RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER **No. 311-05-1942c** dated 30.05.2023

Re:

amendments to the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, 2023, ND No. 2-020101-175-E, and Rules for the Classification and Construction of Sea-Going Ships, 2023, ND No. 2-020101-174-E

Item(s) of supervision:

welding

Entry-into-force date:
01.06.2023

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

Number of pages: 1 + 20

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" of the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships and Part XIV "Welding" of the Rules for the Classification and Construction of Sea-Going Ships

Director General Sergey A. Kulikov

Text of CL:

We hereby inform that the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, 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, interested organizations and persons in the area of the RS Branch Offices' activity.
2. Apply the provisions of the Circular Letter when performing technical supervision of welding consumables, welders' qualification procedure and certification of welding processes on ships contracted for construction of conversion on or after 01.06.2023, in the absence of a ship's data, during review and approval of the technical documentation requested for review on or after 01.06.2023

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

Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships:
Part III: Part III, paras 4.3.3.1, 4.4.4.1, 4.4.4.2, 4.4.4.4, 4.4.5.5.1, 4.5.5, 4.5.7, Table 4.5.8-3, para 7.1.1, Table 7.3.2.1, para 7.4.2.1 and Table 7.4.2.2
Rules for the Classification and Construction of Sea-Going Ships:
Part XIV: Part XIV, Table 2.2.7.1, paras 2.13.6 and 3.1.1.1, Tables 3.1.1.2-1 — 3.1.1.2-3, para 3.1.2.2, Tables 4.9.1.3-2 and 4.9.3.6

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"Thesis" System No. 23-54405

Appendix 1 to Circular Letter
No. 311-05-1942c dated 30.05.2023

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	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.3.3.1	Throughout the text of the Part term "visual and measurement testing" has been replaced by "visual testing"	311-05-1942c of 30.05.2023	01.06.2023
2	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.3.3.1	Para has been supplemented with a group of titanium alloys considering ISO/TR 15608:2017	311-05-1942c of 30.05.2023	01.06.2023
3	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.4.1	Requirements for welders' certification in the welding of non-ferrous metals and their alloys have been specified considering ISO 9606	311-05-1942c of 30.05.2023	01.06.2023
4	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.4.4.1	Requirements for testing methods of welded joint during welders' practical tests have been specified	311-05-1942c of 30.05.2023	01.06.2023
5	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.4.4.2	Requirements for control of butt plate joints have been specified	311-05-1942c of 30.05.2023	01.06.2023
6	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.4.4.4	Requirements for control of butt pipe joints have been specified considering provisions of ISO 9606-1:2012	311-05-1942c of 30.05.2023	01.06.2023

Nos.	Amended paras/chapters/ sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
7	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.4.5.5.1	Requirements for quality estimation of tensile tests of notched pipe specimen have been specified	311-05-1942c of 30.05.2023	01.06.2023
8	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.5.5	Para has been supplemented by requirements for the range of approval of the Welder Approval Test Certificate for titanium alloys considering ISO/TR 15608:2017	311-05-1942c of 30.05.2023	01.06.2023
9	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.5.7	Requirements for the range of approval of the Welder Approval Test Certificate for titanium alloys have been specified considering ISO 9606-5:2000	311-05-1942c of 30.05.2023	01.06.2023
10	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 4.5.8-3	Requirements for the range of approval of the Welder Approval Test Certificate for welding positions of weld test pieces of pipes have been specified considering ISO 9606-1 and 4.5.9	311-05-1942c of 30.05.2023	01.06.2023
11	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 7.1.1	Requirements for approval of welding procedures used for aluminium alloys have been specified considering ISO 15614-2:2005	311-05-1942c of 30.05.2023	01.06.2023
12	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 7.3.2.1	Requirements for the scope of tensile tests of aluminium alloys have been specified considering IACS Recommendation No. 70 and ISO 14614-2:2005	311-05-1942c of 30.05.2023	01.06.2023
13	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 7.4.2.1	Requirements for issuing Welding Procedure Approval Test Certificate (СОТПС) regarding tensile tests of test pieces without removed reinforcement for aluminium alloys have been specified	311-05-1942c of 30.05.2023	01.06.2023

Nos.	Amended paras/chapters/ sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
14	Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, Part III, para 7.4.2.2	Requirements for application of welding consumable grade for aluminium alloy 1581 have been specified considering ISO 15614-2:2005	311-05-1942c of 30.05.2023	01.06.2023
15	Rules for the Classification and Construction of Sea-Going Ships, Part XIV	Throughout the text of the Part term "visual and measurement testing" has been replaced by "visual testing"	311-05-1942c of 30.05.2023	01.06.2023
16	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, Table 2.2.7-1	Requirements for application of welding consumables for aluminium alloy welding have been specified considering ISO 15614-2:2005	311-05-1942c of 30.05.2023	01.06.2023
17	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, para 2.13.6	Terminology for non-destructive testing has been specified in order to harmonize the terms with Part I "General Regulations for Technical Supervision" of the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships (Rules for Technical Supervision)	311-05-1942c of 30.05.2023	01.06.2023
18	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, para 3.1.1.1	Editorial amendment has been made	311-05-1942c of 30.05.2023	01.06.2023
19	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, Tables 3.1.1.2-1 and 3.1.1.2-2	Terminology has been specified in order to harmonize the terms with Part XIII "Materials"	311-05-1942c of 30.05.2023	01.06.2023
20	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, Table 3.1.1.3	Terminology has been specified in order to harmonize the terms with Part XIII "Materials"	311-05-1942c of 30.05.2023	01.06.2023
21	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, para 3.1.2.2	Requirements for specialists on non-destructive testing of welded joints have been specified based on the experience of technical supervision	311-05-1942c of 30.05.2023	01.06.2023

Nos.	Amended paras/chapters/ sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
22	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, Table 4.9.1.3-2	Grades of welding consumables for national aluminium alloys have been specified considering ISO 15614-2:2005	311-05-1942c of 30.05.2023	01.06.2023
23	Rules for the Classification and Construction of Sea-Going Ships, Part XIV, Table 4.9.3.6	Requirements for mechanical properties of butt welds made of aluminium alloys have been specified considering ISO 15614-2:2005	311-05-1942c of 30.05.2023	01.06.2023

Appendix 2 to Circular Letter
No. 311-05-1942c dated 30.05.2023

RULES FOR TECHNICAL SUPERVISION DURING CONSTRUCTION OF SHIPS AND MANUFACTURE OF MATERIALS AND PRODUCTS FOR SHIPS, 2023,

ND No. 2-020101-175-E

PART III. TECHNICAL SUPERVISION DURING MANUFACTURE OF MATERIALS

1 Throughout the text of **Part III** the term "visual and measurement testing" is replaced by "visual testing".

4 WELDING. REGULATIONS FOR WELDERS' CERTIFICATION

2 **Para 4.3.3.1** is replaced by the following text:

"**4.3.3.1** The welders' approval testing according to the results of practical tests is carried out with reference to the groups of base metal type composition in accordance with Tables 4.3.3.1-1, 4.3.3.1-2, 4.3.3.1-3 and 4.3.3.1-4.

Table 4.3.3.1-1

Grouping system for steels according to ISO/TR 15608:2017

Group	Sub-group	Types of steel
1		Steels with a specified minimum yield strength R_{eH} ≤ 460 MPa[a] and with analysis in %: C ≤ 0,25; Si ≤ 0,60; Mn ≤ 1,80; Mo ≤ 0,70[b]; S ≤ 0,045; P ≤ 0,045; Cu[b] ≤ 0,40; Ni[b] ≤ 0,5; Cr ≤ 0,3 (0,4 for castings); Nb ≤ 0,06; V ≤ 0,10[b]; Ti ≤ 0,05
	1.1	Steels with a specified minimum yield strength, R_{eH} ≤ 275 MPa
	1.2	Steels with a specified minimum yield strength, 275 МПа < R_{eH} ≤ 360 MPa
	1.3	Normalized fine grain steels with a specified minimum yield strength R_{eH} > 360 MPa
	1.4	Steels with improved atmospheric corrosion resistance whose analysis may exceed the requirements for the single elements as indicated under 1
2		Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength R_{eH} > 360 MPa
	2.1	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength 360 MPa < R_{eH} ≤ 460 MPa
	2.2	Thermomechanically treated fine grain steels and cast steels with a specified minimum yield strength R_{eH} > 460 MPa
3		Quenched and tempered steels and precipitation hardened fine grain steels except stainless steels with a specified minimum yield strength R_{eH} > 360 MPa
	3.1	Quenched and tempered fine grain steels with a specified minimum yield strength 360 MPa < R_{eH} ≤ 690 MPa
	3.2	Quenched and tempered fine grain steels with a specified minimum yield strength R_{eH} > 690 MPa
	3.3	Precipitation hardened fine grain steels except stainless steels
4		Low vanadium alloyed steels Cr-Mo-(Ni) with Mo ≤ 0,7 % and V ≤ 0,1 %
	4.1	Steel with Cr ≤ 0,3 % and Ni ≤ 0,7 %
	4.2	Steel with Cr ≤ 0,7 % and Ni ≤ 1,5 %
5		Cr-Mo steels free of vanadium with C ≤ 0,35 %
	5.1	Steels with 0,75 % ≤ Cr ≤ 1,5 % and Mo ≤ 0,7 %
	5.2	Steels with 1,5 % < Cr ≤ 3,5 % and 0,7 % < Mo ≤ 1,2 %
	5.3	Steels with 3,5 % < Cr ≤ 7,0 % and 0,4 % < Mo ≤ 0,7 %
	5.4	Steels with 7,0 % < Cr ≤ 10,0 % and 0,7 % < Mo ≤ 1,2 %
6		High vanadium alloyed Cr-Mo-(Ni) steels
	6.1	Steels with 0,3 % ≤ Cr ≤ 0,75 %, Mo ≤ 0,7 % and V ≤ 0,35 %
	6.2	Steels with 0,75 % < Cr ≤ 3,5 %; 0,7 % < Mo ≤ 1,2 % and V ≤ 0,35 %
	6.3	Steels with 3,5 % < Cr ≤ 7,0 %; Mo ≤ 0,7 % and 0,45 % ≤ V ≤ 0,55 %
	6.4	Steels with 7,0 % < Cr ≤ 12,5 %; 0,7 % < Mo ≤ 1,2 % and V ≤ 0,35 %
7		Ferritic, martensitic or precipitation hardened steels with C ≤ 0,35 % and 10,5 % ≤ Cr ≤ 30 %
	7.1	Ferritic stainless steels
	7.2	Martensitic stainless steels
	7.3	Precipitation hardened stainless steels
8		Austenitic stainless steels with Cr ≤ 35 %
	8.1	Austenitic stainless steels with Cr ≤ 19 %

Group	Sub-group	Types of steel
	8.2	Austenitic stainless steels with Cr > 19 %
	8.3	Manganese austenitic stainless steels with 4,0 % < Mn ≤ 12,0 %
	8.4	Austenitic stainless steels with Cr > 18 %; 4% < Mn ≤ 12 % and 3% < Ni ≤ 8%
9		Nickel alloy steels with Ni ≤ 10,0 %
	9.1	Nickel alloy steels with Ni ≤ 3,0 %
	9.2	Nickel alloy steels with 3,0 % < Ni ≤ 8,0 %
	9.3	Nickel alloy steels with 8,0 % < Ni ≤ 10,0 %
10		Austenitic ferritic stainless steels (duplex)
	10.1	Austenitic ferritic stainless steels with Cr ≤ 24,0 % and Ni ≤ 4,0 %
	10.2	Austenitic ferritic stainless steels with Cr > 24,0 % and Ni > 4,0 %
	10.3	Austenitic ferritic stainless steels with Ni ≤ 4,0
11		Steels with chemical composition identical to group 1[c] except content of 0,30 % < C ≤ 0,85 %
	11.1	Steels assigned to group 11 with 0,30 % < C ≤ 0,35 %
	11.2	Steels assigned to group 11 with 0,35 % < C ≤ 0,5 %
	11.3	Steels assigned to group 11 with 0,5% < C ≤ 0,85 %

N o t e . Based on the actual production chemical composition steel of group 2 may be assigned to group 1.
If the material has different minimum yield strengths depending on thickness, the maximum yield strength shall be used to define the sub-group.

a) In accordance with the steel product standards, R_{eH} may be replaced by $R_{p0.2}$ or $R_{t0.5}$.
b) A higher value is accepted, provided that Cr + Mo + Ni + Cu + V ≤ 0,75 %.
c) A higher value is accepted, provided that Cr + Mo + Ni + Cu + V ≤ 1,0 %.

Table 4.3.3.1-2

Grouping system for aluminium and aluminium alloys according to ISO/TR 15608:2017

Group	Sub-group	Type of aluminium and aluminium alloys
21		Pure aluminium impurities content ≤ 1 %
22		Non heat treatable alloys
	22.1	Aluminium-manganese alloys
	22.2	Aluminium-magnesium alloys with Mg ≤ 1,5 %
	22.3	Aluminium-magnesium alloys with 1,5 % < Mg ≤ 3,5 %
	22.4	Aluminium-magnesium alloys with Mg > 3,5 %
23		Heat treatable alloys
	23.1	Aluminium-magnesium-silicon alloys
	23.2	Aluminium-zinc-magnesium alloys
24		Aluminium-silicon alloys with Cu ≤ 1 %
	24.1	Aluminium-silicon alloys with Cu ≤ 1 % and 5 % < Si ≤ 15 %
	24.2	Aluminium-silicon-magnesium alloys with Cu ≤ 1 %, 5 % < Si ≤ 15 % and 0,1 % < Mg ≤ 0,80 %
25		Aluminium-silicon-copper alloys with 5 % < Si ≤ 14,0 %; 1,0 % < Cu ≤ 5,0 % and Mg ≤ 0,8 %
26		Aluminium-copper alloys with 2 % < Cu ≤ 6 %

N o t e . Groups 21 — 23 are generally for wrought materials and groups 24 — 26 are generally used for cast materials.

Table 4.3.3.1-3

Grouping system for copper and copper alloys according to ISO/TR 15608:2017

Group	Sub-group	Type of copper and copper alloys
31		Copper with 6 % Ag and 3 % Fe
32		Copper-zinc alloys
	32.1	Copper-zinc binary alloys
	32.2	Copper-zinc complex alloys
33		Copper-tin alloys
34		Copper-nickel alloys
35		Copper-aluminium alloys
36		Copper-nickel-zinc alloys
37		Copper alloys, low alloyed (with less than 5 % of other elements) not covered by groups 31 — 36
38		Other copper alloys (5 % or more other elements) not covered by groups from 31 — 36

Table 4.3.3.1-4

Grouping system for titanium alloys according to ISO/TR 15608:2017

Group	Sub-group	Type of titanium and titanium alloys
51		Pure titanium
	51.1	Titanium with O_2 ≤ 0,20 %
	51.2	Titanium with 0,20 < % O_2 ≤ 0,25 %
	51.3	Titanium with 0,25 < % O_2 ≤ 0,35 %
	51.4	Titanium with 0,35 < % O_2 ≤ 0,40 %
52		Alpha alloys[a]

Group	Sub-group	Type of titanium and titanium alloys
53		Alpha-beta alloys[b]
54		Near-beta and beta alloys[c]

[a] Alloys covered by group 52 are: Ti-0,2Pd; Ti-2,5Cu; Ti-5Al-2,5Sn; Ti-8Al-1Mo-1V; Ti-6Al-2Sn-4Zr-2Mo; Ti-6Al-2Nb-1Ta-0,8Mo.

[b] Alloys covered by group 53 are: Ti-3Al-2,5V; Ti-6Al-4V; Ti-6Al-6V-2Sn; Ti-7Al-4Mo.

[c] Alloys covered by group 54 are: Ti-10V-2Fe-3Al; Ti-13V-11Cr-3Al; Ti-11,5Mo-6Zr-4,5Sn; Ti-3Al-8V-6Cr-4Zr-4Mo.

".

3 **Para 4.4.1** is replaced by the following text:

"**4.4.1 General requirements for welders' certification performance procedure.**

The procedure for welders' certification comprises taking theoretical examination and practical by the welder to be certified.

The provisions of this Chapter apply to welders' certification who perform welding of steel, aluminium, copper, titanium and their alloy test pieces during practical tests.

Unless otherwise is agreed by the Register, for welders' certification:

welding of aluminium and aluminium alloys is covered by the applicable provisions of ISO 9606-2:2004;

welding of copper and copper alloys is covered by the applicable provisions of ISO 9606-3:1999;

welding of titanium and titanium alloys is covered by the applicable provisions of ISO 9606-5:2000.

The range of approval and test program shall be agreed with the Register prior to welders' certification for welding of above-mentioned non-ferrous metals and their alloys. The scope of testing of welded joint test pieces shall comply with Table 4.4.4.1. At that, the main method to check the continuity of weld metal of butt plate joint test pieces shall be radiographic testing and for thickness of 8 mm and more ultrasonic testing is permitted.

The certification shall be started with the practical testing. If the welder fails to pass the practical testing, he is not admitted to theoretical examination and is considered to have failed to be certified.

During the theoretical examination, the welder shall answer at least 15 questions covering the major sections of general and special (by profession) subjects. The questions are selected for each welding process by the certification panel.

In theoretical examining, the certification panel applies one of the following methods or the combination thereof:

written verification of knowledge;

oral questioning;

computer verification of knowledge;

written description followed by a practical demonstration on the relevant equipment.

The examination results are assessed by the certification panel as "Accepted/Not accepted". The designation "Accepted" corresponds to at least 80 % of the correct answers to the questions asked. The welder is considered to be certified when passing both practical testing and theoretical examination.

If the welder has passed the practical testing, but has failed the theoretical examination, he is allowed to resit the latter by an additional application within half a year since the day of the first examination, but not earlier than two weeks after the initial date of the theoretical examination. In case of reoccurring negative result of the theoretical examination, the welder is considered to have failed the certification.".

4 **Para 4.4.4.1** is replaced by the following text:

"**4.4.4.1** After welding each test piece completed shall be tested according to Table 4.4.4.1 in the as-welded condition. Before cutting out bend and fracture test specimens, visually examine the welds. Specimens shall be tested in the presence of the Register surveyor.

Table 4.4.4.1

Methods of testing of welded joint test pieces in welders' practical tests

Testing methods		Type of welded joint test piece											
		P_1		P_{1tack}	P_3		P_2 and P_4	P_{2tack}	P_5 and P_6		P_7	P_8	
		3 ≤ t < 12	t ≥ 12		3 ≤ t < 12	t ≥ 12			3 ≤ t < 12	t ≥ 12		C_1 and C_2	C_3 and C_4
Visual testing		+	+	+	+	+	+	+	+	+	+	+	+
Radiographic test		+[1, 2]	+[1, 2]	–	+[1, 2]	+[1, 2]	–	–	+[1, 2]	+[1, 2]	+[1, 2]	+	–
Ultrasonic test		+[1, 2]	+[1, 2]	–	+[1, 2]	+[1, 2]	–	–	+[1, 2]	+[1, 2]	+[1, 2]	+	–
Bend test	Weld root and top	+[3]	–	–	+[3, 4]	–	–	–	+[3, 4]	–	–	–	–
	Side bend	–	+[3]	–	–	+[3, 4]	–	–	–	+[3, 4]	–	–	–
Fracture test		+[1]	+[1]	+[5]	+[1, 3, 4]	+[1, 3, 5]	+[6]	+[5]	+[1, 3, 4]	+[1, 3]	–	–	–
Macro examination		–	–	–	–	–	+[6]	–	+(1 pc..)	+(1 pc.)	+(3 pc.)	+(3 pc.)	–
Magnetic particle or dye penetrant testing		–	–	–	–	–	+[6]	–	–	–	+	+	–

[1] Either radiographic or ultrasonic testing (but not both at the same time) shall be used for continuity of weld joints metal.
[2] For thickness of 8 mm and more, the radiographic testing may be replaced by an ultrasonic testing except for austenitic and austenitic ferritic steels (groups 8 and 10, respectively) and for aluminum, copper and titanium alloys.
[3] In addition to the continuity test of weld joints metal, additional bend or fracture tests are mandatory for welding processes 131, 135, 138, 141 and 311.
[4] For outside pipe diameter of butt joints $D \leq 25$ mm, the bend or fracture tests may be replaced by a notched tensile test of the complete test piece (refer to Fig. 4.4.4.4-2).
[5] Additional tests may be required at the discretion of the Register.
[6] Instead of the fracture test of a weld, it is allowed to examine the welding quality using magnetic particle/dye penetrant testing in combination with at least two macro examinations.

Where the remaining backings were used during the qualification tests, they shall be removed prior to destructive (mechanical) tests.

The test specimen for macro examination shall be prepared and etched on one side to clearly reveal the weld. Polishing is not required.

In accordance with the indications in Footnote 3 to Table 4.4.4.1 for welding processes 131, 135, 138, 141 and 311, the testing shall be supplemented by either two additional bend tests (one face and one root or two side bends) or two fracture tests (one face and one root).".

5 **Para 4.4.4.2** is replaced by the following text:

"**4.4.4.2** Test pieces P_1 of butt plate joints.

The continuity of weld metal of butt plate joint test pieces shall be checked by radiographic testing or for thickness of 8 mm and more ultrasonic testing is allowed.

Additional bend test or fracture test shall be carried out for welding processes 131, 135, 138, 141 and 311.

Where additional fracture tests are performed, the welded joint test piece examination length shall be cut into the test specimens of equal width within the examination length discarding the plate ends according to Fig. 4.4.4.2-1, *a*. In so doing, the entire test piece examination length shall be tested by the bending failure of specimens dimensioned according to Fig. 4.4.4.2-1, *c* in such a way that the fracture length is not interrupted.

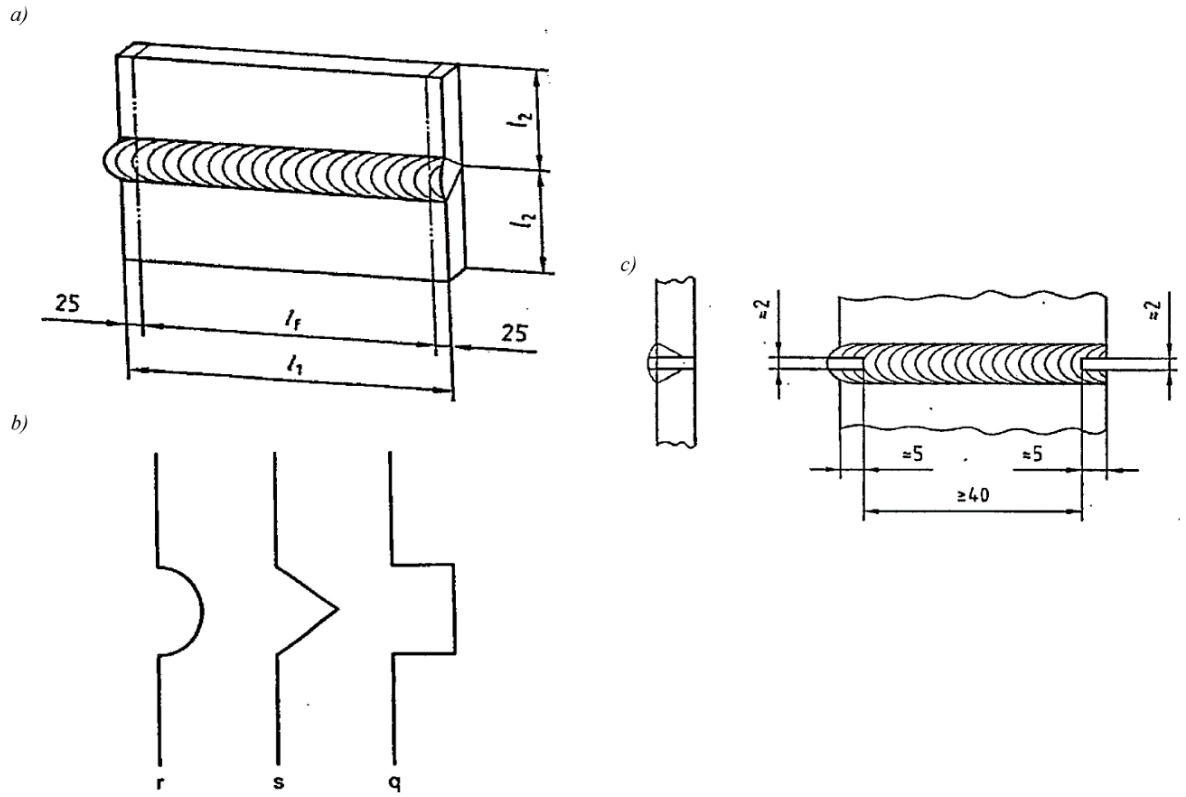

Fig. 4.4.4.2-1
Fracture tests of test pieces P_1 of butt plate joints:
a — diagram of test specimen cutting-out (the examination length l_f is divided into even number of specimens);
b — profiles of cuts for preparation of specimens for fracture test according to ISO 9017:2017;
c — specimen for fracture tests with side cuts of "*q*" type

In the case of single-side welding without the remaining backing, half of the examination length of the test piece shall be tested on test specimens loaded on the face side and the other half on the root side according to Fig. 4.4.4.2-2.

Where additional bend tests are performed, the diagram of cutting-out and the number of test specimens depend on the test type (transverse bend test or side bend test).

For initial qualification, the test shall be applied to two weld face bending test specimens and two weld root bending test specimens. For thicknesses of 12 mm and more, four side bending test specimens of 10 mm thick may be used.

Where additional side bend tests are performed, a minimum of four test specimens shall be taken equally spaced along the examination length. At least one of these side bend test specimens shall be taken from the start and stop area in the examination length. The size of the specimens and the diagram of bend tests shall comply with requirements of 6.4.4.2 and Fig. 4.4.4.2-3.

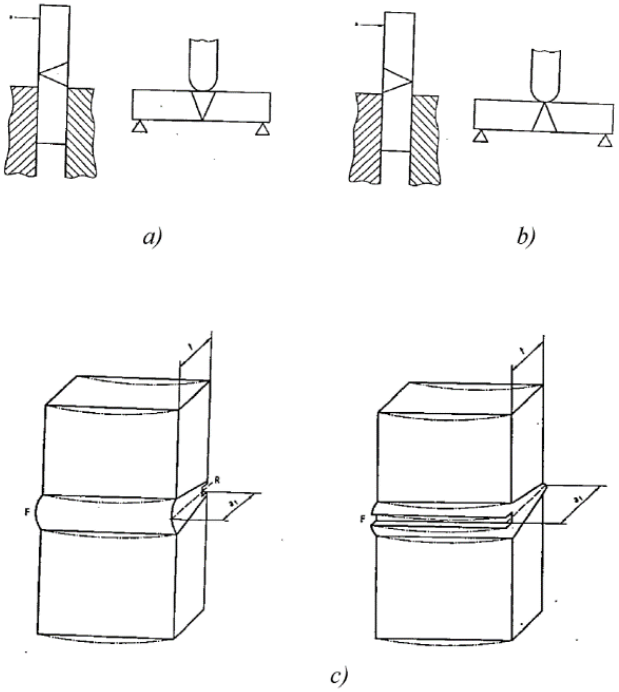

Fig. 4.4.4.2-2
Diagram of fracture test of test pieces P_1 of butt plate joints:
a — with tension on weld root; *b* — with tension on weld reinforcement; *c* — alternative types of specimens for fracture test with "*q*" type profile longitudinal notch in the weld centre with tension on weld root and weld reinforcement

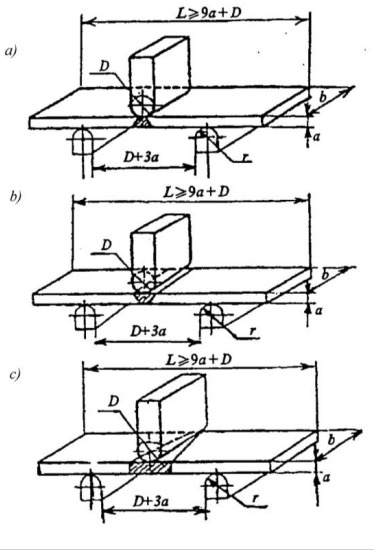

Fig. 4.4.4.2-3
Sizes of specimens and diagram of static bend test with tensioning of the weld face side *(a)*, weld root *(b)* and of side bend tests *(c)* for test pieces P_1 of butt plate joints and P_3, P_5 and P_6 of butt pipe joints".

6 **Para 4.4.4.4** is replaced by the following text:

"**4.4.4.4** Test pieces P_3 of butt pipe joints. The continuity of weld metal of butt pipe joint test pieces shall be checked by radiographic testing or for thickness of 8 mm and more ultrasonic testing is allowed.

Where additional fracture and transverse bend tests for welding processes 131, 135, 138, 141 and 311 are performed, 4 test pieces shall be tested two for the root bend and two face side bend (refer to Fig. 4.4.4.4-1, *b*).

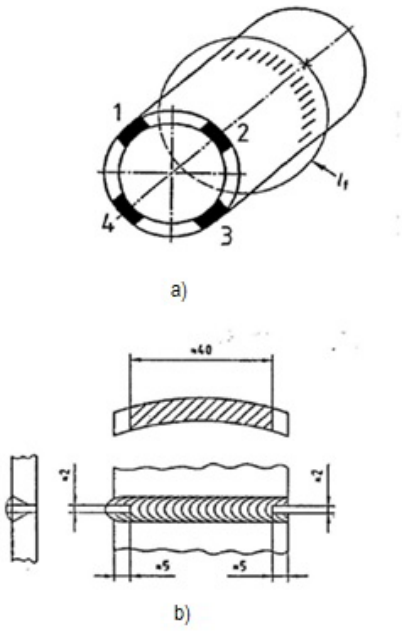

Fig. 4.4.4.4-1
Diagram of cutting-out of test pieces P_3, P_5 and P_6:

a) *1, 2, 3, 4* — places for selection of fracture test or bend test specimens;
l_f — examination length of the weld);
b) fracture test specimen with notch profile

Where additional fracture tests are performed, the whole examination length shall be tested (refer to Fig. 4.4.4.4-1, *a*) for which at least four specimens of sizes according to Fig. 4.4.4.4-1, *b*, shall be tested. If the pipe diameter is too small (examination length of the weld is less than 150 mm) and does not allow making the required number of test specimens, then additional test pieces shall be made and tested in accordance with 4.4.2.4.

In order to achieve a fracture in the weld of the test specimen, the latter may be longitudinally notched on both ends of the specimen as shown in Fig. 4.4.4.4-1, *b.*

In the case of single-side welding without the remaining backing, half of the inspection length of the test piece shall be tested on test specimens loaded on the face side and the other half on the root side according to Fig. 4.4.4.2-2.

Where bend tests are performed, the diagram of cutting-out and number of test specimens depend on the test types and are similar to the ones specified in 4.4.4.2 for butt plate joint.

For test pieces of butt pipe joints with outside pipe diameter $D \leq 25$ mm, the fracture and bend tests may be replaced by tension test of the welded joint test piece with holes and removed reinforcement of the weld as shown in Fig. 4.4.4.4-2. The holes are not allowed in start and stop areas, and in order to create the destruction plane in the centre of the weld, additional or alternative "*q*" or "*s″* type notch profiles are also allowed in circumferential direction according to ISO 9017:2017 (refer to Fig. 4.4.4.2-1, *b*).

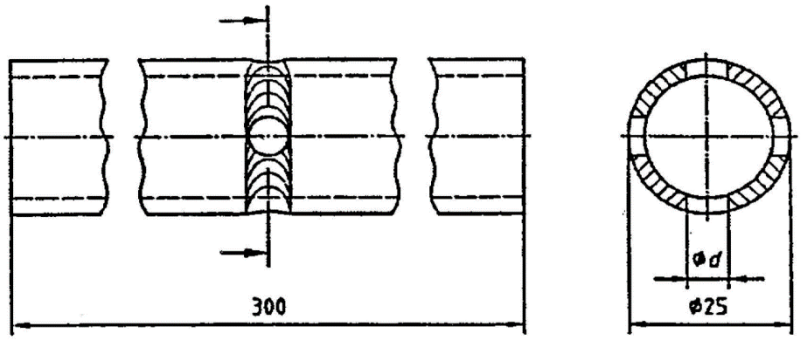

Fig. 4.4.4.4-2
Test specimen for tensile tests of butt pipe joints with outer diameter $D \le 25$ mm.
For pipe thickness: $t \ge 1{,}8$ mm: $d = 4{,}5$ mm
$t < 1{,}8$ mm: $d = 3{,}5$ mm".

7 **Para 4.4.5.5.1** is replaced by the following text:

"**4.4.5.5.1** After the performance of butt welded joint fracture tests, the fracture surface shall be visually tested. The weld defects visible are subject to estimation to quality level B according to ISO 5817:2014. The specified quality estimation shall be applied also for identification of defects at tensile tests of notched test specimen and with removed reinforcement according to Fig. 4.4.4.4-2.".

8 **Para 4.5.5** is replaced by the following text:

"**4.5.5** In order to reduce the number of practical qualification tests, materials with similar welding characteristics are grouped according to ISO/TR15608:2017 (refer to Tables 4.3.3.1-1, 4.3.3.1-2, 4.3.3.1-3 and 4.3.3.1-4).

The practical test during which for welding of any metal in a base metal group confers qualification on the welder for the welding of all other metals within the same group with the range of approval of the Welder Approval Test Certificate, as well as other base metal groups according to Tables 4.5.5-1, 4.5.5-2, 4.5.5-3 and 4.5.5-4.

Table 4.5.5-1

Range of approval of the Welder Approval Test Certificate for base metal (steel)

Base metal group[1] of the test piece		Range of approval based on test results												
		1.1;1.2; 1.4	1.3	2	3	4	5	6	7	8	9		10	11
											9.1	9.2+9.3		
1.1;1.2;1.4		×	–	–	–	–	–	–	–	–	–	–	–	–
1.3		×	×	×	×	–	–	–	–	–	×	–	–	×
2		×	×	×	×	–	–	–	–	–	×	–	–	×
3		×	×	×	×	–	–	–	–	–	×	–	–	×
4		×	×	×	×	×	×	×	×	–	×	–	–	×
5		×	×	×	×	×	×	×	×	–	×	–	–	×
6		×	×	×	×	×	×	×	×	–	×	–	–	×
7		×	×	×	×	×	×	×	×	–	×	–	–	×
8		–	–	–	–	–	–	–	–	×	–	×	×	–
9	9.1	×	×	×	×	–	–	–	–	–	×	–	–	×
	9.2 + 9.3	×	–	–	–	–	–	–	–	–	–	×	–	–
10		–	–	–	–	–	–	–	–	×	–	×	×	–
11		×	×	–	–	–	–	–	–	–	–	–	–	×

[1] Base metal group according to ISO/TR 15608:2017.
Symbols:
«×» — indicates those base metal groups for which the welder is qualified.
«–» — indicates those base metal groups for which the welder is not qualified.

The range of approval of the Welder Approval Test Certificate for metals of different base metal groups is defined in compliance with the following requirements:

.1 the welder may be allowed for welding of dissimilar metal joints in any combination of base metal groups for welding of which he is qualified in accordance with Tables 4.5.5-1,

4.5.5-2 and 4.5.5-3. In this case the welding consumable shall correspond to the group of one of the welded base metal;

.2 when for dissimilar metal joints welding consumables from base metal group 8 (austenitic stainless steels) or 10 (austenitic ferritic stainless steels) are used, all combinations with base metal group 8 or 10 to other base metal groups are covered.

Table 4.5.5-2

Range of approval of the Welder Approval Test Certificate for base metal (aluminium alloys)

Base metal group[1] of the test piece	Range of approval based on test results					
	21	22	23	24	25	26
21	×	×	–	–	–	–
22	×	×	–	–	–	–
23	×	×	×	–	–	–
24	–	–	–	×	×	–
25	–	–	–	×	×	–
26	–	–	–	×	×	×

[1] As in Table 4.5.5-1.
Symbols: as in Table 4.5.5-1.

Table 4.5.5-3

Range of approval of the Welder Approval Test Certificate for base metal (copper and copper alloys)

Base metal group[1] of the test piece	Range of approval based on test results							
	31	32	33	34	35	36	37	38
31	×	–	×	×	×	–	–	–
32	–	×	–	–	–	×	–	–
33	–	–	×	–	–	–	–	–
34	–	–	–	×	×	–	–	–
35	–	–	–	×	×	–	–	–
36	–	×	–	–	–	×	–	–
37	–	–	–	–	–	–	×	–
38	–	–	–	–	–	–	×	×

[1] As in Table 4.5.5-1.
Symbols: as in Table 4.5.5-1.

Table 4.5.5-4

Range of approval of the Welder Approval Test Certificate for base metal (titanium and titanium alloys)

Base metal group[1] of the test piece	Range of approval based on test results							
	51	51.1	51.2	51.3	51.4	52	53	54
51	×	×	×	×	×	–	–	–
51.1	×	×	×	×	×	–	–	–
51.2	×	×	×	×	×	–	–	–
51.3	×	×	×	×	×	–	–	–
51.4	×	×	×	×	×	–	–	–
52	–	–	–	–	–	×	–	–
53	–	–	–	–	–	–	×	–
54	–	–	–	–	–	–	–	×

[1] As in Table 4.5.5-1.
Symbols: as in Table 4.5.5-1.

A practical qualification test made on wrought base metal groups gives qualification for cast material and a mixture of cast and wrought material in the same base metal group.

When welding base metal outside the grouping system according to ISO/TR 15608:2017, a separate qualification test is required.".

9 **Para 4.5.7** is replaced by the following text:

"**4.5.7** The range of approval of the Welder Test Approval Certificate shall be specified on the basis on the following welded joint dimensions:

thickness of the base metal and weld;

outside pipe diameter.

Fillet weld thickness shall be: $0{,}5t \leq a \leq 0{,}7t$ for $t \geq 6$ mm; $0{,}5t \leq a \leq t$ for $t < 6$ mm.

Each practical qualification test shall be conducted within the range of range of approval of the Welder Test Approval Certificate in accordance with the requirements of Tables 4.5.7-1, 4.5.7-2 and 4.5.7-3.

In case of branch welding, criteria of Tables 4.5.7-1 and 4.5.7-2 apply, together with the following rules:

for set-on branch connection, the material thickness and outside pipe diameter are those of the branch;

for set-in or set-through branch connection, the material thickness is that of the main pipe or shell and the outside pipe diameter is that of the branch.

For welded joint test pieces of different outside pipe diameters and base metal thicknesses, the range of approval of the Welder Test Approval Certificate is determined separately for:

the thinnest and thickest material thickness qualified in accordance with Table 4.5.7-1;

Table 4.5.7-1

Ranges of approval of the Welder Test Approval Certificate for base and weld metal thickness for butt welds

Base metal[1]	Thickness of test piece metal in tests t, in mm	Range of approval of base metal and weld metal thickness, in mm
Steels	$t < 3$	from t to $2t$[2]
	$3 \le t \le 12$	from 3 to $2t$[3]
	$t > 12$	from 3
Aluminium and its alloys	$t \le 6$	from $0,7t$ to $2,5t$
	$6 < t \le 15$	$6 < t \le 40$[4]
Copper and its alloys	T	from $0,5t$ to $1,5t$[5]
Titan and titanium alloys	$t \le 3$	from t to $2t$
	$t > 3$	from 3

[1] For multi processes t_1 and t_2 apply according to the instructions in Table 4.5.2.
[2] For gas (oxy-acetylene) welding — from t to $1,5t$.
[3] For gas (oxy-acetylene) welding — from 3 mm to $1,5t$.
[4] For base metal having thickness more than 40 mm, separate certification is required which shall be indicated in the Welder Approval Test Certificates and in the test report.
[5] For gas (oxy-acetylene) welding the welder shall be qualified for the thinnest and thickest base metal thickness, for which he is qualified in practice.

the smallest and largest outside pipe diameter qualified in accordance with Table 4.5.7-2.

Table 4.5.7-2

Range of approval for outside pipe diameter

Base metal	Outside pipe diameter of test piece, in mm	Range of approval by outside pipe diameter, in mm
Steels	$D \le 25$	from D to $2D$
	$D > 25$	from $0,5D$ and more but not less than 25
Aluminium and its alloys	$D \le 25$	from $0,5D$ to $2D$
	$D > 25$	from $0,5D$ and more but not less than 25
Copper and its alloys	$D \le 25$	from D to $2D$
	$D > 25$	from $0,5D$ to $2D$, but not less than 25
Titan and titanium alloys	$D \le 25$	from D to $2D$
	$D > 25$	from $0,5D$ and more but not less than 25

Note. For structural hollow sections, D is the dimension of the smaller side.

Table 4.5.7-3

Range of approval of the Welder Approval Test Certificate for base metal thickness of test piece for fillet welds

Base metal thickness of test piece t, in mm	Range of approval by base metal thickness, in mm
$t < 3$	From t to 3
$t \ge 3$	From 3 and more

Note. The thickness of the fillet weld shall be within the range:
$0,5t \le a \le 0,7t$ for $t \ge 6$ mm;
$0,5t \le a \le t$ for $t < 6$ mm.

".

10 **Table 4.5.8-3** is replaced by the following text:

"Table 4.5.8-3

Range of approval of the Welder Approval Test Certificates for welding positions of weld test pieces of pipes

Test welding position	Range of approval as pet test results	
	Butt welds	**Fillet welds**
PA	PA	PA, PB
PB	–	PA, PB
PC	PA, PC	PA, PB, PC
PD	–	PA, PB, PC, PD, PE
PE	PA, PC, PE	PA, PB, PC, PD
PF	PA, PF	PA, PB, PF
PG	PA, PG	PA, PB, PG
PH (fixed pipe joint)	PA, PE, PF, PH	PA, PB, PD, PE, PF, PH (fillet pipe with plate)
PH (fillet pipe with plate)	–	PA, PB, PD, PE, PF, PH (fillet pipe with plate)
PJ (pipe joint)	PA, PE, PG, PJ	PA, PB, PD, PE, PG, PJ (fillet pipe with plate)
PJ (fillet pipe with plate)	–	PA, PB, PD, PE, PG, PJ (fillet pipe with plate)
H-L045	All except for PG, J-L045	All except for PG, J-L045
J-L045	All except for PF, H-L045	All except for PF, H-L045
PK (fixed pipe joint)	PA, PE, PF, PG, PH, PJ, PK (fixed pipe joint)	PA, PB, PD, PE, PF, PG, PH (fillet pipe with plate), PJ (fillet pipe with plate), PK (fillet pipe with plate)
PK (fillet pipe with plate)	–	PA, PB, PD, PE, PF, PG, PH (fillet pipe with plate), PJ (fillet pipe with plate), PK (fillet pipe with plate)

".

7 APPROVAL OF WELDING PROCEDURES FOR ALUMINIUM ALLOYS

11 **Para 7.1.1** is replaced by the following text:

"**7.1.1** Welding procedures used for the fabrication of aluminium alloy structures being subject to survey by the Register shall be approved by the Register and meet the requirements given below.

Unless otherwise specified and agreed with the Register, the applicable provisions of ISO 15614-2:2005 shall apply to the approval of welding procedures for welding of aluminium and aluminium alloys.".

12 **Table 7.3.2.1** is replaced by the following text:

"Table 7.3.2.1

Examination and testing type	Examination and testing extent	Note
Visual and measurement testing	100 % weld length	–
Radiographic and ultrasonic testing	100 % weld length	For welded joints having thickness $t < 12$ mm, the radiographic testing shall be used, and for $t \geq 12$ mm it is allowed, by an agreement with the Register, to change the radiographic testing for the ultrasonic one
Penetrant testing	100 % weld length	–
Transverse tensile test of flat test specimens	2 test specimens	Tests are conducted on two tensile test specimens with weld reinforcement removed or on two test specimens with the reinforcement complying with the national standard requirements
Transverse static bend test of test specimens	4 test specimens	For welded joints having thickness $t < 12$ mm, two test specimens each with weld root and surface tension shall be tested, and for $t \geq 12$ mm the test for side bend is conducted on dour test specimens
Macrosection examination	1 transverse macrosection	–
Microsection examination	1 transverse microsection	–

".

13 **Para 7.4.2.1** is replaced by the following text:

"**7.4.2.1** In order to determine the properties of welded butt joints, the following test specimens shall be used:

tensile test specimens according to 6.4.4.1 with the reinforcement relieved or with the weld reinforcement according to the requirements of national standards; where the tensile tests of the test pieces with weld reinforcement are carried out, when issuing СОТПС the note shall contain an entry on testing of test pieces with reinforcement and that the application of this СОТПС is limited by weld joints without reinforcement removed;

specimens for the static bend test of the weld surface and root according to 6.4.4.2;

specimens for the static bend test of the weld side surface according to 6.4.4.2;

macrosections prepared and etched on one side to clearly reveal the base metal, fusion line, heat-affected zone and the weld including the build-up of runs;

microsection prepared and etched on one side to include the heat-affected zone, fusion line and weld metal into the work area.".

14 **Table 7.4.2.2** is replaced by the following text:

"Table 7.4.2.2

Base metal		Grade of welding consumable	Properties of welded joints (at least)		
			Tensile strength	Static bend[1]	
Grade	Condition of supply		R_m, MPa	Ratio d/t_s[2]	Bend angle, in deg.
International alloys					
5754	O, F, H111, H24	RA/WA	190	4	180
5086	O, F, H111, H116, H32, H34	RB/WB	240	6	180
5083	O, F, H116, H321	RC/WC	270	6	180
5383,5456	O, H111, H116, H321	RC/WC	290	6	180
5059	O, H111, H116, H321	RC/WC	330	6	180
6005A	T5, T6	RD/WD	165	7	180
6061	T4	RD/WD	165	6	180
	T5, T6	RD/WD	165	7	180
6082	T4	RD/WD	170	6	180
	T5, T6	RD/WD	170	7	180
National alloys					
1530	O, H111, H112,	R1/W1			
	$t_s \le 12,5$ mm		185	4	180
	$t_s > 12,5$ mm		165	4	180
1550	O, H111, H112,	R2/W2			
	$t_s \le 12,5$ mm		275	6	180
	$t_s > 12,5$ mm		255	6	180
1561	O, H111, H112,	R3/W3	305	6	180
1565ч	O, H112, H116, H321	R4/W4	335	6	180
1561H	H32, H321	R3/W3	305	6	180
1575	O, H111, H112	R4/W4	360	6	180
1581	O, H112				
		R4/W4	350	6	180
[AlSi1MgMn]	T5, T6	R5/W5	165	7	180

[1] At assessment of the test results the following shall be taken into consideration: after the specimen bending through the required angle, no defects more than 3 mm in length shall appear on its surface; defects on the specimen edges may be neglected if they were not caused by poor fusion.

[2] Symbols: d — diameter of punch or inner roller, in mm;
t_s — bend test specimen thickness, in mm.

".

RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2023,

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PART XIV. WELDING

15 Throughout the text of Part XIV term "visual and measurement testing" is replaced by "visual testing".

2 TECHNOLOGICAL REQUIREMENTS FOR WELDING

16 **Table 2.2.7-1** is replaced by the following text:

"Table 2.2.7-1

Grade of welding consumable	Hull structural aluminium alloys												
	International						National						
	5754	5086	5083	5383, 5456	5059	6061, 6005A, 6082	1530	1550	1561	1565ч	1575	(AlSiMgMn)	1581
RA/WA (5754)	+	–	–	–	–	–	+	–	–	–	–	–	–
RB/WB (5086)	+	+	–	–	–	–	+	–	–	–	–	–	–
RC/WC (5083)	+	+	+	–	–	+	+	+	–	–	–	+	–
RC/WC (5383)	+	+	+	+	–	+	+	+	–	–	–	+	–
RC/WC (5456)	+	+	+	+	–	+	+	+	–	–	–	+	–
RC/WC (5059)	+	+	+	+	+	+	+	+	+	+	–	+	+
RD/WD (6061)	–	–	–	–	–	+	–	–	–	–	–	+	–
RD/WD (6005A)	–	–	–	–	–	+	–	–	–	–	–	+	–
RD/WD (6082)	–	–	–	–	–	+	–	–	–	–	–	+	–
R1/W1 (1530)	+	–	–	–	–	–	+	–	–	–	–	–	–
R2/W2 (1550)	+	+	+	–	–	+	+	+	–	–	–	+	–
R3/W3 (1561)	+	+	+	+	+	+	+	+	+	+	–	+	+
R4/W4 (1565ч)	–	–	–	–	–	–	–	–	+	+	+	+	+
R4/W4 (1575)	–	–	–	–	+	–	–	–	+	+	+	–	+
R4/W4 (1581)	–	–	–	–	–	–	–	–	+	+	+	+	+
R5/W5 (AlSiMgMn)	–	–	–	–	–	+	–	–	–	–	–	+	–

".

16 **Para 2.13.6** is replaced by the following text:

"**2.13.6** Total illumination in working spaces during work shall not be less than 50 lux. Except general illumination there shall be provided local lighting — directly at the workplaces:

not less than 75 lux – while checking the quality of welding joints by visual testing;

not less than 150 lux — during input inspection of welding consumables and the quality control of their preparation.".

3 TESTING OF WELDED JOINTS

17 **Para 3.1.1.1** is replaced by the following text:

"**3.1.1.1** Non-destructive testing of welded joints may be effected by the following main (refer to 3.1.1.1.1 — 3.1.1.1.6) and advanced (ADNT) methods (refer to 3.1.1.1.7 — 3.1.1.1.9):

.1 visual testing (VT);

.2 magnetic particle testing (MT);

.3 penetrant testing, including dye penetrant testing, fluorescent penetrant testing and fluorescent-dye penetrant testing (PT);

.4 radiographic testing, including X-ray testing and gamma-ray testing (RT);

.5 ultrasonic testing (UT);

.6 tightness testing (in compliance with Appendix 1, Part II "Hull";

.7 digital radiography (RT-D):

.7.1 computed radiography using storage phosphor imaging plates (RT-CR);

.7.2 digital detector array radiography (DDA);

.8 phased array ultrasonic testing (PAUT): automated ultrasonic examinations (AUT) and semi-automatic ultrasonic examinations (SAUT);

.9 time of flight diffraction (TOFD).".

18 **Table 3.1.1.2-1** is replaced by the following text:

"Table 3.1.1.2-1

Generally accepted methods for detection of accessible surface imperfections for all types of welds, including fillet welds according to ISO 17635:2016

Materials	Testing method
Low-carbon steel, Ferritic stainless steel	VT VT and MT VT and PT
Austenitic steel	VT VT and PT
Aluminium alloys	VT VT and PT
Copper-nickel alloys	VT VT and PT
Titanium alloys	VT VT and PT

".

19 **Table 3.1.1.2-2** is replaced by the following steel:

"Table 3.1.1.2-2

Generally accepted methods of detection of internal imperfections for butt and T-joints with full penetration in compliance with ISO 17635:2016

Materials and type of joint	Nominal thickness of base metal *t,* mm		
	$t \le 8$	$8 < t \le 40$	$t > 40$
Low-carbon steel, ferritic stainless steel, butt joints	RT or (UT)	RT or UT	UT or (RT)
Low-carbon steel, ferritic stainless steel, T-joints and fillet joints	(UT) or (RT)	UT or (RT)	UT or (RT)
Austenitic butt joints	RT	RT or (UT)	RT or (UT)
Austenitic T-joints and fillet joints	(UT) or (RT)	(UT) and/or (RT)	(UT) or (RT)
Aluminium butt joints	RT	RT or UT	RT or UT
Aluminium T-joints and fillet joints	(UT) or (RT)	UT or (RT)	UT or (RT)
Nickel and copper alloy butt joints	RT	RT or (UT)	RT or (UT)
Nickel and copper alloy T-joint and fillet joints	(UT) or (RT)	(UT) or (RT)	(UT) or (RT)
Titanium butt joints	RT	RT or (UT)	
Titanium T-joints and fillet joints	(UT) or (RT)	UT or (RT)	
Note. Methods in parenthesis are only applicable with: the lower boundary of the base metal thickness for ultrasonic testing method is determined with the applied equipment and standards. In accordance with normative documents applied in shipbuilding ultrasonic testing for thicknesses of under 8 mm is not applied. For thicknesses of under 8 mm the Register may consider the possibility of using the appropriate advanced UT method in accordance with 3.1.1.1; for radiographic testing the upper boundary of its application of the base metal thickness is determined as per the capabilities of radiation sources and exposure time (refer to 3.2.4); the capability of using radiographic testing for T-joints and fillet joints is calculated by the ratio of thickness of the welded metal in the radiographic testing direction to the total thickness of the base and welded metal in the radiographic testing direction (the use of radiographic testing is not feasible with a decrease in this ratio of less than 0,3); for materials with high degradation of the signals (austenitic steels, nickel and copper alloys) the use of ultrasonic testing method requires the use of special procedures.			

".

20 **Table 3.1.1.3** is replaced by the following text:

"Table 3.1.1.3

Generally accepted methods of detection of internal imperfections for welded joints with full penetration in compliance with ISO 17635:2016

Materials and weld joints	Base metal thickness, *t*	Applicable methods
Low-carbon steel, ferritic stainless steel, butt welds with full penetration	*t* < 6 mm	RT-D
	6 mm ≤ *t* ≤ 40 mm	PAUT, TOFD, RT-D
	t > 40 mm	PAUT, TOFD, RT-D*
Low-carbon steel, ferritic stainless steel, tee joints and corner joints with full penetration	*t* ≥ 6 mm	PAUT, RT-D*
Low-carbon steel, ferritic stainless steel, cruciform joints with full penetration	*t* ≥ 6 mm	PAUT*
Austenitic stainless steel butt welds with full penetration[1]	*t* < 6 mm	RT-D
	6 mm ≤ *t* ≤ 40 mm	RT-D, PAUT*
	t >40 mm	PAUT*, RT-D*
Austenitic stainless steel tee joints, corner joints with full penetration[1]	*t* ≥6 mm	PAUT*, RT-D*
Aluminum tee joints and corner joints with full penetration	*t* ≥ 6 mm	PAUT*, RT-D*
Aluminum cruciform joints with full penetration	*t* ≥ 6 mm	PAUT*
Aluminum butt welds with full penetration	*t* < 6 mm	RT-D
	6 mm ≤ *t* ≤ 40 mm	RT-D, TOFD, PAUT
	t > 40 mm	TOFD, PAUT, RT-D*
Cast Copper Alloy	All	PAUT, RT-D*
Steel forgings	All	PAUT, RT-D*
Steel castings	All	PAUT, RT-D*
Base materials/Rolled steels, Wrought Aluminum Alloys	*t* < 6 mm	RT-D
	6 mm ≤ *t* ≤ 40 mm	PAUT, TOFD, RT-D
	t > 40 mm	PAUT, TOFD, RT-D*

[1] The ultrasonic testing of anisotropic material using advanced methods will require specific procedures and techniques. Additionally, the use of complementary techniques and equipment may also be required, e.g. using angle compression waves, and/or creep wave probes for detecting defects close to the surface.

* Only applicable with limitations, need special qualification subject to acceptance by the Register.

".

21 **Para 3.1.2.2** is replaced by the following text:

"**3.1.2.2** The shipbuilder/ship repairer or its subcontractors is responsible for the qualification and preferably 3rd party certification of its supervisors and operators to a recognized certification scheme based on ISO 9712:2012.

Personnel qualification to an employer-based qualification scheme as e.g. SNT-TC-1A, 2016 or ANSI/ASNT CP-189, 2016, may be accepted if the shipbuilder or its subcontractors written practice is reviewed and found acceptable by the Register. The shipbuilder/ship repairer or its subcontractors written practice shall as a minimum, except for the impartiality requirements of a certification body and/or authorized body, comply with ISO 9712:2012.

The supervisors' and operators' certificates and competence shall comprise all industrial sectors and techniques being applied by the shipbuilder or its subcontractors.

Level 3 personnel shall be certified by an accredited certification body.".

4 WELDING CONSUMABLES

22 **Table 4.9.1.3-2** is replaced by the following text:

"Table 4.9.1.3-2

Grades of welding consumables for national aluminium alloys

Grade	Base metal for tests and alloy designation	
	Numerical code	Chemical symbol
R1/W1	1530	AlMg3,5Si0,6
R2/W2	1550	AlMg5,0Mn0,6
R3/W3	1561	AlMg6,0Mn1
R4/W4	1565ч	AlMg6,0Mn1

Grade	Base metal for tests and alloy designation	
	Numerical code	Chemical symbol
R4/W4	1575	AlMg6,0Mn0,5Sc
R4/W4	1581	AlMg5Sc0,03
R5/W5	–	AlSiMgMn
Note. Approval of higher strength AlMg base materials also covers the lower strength AlMg grades and their combinations.		

".

23 **Table 4.9.3.6** is replaced by the following text:

"Table 4.9.3.6

Requirements for mechanical properties of butt welded joints

Grade of welding consumable	Numerical code of base metal for testing	Tensile strength R_m, MPa	Bend test	
			Mandrel diameter D[1]	Bend angle[2], deg.
International alloys				
RA/WA	5754	190	3*t*	180
RB/WB	5086	240	6*t*	
RC/WC	5083	275	6*t*	
	5383 or 5456	290	6*t*	
	5059	330	6*t*	
RD/WC	6061, 6005A or 6082	170	6*t*	
National alloys				
R1/W1	1530	185[3]	6*t*	180
R2/W2	1550	275[3]	6*t*	
R3/W3	1561	305[3]	6*t*	
R4/W4	1565ч	335[3]	6*t*	
R4/W4	1575	360	6*t*	
R4/W4	1581	350	6*t*	
R5/W5	(AlSiMgMn)	170	6*t*	

[1] *t* — specimen thickness during test.

[2] When evaluating the test results, one shall be guided by the following: no any single crack of over 3 mm long in any direction is allowed on the specimen surface; cracks at the corners of a test specimen may be ignored in the evaluation, unless there is evidence that they result from lack of fusion.

[3] For welded joints of up to 12,5 mm thick inclusive.

".