}}. \]

13 **Para 3.10.3.4.1.** The definition of parameter \( \beta_m^A \) in the explication to Formula (3.10.3.4.1) is replaced by the following text:

“\( \beta_m^A \) = angle \( \beta' \) in the design section of region A for which the value of the \( u \) parameter is maximum (refer to 3.10.3.3.1).”

14 **Para 3.10.3.4.2.** The definition of parameter \( \beta_m^{A_1} \) in the explication to Formula (3.10.3.4.2) is replaced by the following text:

“\( \beta_m^{A_1} \) = angle \( \beta' \) in the design section of region \( A_1 \) for which the value of the \( u \) parameter is maximum (refer to 3.10.3.3.1).”

15 New **Para 3.10.3.8** is introduced reading as follows:

“3.10.3.8 Ice load parameters for the bow areas with the vertical side (\( \beta < 5 \)) in the region of alternating draughts, or bulbous bows.

3.10.3.8.1 For ships of ice classes, the ice pressure, in kPa, shall be determined by the following formula:

\[ p_{AI} = 0.985 p_{ref}^i v_m \left( \frac{\Delta}{1000} \right)^{0.0132}, \ 1 \leq \Delta \leq 5 \text{ thousand t}; \]

\[ p_{AI} = 0.976 p_{ref}^i v_m \left( \frac{\Delta}{1000} \right)^{0.0052}, \ 5 < \Delta \leq 200 \text{ thousand t}; \]

for ice classes Arc4, Arc5, Arc6, Arc7

\[ p_{AI} = 0.790 p_{ref}^i v_m \left( \frac{\Delta}{1000} \right)^{0.0614} \]

where \( p_{ref}^i \) = factor to be taken from Table 3.10.3.8.1-1 based on the ice class;

\( v_m \) = maximum value of the shape factor \( v \) to be determined in bow area sections with the vertical side at design waterline by the formula

\[ v \left( \frac{x}{L}, \alpha \right) = b_0^v + b_1^v \frac{x}{L} + b_2^v \alpha + b_3^v \left( \frac{x}{L} \right)^2 + b_4^v \alpha^2 + b_5^v \left( \frac{x}{L} \right) \alpha; \]

\( b_i^v \) = factors to be taken from Table 3.10.3.8.1-2;

\( \Delta = \) displacement at design ice waterline, t.

For ships with bulbous bows, when determining the design loads on the bulb structure, \( v_m \) is determined at the ballast waterline, if it passes through the bulb, otherwise – at the waterline, where inclination angle of the bulb plating is \( \beta = 0 \ldots 5 \).

Table 3.10.3.8.1-1

<table>
<thead>
<tr>
<th>( \Delta )</th>
<th>Ice1</th>
<th>Ice2</th>
<th>Ice3</th>
<th>Ice1</th>
<th>Ice2</th>
<th>Ice3</th>
<th>Arc4</th>
<th>Arc5</th>
<th>Arc6</th>
<th>Arc7</th>
</tr>
</thead>
</table>
| 1 \leq \Delta \leq 5 \text{ thousand t} | \begin{tabular}{c|c|c|c|c|c|c} 
1100 & 1430 & 1760 & 1120 & 1460 & 1810 & 3620 & 5910 & 10360 & 16020 \\
\hline
\end{tabular} | \begin{tabular}{c|c|c|c|c|c|c} 
5 \leq \Delta \leq 200 \text{ thousand t} & 1,5 & 2,0 & 3,7 & 4,8 & \end{tabular} |
| \( p_{ref}^i \) | \begin{tabular}{c|c|c|c|c|c|c} 
- & - & - & - & - & - & 1,5 & 2,0 & 3,7 & 4,8 \\
\hline
\end{tabular} | \begin{tabular}{c|c|c|c|c|c|c} 
b_{11}^v & 0,65 & 0,80 & 1,00 & 0,65 & 0,80 & 1,00 & - & - & - \\
\hline
\end{tabular} |
| \( l_{ref}^i \) | \begin{tabular}{c|c|c|c|c|c|c} 
3,66 & 4,33 & 4,27 & 12,05 & 14,22 & 13,94 & 4,55 & 4,52 & 4,39 & 4,23 \\
\hline
\end{tabular} |
3.10.3.8.2 Vertical distribution of ice pressure, in m, for ice class ships Ice1, Ice2, Ice3 shall be determined by the formula
\[ b_A = b_{ref} u_{b,m} \]
where \( b_{ref} \) is the factor taken as per Table 3.10.3.8.1-1 depending on the ice class;
\( u_{b,m} \) is the maximum value of the shape factor \( u_b \) to be determined in sections of bow area with the vertical side at design ice waterline by the formula
\[ u_b(x) = b_0^u + b_1^u \frac{x}{L} + b_2^u \frac{x^2}{L^2}; \]
\( b_i^u \) are factors to be taken from Table 3.10.3.8.3.
Vertical distribution of ice pressure, in m, for ships of ice classes Arc4, Arc5, Arc6, Arc7 shall be determined by the formula
\[ b_A = b_i^u \]
where \( b_i^u \) is taken from Table 3.10.3.8.1-1 based on the ice class.

### Table 3.10.3.8.2

<table>
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<th>( b_i^u )</th>
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<th>Ice3</th>
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<tbody>
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<td>( b_0^u )</td>
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<td>2,283</td>
<td>2,146</td>
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<tr>
<td>( b_1^u )</td>
<td>-11.88</td>
<td>-11.85</td>
<td>-10.28</td>
</tr>
<tr>
<td>( b_2^u )</td>
<td>22,14</td>
<td>22,02</td>
<td>17,60</td>
</tr>
</tbody>
</table>

3.10.3.8.3 Horizontal distribution of ice pressure, in m, shall be determined by the following formulae:

- For ships of ice classes Ice1, Ice2, Ice3
  \[ l_A = 0.748 l_{ref} u_{l,m} \left( \frac{\Delta}{1000} \right)^{0.3065}, \ 1 \leq \Delta \leq 5 \text{ thousand t}; \]
  \[ l_A = 0.218 l_{ref} u_{l,m} \left( \frac{\Delta}{1000} \right)^{0.3311}, \ 5 \leq \Delta \leq 200 \text{ thousand t}; \]

- For ships of ice classes Arc4, Arc5, Arc6, Arc7
  \[ l_A = 0.337 l_{ref} u_{l,m} \left( \frac{\Delta}{1000} \right)^{0.2906} \]

where \( l_{ref} \) is the factor to be taken from Table 3.10.3.8.3-1 based on the ice class;
\( u_{l,m} \) is the maximum value of the shape factor \( u_l \) to be determined in sections of bow area with the vertical side at design waterline by the formula
\[ u_l(x, \alpha) = b_0^u + b_1^u \frac{x}{L} + b_2^u \alpha + b_3^u \frac{x^2}{L^2} + b_4^u \alpha^2 + b_5^u \frac{x^3}{L^3} \alpha; \]
\( b_i^u \) are factors to be taken from Table 3.10.3.8.3.
3.10.3.8.4 For ships of ice classes Ice1, Ice2, Ice3 with stretched area of vertical side (from the forward perpendicular to parallel midship body), intermediate regions of ice strengthening may be added at the length of bow. In this case, the values of hull shape factors \( v_m, u_{b,m}, u_{l,m} \) shall be taken equal to the maximum value of the relevant factors determined for each intermediate regions at design ice waterline.

3.10.3.8.5 For ships of ice classes Arc4, Arc5, Arc6, Arc7 with bulbous bows and extended bow area at design waterline, an intermediate region of ice strengthening inside the region A may be added, in addition to the requirements of 3.10.3.1. In this case, the values of hull shape factors \( v_m, u_{b,m}, u_{l,m} \) shall be taken equal to the maximum value of the relevant factors determined for each intermediate region inside the A region at design waterline.

16 Para 3.10.4.1. The definition of parameter \( u \) in the explication to Formula (3.10.4.1) is replaced by the following text:

"\( u \) = annual reduction of shell plating as a result of corrosion wear and abrasion, in mm per year, to be taken from Table 3.10.4.1 of this Part. When taking measures to protect the shell plating from corrosion wear and abrasion complying with 6.5.3, Part XIII "Materials" and 3.5.1, Part III "Technical Supervision during Manufacture of Materials" of the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, the value \( u \) may be reduced by 25 % when applying Class II protective coatings and by 50 % when applying protective coatings of Class I. In this case the value \( \Delta s_{w,c} \) shall not be taken less than determined in 1.1.5.2 of this Part. In the drawings of hull structures the scantlings determined at \( u \) according to Table 3.10.4.1 of this Part shall be additionally indicated. A special entry shall be made in the Classification Certificate of such ships (refer to 2.3.1, Part I "Classification" of these Rules)."

17 Para 3.10.4.10.1. Formula (3.10.4.10.1-1) shall be replaced by the following formula:

\[ S = k_k \eta f(\Delta) . \]

The explication to Formula (3.10.4.10.1-1) is supplemented by the following definition of parameter \( \eta \):

"\( \eta \) = application factor of mechanical properties of material determined according to 1.1.4.3.".

18 Para 3.10.4.10.1. Formula (3.10.4.10.1-2) shall be replaced by the following formula:

\[ W = 1,16 \eta pb . \]

The explication to Formula (3.10.4.10.1-2) is supplemented by the following definition of parameter \( \eta \):

"\( \eta \) = application factor of mechanical properties of material determined according to 1.1.4.3.".

### Table 3.10.3.8.3

<table>
<thead>
<tr>
<th>( b_i^1 )</th>
<th>( 1 \leq \Delta \leq 5 ) thousand t</th>
<th>( 5 &lt; \Delta \leq 200 ) thousand t</th>
<th>Arc4</th>
<th>Arc5</th>
<th>Arc6</th>
<th>Arc7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice1</td>
<td>Ice2</td>
<td>Ice3</td>
<td>Ice1</td>
<td>Ice2</td>
<td>Ice3</td>
<td>Ice1</td>
</tr>
<tr>
<td>( b_{11}^1 )</td>
<td>0.186</td>
<td>0.171</td>
<td>0.166</td>
<td>0.167</td>
<td>0.155</td>
<td>0.139</td>
</tr>
<tr>
<td>( b_{21}^1 )</td>
<td>-3.339</td>
<td>-3.319</td>
<td>-2.377</td>
<td>-3.297</td>
<td>-3.318</td>
<td>-2.607</td>
</tr>
<tr>
<td>( b_{31}^1 )</td>
<td>0.0241</td>
<td>0.0227</td>
<td>0.0184</td>
<td>0.0231</td>
<td>0.0216</td>
<td>0.0222</td>
</tr>
<tr>
<td>( b_{41}^1 )</td>
<td>17.2</td>
<td>17.6</td>
<td>18.4</td>
<td>17.4</td>
<td>17.9</td>
<td>15.02</td>
</tr>
<tr>
<td>( b_{51}^1 )</td>
<td>-0.0003</td>
<td>-0.0003</td>
<td>-0.0002</td>
<td>-0.0003</td>
<td>-0.0003</td>
<td>-0.0003</td>
</tr>
<tr>
<td>( b_{61}^1 )</td>
<td>0.148</td>
<td>0.159</td>
<td>0.110</td>
<td>0.153</td>
<td>0.165</td>
<td>0.152</td>
</tr>
</tbody>
</table>
19 Para 3.10.4.10.1. The paragraph precedent to Formula (3.10.4.10.1-4) is replaced by the following text:

"In this case, the plate thickness \( s \), in mm, of combined and plate stems shall not be less than determined by the formula:"

20 Para 3.10.4.10.2 is deleted.

21 Para 3.10.4.11.3 is replaced with the following text:

"3.10.4.11.3 Dimensions of the bulb structural elements shall be determined by calculation procedures specified in 3.10.4 for ice load parameters determined in accordance with 3.10.3.8.2 – 3.10.3.8.5. In any case, the thickness of the bulb shell plating shall not be less than the thickness of the shell plating in region Al.".

22 Paras 3.10.4.11.4 and 3.10.4.11.5 are deleted.

23 Para 3.10.4.11.6 is renumbered 3.10.4.11.4. Formulae (3.10.4.11.6-1) – (3.10.4.11.6-5) renumbered (3.10.4.11.4-1) – (3.10.4.11.4-5) accordingly.

24 The definition of parameter \( s \) in the explication to Formula (3.10.4.11.4-1) is replaced by the following text:

"\( s = \) the bulb shell plating thickness according to 3.10.4.11.3.".

25 Paras 3.10.4.11.7 – 3.10.4.11.9 are deleted.