RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER **No. 314-01-1288c** dated 18.11.2019

Re:

amendments to the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, 2019, ND No. 2-020101-118-E

Item(s) of supervision:

Welding procedures

Entry-into-force date: ~~Valid till:~~ ~~Validity period extended till:~~
20.12.2019

~~Cancels / amends / adds Circular Letter No.~~ ~~dated~~

Number of pages: 1+8

Appendices:

Appendix 1: Information on amendments introduced by the Circular Letter.

Appendix 2: text of amendments to Part III "Technical Supervision during Manufacture of Materials".

Director General Konstantin G. Palnikov

Text of CL:

We hereby inform that the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, based on the results of scientific research "Improvement of RS requirements for welding materials and welding processes of ship hull high-strength steel structures, including the structures operating at low temperatures", shall be amended as specified in Appendix 2 to the Circular Letter. These amendments shall apply to the initial approval of welding procedures, applications for approval of which have been submitted after the entry-into-force date of the Circular Letter.

It is necessary to do the following:

1. Familiarize the RS surveyors, as well as the interested organizations in the area of the RS activities with the content of the Circular Letter.
2. Apply the provisions of the Circular Letter in the RS practical activities.

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

Section 6: 6.2.1, 6.3.1.1.2, 6.3.1.1.4, 6.3.1.7, 6.3.2.1.4, 6.3.2.2.3, 6.3.2.2.6, Table 6.4.1.1, 6.4.2, 6.4.4.8, Table 6.6.2.2.2, 6.6.3.6.3, 6.6.3.7

Person in charge: Tumanov A.S. 314 +7(812) 605-05-29 ext. 2254

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Appendix 1 to Circular Letter
No. 314-01-1288c dated 18.11.2019

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

No	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
1	6.2.1	The definition "Heat input" has been introduced	314-01-1288c of 18.11.2019	20.12.2019
2	6.3.1.1.2	Requirements for the number of the Tekken test pieces have been introduced	314-01-1288c of 18.11.2019	20.12.2019
3	6.3.1.1.4	Requirements for preparation of the Tekken test pieces' edges have been introduced	314-01-1288c of 18.11.2019	20.12.2019
4	6.3.1.7	Requirements to the Tekken test pieces for cold cracking resistance of their base and welding materials have been introduced	314-01-1288c of 18.11.2019	20.12.2019
5	6.3.2.1.4	Requirements for manufacturing of the Tekken test pieces have been introduced	314-01-1288c of 18.11.2019	20.12.2019
6	6.3.2.2.3	Requirements for Tekken test pieces welding parameters have been introduced	314-01-1288c of 18.11.2019	20.12.2019
7	6.3.2.2.6	Welding scheme for the Tekken test piece test joint has been introduced	314-01-1288c of 18.11.2019	20.12.2019
8	Table 6.4.1.1	Requirements for control and extent of the Tekken test pieces testing have been introduced	314-01-1288c of 18.11.2019	20.12.2019
9	6.4.2	Requirements for location of sampling areas in the Tekken test pieces have been introduced	314-01-1288c of 18.11.2019	20.12.2019
10	6.4.4.8	Requirements for cold crack testing have been introduced	314-01-1288c of 18.11.2019	20.12.2019
11	Table 6.6.2.2.2	The requirements for the range of approval of welding procedure during certification testing of the Tekken test pieces have been introduced	314-01-1288c of 18.11.2019	20.12.2019

No	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
12	6.6.3.6.3	Requirements for the range of approval for welding procedure by heat input value have been introduced	314-01-1288c of 18.11.2019	20.12.2019
13	6.6.3.7	Requirements for the range of approval for welding procedure with no preheating have been introduced	314-01-1288c of 18.11.2019	20.12.2019

Appendix 2 to Circular Letter
No. 314-01-1288c dated 18.11.2019

RULES FOR TECHNICAL SUPERVISION DURING CONSTRUCTION OF SHIPS AND MANUFACTURE OF MATERIALS AND PRODUCTS FOR SHIPS, 2019,

ND No. 2-020101-118

PART III. TECHNICAL SUPERVISION DURING MANUFACTURE OF MATERIALS

6 APPROVAL OF WELDING PROCEDURES FOR STEEL STRUCTURES AND ITEMS

1 **Para 6.2.1** after the definition "Welding procedure qualification record (WPQR)" is supplemented by the definition "Heat input E_1" reading as follows:

"Heat input E_1 means electric energy consumed per unit weld length and calculated by the formula $E_1 = \frac{IU}{v}$, kJ/cm, where I means welding current, A; U means welding voltage, B; v means welding speed, cm/s.".

2 **Para 6.3.1.1.2** is replaced by the following text:

"**6.3.1.1.2** Length or number of test pieces shall be sufficient to allow all required qualification tests to be carried out in compliance with the requirements stated bellow. Additional test pieces, or longer test pieces than the minimum size, may be prepared in order to allow for extra and/or for re-testing specimens in compliance with the requirements of the present Section.

The number of the Tekken test pieces for cold cracking tests shall be as follows:

at least one test piece for gas-shielded automatic welding and self-shielded tubular-cored arc welding (without additional gas shielding);

at least two test pieces for manual metal arc welding with covered electrode, partly mechanized gas-shielded welding and self-shielded tubular-cored arc welding (without additional gas shielding).".

3 **Para 6.3.1.1.4** is replaced by the following text:

"**6.3.1.1.4** Edge preparation and welding of test pieces shall be carried out in accordance with the pWPS to be qualified. In so doing, the general conditions of welding in production for process procedure subject to the Register approval shall be met.

Edge preparation for the Tekken test pieces shall be carried out by machining means (a saw, a milling cutter or a cutting wheel) followed by milling or grinding of the edges to be welded with a roughness of max. Rz 80. Surfaces to be welded shall be smooth, free from scale, rust, oil, grease and other contaminants. Non-welded edges of the test specimens may be in condition after gas cutting.".

4 **New para 6.3.1.7** is introduced reading as follows:

"**6.3.1.7** Welding procedures for high strength steels are approved considering testing results of the Tekken test pieces prepared in accordance with Fig. 6.3.1.7 from base and welding materials for cold cracking according to GOST R ISO 17642-2-2012.

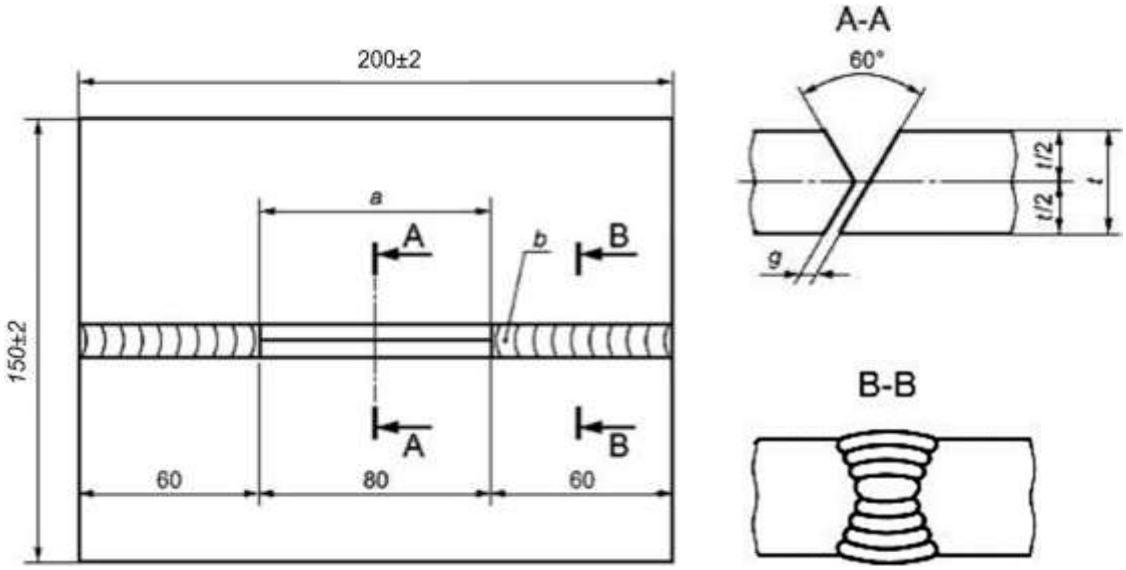

Fig. 6.3.1.7
The Tekken test piece after anchor welding:
a – tested weld deposition zone; b – anchor weld; g – root gap of (2,0 ± 0,2) mm; t – plate thickness taken as the largest of the declared thicknesses for a given steel grade, but not less than 12 mm.**".**

4 **New para 6.3.2.1.4** is introduced reading as follows:

"**6.3.2.1.4** For the Tekken test piece. Anchor welds shall be made with welding materials used for the tested weld. Anchor welds shall be welded in the modes recommended by the manufacturer of welding materials. To weld anchor welds, it is allowed to use other welding materials with the yield strength equal to or lower than the yield strength of the base metal by no more than 25 %. To prevent hydrogen cracking, if necessary, pre-heating, heating between welding runs and post-heating shall be used in the welding process. To ensure the lowest hydrogen content, all welding materials used to make anchor welds shall be dried up according to the manufacturer's recommendations. After completing anchor welds, they should be cooled down to ambient temperature and visually inspected for surface cracks in accordance with ISO 17637 (inspection class is not regulated).".

5 **Para 6.3.2.2.3** is replaced by the following text:

"**6.3.2.2.3** The welding parameters shall comply with the pWPS requirements. Besides, the welding of test pieces shall be carried out for the most unfavourable set of welding parameters, e.g. at maximum values of welding current and heat input (in cases, when impact testing is required) or when the pWPS heat input is reduced by 25 % for welding of high strength steels on the Tekken test piece (for cold crack testing). Non-observance of this test condition requires additional validation and, if this is not available or not correct, the Register has the right to require from the manufacturer of welded structures limitation of weld conditions (heat input) in pWPS down to values actually observed in the tests and corresponding to the range of approval.".

6 **New para 6.3.2.2.6** is introduced reading as follows:

"**6.3.2.2.6** The welding scheme for the Tekken test piece test joint shall correspond to Fig. 6.3.2.2.6. The weld shall be made in one run. After welding, the sample shall be kept at ambient temperature for at least 48 hours before the start of crack testing. The ambient temperature during welding shall be taken as the temperature of the ambient air during the welding. This temperature shall be entered to the WPS.

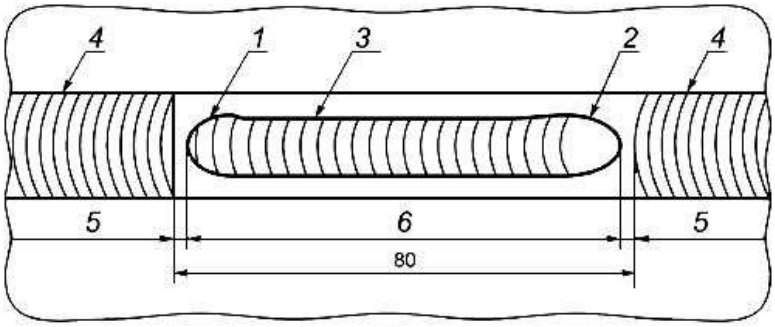

Fig. 6.3.2.2.6
The welding scheme for the Tekken test piece test joint:
1 – beginning of weld; 2 – end of weld; 3 – test weld; 4 – anchor weld; 5 – size equal to approximately 2 mm;
6 – size equal to approximately 76 mm".

7 **Table 6.4.1.1** "Requirements for extent of testing for approval of welding procedure" is supplemented with row "4" reading as follows:

"

Nos.	Type of welded test piece	Type of test	Extent of testing
4	Tekken test piece	Visual testing for surface cracks Macro examination of the test weld for cracks	100 % of weld length 4 transverse specimens in the absence of any visible surface cracks in the weld

".

8 The **text of para 6.4.2** is replaced by the following text:

"**6.4.2 Requirements for location and taking of test specimens for mechanical tests.**

Test specimens for mechanical tests shall be taken after all non-destructive testing (NDT) has been carried out and which has passed the relevant inspection criteria for the NDT method(s) used within the scope of requirements specified in Table 6.4.1.1. It is acceptable to take the test specimens from locations avoiding areas which have imperfections within the acceptance limits for the NDT method(s) used.

Test specimens for mechanical tests shall be taken in accordance with Figs. 6.4.2-1 — 6.4.2-5. Test specimens from Tekken test piece shall be taken in accordance with Fig. 6.4.2-6.".

9 **Para 6.4.2** is supplemented by the following **new Figure 6.4.2-6**:

"

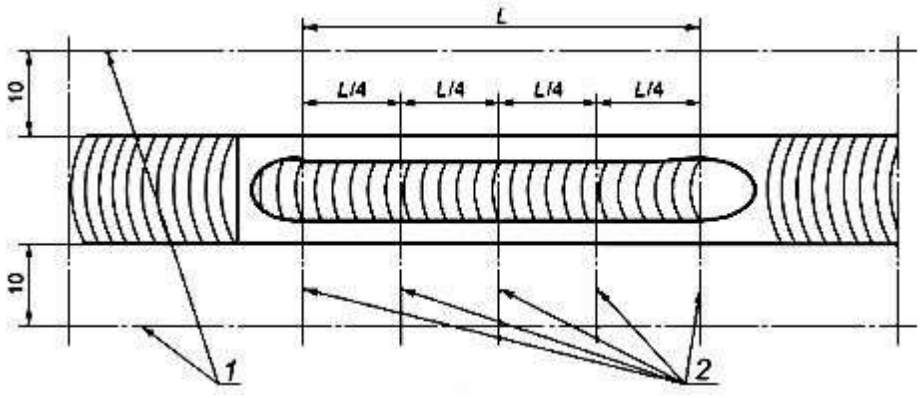

Fig. 6.4.2-6
Location of test specimens:
1 – cutting towards the specimen width;
2 – position of the test section.".

10 **New para 6.4.4.8** is introduced reading as follows:

"**6.4.4.8** Cold cracking test.

6.4.4.8.1 The test weld shall be inspected visually for surface cracks in accordance with ISO 17637 (inspection class is not regulated). If there are any visible surface cracks, the test is considered failed. If no cracks are found, then the weld test specimens shall be examined on macrosections.

N o t e . If it is not possible to identify the visible defect as a crack, then the weld test specimens shall be further examined on macrosections.

6.4.4.8.2 Surfaces of macrosections shall be prepared in accordance with 6.4.4.6 and inspected for any possible cracks. The inspection shall be carried out using optical instruments of at least x50 magnification. The conclusion that the specimens have no cracks shall be confirmed with the use of magnification of at least x200. 3 options for inspection results are possible as follows:

.1 no cracks are found on macro-sections, the test is considered to have satisfactory results;

.2 cracks with a length of under 0,5 mm inclusive are found on macrosections, the test is considered to have satisfactory results;

.3 cracks with a length over 0,5 mm are found on macrosections, the test is considered to have unsatisfactory results;

N o t e . If the first and the last test specimens have cracks in the sections which are closest to the anchor welds, it is necessary to perform visual evaluation of the deposited weld metal area of the specified test specimen, which shall not be significantly smaller than the area of the deposited weld metal cross-section at the opposite side. Otherwise, the test specimen at the side of the cross-section with a smaller deposited metal area shall be re-grinded up to the area close to the opposite side weld area and shall be re-checked for cracks.

6.4.4.8.3 If tests are failed, the welding technology in the pWPS shall be amended. When making amendments to the welding technology, the cold cracking tests shall be repeated.

N o t e . The increased resistance to cold cracking can be achieved through preheating, increasing the welding heat input, using "softer" formable welding materials, etc.
When choosing a preheat temperature, it is allowed to follow:

.1 Table 6.4.4.8.3;

.2 metal welding recommendations of the British Standard EN 1011-2, which includes impact on the preheating temperature (Tp), carbon equivalent (CET), plate thickness (d), diffusion hydrogen content in the weld metal (HD), and the welding heat input (Q) by the following formula:

$Tp = 697 \times CET + 160 \times tg(d/35) + 62 \times HD\ 0{,}35 + (53 \times CET - 32) \times Q - 328$ (ºC).

This ratio is valid for structural steels with the following parameters:

YS up to 1000 MPa;

CET = from 0,2 to 0,5 %;

d = from 10 to 90 mm;

HD = from 1 to 20 ml/100 g;

Q = from 0,5 to 4,0 kJ/mm.

When setting the preheating temperature according to the recommendations given, the lowest temperature shall be selected from the two ones. If unsatisfactory results are obtained from tests (specimen cracks), it is necessary to increase the preheating temperature up to the inter-roll temperature in accordance with the pWPS.

T a b l e 6.4.4.8.3

Preheating temperature requirements for high strength steel welding

Welded steel grade	Metal thickness, mm	Ambient air temperature, °C	Diffusion hydrogen content in the deposited metal, $cm^3/100g$	Minimal preheating temperature, °C
(A/F)690	Up to 130	From 0 and above	Up to 3,0 (H3)	80
			Above 3,0 up to 5,0 (H5)	100

Welded steel grade	Metal thickness, mm	Ambient air temperature, °C	Diffusion hydrogen content in the deposited metal, $cm^3/100g$	Minimal preheating temperature, °C
		From 0 to -10	Up to 3,0 (H3)	120
			Above 3,0 up to 5,0 (H5)	130
		From -11 to -15	Up to 3,0 (H3)	Following the manufacturer's recommendations agreed by RS
(A/F)690 and (A/F)550	Up to 40	From 0 and above	Up to 3,0 (H3)	40
			Above 3,0 up to 5,0 (H5)	60
		From 0 to -15	Up to 3.0 (H3)	80
			Above 3,0 up to 5,0 (H5)	100
		From -16 to -20	Up to 3,0 (H3)	Following the manufacturer's recommendations agreed by RS
	41-100	From 0 and above	Up to 3,0 (H3)	60
			Above 3,0 up to 5,0 (H5)	100
		From 0 to -15	Up to 3,0 (H3)	120
			Above 3,0 up to 5,0 (H5)	120
		From -16 to -20	Up to 3,0 (H3)	Following the manufacturer's recommendations agreed by RS
(A/F)500	Up to 40 inclusive	From 0 and above	Up to 3,0 (H3)	Without heating
			Above 3,0 up to 5,0 (H5)	40
			Above 5,0 up to 10,0 (H10)	60
		Below 0 down to -15	Up to 3,0 (H3)	60
			Above 3,0 up to 5,0 (H5)	80
		Below -15 down to -20	Up to 3,0 (H3)	100
	Above 40 up to 100 inclusive	From 0 and above	Up to 3,0 (H3)	60
			Above 3,0 up to 5,0 (H5)	80
		Below 0 down to -15	Up to 3,0 (H3)	80
			Above 3,0 up to 5,0 (H5)	100
		Below -15 down to -20	Up to 3,0 (H3)	Following the manufacturer's recommendations agreed by RS

N o t e s : 1. The Table establishes the minimum level of requirements for preheating temperature and interpass temperature for hardened and tempered steel in terms of cold crack susceptibility.

2. For steels of categories (A/F)500, manufactured using thermomechanical processing with accelerated cooling and having Ceqv ≤ 0,41 %, lower heating temperatures and interpass temperatures are allowed.

3. Actual values of preheating temperatures and interpass temperature shall be approved by the Register on the basis of tests for approving of welding procedures, including control of all the limiting parameters of a specific project (maximum hardness of the heat-affected zone, weld, etc.).

4. Preheating is regulated for welding methods with a heat input value not exceeding 3,5 kJ/mm.

5. Welding of steels with a yield strength of above 690 MPa is carried out at positive temperatures (above 0°C), if welding is carried out at negative temperatures (from 0°C to -10°C) with low-alloyed welding materials, the values of the minimum preheating temperature increase by 50°C. At temperatures from - 10°C to -25°C, welding is carried out only with austenitic welding materials with edge preheating for at least 40°C.

11 **Table 6.6.2.2.2** "Approval range of base metal thickness t for butt and T-joint welds and fillet welds". The column "Range of approval" is supplemented by footnote "4" reading as follows:

"[4]During certification tests on the Tekken test piece, the range of approval is limited to 3 to 1,0 *t* inclusive.".

12 **New para 6.6.3.6.3** is introduced reading as follows:

"**6.6.3.6.3** The range of approval of the welding procedure by heat input value shall not be less than the nominal value that occurred during welding of the Tekken test piece in course of certification testing.".

13 **Para 6.6.3.7** is supplemented by the following text:

"If there is no preheating temperature, the range of approval of the welding procedure shall not be lower than the ambient temperature that occurred during welding of the test piece in cold cracking certification tests.

The specified temperatures shall be recorded in the test reports and shall be entered to the WPS.".