RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER **No. 314-04-1831c** dated 03.10.2022

Re:

amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2022, ND No. 2-020101-152-E

Item(s) of supervision:

materials and welding

Entry-into-force date:
01.11.2022

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

Number of pages: 1 + 17

Appendices:

Appendix 1: information on amendments introduced by the Circular Letter

Appendix 2: text of amendments to Parts XIII "Materials" and XIV "Welding"

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. Bring the content of the Circular Letter to the notice of the RS surveyors, as well as interested organizations and persons in the area of the RS Branch Offices' activity.
2. Apply the provisions of the Circular Letter during review and approval of technical documentation on materials used on ships contracted for construction or conversion on or after 01.11.2022, in case of absence of a ship's data, during review and approval of documentation on materials requested for review on or after 01.11.2022.

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

Rules for the Classification and Construction of Sea-Going Ships

Part XIII: paras 2.2.10.2.1.3, 2.6.3, 2.6.4, 3.5.1.7, 3.5.3.1.1, 3.5.3.3.1.2, 3.5.3.3.2 — 3.5.3.3.6, 3.5.4 and 3.5.5.2, Tables 3.5.4, 3.16.1.9.1 and 5.1.3-1, para 6.5.4.4, Chapter 6.11, Table 9.2.3-3 and Chapter 11.3;

Part XIV: para 2.2.5.1, Table 2.2.5-2, para 3.4.5.3, Table 3.4.5.3 and Chapter 4.11

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"Thesis" System No. 22-188396

Appendix 1 to Circular Letter
No. 314-04-1831c dated 03.10.2022

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	Part XIII (paras 2.2.10.2.1.3, 3.5.1.7, 3.5.3.1.1, 3.5.3.3.1.2, 3.5.3.3.2 — 3.5.3.3.6, 3.5.4, 3.5.5.2 and Table 3.5.4)	Throughout the text of the Part the symbol of design temperature of structural member and material has been brought into compliance with that adopted in Part II "Hull"	314-04-1831c of 03.10.2022	01.11.2022
2	Part XIII, para 2.6.3	Requirements for data to be determined during tests have been specified	314-04-1831c of 03.10.2022	01.11.2022
3	Part XIII, para 2.6.4	Requirements for data to be recorded in the test reports have been specified	314-04-1831c of 03.10.2022	01.11.2022
4	Part XIII, Table 3.16.1.9.1	Requirements for the scope of testing of stainless steel has been specified considering the experience of technical supervision	314-04-1831c of 03.10.2022	01.11.2022
5	Part XIII, Table 5.1.3-1	Requirements for the permissible conditions of supply of the alloy 1565ч have been specified and requirements for its mechanical properties have been established	314-04-1831c of 03.10.2022	01.11.2022
6	Part XIII, para 6.5.4.4	Requirements for determination of total pore area have been specified	314-04-1831c of 03.10.2022	01.11.2022
7	Part XIII, Chapter 6.11	New Chapter with the requirements for FRP for manufacture of elements of ship's cranes has been introduced considering proposals and studies from the industry	314-04-1831c of 03.10.2022	01.11.2022
8	Part XIII, Table 9.2.3-3	Requirements for impact toughness of titanium alloy ПТ-3В have been specified	314-04-1831c of 03.10.2022	01.11.2022
9	Part XIII, Chapter 11.3	Chapter has been completely revised considering the experience of technical supervision	314-04-1831c of 03.10.2022	01.11.2022
10	Part XIV, para 2.2.5.1	Requirements for the scope of approval of welding consumables for high strength steel have been specified considering IACS UR W32 Rev.2 Corr.1	314-04-1831c of 03.10.2022	01.11.2022

Nos.	Amended paras/chapters/ sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
11	Part XIV, Table 2.2.5-2	Requirements for strength level of steels covered by the scope of approval of welding consumables have been specified	314-04-1831c of 03.10.2022	01.11.2022
12	Part XIV, para 3.4.5.3	Reference to ISO standard has been specified	314-04-1831c of 03.10.2022	01.11.2022
13	Part XIV, Table 3.4.5.3	Table has been corrected in compliance with the requirements of ISO 10675-1:2021	314-04-1831c of 03.10.2022	01.11.2022
14	Part XIV, Chapter 4.11	New Chapter with the requirements for approval of welding consumables for copper and its alloys has been introduced	314-04-1831c of 03.10.2022	01.11.2022

Appendix 2 to Circular Letter
No. 314-04-1831c dated 03.10.2022

RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2022,

ND No. 2-020101-152-E

PART XIII. MATERIALS

2 PROCEDURES OF TESTING

1 **Para 2.2.10.2.1.3** is replaced by the following text:

"**2.2.10.2.1.3** In the course of testing control is effected over the area of crystalline (brittle) or fibrous (ductile) components in the specimen fracture and over the test temperature. Moreover, upon completion of the tests, the existence of cleavage in the fracture within the fibrous component is estimated. In case of multiple cleavage or single cleavage that extends for more than one-half the specimen high (specimen high minus notch depth) an entry shall be made in the test report and the estimation of $T_{D(Tkb)}$ temperature of material usability is deemed invalid.".

2 **Para 2.6.3** is replaced by the following text:

"**2.6.3 Determination of porosity.**

Welds shall be subjected to breaking in such a manner that pore boundaries are clearly visible. Breaking shall be done alone the bisecting line of the angle made by the edges of the welded joint. If this requirement is not fulfilled, the specimen shall be discarded. Evaluation shall be done at x10 magnification. The image shall be projected onto a polished glass disc of about 200 mm in diameter, where the area of pores shall be determined. The size of an individual pore shall be determined as the largest in the two mutually perpendicular directions. The pore projection is determined as an ellipse with two sizes as main axes, on the basis of which the pore area is calculated.

Pores, the largest main axes of which are ≤0,5 mm, non-magnified, are not evaluated. Evaluation shall be done on the basis of 100 mm: 60 mm from the beginning of the weld and 40 mm from the end of the specimen are not included in the estimation of the results. The following data shall be determined for each specimen:

the number of pores, n;
the value of area of an individual pore, mm^2;
the mean area of an individual pore, mm^2;
the total pore area, F mm^2.".

3 **Para 2.6.4** is replaced by the following text:

"**2.6.4 Test report.**

A test report shall be compiled for each test, containing the following:
primer mark/brand name;
characteristics of the coating pigments;
characteristics of the bonding base of the coating;
chemical composition of the specimens of the base metal and welding wire;
coating thickness (individual and mean values);
calculation results based on tests, containing:
number of pores, n; mean area of individual pores, mm^2; total pore area, mm^2;
conclusion on the compliance with the requirements of 6.5.4.4;

date, name and address of the testing centre. The signature of the executive in charge and the person responsible for conducting the tests.

The following documents shall be attached to the report:

a report on selection of the specimens from the batch of products indicating the batch number;

Manufacturer's Certificates for the shop primer;

Manufacturer's Certificates for the base metal and welding consumables;

the Manufacturer's Certificate for the shielding gas used during welding tests for pore formation.".

3 STEEL AND CAST IRON

4 **Para 3.5.1.7** is replaced by the following text:

"**3.5.1.7** For manufacture of hull structural members of ships and MODU/FOP, with thicknesses beyond the scope of those specified by the Rules, as well as members subjected to long-term exposure to low temperatures and multi-cycle loads it is recommended to apply steel with index "Arc" complying with the requirements of 3.5.3 with T_D meeting the design temperature of structural member T_d.".

5 **Para 3.5.3.1.1** is replaced by the following text:

"**3.5.3.1.1** "Arc" is the symbol added to the designation of steel grade for which additional tests were performed according to the Register programs to determine ductility properties meeting the relevant requirements for Z-properties not less than 35 % according to the requirements of 3.14. The minimum material service/operating temperature T_D (without the minus symbol) down to which the steel may be used for any structural members without limitations shall be indicated next to the symbol. Example of designation: PCF40Arc30. The firm recognized as manufacturer of steel with index "Arc" may deliver rolled products with this index and temperature values in the range of – 10 °C up to T_D.".

6 **Para 3.5.3.3.1.2** is replaced by the following text:

"**.2** determining the crack resistance parameter *CTOD* for the base metal and HAZ metal in testing the specimens cut from butt-welded joints in accordance with 2.2.10.5 for rolled plates with thickness of 16 mm and more.

Tests of steel with index "Arc" to determine T_D temperature, as a rule, are carried out in the temperature interval including T_d temperature. The value of T_D is determined with 10 °C interval.

Where one procedure for steel manufacture is concerned (smelting, rolling, condition of supply), the results of the above tests obtained with the thickest rolled products may be extended to the rolling products with thicknesses smaller by 40 %, of all lower grades and strength levels where chemical composition, production technology and technology of heat treatment are identical to the tested material. At that, if, according to the calculations, the spread reaches the thickness of 10 mm and less, the minimum thickness approved by the Register shall be ≥ 10 mm.".

7 **Paras 3.5.3.3.2 — 3.5.3.3.6** are replaced by the following text:

"**3.5.3.3.2** The average value of *CTOD* for base metal shall be not less than that specified in Table 3.5.3.3.2 with the minimum value at least 0,7 of the required one. Tests are carried out in accordance with the requirements of Section 2 by RS-approved programs.

The lowest test temperature at which requirements specified in Table 3.5.3.3.2 are met, is assumed to be the minimum temperature $T_{D(CTODbm)}$ for the given type of tests.

Table 3.5.3.3.2

Requirements for CTOD value for base metal with index "Arc", mm

Thickness, mm, max.	Strength level (required minimum value of yield stress, MPa)									
	normal	315	355	390	420	460	500	550	620	690
20	–	0,10	0,10	0,10	0,10	0,15	0,15	0,15	0,20[1]	0,20[1]
30	–	0,15	0,15	0,15	0,15	0,20	0,20	0,20	0,20[1]	0,25[1]
40	0,10	0,15	0,15	0,20	0,20	0,20	0,20	0,25	0,25[1]	0,30[1]
50	0,15	0,20	0,20	0,20	0,20	0,25	0,25	0,25[1]	0,25[1]	0,30[1]
70	0,20	0,20	0,20	0,25	0,25	0,30	0,30	0,30[1]	0,30[1]	0,35[1]
80	0,20	0,25	0,25	0,25	0,30	0,30	0,30	0,30[1]	0,35[1]	0,35[1]
100	0,25	0,25	0,25	0,30	0,30	0,35	0,35	0,35[1]	0,40[1]	0,40[1]

[1] The test result is also considered satisfactory, if prior to non-stable brittle fracture for all tested specimens the maximum load has been obtained irrespective of obtained value δ_m, refer to 2.2.10.5.1.1.

3.5.3.3.3 The average value of *CTOD* for the HAZ metal shall be not less than that required by Table 3.5.3.3.3 with the minimum value at least 0,5 of the required one. If the number of correct tests is increased up to five and more, the lowest result may be ignored.

The lowest test temperature at which Table 3.5.3.3.3 requirements are met, is assumed to be the minimum temperature $T_{D(CTODhaz)}$ for the given type of tests.

Table 3.5.3.3.3

Requirements for CTOD value for HAZ metal, mm

Thickness, mm, max.	Strength level (required minimum value of yield stress, MPa)									
	normal	315	355	390	420	460	500	550	620	690
20	–	0,10	0,10	0,10	0,10	0,10	0,15	0,15	0,15[1]	0,20[1]
30	–	0,10	0,10	0,10	0,15	0,15	0,15	0,15	0,20[1]	0,20[1]
40	0,10	0,10	0,10	0,15	0,15	0,15	0,15	0,15	0,20[1]	0,20[1]
50	0,10	0,10	0,10	0,15	0,15	0,15	0,15	0,20[1]	0,20[1]	0,25[1]
70	0,10	0,15	0,15	0,15	0,20	0,20	0,20	0,25[1]	0,25[1]	0,30[1]
80	0,15	0,15	0,15	0,20	0,20	0,20	0,25	0,25[1]	0,30[1]	0,30[1]
100	0,15	0,15	0,20	0,20	0,20	0,25	0,25	0,30[1]	0,35[1]	0,35[1]

[1] The test result is also considered satisfactory, if prior to non-stable brittle fracture for all tested specimens the maximum load has been obtained irrespective of obtained value δ_m, refer to 2.2.10.5.1.1.

3.5.3.3.4 Based on the results of NDT, T_{kb} and *DWTT* the design material temperatures ($T_{D(NDT}$, $T_{D(Tkb)}$, $T_{D(DWTT)}$) for each test type are determined, the greatest of all the values is $T_{D(b\text{-}d)}$, assumed to be the ductile-brittle transition temperature of the sampling steel. Depending on the rolled products thickness the required temperature values $T_{D(NDT}$, $T_{D(Tkb)}$, $T_{D(DWTT)}$ for the steel marked with index "Arc" are given in Table 3.5.3.3.4.

Table 3.5.3.3.4

Determination of temperatures $T_{D(NDT)}$, $T_{D(Tkb)}$, $T_{D(DWTT)}$

Rolled product thickness, mm	$T_{D(NDT)}$, °C	$T_{D(Tkb)}$, °C	$T_{D(DWTT)}$, °C
From 10 up to 15 incl.	–	T_{kb}	*DWTT*
Over 15 up to 25 incl.	*NDT*	T_{kb}	*DWTT*
Over 25 up to 30 incl.	*NDT* + 15	T_{kb}	*DWTT*
Over 30 up to 40 incl.	*NDT* + 20	T_{kb} – 15	*DWTT* – 10
Over 40 up to 50 incl.	*NDT* + 25	T_{kb} – 25	—
Over 50 up to 60 incl.	*NDT* + 30	T_{kb} – 30 [1]	—
Over 60	*NDT* + 30		—

[1] Provided in addition to: $T_{kb} < 0{,}5T_{D(NDT)} + 15$.

Note. Additional condition means $T_{kb} \le -5°$ for Arc40, and $T_{kb} \le -15°$ for Arc60.

For the metal thickness of 40 mm and more, in case the difference between *NDT* and T_{kb} temperatures is over 50 °C, to control discontinuity of the material properties on resistance to brittle fracture, *NDT* specimens cut out from the mid-thickness of rolled products may be additionally tested in accordance with 2.2.10.3. *NDT* obtained during the test may be

considered as a replacement of temperature $T_{D(Tkb)}$. It is possible to determine $T_{D(b-d)}$ based on one or two ductile-brittle transition temperatures determined: $T_{D(NDT)}$, $T_{D(Tkb)}$ *or* $T_{D(DWTT)}$.

3.5.3.3.5 In all types of tests the greatest value shall be accepted as the minimum operating material temperature T_D, up to which the steel in question may be used for all the structural members without limitations:

$$T_D = \max\left(T_{D(CTODbm)}, T_{D(CTODhaz)}, T_{D(b-d)}\right).$$

3.5.3.3.6 *CTOD* acceptance testing shall be carried out during "Arc"-indexed rolled products manufacturing. At that, a set of three samples shall be taken from one square cut end of one plate from each batch in thickness approximating the full rolled product thickness. The samples shall be taken at 1/4 of the plate's width perpendicular to the rolling direction. The cut shall be located on thickness of the plate as for impact test specimens. Acceptance criteria are specified in Table 3.5.3.3.2.

For "Arc"-indexed rolled products with thickness of less than 16 mm, *CTOD* testing may be replaced by tests for determining temperature T_{kb}. Compliance with the requirements of 2.2.10.2 (70 % of fibrous component) for temperature T_D in accordance with the scope of recognition shall be considered as the acceptance criterion.".

8 **Para 3.5.4** is replaced by the following text:

"**3.5.4 Requirements for rolled plates with thickness of 15 mm and less.**

Manufacture and supply of steel rolled products designed for operation at low temperatures having thickness between 6 and 15 mm inclusive, is not allowed without mechanical tests. Mechanical tests shall mandatory include impact bending tests (*KV*) at a temperature not exceeding T_D on test specimens in compliance with 2.2.3.1.

For the rolled products with strength class of 460 MPa and above, additional tests results shall be submitted (refer to 2.2.10). Procedures, criteria and scope of these tests shall be agreed with the Register in advance. Besides, if the above special tests were not performed, special standards shall be specified for the impact energy of the base metal and welded joint metal (refer to Table 3.5.4) at a temperature not exceeding T_D. The impact energy may be reduced to 70 % of the required value for one of the three test specimens. For the rolled products with thickness of less than 10 mm, the required impact energy shall be determined by Formula (2.2.3.1.1).

Table 3.5.4

The impact energy standards for Grade F rolled plates and their welded joints with thickness of up to 15 mm at a temperature not exceeding T_D for the ships of ice class and icebreakers in absence of the special tests

Minimum yield stress in MPa	Minimum average value for three test pieces	
	Rolled product thickness up to 10 mm	Rolled product thickness above 10 to 15 mm inclusive.
460	46 *L*, 31 *T*	60 *L*, 40 *T*
500	50 *L*, 33 *T*	68 *L*, 45 *T*
550	55 *L*, 37 *T*	83 *L*, 55 *T*
620	70 *L*, 46 *T*	98 *L*, 65 *T*
690	86 *L*, 57 *T*	120 *L*, 80 *T*

".

9 **Para 3.5.5.2** is replaced by the following text:

"**3.5.5.2** Mechanical properties.

The mechanical properties of forged steel shall meet the requirements of 3.7.3. The required impact energy value during impact testing at the minimum design temperature T_d is specified in the RS-agreed standards and/or an approved specification, but shall be as follows:

not less than 27 J at the yield stress of steel less than 400 MPa;

not less than 41 J at the yield stress of steel from 400 to 690 MPa.

The percentage of fibrous component in the fracture of a specimen determined after impact testing shall be not less than 50 %.

To approve steel for essential forgings used at –30 °C and below, resistance to brittle fracture may be confirmed either by testing according to the *NTD* procedure (refer to 2.2.10.3) or by other test methods agreed with the Register, e.g. crack resistance tests.

The requirements for forgings for cargo-handling gear are set forth in Section 3 of the Rules for the Cargo Handling Gear of Sea-Going Ships.".

10 **Table 3.16.1.9.1** is replaced by the following text:

"Table 3.16.1.9.1

Types of semi-finished products of stainless steel tests

Characteristics to be determined	Steel class								
	M-1	MF-2	F-3	AM-4	A-5	A-6	A-7	AF-8	A-9
Mechanical properties at 20 °C:									
tensile strength R_m	+	+	+	+	+	+	+	+	+
yield stress $R_{po.2}$	+	+	+	+	+	+	+	+	+
elongation A_5	+	+	+	+	+	+	+	+	+
reduction in area Z	+	+	+	+	+	+	+	+	+
Same at operating temperature	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]
Impact toughness at KCV^{+20}	+	+	+	+	–	–	–	+	+
Impact toughness at a temperature below *KCV*	+[1]	+[1]	–	+[1]	+[1]	+[1]	+[1]	+[1]	+
Impact energy at a temperature below *KV*	–	–	–	–	+[1]	+[1]	+[1]	+	+[1]
Susceptibility to intergranular corrosion	+[2]	+	+	+	+	+	+	+	+
Macrostructure examination	+	+	+	+	+	+	+	+	+
a-phase examination	–	–	–	–	+[1]	+[1]	+[1]	–	+[1]
Grain size control	–	–	+	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]
Process tests	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]
Testing of the geometric dimensions	+	+	+	+	+	+	+	+	+
Non-destructive testing[3]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+
Control of non-metallic inclusion content	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]	+[1]
Determination or confirmation of brittleness critical temperature	+[1]	+[1]	+[1]	+[1]	–	–	–	–	–
Determination of a crack resistance parameter CTOD	–	–	–	–	–	–	–	–	+[1]
Through thickness tensile tests	–	–	–	–	–	–	–	–	+[1]

[1] When specified in the approved normative documentation excluding the pipes.
[2] Only for steel mark 07Х16Н4Б.
[3] The requirements of this Table for performance of non-destructive testing do not cover pipes. The requirements for non-destructive testing of pipes are specified in 3.16.4.4.

".

5 ALUMINIUM ALLOYS

11 **Table 5.1.3-1** is replaced by the following text:

"Table 5.1.3-1

Mechanical properties for rolled products

Grade	Temper condition	Thickness *t*, mm	Yield stress $R_{p0,2}$, N/mm², min.	Tensile strength R_m, N/mm², min.	Elongation, %, min.	
					A_{50} mm	A_{5d}
5083	O	3 ≤ *t* ≤ 50	125	275 — 350	16	14
	H111		125	275 — 350	16	14
	H112		125	275	12	10
	H116		215	305	10	10
	H321		215 — 295	305 — 385	12	10
5383	O	3 ≤ *t* ≤ 50	145	290	–	17
	H111		145	290	–	17
	H116		220	305	10	10
	H321		220	305	10	10
5059	O	3 ≤ *t* ≤ 50	160	330	24	24
	H111	3 ≤ *t* ≤ 50	160	330	24	24
	H116	3 ≤ *t* ≤ 50	270	370	10	10
		20 ≤ *t* ≤ 50	260	360	–	10
	H321	3 ≤ *t* ≤ 20	270	370	10	10
		20 ≤ *t* ≤ 50	260	360	–	10
5086	O	3 ≤ *t* ≤ 50	95	240 — 305	16	14
	H111		95	240 — 305	16	14
	H112	3 ≤ *t* ≤ 12,5	125	250	8	–

Grade	Temper condition	Thickness t, mm	Yield stress $R_{p0,2}$, N/mm^2, min.	Tensile strength R_m, N/mm^2, min.	Elongation, %, min.	
					A_{50} mm	A_{5d}
		12,5 ≤ t ≤ 50	105	240	–	9
	H116	3 ≤ t ≤ 50	195	275	10°	9
5754	O	3 ≤ t ≤50	80	190 — 240	18	17
	H111		80	190 — 240	18	17
5456	O	3 ≤ t ≤ 6,3	130 — 205	290 — 365	16	
		6,3 ≤ t ≤ 50	125 — 205	285 — 360	16	14
	H116	3 ≤ t ≤ 30	230	315	10	10
		30 ≤ t ≤ 40	215	305	–	10
		40 ≤ t ≤ 50	200	285	–	10
	H321	3 ≤ t ≤ 12,5	230 — 315	315 — 405	12	–
		12,5 ≤ t≤ 40	215 — 305	305 — 385	–	10
		40 ≤ t ≤ 50	200 — 295	285 — 370	[1]	10
National alloys						
1530	O/H112	3 ≤ t ≤ 12,5	80	185	15	–
		12,5 ≤ t ≤ 50	60	165	–	11
1550	O/H112	3 ≤ t ≤ 12,5	125	275	15	–
		12,5 ≤ t ≤ 50	110	255	–	12
1561	O/H112	3 ≤ t ≤ 12,5	175	335	12	–
		12,5 ≤ t ≤ 50	175	335	–	10
1561Н	H32/H321	3 ≤ t ≤ 12,5	245	355	10	–
		12,5 ≤ t ≤ 50	225	335	–	12
1565ч	O/H112	2≤ t≤ 4	145	330		18
		5	170	330		15
		5,5 ≤ t ≤ 10,5	175	335		15
		11,0 ≤ t ≤ 40,0	175	335		15
		40 ≤ t ≤ 60	175	330		15
		60 ≤ t ≤ 80	170	310		12
	H116	2 ≤ t ≤ 10,5	260	360	10	–
		10,5 ≤ t ≤ 30	270	370	–	10
	H321	2 ≤ t ≤ 10,5	260	360	10	–
		10,5 ≤ t ≤ 30	270	370	–	10
1575	O/H112	3 ≤ t ≤ 12,5	295	400	11	–
1581	O/H112	1,5 ≤ t ≤ 6,0	205	345	–	15
		6 < t ≤ 10,5	200	350		15
		10,5 < t ≤ 50,0	190	350		14

[1] 8 % for thicknesses up to and including 6,3 mm.

N o t e s : 1. The values in the Table are applicable for longitudinal and transverse specimens as well.
2. The mechanical properties for the O and H111 tempers are the same. However, they are separated to discourage dual certification as these tempers represent different processing.

".

6 PLASTICS AND MATERIALS OF ORGANIC ORIGIN

12 **Para 6.5.4.4** is replaced by the following text:

"**6.5.4.4** A primer not removed before welding shall have the following results of qualification testing performed in compliance with the requirements of 2.6: the total pore area, F mm^2 in each specimen shall not exceed 150 mm^2.".

13 **New Chapter 6.11** is introduced reading as follows:

"6.11 POLYMER COMPOSITE MATERIALS (FIBER-REINFORCED PLASTICS) USED IN THE MANUFACTURE OF STRESS-BEARING STRUCTURES OF SHIP'S CRANES.

6.11.1 These requirements apply to structural fiber-reinforced plastics (FRP) based on reinforcement cores manufactured of glass and/or carbon fibers and polymer binders: polyester, vinylester and epoxy ones, which are used for manufacture of stress-bearing structures of ship's cranes in accordance with Section 7 of the Rules for Cargo Handling Gear of Sea-Going Ships.

6.11.2 The choice of FRP components shall be confirmed by obtained design structural features, strength calculations and tests.

6.11.2.1 FRP specimens manufactured of carbon and glass fibers based on epoxy binders shall be tested to obtain the following properties:

density;

fiber volume fraction — ISO 1183;

strength and modulus of elasticity in elongation along the fibers — ISO 527-5, ISO 9163 (for on load tap changing technology, the beam diameters — 2 and 5 mm);

strength and modulus of elasticity in compression along fiber — ISO 14126, ISO 3597 (for on load tap changing technology, the beam diameters — 2, 5 and 7 mm);

shear strength and modulus— ASTM D7078/D7078M (GOST R 57207);

interlaminar shear strength — ASTM D2344.

6.11.2.2 FRP specimens with other composition than that given in 6.11.2.1 shall be observed for determination of operational factor influence on change of properties of such FRP for the planned period of application and chosen operational mode of a crane. These factors include:

tests for exposure of salt mist (method recommended in ISO 9227);

tests for exposure of ultraviolet (method recommended in ISO 4892-2, A method);

tests for exposure to cycling loads (elongation — compression cycle) on specimens for tensile and compression tests without fracturing;

number of load cycles 1 x 105 (method recommended in ISO 13003);

exposure to moisture (method of manufacturer/laboratory).

6.11.3 Reinforcement materials.

6.11.3.1 Reinforcement materials in FRPs shall ensure specified stiffness and strength characteristics, including the material exposed to various operational factors in accordance with type and class of the crane.

6.11.3.2 The following types of fibers are allowed: glass and carbon fibers.

6.11.3.3 Other types of fibers may be accepted if FRP physical and mechanical properties with application of these fibers are not less than that given in Table 2.3.1.3 of Part XVI "Structure and Strength of Fiber-Reinforced Plastic Ships" and considering satisfactory results of additional studies of FRP specimens in accordance with 6.11.2.2.

6.11.3.4 Material with fiber density 200 to 4800 tex[1] is allowed to be used as a reinforcement material.

6.11.3.5 During the incoming inspection of fibers and reinforcement materials on their basis the requirements of 2.3.1.6, Part XVI "Structure and Strength of Fiber-Reinforced Plastic Ships" shall be met.

6.11.3.6 The fibers and reinforcement materials on their basis shall be supplied with a Manufacturer's Certificate of Quality in accordance with 2.3.1.8, Part XVI "Structure and Strength of Fiber-Reinforced Plastic Ships".

6.11.4 Binder materials.

6.11.4.1 Epoxy resin is accepted as a primary component of FRP binder for manufacture of structural members of ship's cranes. Other binders may be accepted considering satisfactory results of additional studies of FRP specimens in accordance with 6.11.2.2.

6.11.4.2 All resins used for manufacture shall be subject to incoming inspection.

6.11.4.3 Within the incoming inspection the binder characteristics confirmed by the technical documentation and quality control standards of the manufacturer shall be checked.

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[1] Complies with the linear density of fibers. It is a mass of a woven roving of 1 km in length.

Tests to determine binder characteristics shall be carried out by the firm (manufacturer) according to the international and/or national standards or other documents agreed with the Register. Testing may be also carried out by a laboratory recognized by the Register. If Type Approval Certificate (CTO) is available, the testing shall be carried out by the firm (manufacturer) of fibers and reinforcement materials, and the results shall be recorded in the Manufacturer's Certificate of Quality of each product batch produced.".

9 TITANIUM ALLOYS

14 **Table 9.2.3-3** is replaced by the following text:

"Table 9.2.3-3

Mechanical properties of forgings and stamped billets

Alloy	Direction of cutting out specimens	Yield stress $R_{p0,2}$, MPa	Tensile strength, min	R_m, MPa, min. Diameter or thickness (wall thickness), mm	Elongation A_{5d}, %, min.	Reduction of area, %	Impact toughness, *KCU*, kJ/m^2
ПТ-3В	Longitudinal	589	638	≤100	6 — 10	25	687
				> 100 to ≤ 200	9	25	589
				>200 to ≤ 450	8	22	
				>450 to ≤ 650	7		
	Tangential (transversal)	540	589	≤ 100	7	20	589
				>100 to ≤ 200	7	15	
				>200 to ≤ 450	6	15	
				>450 to ≤ 650	5	13	
5В	Longitudinal	755	805	≤ 100	9	22	491
				>100 to ≤ 650	8	18	
	Tangential			>120 to ≤ 200	7	15	
				>120 to ≤ 650	5	11	
37	Longitudinal	764	815	≤ 200	10	22	491
				>200 to ≤ 650	7	17	
	Tangential	736	786	>120 to ≤ 200	9	18	
				>200 to ≤ 650	6	12	

".

11 ADDITIVE MANUFACTURING PRODUCTS

15 **Chapter 11.3** is replaced by the following text:

"**11.3 METAL ADDITIVE PRODUCTS**

11.3.1 General.

11.3.1.1 The present requirements cover metal semi-manufactured articles, end products of ship's arrangements and ship machine-building components from metals produced using additive manufacturing methods.

Metal powder, welding wire or strip may be used as precursors. Most commonly, heat input required for the synthesis is supplied by laser beam, electronic beam, plasma, electric arc or other ways.

11.3.1.2 This Chapter contains the requirements for additive product material pertaining to scope of required tests, delivery characteristics and surface condition.

11.3.1.3 Selection of the particular applicable type of metal for manufacture of additive products is within the manufacturer's responsibility. Correctness of selection shall be verified by the tests.

11.3.1.4 Material grade designation shall be maintained in compliance with national and international standards.

11.3.2 Production.

11.3.2.1 Additive products are manufactured according to specifications, technical conditions, standards or other normative documents, which the supply complies with.

11.3.2.2 RS recognition of additive products manufacturers shall be carried out in compliance with 2.1, 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. Scope of application of the issued Recognition Certificate for Manufacturer covers the surveyed metals and additive synthesis methods. Furthermore, apart from the requirements of other sections of the Rules, the Certificate shall contain the following:

types (steel, titanium or other alloys, compositions, etc.);

kinds (carbon steel, corrosion-resistant steel, etc.);

classes and grades (categories) (AF-7, BT6, etc.);

synthesis process (laser melting (Directed Energy Deposition (DED), Direct Metal Deposition (DMD)), selective laser melting (SLM), etc.);

types of precursors applied (powder, wire, strip, etc.);

applied condition of supply;

maximum overall dimensions of the product.

11.3.2.3 The manufacturer's responsibility shall be determined by the normative document for supply and shall ensure compliance of additive manufacturing and additive product properties with the specified requirements of the normative document and these Rules. Where occurrences of product quality index reduction are detected by control system, the manufacturer shall identify them and take appropriate measures for prevention thereof. Report on performed investigations and appropriate actions shall be submitted to the Register.

11.3.2.4 During the manufacturer survey, normative documentation regulating the procedures of production process, such as applied radiated power, rebuild welding rate, etc. shall be submitted. In compliance with the requirements of 11.3.2.3, the manufacturer is responsible for further observation of all specified processing methods during the additive product manufacture. The relevant records shall be controlled by the manufacturer and submitted to the RS representative during the survey.

Deviations from the established synthesis procedures may be permitted provided that the quality of manufactured products meets the requirements to product materials. The specified deviations shall be agreed with the Register.

11.3.2.5 Synthesis of additive products shall be performed using metal powder, combination of welding wire with gas or inert gas, combination of welding wire or strip and flux. Chemical composition of precursors shall be controlled by the manufacturer of the additive product by verifying the compliance of international and national standards, technical conditions, technical requirements, specifications or other normative documents.

When precursors are manufactured at one firm, and the additive product synthesis is carried out at another firm, a precursor Manufacturer's Certificate specifying the batch number and, at least, chemical composition shall be submitted to the surveyor.

11.3.2.6 Each precursor batch shall be subjected to inspection prior to use by the following parameters:

check of accompanying documentation (Manufacturer's Certificate);

check of packing;

check of chemical composition;

check of powder granulometric composition, where applicable;

check of powder pour density and plastic yield, where applicable.

Determination of chemical and granulometric composition, pour density and plastic yield of powder shall be carried out in accordance with the procedures that shall be included in the test program approved by the Register. Incoming inspection shall be carried out at the most one month prior to the additive manufacturing start.

Where the Register identifies significant defects of metal structure of the product, verification of geometric and other parameters of the precursor may be requested.

In case of repeated application of precursors, the manufacturer shall provide relevant conditions for their storage as well as perform control over their technological properties and geometric parameters. Such precursors shall be subject to mandatory agglomeration sieving. In addition, the area of product designed for sampling shall be made of precursor of the worst quality if different precursors are used for fabricating.

11.3.2.7 Incoming inspection of welding wire, strip and flux applied for manufacture of additive products shall be carried out in compliance with the national and international standards agreed by RS.

11.3.2.8 Procedures of tensile test, impact test, metallographic examination, tests for intergranular, pitting and crevice corrosion resistance, α-phase determination, etc. of additive product material shall comply with the requirements of Section 2 and/or national and international standards agreed by RS.

11.3.2.9 While selecting precursor material grade, the required performance properties shall be taken into account based on the product functionality and the requirements of applicable sections of this Part for prototypes and/or documents for supply for chemical composition of the prototypes.

11.3.2.10 During the approval of the requirements to mechanical properties of additive product material by the Register, the requirements of the documents for supply, as well as the requirements specifying the product purpose in respect of the minimum operating temperature, possible exposure to corrosive environment, cycling of operating loads and other operating conditions shall be taken into consideration.

11.3.2.11 Selection of the condition of supply shall be determined by the required quality of additive product that ensure obtaining of mechanical properties, in its turn determined by documents for supply. Unless stated otherwise, the following supply conditions are permitted:

in the condition without heat treatment;

homogenizing annealing;

normalizing;

heat refining (quenching and tempering).

Parameters of additional heat treatment shall be included in documentation regulating the procedures of production process.

11.3.2.12 For additive products made by a method of direct laser deposition from low-alloyed and corrosion-resistant steel of 09ХН2МД, 08ГДНФЛ and 06Х15Н4ДМЛ grades, heat treatment is required.

11.3.2.13 The manufacturer shall attract attention of the consumer to the material susceptibility to fatigue as well as depth of the product surface layer of high discontinuity if applicable.

11.3.3 Sampling.

11.3.3.1 Prior to the preparation of scheme of taking samples, the manufacturer shall provide the justification of material target structure selection. Selection of sampling point or procedure for synthesis technology of reference samples shall be based on the necessity to control the worst properties and material structure and/or the most significant sections regarding operational conditions of the product. The analysis of differences of estimated properties and structure of the additive product layer shall be submitted to the Register.

11.3.3.2 As a rule, in order to conduct the prescribed tests, an additional product to the batch shall be synthesized subject to preparation for specimen manufacture. This product shall be manufactured according to the same technology, using the same equipment and from the precursor of the same batch, and with the same heat treatment as the products from the batch.

11.3.3.3 It is permitted to take samples from extra part to the additive product body from the batch. The procedure of sampling and specimen cutting out shall be specified in design documentation and/or test program approved by the Register. At that, the manufacturer shall preliminarily prove that the extra part to the additive product body does not significantly influence (positively or negatively) the quality and properties of the product layers. The sampling and specimen manufacture shall be performed upon completion of all types of heat treatment.

11.3.3.4 For scheduled testing and control, additive synthesis of samples separate from the product is permitted as well. Built samples shall be manufactured successively with the products from the batch of precursor of the same batch, using the same equipment as the whole batch. Synthesis technology of samples shall provide the structure and properties complying with the product material. This compliance shall be preliminary proved to the Register. In this case, the dimensions of a sample in thickness and diameter may differ from the maximum dimensions of the additive product not more than by 25 % or with at least 1 mm of machining allowance, whichever is less.

Built samples shall be subjected to heat treatment in one furnace charge with the additive product submitted for survey.

11.3.3.5 Dimensions of samples shall ensure performance of the required tests and possible retesting.

11.3.3.6 Specimens for mechanic testing and microstructure check, taking into consideration the possible properties anisotropy, shall be cut in two directions with respect to synthesis direction, i.e. longitudinal axes of specimens shall be parallel and perpendicular respectively to direction of the additive product fabrication. When manufacturing specimens the surface layer of the sample shall be considered depending on the provided machining during manufacture of product.

11.3.4 Scope of testing.

11.3.4.1 Types of tests the additive products to be subjected to are given in Table 11.3.4.1. Tests to be carried out for supplies under the RS technical supervision are marked by "+".

Table 11.3.4.1

Types of additive product tests

Parameters	Types of materials		
	Low-alloyed steels	Corrosion-resistant steels	Titanium alloys
Chemical composition	+	+	+
Tensile tests at 20 °C:			
tensile strength R_m	+	+	+
yield stress $R_{0,2}$	+	+	+
elongation A_5	+	+	+
relative reduction Z	+	+	+
fatigue endurance σ_R[1]	+	+	+
Fracture energy at impact bending at the minimum operating temperature	+	+	+
Microstructure check	+	+	+
α-phase control	–	+[2]	–
Intergranular corrosion resistance	–	+	–
Pitting and crevice corrosion resistance	–	+	–
Non-destructive testing	+	+	+

N o t e . Types of samples and testing procedures shall comply with the requirements of Section 2.

[1] If the finished product is subjected to cycle load.

[2] For austenitic steels prior to heat treatment.

11.3.4.2 Additive products shall be submitted for testing in batches or in pieces. In case of survey of a batch of additive products, one product from the batch shall be subjected to mechanical tests. Each product of the batch shall be subjected to non-destructive testing.

The batch shall consist of additive products of the same name and range, manufactured from precursor of one batch, at the similar synthesis process parameters, and heat treatment shall be carried out in the same furnace charge. Batch size shall be also restricted by a total weight of additive products equal to 200 kg.

Additive products from low-alloyed steel covered by the requirements for cold resistance shall be submitted for testing in pieces.

11.3.4.3 If not otherwise stated, a minimum number of specimens shall be made from one sample according to Table 11.3.4.3.

Table 11.3.4.3

Test type	Number of specimens
Determination of chemical composition	One
Tensile test	Three test specimens per each of two directions
Determination of impact energy	Three test specimens per each of two directions
Intergranular corrosion resistance	4 (two check samples)
Pitting corrosion and gap corrosion resistance	Three test specimens per each test type
Microstructure check	One specimen per two faces of cross section preparing

11.3.4.4 Retesting of additive product material shall be carried out in compliance with 1.3.2.3. In retesting the parameters having unsatisfactory results shall be determined. In this case the scope of testing shall be duplicated.

11.3.4.5 The list of the controlled properties may be extended in case the consumer provides special requirements.

11.3.5 Non-destructive testing.

11.3.5.1 Non-destructive testing of the additive products shall be carried out using the following procedures:

visual testing and measuring;

radiographic testing.

Use and scope of other control methods shall be agreed with the consumer.

11.3.5.2 Non-destructive testing shall be carried out in compliance with 2.5, 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 in compliance with the selected prototypes, and/or national and international standards agreed by the Register.

11.3.5.3 Non-destructive testing of semi-finished propellers shall be performed based on the requirements of 3.12.7 or 4.2.7 depending on the selected material of precursor.

11.3.6 Surface condition.

11.3.6.1 The surface quality of objects of additive products application shall comply with the requirements of design documentation and/or national and international standards.

The surface quality and structure of surface layer of the additive product shall be considered during design of electronic geometric model of further mechanical treatment and operation. Manufacturer quality system shall ensure the required scope surface check of product and surface layer of samples preceding the product supply to the consumer. Where material surface defects are detected during the latter stages of manufacture, repair may be carried out in compliance with 11.3.6.2.3. Product repair shall be agreed with the consumer.

11.3.6.2 Acceptance criteria.

11.3.6.2.1 Acceptance criteria of the additive product shall be agreed with the consumer and presented in the documents for supply.

11.3.6.2.2 Cracks, flaw, delaminations, sharp edges and other visible surface defects, as well as preventing end use of the products require cutting-out or grinding with subsequent repair.

11.3.6.2.3 Surface defect elimination.

11.3.6.2.3.1 Grinding of defects without rebuild welding is acceptable under the following conditions:

elimination of surface defects by local grinding is permitted for the depth not exceeding 7 % of the nominal thickness, but not exceeding 3 mm;

the area of separate grinding zones shall not exceed 1 % of the total area of the additive product;

the total grinding area shall not exceed 2 % of the total area of the additive product;

In such a case, the defects located at the distance less than their average width from each other are considered as a single defect area;

Grinded surface shall have smooth transition to surrounding surface of the product. Complete elimination of the defect shall be verified by magnetic particle or by dye penetrant testing.

11.3.6.2.3.2 Surface reconditioning after defect elimination

Elimination of additive product defects by rebuilding shall be carried out using precursors of the same grade as the additive products manufactured.

Technology process of surface defect elimination by rebuilding shall be submitted to the Register for approval. Elimination of defects shall be accompanied by subsequent non-destructive testing.

11.3.6.2.3.3 The requirements of 3.12.9 or 4.2.8 apply to defect elimination on semi-finished propellers depending on the selected material of precursor.

11.3.7 Marking and documents.

11.3.7.1 Identification, marking and the documents issued shall comply with the requirements of 1.4.

11.3.7.2 Each additive product shall be accompanied with the RS Certificate.

PART XIV. WELDING

2 TECHNOLOGICAL REQUIREMENTS FOR WELDING

16 **Para 2.2.5.1** is replaced by the following text:

"**.1** the scope of application of the particular welding consumable grade has the following limitations for welding of the base metal depending on its strength level as specified in Table 2.2.5-2:

scope of application of welding consumables approved for strength levels Y42, Y46 and Y50 may cover the welding of steels in the two strength levels below that for which they have been approved;

scope of application of welding consumables approved for strength levels Y55, Y62 and Y69 may cover the welding of steels in the one strength level below that for which they have been approved.

scope of application of welding consumables approved for strength level Y89 may cover the welding of steels in the same strength level;

scope of application of welding consumables approved for strength level Y96 may cover the welding of steels in the one strength level below that for which they have been approved.".

17 **Table 2.2.5-2** is replaced by the following text:

"Table 2.2.5-2

Identification of welding consumables grades by strength level	Identification of higher and high strength and steel grades by strength level									
	(A/F) 36	(A/F) 40	(A/F) 420	(A/F) 460	(A/F) 500	(A/F) 550	(A/F) 620	(A/F) 690	(A/E) 890	(A/E) 960
(3Y/5Y)42	+	+	+	–	–	–	–	–	–	–
(3Y/5Y)46	–	+	+	+	–	–	–	–	–	–
(3Y/5Y)50	–	–	+	+	+	–	–	–	–	–
(3Y/5Y)55	–	–	–	–	+	+	–	–	–	–
(3Y/5Y)62	–	–	–	–	–	+	+	–	–	–
(3Y/5Y)69	–	–	–	–	–	–	+	+	–	–
(3Y/4Y)89	–	–	–	–	–	–	–	–	+	–
(3Y/4Y)96	–	–	–	–	–	–	–	–	+	+

".

3 TESTING OF WELDED JOINTS

18 **Para 3.4.5.3** is replaced by the following text:

"**3.4.5.3** If otherwise is not agreed with the Register, assessment of the welded joints quality on the radiographic testing results shall be carried out in accordance with ISO 10675-1:2021 (refer to Table 3.4.5.3) for the quality levels specified by the requirements of 3.4.1.2 or 3.4.1.3.".

19 **Table 3.4.5.3** is replaced by the following text:

"Table 3.4.5.3

Acceptance levels of internal indications in butt welds

No.	Type of internal imperfections in accordance with ISO 6520-1:2007		Limits for imperfection for quality levels		
			1	2[1]	3[1]
1	Cracks	100	Not permitted	Not permitted	Not permitted
2*a*	Gas pore and Uniformly distributed porosity Single layer weld	2011 2012	$A \le 1$ % $d \le 0{,}2s$, max. 3 mm L = 100 mm	$A \le 1{,}5$ % $d \le 0{,}3s$, max. 4 mm L = 100 mm	$A \le 2{,}5$ % $d \le 0{,}4s$, max. 5 mm L = 100 mm
2*b*	Gas pore Uniformly distributed porosity Multi layer weld	2011 2012	$A \le 2$ % $d \le 0{,}2$s, max. 3 mm L = 100 mm	$A \le 3$ % $d \le 0{,}3$s, max. 4 mm L = 100 mm	$A \le 5$ % $d \le 0{,}4$s, max. 5 mm L = 100 mm
3	Clustered (localized) porosity	2013	$d_A \le w_p/2$, max. 15 mm $d \le 0{,}2s$, max. 3 mm	$d_A \le w_p$, mx. 20 mm $d \le 0{,}3s$, max. 4 mm	$d_A \le w_p$, max. 25 mm $d \le 0{,}4s$, max. 5 mm
4	Linear porosity (Lines)	2014	$l \le s$, max. 25 mm $d \le 0{,}2$s, max. 2 mm L = 100 mm	$l \le s$, max. 50 mm $d \le 0{,}3$s, max. 3 mm L = 100 mm	$l \le s$, max. 75 mm $d \le 0{,}4$s, max. 4 mm L = 100 mm
5	Wormholes (pipes) and elongated cavity	2016 2015	$h < 0{,}2s$, max. 2 mm $\Sigma l \le$ s, max. 25 mm L = 100 mm	$h < 0{,}3s$, max. 3 mm $\Sigma l \le$ s, max. 50 mm L = 100 mm	$h < 0{,}4s$, max. 2 mm $\Sigma l \le$ s, max. 75 mm L = 100 mm
6	Shrinkage cavity (except for crater pipe — 2024)	202	Not permitted	Not permitted	$h < 0{,}4s$, max. 4 mm $l \le 25$ mm
7	Crater pipe	2024	Not permitted	Not permitted	$h < 0{,}2t$, max. 2 mm $l \le 0{,}2t$, max. 2 mm
8	Slag inclusions, Flux inclusions, Oxide inclusions	301 302 303	$h < 0{,}2s$, max. 2 mm $\Sigma l \le s$, max. 25 mm L = 100 mm	$h < 0{,}3s$, max. 3 mm $\Sigma l \le s$, max. 50 mm L = 100 mm	$h < 0{,}4s$, max. 4 mm $\Sigma l \le s$, max. 75 mm L = 100 mm
9	Metallic inclusions other than copper	304	$l \le 0{,}2s$, max. 2 mm	$l \le 0{,}3s$, max. 3 mm	$l \le 0{,}4s$, max. 4 mm
10	Copper inclusiond	3042	Not permitted	Not permitted	Not permitted
11[2]	Lack of fusion	401	Not permitted	Not permitted	Permitted not breaking the surface $l \le 0{,}4s$, max. 4 mm Permitted but only intermittent and not surfaced $\Sigma l \le 25$ mm, L = 100 mm
12[2]	Lack of penetration	402	Not permitted	Not permitted	$\Sigma l \le 25$ mm, L = 100 mm

Symbols:
l – length of imperfection projection, in mm;
L — any (with imperfection maximum density) 100 mm weld length;
s — nominal thickness of the butt weld, in mm;
t — material thickness, in mm;
w_p — weld width, in mm;
A – the sum of the different pore areas related to the evaluation area $w_p \times L$, in %;
d – pore diameter, in mm;
d_A – diameter of area surrounding a pore, in mm;
h – width of imperfection projection, mm;
Σl — maximum total length of weld imperfection projection L, in mm;

[1] Quality levels 2 and 3 cab have index "×" which designates all imperfections above 25 mm and are not permitted.
[2] If the weld length is under 100 mm the maximum imperfection length shall not be above 25 % of that length.

".

4 WELDING CONSUMABLES

20 **New Chapter 4.11** is introduced reading as follows:

"4.11 WELDING CONSUMABLES FOR COPPER ALLOYS

4.11.1 General.

4.11.1.1 The provisions of this Chapter specify the conditions of approval and survey of welding consumables to be used for equipment and products of copper and its alloys as per the requirements of Section 4 of Part XIII "Materials". Where no special requirements are given

herein, those for the approval of welding consumables for normal and higher strength hull structural steels shall apply in analogous manner.

4.11.1.2 Approval of a wire or a rod shall be granted in conjunction with a specific shielding gas type composition group according to Table 4.9.1.4 or defined in terms of composition and purity of "special" gas to be designated with group sign "S". The shielding gas composition shall be indicated in a test report and the Certificate of Approval for Welding Consumables. The approval of the wire with any particular gas can be applied or transferred to any combination of the same wire and any gas in the same numbered type composition group as defined in Table 4.9.1.4. For special gases designated with sign "S" the approval is valid only for the specific composition and purity of the shielding gas or mixture used in testing.

4.11.1.3 The approval procedure and the requirements for manufacturers shall be in accordance with 4.1.3. The requirements for test performance and results evaluation shall comply with the provisions in 4.2. The scope of testing for approval of welding consumables for copper and its alloys shall be limited by the deposited metal test according to 4.11.2.

4.11.2 Deposited metal test.

Deposited metal tests shall be carried out in compliance with the requirements of 4.10.2. The results of the chemical analysis in main alloying elements and impurities shall be within the limits specified by the manufacturer.

4.11.3 Annual tests.

The annual tests to endorse the COCM shall include the preparation and testing of the deposited metal test assembly as specified in 4.11.2.".