# RUSSIAN MARITIME REGISTER OF SHIPPING

**CIRCULAR LETTER** **No.** 314-53-1049c dated 18.10. 2017

Re:

introduction of new Chapter 9.6 "Steel-titanium laminated composite material" to Part XIII "Materials" of the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E

Item of technical supervision:

steel-titanium laminated composite material intended for ship machine- building; ships under construction

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|---|---|
| Implementation | from the date of publication |
| Valid: till | ND re-publication |
| Validity period extended till | - |
| Cancels / amends / supplements Circular Letter No. - | - |
| Number of pages: | 1+5 |
| Appendices: | text of amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E |

Director General K.G. Palnikov

Amends Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E

We hereby inform of the introduction of new Chapter 9.6 "Steel-titanium laminated composite material" to Part XIII "Materials" of the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-Egiven in the Appendix to the Circular Letter.

These Amendments will be introduce to the Rules for the Classification and Construction of Sea-Going Ships during their re-publication.

It is necessary to do the following:

1. Apply the provisions of the Circular Letter during the review and approval of ships' technical documentation and technical supervision in industry.
2. Familiarize the RS surveyors, interested organizations and persons in the area of the RS Branch Offices' activity with the content of the Circular Letter.

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"Thesis" System 17-195820

Appendix to Circular Letter
No. 314-53-1049 c of 18.10.2017

**RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2017, ND No. 2-02101-095-E**

**PART XIII** MATERIALS

**9** TITANIUM ALLOYS
shall be supplemented with new Chapter 9.6 reading as follows:

**"9.6 STEEL-TITANIUM LAMINATED COMPOSITE MATERIAL**

**9.6.1 General requirements.**

**9.6.1.1** The present requirements apply to semi-finished products of steel-titanium laminated composite material (steel-titanium semi-finished products) intended for the ship machinery construction (condensers and heat exchangers) subject to the technical supervision by the Register in accordance with the requirements of other parts of the Rules.

**9.6.1.2** Steel-titanium semi-finished products shall be manufactured in compliance with the documentation approved by the Register at the enterprises recognized by the Register based on the requirements given in **1.3** and under technical supervision by the Register.

The Register representative performing technical supervision at the manufacturer of steel-titanium semi-finished products with no metallurgical production of all the composite material components shall be provided with the manufacturer quality certificates for basic materials and the Register Basic Materials Certificates. The Register may also require data to confirm the possibility of using steel-titanium semi-finished products during the service.

**9.6.1.3** Steel-titanium semi-finished products may be manufactured by explosion welding, hot rolling or other manufacturing methods.

**9.6.1.4** Steel-titanium semi-finished products shall be manufactured not using cold rolling as final operation to obtain the required thickness.

**9.6.1.5** Hull structural steel, which complies with the requirements of 3.2, or steel complying the national/international standards,the application of which is agreed with the Register the standards are specified in the approved documentation), is generally used as the base metal (steel) layer of steel-titanium semi-finished products.

**9.6.1.6** Rolled plate and strip products of wrought steel-titanium alloys in annealed condition which comply with the requirements of 9.2, are used as titanium layer of steel-titanium semi-finished products.

**9.6.1.7** In general, rolled steel and titanium for steel-titanium semi-finished products shall be manufactured by the enterprises recognized in accordance with 1.3 and under technical supervision by the Register.

**9.6.2 Chemical composition and mechanical properties.**

**9.6.2.1** The chemical composition and mechanical properties of basic materials as well as properties of steel-titanium semi-finished products shall comply with the documentation approved by the Register. The chemical composition and mechanical properties of base materials intended for manufacture of steel-titanium semi-finished product shall complywith the requirements of 3.2 or national/international standards (refer to 9.6.1.5) and 9.2.

**9.6.2.2 Condition of supply.**

9.6.2.2.1 Steel-titanium semi-finished products shall be supplied in the condition complying with the RS-approved documentation.

**9.6.2.3 Scope of testing.**

**9.6.2.3.1** The scope of testing and sampling of basic materials, steel and titanium alloys for steel-titanium semi-finished products shall be in accordance with the requirements of 3.2 or national/international standards (refer to 9.6.1.5) and 9.2, accordingly.

**9.6.2.3.2** During the initial survey for recognition of steel-titanium semi-finished product manufacture by the Register according to 1.3, the scope of prototype testing shall be based on the program developed by the manufacturer of steel-titanium semi-finished product and approved by the Register. The control test program at manufacturer's recognition shall include the following tests:

pull-off and shear tests to determine adhesion of test specimen layers in composite titanium-steel material;

bend tests to determine plybond strength of test specimen layers in composite steel-titanium material;

micro analysis of metal in the layer interface zone of composite steel-titanium material.

Tests shall be carried out on a control batch. For each manufacturing process stated (the same basic material supplier, the same size, the same condition of supply), 2 semi-finished products of a batch shall be submitted for testing.

Each semi-finished product of the control batch shall be subject to visual and ultrasonic testing to determine layer discontinuity zone.

**9.6.2.3.2.3** During manufacture, the scope of testing shall be determined on the basis of the material delivery documentation approved by the Register or the national/international standard recognized by the Register. Semi-finished products shall be submitted for testing in batches. A batch shall consist of semi-finished products of the same condition of supply, the same size, manufactured by the same process and using basic materials received from the same supplier. In general, not less than 10 % of semi-finished products shall be taken.

From each semi-finished product submitted for testing, samples shall be taken for pull-off and shear tests to determine layer adhesion.

Visual and ultrasonic testing to determine layer discontinuity zones shall be conducted on each semi-finished product in the batch.

**9.6.2.3.4 Sampling and testing.**

**9.6.2.3.4.1** The samples shall be taken at a distance not less than 25 mm from the edge of the semi-finished product from a place as far from the point of initiation of the explosion.

**9.6.2.3.4.2** Bend tests to determine plybond strength of test specimen layers in composite steel-titanium material.

Bend test of bimetallic specimens at an angle of 80° shall be performed for the qualitative assessment of steel and titanium layer plybond strength. No layer separation during bending shall be a performance criterion. Two test specimens shall be taken from a sample for bend test. One bend test shall be carried out with the specimen of the titanium layer on the tensioned side and the other one with the specimen of the titanium layer on the compressed side. The procedure for test specimens' preparation and test performance shall comply with the manufacturer's documentation approved by the Register, national and/or international standards.

**9.6.2.3.4.3** Pull-off and shear tests of steel-titanium semi-finished product layers.

**9.6.2.3.4.3.1** Pull-off and shear tests of steel-titanium semi-finished product layers obtained by explosion welding.

The tests shall be carried out on one specimen of each type (pull-off and shear tests).

Pull-off and shear tests shall be carried out at the room temperature.

The procedures of pull-off and shear tests are similar to those for steel-titanium semi-finished product (5.3).

Pull-off tests shall be carried out on specimens asshown in Fig. 5.3.2.3.4.3.2-1.

Shear tests shall be carried out on specimens as shown in Fig. 5.3.2.3.4.3.2-2.

For all the specimens tested, the ultimate pull-off and shear strength shall comply with the documentation approved by the Register.

Where the ultimate pull-off or shear strength of a laminated composite material is below the specified minimum, two additional pull-off and shear testspecimens shall be tested.

Each new value shall not be less than the specified minimum value.

Where the ultimate pull-off or shear strength of a laminated composite material is below the specified minimum value but exceeds 70 % of theminimum value, two additional pull-off and shear test specimens taken from each end of the semi-finished product shall be tested.

Each new value shall not be less than the specified minimum value.

**9.6.2.3.4.4** Visual and non-destructive testing.

**9.6.2.3.4.4.1** Each steel-titanium semi-finished product shall be subject to 100 % visual testing and ultrasonic testing to determine layer discontinuity zones.

**9.6.2.3.4.4.2** The layer adhesion quality shall be determined by ultrasonic testing based on approved assessment criteria.

**9.6.2.3.4.4.3** Micro structural analysis of interface between titanium and steel layers of steel-titanium semi-finished products.

Manufacturer shall submit the photos of interface surface between the layers of composite material with x(10÷20) and x 100 magnification. Microstructural analysis shall be made on the sections cutout of the samples for mechanical tests.

**9.6.3 Inspection.**

**9.6.3.1** All steel-titanium semi-finished products shall undergo surface inspection. Absence of defects not permitted under delivery documentation approved by the Register shall be guaranteed by the manufacturer, with a relevant entry to be made in the manufacturer's certificate of quality. The surface defects resulting from

manufacturing procedure are permitted if their depth is within the negative deviations specified in the documentation.

It is allowed to rectify the detected surface defects by grinding or flogging, provided these corrections do not change the size of the semi-finished productout of the allowed tolerances. For steel-titanium semi-finished products, repairing of surface defects of steel and titanium layers is not permitted.

**9.6.4 Marking.**

**9.6.4.1** The basic requirements for marking are set forth in 1.4.

Every semi-finished product shall have manufacturer's marking and the Register stamp clearly made in the specified manner and in a due place.

The marking shall include, as a minimum:

name and/or designation of the manufacturer;

grades of titanium alloy and steel;

condition of supply;

number of a batch, semi-finished product or identification number according to manufacturer's system, which allows tracing complete production process.

If the semi-finished products are delivered in bundles, the marking may be made on tags.

**9.6.5 Documents.**

**9.6.5.1** If supply is provided by piece, every batch of semi-finished product, which has undergone testing shall be provided with the Register certificate or manufacturer's document witnessed by the Register representative. The Register certificate shall include, as a minimum:

order number;

construction project number, if known;

name, number, dimensions and mass of a semi-finished product;

grades of titanium alloy and steel, standards for supply;

condition of supply;

number of a batch or a semi-finished product or identification number, which allows identifying the supplied material.

The Register certificate shall be compulsory supplemented with the results of the chemical analysis and mechanical tests, which confirm the material conformity with the Register requirements (the supplement may be manufacturer's certificate and/or test reports).

If materials are supplied with manufacturer's certificates witnessed by the Register representative, their form and contents shall be agreed with the Register and the customer.

**9.6.6 Welding of semi-finished products of STEEL-TITANIUM laminated composite material.**

**9.6.6.1** Welded joints of steel-titanium semi-finished products to steel and titanium hull structural members shall be made by separate welding of layers between similar materials using fillet, overlap or butt welds.

**9.6.6.2** Welding processes shall be approved in accordance with Sections 2 and 4 (2.13 and 4.10), Part XIV "Welding", as well as Section 8, 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.