



RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER

No. 314-27-1209c

dated 03.04.2019

Re:

amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2019, ND No. 2- 020101-114-E

Item(s) of supervision:

fiber-reinforced plastic for ships

Entry-into-force date:

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Appendices:

Appendix 1: information on amendments introduced by the Circular Letter

Appendix 2: text of amendments to Part XVI "Structure and Strength of Fiber-Reinforced Plastic Ships"

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. Apply the provisions of the Circular Letter during review and approval of technical documentation of ships.
 2. Bring the content of the Circular Letter to the notice of RS surveyors and interested persons in the area of RS Branch Offices' activity.
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List of the amended and/or introduced paras/chapters/sections:

Part XVI, Appendix 2: Tables 3.2 – 3.5, paras 3.4, 3.5.3, 3.6.7, 3.6.8, 4.6.3

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**Information on amendments introduced by the Circular Letter
(for inclusion in the Revision History to the RS Publication)**

| Nos. | Amended paras/chapters/sections | Information on amendments | Number and date of the Circular Letter | Entry-into-force date |
|------|---------------------------------|--|--|-----------------------|
| 1 | Appendix 2 Table 3.2 | The column "Alternative test procedures" has been deleted. The contents have been transferred to the column "Test procedure". References to GOST 23802-79, GOST 23803-79, GOST 23804-79, GOST 23805-79, GOST 23813-79, GOST 23814-79, GOST 23816-79 standards have been deleted. References to GOST 32652 and ISO 1172 standards have been introduced. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |
| 2 | Appendix 2 Table 3.3 | The column "Alternative test procedures" has been deleted. The contents have been transferred to the column "Test procedure". References to GOST 23804-79, GOST 23808-79, GOST 23809-79, GOST 23810-79 standards have been deleted. References to GOST 33845 and ISO 13003 standards have been introduced. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |
| 3 | Appendix 2 Para 3.4 | Reference to GOST 23801-79 standard has been deleted. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |
| | Appendix 2 Table 3.4 | The column "Alternative test procedures" has been deleted. The contents have been transferred to the column "Test procedure". The titles of the standards and references to GOST 23813-79 and GOST 23814-79 standards have been deleted. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |
| 5 | Appendix 2 Para 3.5.3 | Reference to GOST 23806-79 standard has been deleted. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |

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|---|--------------------------|--|----------------------------------|------------|
| 6 | Appendix 2 Table 3.5 | <p>The column "Alternative test procedures" has been deleted. The contents have been transferred to the column "Test procedure".</p> <p>Item 4 "Endurance in bending at vibration" has been deleted.</p> <p>Item 5 "Tension-compression creep" has been renumbered to 4 accordingly.</p> <p>The titles of the standards and references to GOST 23808-79 and GOST 23811-79 standards have been deleted.</p> <p>References to GOST R 57714 and ASTM D 2990 standards have been introduced.</p> | 314-27-1209c dated 03.04.2019 | 03.04.2019 |
| 7 | Appendix 2 Para 3.6.7 | Reference to GOST 23816-79 standard has been replaced with a reference to the applied procedures. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |
| 8 | Appendix 2 Para 3.6.8 | Reference to GOST 23816-79 standard has been replaced with a reference to the applied procedures. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |
| 9 | Appendix 2 Para 4.6.3 | Reference to GOST 23804-79 standard has been deleted, reference to GOST 23816-79 standard has been replaced with a reference to the applied procedures. | 314-27-1209c dated 03.04.2019 | 03.04.2019 |

**RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING
SHIPS, 2019,
ND No. 2-020101-114-E**

**PART XVI. STRUCTURE AND STRENGTH OF FIBER-REINFORCED PLASTIC
SHIPS**

APPENDIX 2

**STANDARD TEST PROGRAM FOR SAMPLES OF NEW FRPS AND TYPE
STRUCTURES AND ASSEMBLIES MADE OF THEM**

3 SCOPE AND TYPES OF TESTS FOR FRPS AND LIGHTWEIGHT CORES

1 **Table 3.2** is replaced by the following text:

"Table 3.2

List of FRP characteristics determined in the initial state and test procedures under short-term loading

| Nos. | Characteristic | Test procedure | Direction of the test specimens, deg. |
|------|--|--|---------------------------------------|
| 1 | Density | GOST 15139-69 ASTM D 792 ASTM D 1505 ISO 1183 NF T 57-102 | — |
| 2 | Binder percentage | GOST 32652 ISO 1172 ASTM D 792 ASTM D 2734 ASTM D 3171 SACMA RM 10 | — |
| 3 | Young's modulus | ASTM D 638 (Type 1) ASTM D 3039/D 3039M | 0° 45° 90° |
| 4 | Shear modulus in the reinforcement plane | ASTM D 3518 ASTM D 4255 | 0° 45° 90° |
| 5 | Interlaminar shear modulus ¹ | ASTM D 2344 ASTM D 2733 SACMA SRM 8R | 0° 45° 90° |
| 6 | Poisson's ratio and tensile elongation | ASTM D 3039/D 3039M ASTM D 638 (Type 1) | 0° 45° 90° |
| 7 | Tensile strength at break | ASTM C 393/C 393M ASTM D 638/D 638M ASTM D 3039/D 3039M ASTM D 54502 NF T 57-101 ISO 527 ISO 3268 SACMA RM4 SACMA RM9 | 0° 45° 90° |

| | | | |
|---|--|--|------------------|
| 8 | Compression strength at break | ASTM D 638 ASTM D 695 ASTM D 3410 ASTM D 5449 ASTM D 5467 ASTM D 6484/D 6484M ISO 527 SACMA RM 1 SACMA RM 6 | 0° 45° 90° |
| 9 | Flexural breaking strength ¹ | GOST 4648-71 GOST 25.604-82 ASTM C 393/C393M ² ASTM D 790 ISO 178 ISO 14125 NF T 57-105 | 0° 45° 90° |
| 10 | Shear breaking strength in the reinforcement plane | ASTM C 273 ASTM D 3518/D 3518M ASTM D 4255 ASTM D 5379 ASTM D 5448 IICO1922 SACMA RM 7 | — |
| 11 | Interlaminar shear strength at break ¹ | ASTM D 2344 ASTM D 2733 ASTM D 5379/D 5379 M-12 ² ASTM E 143 ISO 4585 NF T 57-104 SACMA RM 8 | 0° 45° 90° |
| ¹ FRP characteristics at an angle of 45° are determined based on biaxial diagonal fabrics (+45°/- 45°). ² Applied to FRP one-directional reinforcement scheme. | | | |

2 **Table 3.3** is replaced by the following text:

"Table 3.3

List of FRP characteristics determined in the initial state and test procedures under short- term loading

| Nos. | Characteristic | Test procedure | Direction of the test specimens, deg. |
|--|--|---|---------------------------------------|
| 1 | Endurance limit tensile strength at 2 x 10 ⁶ cycles ¹ | ASTM D 3479 ISO 527 | 0° 45° |
| 2 | Endurance limit in compression at 2 x 10 ⁶ cycles ¹ | GOST 33845 ISO 13003 ISO 527 | 0° 45° |
| 3 | Bending endurance limit at 2 x 10 ⁶ cycles ¹ | GOST 33845 ISO 13003 ISO 14125 ASTM D 7774 | 0° 45° |
| 4 | Endurance limit at interlaminar shear at 2 x 10 ⁶ cycles ¹ | GOST 33845 ISO 13003 ISO 14130 | 0° 45° |
| 5 | Creep rupture tensile strength at 10 ³ h ¹ | GOST R 57714 ASTM D 2990 | 0° 45° |
| ¹ Refer to Note 1 to Table 3.2. | | | |

3 **Para 3.4** is replaced by the following text:

"**3.4** Quality of laminates (blanks) and cutting of their specimens shall comply with the requirements of this Appendix and/or a standard agreed with the Register."

4 **Table 3.4** is replaced with the following text:

"Table 3.4

List of lightweight core characteristics to be estimated¹ and test procedures

| Nos. | Characteristic | Test procedure |
|------|-------------------------------|---|
| 1 | Ultimate water absorption | GOST 20869-75 ISO 2896 |
| 2 | Young's modulus | GOST 18336-73 GOST 17370-71 ² ASTM E1875-13 ASTM D 1621 ASTM D 1623 ² |
| 3 | Shear modulus | ASTM C 273 |
| 4 | Tensile strength at break | GOST 17370-71 ASTM D 1623 |
| 5 | Compression strength at break | GOST 23206-78 ASTM D 1621 |
| 6 | Shear breaking strength | ASTM C 273 ASTM C393/C393M |

¹ Elastic and strength characteristics of the lightweight core based on mats shall be determined in 0° and 90° directions in the mat laying plane, with 0° direction positioned along the mat fabric.

² These standards determine the technique of tensile test of specimens without specifying the technique of Young's modulus determination.

5 **Para 3.5.3** is replaced by the following text:

3.5.3 Tests of FRP specimens at an elevated temperature of 60 °C shall be carried out to determine the characteristics in items 3 – 5, 8, 11 of Table 3.2. Depending on the supposed operation conditions, tests of FRP specimens may be carried out under other values of elevated temperatures."

6 **Table 3.5** is replaced by the following text:

"Table 3.5

List of additional characteristics of polymer composites and their estimation techniques

| Nos. | Characteristic | Test procedure |
|------|--|--|
| 1 | Ultimate tensile-compression strength in transversal direction | ASTM D 6415 ASTM C 297 |
| 2 | Crack resistance (Modes I and II) | ASTM D 5528-01 (Mode I), Method of bending a framing member with a notch on one side (ENF) (Mode II) |
| 3 | Charpy's impact strength | GOST 4647-80 ISO 179 |
| 4 | Tension-compression creep | GOST R 57714 ASTM D 2990 |

7 **Para 3.6.7** is replaced by the following text:

3.6.7 Impregnability and resin-saturation of the reinforcement material (determination of impregnation speed for comparative testing) and resin-saturation are determined according to the procedures specified in item 2 of Table 3.2."

8 **Para 3.6.8** is replaced by the following text:

"**3.6.8** Binder percentage in FRP is determined according to the procedures specified in item 2 of Table 3.2.".

9 **Para 4.6.3** is replaced by the following text:

"**4.6.3** From laminates in three different regions (near shorter sides and in the middle) prismatic specimens are cut out (refer to Fig. 2):

for static bending test as per GOST 4648-71, GOST 25.604-79 (dimensions 200×20 mm), 10 pcs per reinforcement direction;

for interlaminar shear test – dimensions 60×10 mm, 10 pcs per reinforcement direction;

for determination of density as per GOST 15139-69;

for determination of binder percentage according to the procedures specified in item 2 of Table 3.2.".