RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER **No. 314-04-1567c** dated 27.05.2021

Re:

amendments to the Rules for the Classification and Construction of Sea-Going Ships in connection with coming into force of IACS Unified Requirements (UR) W33 (Dec. 2019 and Rev.1 May 2020) and W34 (Dec. 2019)

Item(s) of supervision:

ships under construction

Entry-into-force date: ~~Valid till~~: ~~Validity period extended till~~:
01.07.2021

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

Number of pages: 1 + 21

Appendices:

Appendix 1: information on amendments introduced by the Circular Letter

Appendix 2: text of amendments to Part 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 provisions of the Circular Letter during review and approval of the technical documentation on ships contracted for construction or conversion on or after 01.07.2021, in the absence of a contract — on ships, the keels of which are laid or which are at a similar stage of construction on or after 01.07.2021, as well as during review and approval of the technical documentation on ships, the delivery of which is on or after 01.07.2021.

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

Part XIV: para 3.1.1.1, Table 3.1.1.2-2, paras 3.1.1.3, 3.1.2, 3.1.3.1, 3.1.3.3, 3.1.3.4, 3.2.1.1, 3.2.1.2 and 3.2.2, Figure 3.2.2.5, paras 3.2.2.7, 3.2.2.8, 3.2.3.4, 3.2.5.1, 3.2.5.13, 3.2.6.20, 3.2.6.21, 3.2.7.5, 3.2.7.7, 3.2.8 — 3.2.12 and 3.3.1, Table 3.3.1, paras 3.3.5, 3.3.8 and 3.3.9, para and Table 3.4.1.2, paras 3.4.1.3, 3.4.1.4 and 3.4.2, para and Table 3.4.3.1, para and Table 3.4.4.1, para and Table 3.4.5.3, para and Table 3.4.6.1, paras 3.4.6.2, 3.4.6.3 and 3.4.7

Person in charge: Sergey M. Kordonets 314 +7 (812)312-85-72

"Thesis" System No. 21-103971

**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	Para 3.1.1.1	Terminology has been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020); requirements for non-destructive testing (NDT) procedures have been specified considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
2	Table 3.1.1.2-2	Reference to ISO standard has been specified; requirements for application of NDT procedures have been specified considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
3	Para 3.1.1.3	A new para with the requirements for advanced NDT methods has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
4	Para 3.1.2	Requirements for personnel involved in NDT have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
5	Para 3.1.3.1	Requirements for the scope of NDT have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
6	Para 3.1.3.3	Requirements for adherence to specifications and NDT procedures have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021

Nos.	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
7	Para 3.1.3.4	Requirements for drawing up NDT results report have been specified	314-04-1567c of 27.05.2021	01.07.2021
8	Para 3.2.1.1	Requirements for welds testing have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
9	Para 3.2.1.2	Terminology has been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
10	Para 3.2.2	References to ISO standards have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
11	Figure 3.2.2.5	Term in the title of the Figure has been specified	314-04-1567c of 27.05.2021	01.07.2021
12	Para 3.2.2.7	Reference to ISO standard has been specified	314-04-1567c of 27.05.2021	01.07.2021
13	Para 3.2.2.8	Terminology has been specified (Russian version of the Rules only)	314-04-1567c of 27.05.2021	01.07.2021
14	Para 3.2.3.4	Requirements for NDT temperature and method have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
15	Para 3.2.5.1	Reference to ISO standard has been specified; requirements for surfaces of welds have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
16	Para 3.2.5.13	Para has been revised; requirements for radiographic testing method have been specified considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
17	Para 3.2.6.20	New para with the requirements for ultrasonic testing has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021

Nos.	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
18	Para 3.2.6.21	New para with the requirements for time of flight diffraction NDT testing has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
19	Para 3.2.7.5	Requirements for test report have been specified considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
20	Para 3.2.7.7	New para with the requirements for report data has been introduced considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
21	Para 3.2.8	New para with the requirements for ANDT procedure and process certification has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
22	Para 3.2.9	New para with the requirements for surface condition of tested specimens has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
23	Para 3.2.10	New para with the requirements for ANDT welding procedures has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
24	Para 3.2.11	New para with the requirements for ANDT methods application has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
25	Para 3.2.12	New para with the requirements for NDT results has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021

Nos.	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
26	Para 3.3.1	Requirements for NDT area selection and scope have been specified considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021
27	Table 3.3.1	Terminology has been specified	314-04-1567c of 27.05.2021	01.07.2021
28	Para 3.3.5	Requirements for NDT areas have been specified	314-04-1567c of 27.05.2021	01.07.2021
29	Paras 3.3.8 and 3.3.9	New para 3.3.8 with the requirements for the scope of testing has been introduced considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020); the existing para 3.3.8 has been renumbered 3.3.9	314-04-1567c of 27.05.2021	01.07.2021
30	Para and Table 3.4.1.2	Reference to ISO standard has been specified	314-04-1567c of 27.05.2021	01.07.2021
31	Para 3.4.1.3	Reference to ISO standard has been specified; requirements for quality level of welds have been specified	314-04-1567c of 27.05.2021	01.07.2021
32	Para 3.4.1.4	References to ISO standards have been specified	314-04-1567c of 27.05.2021	01.07.2021
33	Para 3.4.2	Reference to ISO standard has been specified; terminology has been specified	314-04-1567c of 27.05.2021	01.07.2021
34	Para 3.4.3.1	Reference to ISO standard has been specified	314-04-1567c of 27.05.2021	01.07.2021
35	Table 3.4.3.1	References to ISO standards have been specified	314-04-1567c of 27.05.2021	01.07.2021
36	Para 3.4.4.1	Reference to ISO standard has been specified	314-04-1567c of 27.05.2021	01.07.2021
37	Table 3.4.4.1	References to ISO standards have been specified	314-04-1567c of 27.05.2021	01.07.2021
38	Para and Table 3.4.5.3	Reference to ISO standard has been specified	314-04-1567c of 27.05.2021	01.07.2021
39	Para and Table 3.4.6.1	Reference to ISO standard has been specified	314-04-1567c of 27.05.2021	01.07.2021

Nos.	Amended paras/chapters/sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
40	Para 3.4.6.2	Reference to ISO standard has been specified	314-04-1567c of 27.05.2021	01.07.2021
41	Para 3.4.6.3	New para with the requirements for NDT results assessment has been introduced considering IACS UR W33 (Dec. 2019 and Rev.1 May 2020)	314-04-1567c of 27.05.2021	01.07.2021
42	Para 3.4.7	New para with the requirements for the welds quality assessment resulting from ANDT has been introduced considering IACS UR W34 (Dec. 2019)	314-04-1567c of 27.05.2021	01.07.2021

RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2021

ND No. 2-020101-138-E

PART XIV WELDING

3 TESTING OF WELDED JOINTS

1 **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) (refer to 3.1.1.1.7 — 3.1.1.1.9) methods:

.1 visual testing (VT) and measurement testing;

.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" of the Rues for the Classification and Construction of Sea-Going Ships);

.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).".

2 **Table 3.1.1.2-2**. The title of the Table is replaced by the following text:

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

Note of the Table is replaced by the following text:

"N o t e . 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 according to 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.".

3 **New para 3.1.1.3** is introduced reading as follows:

"**3.1.1.3** The capabilities of advanced non-destructive testing methods (ANDT) applicable for testing of different types of weld joints are given Table 3.1.1.3.

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 material thickness, *t*	Applicable методs
Ferritic butt welds with full penetration	*t* < 6мм	RT-D
	6 mm ≤ *t* ≤ 40 mm	PAUT, TOFD, RT-D
	t > 40 mm	PAUT, TOFD, RT-D*
Ferritic tee joints and corner joints with full penetration	*t* ≥ 6 mm	PAUT, RT-D*
Ferritic 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.

4 **Paras 3.1.2** is replaced by the following text:

"**3.1.2 Requirements for testing laboratories and personnel.**

3.1.2.1 Non-destructive testing and quality assessment of welded joints shall be performed by testing laboratories (centres) which competence and status comply with the requirements for accreditation in accordance with national or international standards. The Recognition (Accreditation) Certificate issued by the Register or by other authorized national body is a document confirming competence of the testing laboratory. In the latter case the copy of the Certificate with supplements shall be submitted to the Register surveyor prior to start of welding.

Requirements for testing laboratories performing non-destructive testing and the procedure of their recognition by the Register comply with the provisions of Section 10, 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

3.1.2.2 The shipbuilder 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 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.

3.1.2.3 The shipbuilder or its subcontractors shall have a supervisor or supervisors, responsible for the appropriate execution of NDT operations and for the professional standard of

the operators and their equipment, including the professional administration of the working procedures. The shipbuilder or its subcontractors shall employ, on a full-time basis, at least one supervisor independently certified to Level 3 in the method(s) concerned as per the requirements of 3.1.2.4. It is not permissible to appoint Level 3 personnel; they must be certified by an accredited certification body. Shipbuilder or its subcontractors may not directly employ a Level 3 in all the stated methods practiced. In such cases, it is permissible to employ an external, independently certified, Level 3 in those methods not held by the full-time Level 3(s) of the shipbuilder or its subcontractors.

The supervisor shall be directly involved in review and acceptance of NDT Procedures, NDT reports, calibration of NDT equipment and tools. The supervisor shall on behalf of the shipbuilder or its subcontractors re-evaluate the qualification of the operators annually.

3.1.2.4 Certification levels.

3.1.2.4.1 The operator carrying out the NDT and interpreting indications, shall as a minimum, be qualified and certified to Level 2 in the NDT method(s) concerned and as described below.

However, operators only undertaking the gathering of data using any NDT method and not performing data interpretation or data analysis may be qualified and certified as appropriate, at level 1.

The operator shall have adequate knowledge of materials, welding, structures or components, NDT equipment and limitations that are sufficient to apply the relevant NDT method for each application appropriately.

3.1.2.4.2 A person certified in accordance with ISO 9712:2012 may be certified in one or more of the following three levels.

Level 1.

The person certified by Level 1 shall be competent to implement the non-destructive testing in accordance with the NDT instructions and under the supervision of personnel of Level 2 or 3. As part of the scope executed covered by the Certificate, Level 1 personnel can be qualified by the employer to perform the following steps in accordance with the instructions of non-destructive testing and in the field of competence, specified in the Certificate:

installation of non-destructive testing equipment;

implementation of control;

keep records and assess testing results;

draw a report on the results.

The personnel certified by Level 1, shall not bear responsibility for the choice of method or testing procedures, nor of assessment of results.

Level 2.

The person certified by Level 2, shall have the competence to implement the nondestructive testing in accordance with established procedures. Within the scope of the Certificate, Level 2 personnel may be entitled by the employer to:

select the non-destructive testing method to implement non-destructive testing procedure;

determine the limitations on the application of the testing method;

the use of sets of regulations (codes of practice), standards, specifications and procedures for non-destructive testing to make up practical instructions adapted to the actual operating conditions;

implementation of parameters set-up and check of the equipment tuning;

performance monitoring and supervision of control;

interpretation and assessment of results in accordance with the relevant legal regulations, standards, specifications and procedures;

preparation of NDT instructions;

execution and control of all the tasks of Level 2 or below Level 2;

ensure personnel management as per Level 2 or below Level 2; preparation of a report on the results of non-destructive testing (NDT).

Level 3.

The person certified by Level 3, shall show competence to implement and implement directly the non-destructive testing for which he is certified. Within the scope of the Certificate, Level 3 personnel may be entitled by the employer to:

accepting full responsibility for the day premises (spaces) for testing or examination centre and personnel;

framework, review of editorial and technical correctness and approval of NDT instructions and procedures;

interpretation of sets of regulations (codes of practice), standards, specifications and procedures;

assignment of specific testing methods, procedures and instructions used by nondestructive testing;

performance and control of all the tasks of all the levels; provision of management at all levels;

taking part in commissions on certification exams for non-destructive testing specialists of all levels in compliance with the requirements of the applicable standard and in agreement with the certification body.

Level 3 personnel shall show:

competence in the assessment and interpretation of the results in the framework of the existing sets of regulations, standards, specifications and procedures;

sufficient working knowledge of the materials, technology and manufacturing process to select the method of non-destructive testing and render assistance in setting assessment criteria, where they do not exist; general knowledge of other NDT methods. In view of the above, the following qualification requirements for personnel allowed to perform non-destructive testing of welded joints shall be adhered:

.1 the scope of the Register recognition of the qualification of specialists in ultrasonic testing is, as a rule, limited by the normative documents (standards) used for their special and practical testing during certification;

.2 specialists of at least Level 1 qualification are approved for radiographic testing (without the right to issue conclusions) and of at least Level 2 qualification — for other nondestructive testing methods;

.3 issue of conclusion on the specific non-destructive testing method, check of the equipment operability, as well as drawing up of non-destructive testing charts in accordance with valid normative documents shall be performed by specialists of at least Level 2 qualification;

.4 agreement of non-destructive testing charts, assignment of specific testing methods, procedures and used NDT instructions as well as interpretation of code of practice, standards, specifications and procedures shall be performed by specialists of at least Level 2 qualification.".

5 **Para 3.1.3.1** is replaced by the following text:

"**3.1.3.1** The extent of testing and the number of checkpoints shall be agreed between the shipbuilder and the Register. Unless agreed otherwise, the testing plan for welded joints of hull structures shall be prepared and submitted to the Register for approval. For pipelines, as well as for particular products manufactured under the Register technical supervision, the necessary information may be provided on the relevant drawings without drawing up a separate document. The testing plan shall contain the following information:

.1 details and welded joints subject to testing during the acceptance of welded structures;

.2 scope and methods of testing;

.3 testing locations determined in advance;

.4 requirements for quality assessment of welded joints;

.5 testing standards or written specifications.".

6 **Paras 3.1.3.3** and **3.1.3.4** are replaced by the following text:

"**3.1.3.3** It is the shipbuilder's responsibility to assure that testing specifications and procedures are adhered to during the construction and the reports are made available to the Register on the findings made by the NDT. Records on the performed inspections and testing shall be prepared for all types of testing (initial, additional and repeated after repair) and submitted to the Register surveyor together with the reports confirming the results of non-destructive testing. Conclusion on non-destructive testing results for welding joints shall contain the information specified in 3.2.7 and 3.2.12.

3.1.3.4 Results of repeated testing after repair shall be separated in records. Conclusion on non-destructive testing results shall be signed by a person having performed testing (non-destructive testing operator) and by a person responsible for testing duly authorized by the testing laboratory.

Conclusion on non-destructive testing results shall be signed by a person having performed testing (non-destructive testing operator), and by a person responsible for testing (as a rule, NDT supervisor), duly authorized by the testing laboratory.".

7 **Paras 3.2.1.1** and **3.2.1.2** are replaced by the following text:

"**3.2.1.1** The testing volume shall be the zone which includes the weld and base metal for at least 10mm each side of the weld, or the width of the heat affected zone (HAZ), whichever is greater.

Acceptance non-destructive testing of welded joints shall be carried out (unless otherwise specified) after completion of all welding and straightening work prior to painting or priming, or prior to application of galvanic and other coverings. Areas to be examined shall be free from scale, slag, loose rust, weld spatter, oil, grease, dirt or paint that might affect the sensitivity of the testing method. Preparation and cleaning of welds for subsequent NDT shall be in accordance with the accepted NDT procedures, and shall be to the satisfaction of the surveyor. Surface conditions that prevent proper interpretation may be cause for rejection of the weld area of interest.

NDT shall be conducted after welded joints have cooled to ambient temperature.

For high-tensile steel and high strength steels for welded structure with specified minimum yield stress in the range of 420 N/mm^2 to 690 N/mm^2, acceptance NDT shall not be carried out before 48 h after completion of welding.

For steel with specified minimum yield greater than 690 N/mm^2 NDT shall not be carried out before 72 h after completion of welding.

During welding high strength steels structures, the acceptance testing shall be carried out in two stages: primary and duplicate testing. The primary testing shall be carried out in 48 h or 72 h after the completion of welding works in accordance with the acceptance testing procedure for high strength steels

The duplicate testing shall be performed only on welded joints made at subzero temperatures, approved by the primary testing results, not earlier than 10 days after the primary testing. The scope of the duplicate testing is assigned depending on the Class of the ship's hull structural members in accordance with 1.2.3.7 of Part II "Hull" and shall be 100 % for structural members of Class III, 50 % for structural members of Class II, and 25 % for structural members of Class I.

N o t e s: 1. If a manufacturer can submit a documentary evidence of resistance to cold cracking for the applied materials and welding procedure, the time between the completion of welding and start of testing may be reduced for A/F40 or lower grade steels up to 40 mm thick and for A/F500 or higher grade steels up to 20 mm thick.

2. This requirement does not cover operational technical testing performed during manufacture of products in accordance with the requirements of technical regulation (e.g., the layer testing of welded joints by visual testing, testing of welded joints with partially filled groove etc.).

3. For stem structures of icebreakers and ice class ships, at least 72 h shall pass between the completion of welding and start of acceptance testing of welded joints.

4. The duplicate testing of high strength steel welded joints shall be carried out at the manufacturers' producing high strength steel structures for the first time, as well as after eliminating defects in the form of cold cracks.".

3.2.1.2 All welded joints shall be initially subjected to visual and measurement testing of 100 % length on both sides of joint (if this is technically feasible) to meet the requirements of 3.2.2. All impermissible defects and deficiencies as per form and size of joint as well as other defects preventing non-destructive testing by other methods shall be eliminated, and locations of repair shall be repeatedly accepted by the welding structures manufacturer's control body. The Register reserves a right to require additional testing areas by relevant methods in those locations where visual testing visual and measurement testing detected defects indicative of a serious breach of the welding procedure.".

8 **Para 3.2.2** is replaced by the following text:

"**3.2.2 Visual and measurement testing of welded joints**.

3.2.2.1 Visual and measuring testing of welded joints shall be carried out in compliance with the requirements of ISO 17637-2003, ISO 6520-1:2007 or other agreed international and national standards.".

9 **Figure 3.2.2.5.** The title of the Figure is replaced by the following text:

"Fig. 3.2.2.5 Access conditions to check surface at visual and measurement testing".

10 **Para 3.2.2.7**. In the first sentence the text "ISO 6520" is replaced by "ISO 6520-1:2007".

11 **Para 3.2.2.8**. Terminology is specified (Russian version of the Rules only).

12 **Para 3.2.3.4** is replaced by the following text:

"**3.2.3.4** The temperature of parts examined shall be typically between 5 °C and 50 °C, outside this temperature range special low/high temperature penetrant and reference comparator blocks shall be used.".

13 **Para 3.2.5.1** is replaced by the following text:

"**3.2.5.1** Radiographic testing of welded joints shall be applied and carried out in accordance with written specifications (procedures) developed on the basis of ISO 17636-1:2013 or other agreed international and national standards.

The inside and outside surfaces of the welds to be radiographed shall be sufficiently free from irregularities that may mask or interfere with interpretation. Surface conditions that prevent proper interpretation of radiographs may be cause for rejection of the weld area of interest.".

14 **Para 3.2.5.13** is replaced by the following text:

«**3.2.5.13** Radiographic testing of the welded joints with the use of digital detectors (digital radiography RT-D).

3.2.5.13.1 Radiographic testing of welded joints with the use of digital detectors (digital radiography RT-D) shall be applied and carried out in accordance with written specifications (procedures) developed on the basis of ISO 17636-1:2013 or other agreed international and national standards.

3.2.5.13.2 The radiographic testing of the welded joints with the use of digital detectors (digital radiography RT-D) may be used for the rolled sheets and plates and pipes for detection of the defects with computed radiography (CR) or radiography with the use of digital detector array (DDA).

Computed radiography (CR) is a system with a phosphor imaging plate (IP). The complete system comprises a phosphor imaging plate (IP) and a respective reading device (scanner or reader), which converts information from the IP into a digital image.

Digital detector array (DDA) system is a system comprising an electronic device converting the ionization or penetrating radiation into a set of separate analogue signals, which are later digitized and sent to the computer to be displayed as a digital image corresponding to distribution of the radiant energy transmitted to the device's receiving surface. The digital detectors provide a digital grey scale image with a grey value (GV), which can be decoded and assessed with a computer.

Grey value (GV) is a numeric value of pixel on the digital image.

3.2.5.13.3 The requirements for minimum sensitivity of the radiographic testing with the use of digital detectors corresponding to classes A and B shall be equivalent to those given in Tables 3.2.5.7-1, 3.2.5.7-2 and 3.2.5.7-3 for IR of wire type for the film radiography.

3.2.5.13.4 Specification (procedure) of the radiographic testing of the welded joints with the use of digital detectors (digital radiography RT-D) shall be written and include at least the information given in Table 3.2.5.13.4.

Table 3.2.5.13.4

Requirements for digital radiography procedure

Requirement
material types or weld configurations to be examined, including thickness dimensions and material product form (castings, forgings, pipe, plate, etc.)
Digitizing system description:
manufacturer and model No. of digitizing system
physical size of the usable area of the image monitor
film size capacity of the scanning device
spot size(s) of the film scanning system
image display pixel size as defined by the vertical/horizontal resolution limit of the monitor
illuminance of the video display
data storage medium
Digitizing Technique:
digitizer spot size (in microns) to be used
loss-less data compression technique, if used
method of image capture verification
image processing operations
time period for system verification
Spatial resolution used:
contrast sensitivity (density range obtained)
dynamic range used
spatial linearity of the system
material type and thickness range
source type or maximum X-ray voltage used
detector type
detector calibration
minimum source-to-object distance
distance between the test object and the detector
source size
test object scan plan (if applicable)
image quality measurement tools
image Quality Indicator (IQI)
wire image quality indicator
duplex image quality indicator
image identification indicator
testing levels, acceptance levels and/or recording levels
personnel qualification requirements
surface condition
records, including minimum calibration data to be recorded
environmental and safety issues

3.2.5.13.5 Regarding choice of testing level for digital radiography (RT-D) per ISO 17636-2:2013 this is referred to in Section 8.4.".

15 **New paras 3.2.6.20** and **3.2.6.21** are introduced reading as follows:

"**3.2.6.20 Ultrasonic testing method. Automated ultrasonic examination using Phased array Ultrasonic Testing (PAUT).**

3.2.6.20.1 Phased Array Ultrasonic Testing (PAUT) is used for metal welded joints made by fusion welding with the minimum thickness of 6 mm.

Depending on automation degree, there are automated (AUT) and semi-automated (SAUT) ultrasonic testing using phased array.

Automated ultrasonic examination (AUT) is a technique of ultrasonic examination performed with equipment and search units that are mechanically mounted and guided, remotely operated, and motor-controlled (driven) without adjustments by the technician. The equipment used to perform the examinations is capable of recording the ultrasonic response data, including the scanning positions, by means of integral encoding devices such that imaging of the acquired data can be performed.

Semi-automated ultrasonic examination (SAUT) is a technique of ultrasonic examination performed with equipment and search units that are mechanically mounted and guided, manually assisted (driven), and which may be manually adjusted by the technician. The

equipment used to perform the examinations is capable of recording the ultrasonic response data, including the scanning positions, by means of integral encoding devices such that imaging of the acquired data can be performed.”.

3.2.6.20.2 Phased array ultrasonic testing (PAUT) shall be conducted in accordance with the procedures based on ISO 13588:2019, ISO 18563-1:2015, ISO 18563-2:2017, ISO 18563-3:2015 and ISO 19285:2017 or agreed standards and appropriate RS requirements.

3.2.6.20.3 PAUT procedure shall be written and include the following information as in minimum shown in Table 3.2.6.20.3. When an essential variable shall change from the value specified in Table 3.2.6.20.3, or range of values, the written procedure shall require requalification. When a nonessential variable shall change from the specified value, or range of values, requalification of the written procedure is not required. All changes of essential or nonessential variables from the value, or range of values, specified by the written procedure shall require revision of, or an addendum to, the written procedure.

Table 3.2.6.20.3

Requirements of a phased array ultrasonic testing procedure (PAUT)

Requirement	Essential Variable	Nonessential Variable
Material types or weld configurations to be examined, including thickness dimensions and material product form (castings, forgings, pipe, plate, etc.)	X	–
The surfaces from which the examination shall be performed	X	–
Technique(s) (straight beam, angle beam, contact, and/or immersion)	X	–
Angle(s) and mode(s) of wave propagation in the material	X	–
Search unit type, frequency, element size and number, pitch and gap dimensions, and shape	X	–
Focal range (identify plane, depth, or sound path)	X	–
Virtual aperture size (i.e., number of elements, effective height[1], and element width)	X	–
Focal laws for E-scan and S-scan (i.e., range of element numbers used, angular range used, element or angle increment change)	X	–
Special search units, wedges, shoes, or saddles, when used	X	–
Ultrasonic instrument(s)	X	–
Calibration [calibration block(s) and technique(s)]	X	–
Directions and extent of scanning	X	–
Scanning (manual vs. automatic)	X	–
Method for sizing indications and discriminating geometric from flaw indications	X	–
Computer enhanced data acquisition, when used	X	–
Scan overlap (decrease only)	X	–
Personnel performance requirements, when required	X	–
Testing levels, acceptance levels and/or recording levels	X	–
Personnel qualification requirements	–	X
Surface condition (examination surface, calibration block)	–	X
Couplant (brand name or type)	–	X
Post-examination cleaning technique	–	X
Automatic alarm and/or recording equipment, when applicable	–	X
Records, including minimum calibration data to be recorded (e.g., instrument settings)	–	X
Environmental and safety issues	–	X

[1] Effective height is the distance from the outside edge of the first to last element used in the focal law.

3.2.6.20.4 Preparation for testing.

3.2.6.20.4.1 Testing levels.

The testing levels of PAUT examination specified in the testing procedure shall be in accordance with ISO 13588:2019 identifying four testing levels, each corresponding to a different probability of detection imperfections (defects).

The requirements to welded joint examination shall be in accordance with ISO 13588:2019 and the requirements below.

Materials subject to PAUT examinations shall comply with Table 3.1.1.3-1.

3.2.6.20.4.2 Volume to be inspected.

The purpose of the testing shall be defined by the testing procedure. Based on this, the volume to be inspected shall be determined.

A scan plan shall be provided. The scan plan shall show the beam coverage, the weld thickness and the weld geometry. Ultrasonic beams overlapping the volume to be inspected shall be ensured.

If the evaluation of the indications is based on amplitude only, an E-scan (or linear scan) shall be utilized to scan the fusion faces of welds, so that the sound beam is perpendicular to the fusion face ± 5º. This requirement may be omitted if an S-scan (or sectorial scan) can be demonstrated to verify that discontinuities at the fusion face can be detected and sized, using the stated procedure (note, this demonstration shall utilize reference blocks containing suitable reflectors in location of fusion zone).

3.2.6.20.4.3 Reference blocks.

Depending on the testing level, a reference block shall be used to determine the adequacy of the testing (e.g. coverage, sensitivity setting). The design and manufacture of reference blocks shall be in accordance with ISO 13588:2019 or recognized equivalent standards and the specific requirements of the Register.

3.2.6.20.4.3 Indication assessment.

Indications detected when applying testing procedure shall be evaluated either by length and height or by length and maximum amplitude. Indication assessment shall be in accordance with ISO 19285:2017 or recognized standards and the specific requirements of the Classification Society. The sizing techniques include reference levels, Time Corrected Gain (TCG), Distance Gain Size (DGS) and 6 dB drop. 6 dB drop method shall only be used for measuring the indications larger than the beam width.

3.2.6.21 Time of flight diffraction (TOFD).

3.2.6.21.1 Time of flight diffraction (TOFD) is based on interaction of ultrasonic waves with the imperfection edges. This imperfection result in radiation of diffraction waves in the wide angle range. Detection of diffraction waves allows to identify the imperfection availability.

Time of flight diffraction (TOFD) shall be carried out in accordance with procedure based on ISO 10863:2011 and ISO 15626:2018 or recognized standards and the specific requirements of the Register.

3.2.6.21.2 TOFD procedure shall be written and include the following information as shown in Table 3.2.6.21.2. When an essential variable in Table 3.2.6.21.2 shall change from the specified value, or range of values, the written procedure shall require requalification. When a nonessential variable shall change from the specified value, or range of values, requalification of the written procedure is not required. All changes of essential or nonessential variables from the value, or range of values, specified by the written procedure shall require revision of, or an addendum to, the written procedure.

Table 3.2.6.21.2

Requirements for a time of flight diffraction procedure (TOFD)

Requirement	Essential Variable	Nonessential Variable
Weld configurations to be examined, including thickness dimensions and material product form (castings, forgings, pipe, plate, etc.)	X	–
The surfaces from which the examination shall be performed	X	–
Angle(s) of wave propagation in the material	X	–
Search unit type(s), frequency(ies), and element size(s)/shape(s)	X	–
Special search units, wedges, shoes, or saddles, when used	X	–
Ultrasonic instrument(s) and software(s)	X	–
Calibration [calibration block(s) and technique(s)]	X	–
Directions and extent of scanning	X	–
Scanning (manual vs. automatic)	X	–
Data sampling spacing (increase only)	X	–
Method for sizing indications and discriminating geometric from flaw indications	X	–
Computer enhanced data acquisition, when used	X	–
Scan overlap (decrease only)	X	–
Personnel performance requirements, when required	X	–
Testing levels, acceptance levels and/or recording levels	X	–
Personnel qualification requirements	–	X
Surface condition (examination surface, calibration block)	–	X
Couplant (brand name or type)	–	X
Post-examination cleaning technique	–	X
Automatic alarm and/or recording equipment, when applicable	–	X
Records, including minimum calibration data to be recorded (e.g., instrument settings)	–	X
Environmental and safety issues	–	X

3.2.6.21.3 Preparation for testing.

3.2.6.21.3.1 Testing levels.

Testing levels of TOFD examination specified in the procedure shall comply with ISO 10863:2011 identifying four testing levels, each corresponding to a different probability of detection of imperfections.

3.2.6.21.3.2 Volume to be inspected.

The purpose of the testing shall be defined by the testing procedure. Based on this, the volume to be inspected shall be determined.

A scan plan shall be provided. The scan plan shall show the locations of the probes, beam coverage, the weld thickness and the weld geometry. Ultrasonic beams overlapping the volume to be inspected shall be ensured.

Due to the nature of the TOFD method, there is a possibility that the scan plan may reveal weld volume zones that will not receive full TOFD coverage (commonly known as dead zones, either in the lateral wave, back wall, or both). If the scan plan reveals that these dead zones are not adequately inspected, then further TOFD scans and/or complementary NDT methods shall be applied to ensure full inspection coverage.".

16 **Para 3.2.7.5** is supplemented by the following text:

"number of radiographs (exposures);
angle of radiation beam through the weld (from normal).".

17 **New para 3.2.7.7** is introduced reading as follows:

"**3.2.7.7** The inspection records specified in 3.2.7 the records of repaired welds.".

18 **New paras 3.2.8 — 3.2.12** are introduced reading as follows:

"**3.2.8 Technique and procedure of advanced non-destructive testing (ANDT).**

3.2.8.1 General.

The shipbuilder or manufacturer shall submit to the Register the following documentation for review:

the technical documentation of the ANDT.

the operating methodology and procedure of the ANDT in accordance with the requirements of 3.2.11;

result of software simulation, when applicable.

3.2.8.2 Software simulation.

Software simulation may be required by the Register, when applicable for PAUT or TOFD techniques. The simulation may include initial test set-up, scan plan, volume coverage, result image of artificial flaw etc. In some circumstances, artificial defect modeling/simulation may be needed or required by the project.

3.2.8.3 Procedure qualification test.

The procedure qualification for ANDT system shall include the following steps:

review of available performance data for the inspection system (detection abilities and defect sizing accuracy);

identification and evaluation of significant parameters and their variability;

planning and execution of a repeatability and reliability test program which includes onsite demonstration;

documentation of results from the repeatability and reliability test programs.

N o t e . The data from the repeatability and reliability test program shall be analyzed with respect to comparative qualification block test report and onsite demonstration. The qualification block shall be in accordance with ASME Sec. V, Art. 14, Appendix II, or agreed by the Register, and at least the intermediate level qualification blocks shall be used. The high-level qualification blocks shall be used when sizing error distributions and an accurate POD need to be evaluated. The demonstration process onsite shall be witnessed by the Register surveyor.

3.2.8.4 NDT procedure approval.

The testing procedure shall be evaluated based upon the qualification results, if satisfactory, the procedure can be considered approved.

3.2.8.5 Onsite review.

For the test welds, supplementary ANDT shall be performed on an agreed proportion of welds to be cross checked with other methods. Alternatively, other documented reference techniques may be applied to compare with ANDT results.

Data analyses shall be performed in accordance with the above activities. Probability of detection (PoD) and sizing accuracy shall be established when applicable.

When the result of inspection review does not conform to the approved procedure, the inspection shall be suspended immediately. Additional procedure review qualification and demonstration shall be undertaken to account for any non-conformity.

When a significant non-conformity is found, the Register has the right to reject the results of such activities.

3.2.9 Surface condition.

Area to be examined shall be free from scale, loose rust, weld spatter, oil, grease, dirt or paint that might affect the sensitivity of the testing method.

Where there is a requirement to carry out PAUT or TOFD through paint, the suitability and sensitivity of the test shall be confirmed through an appropriate transfer correction method defined in the procedure. In all cases, if transfer losses exceed 12 dB, the reason shall be considered and further preparation of the scanning surfaces shall be carried out, if applicable. If testing is done through paint, then the procedure shall be qualified on a painted surface.

The requirement for acceptable test surface finish shall ensure accurate and reliable detection of defects. For the testing of welds, where the test surface is irregular or has other features likely to interfere with the interpretation of NDT results, the weld shall be ground or machined.

3.2.10 Welding processes for which the advanced non-destructive testing (ANDT) may apply are given in Table 3.2.10.

Table 3.2.10-1

Welding processes for which the advanced non-destructive testing (ANDT) may apply

Welding process		**ISO 4063:2009**
Manual welding	Shield Metal Arc Welding(SMAW)	111
Resistance welding	Flash welding(FW)	24
Semi-automatic welding	1. Metal Inert Gas welding(MIG) 2. Metal Active Gas welding(MAG) 3. Flux Cored Arc Welding(FCAW)	131 135, 138 136
TIG welding	Gas Tungsten Arc Welding(GTAW)	141
Automatic welding	1. Submerged Arc Welding(SAW) 2. Electro-gas Welding(EGW) 3. Electro-slag Welding(ESW)	12 73 72

3.2.11 Requirements to examination using the advanced non-destructive testing (ANDT). General.

3.2.11.1 The shipyard or manufacturer shall ensure that personnel carrying out NDT or interpreting the results of NDT are qualified to the appropriate level in accordance with 3.1.2.2 — 3.1.2.4.

3.2.11.2 ANDT specifications (procedures).

All advanced non-destructive testing (ANDT) shall be carried out to a procedure that is representative of the item under inspection.

Procedures shall identify the component (or area) to be examined, the NDT method, equipment to be used and the full extent of the examinations including any test restrictions.

Procedures shall include the requirement for components to be positively identified and for a datum system or marking system to be applied to ensure repeatability of inspections.

Procedures shall include the method and requirements for equipment calibrations and functional checks, together with specific technique sheets / scan plans, for the component under test.

Procedures shall be approved by personnel qualified to Level 3 in the appropriate technique in accordance with a recognized standard.

Procedures shall be reviewed by the Register.

3.2.11.3 The requirements for the procedure of the advanced non-destructive testing method PAUT shall be as a minimum in accordance with 3.2.6.20. Depending on the complexity of the item under test and the access to surfaces, there may be a requirement for additional scans and/or complementary NDT techniques to ensure that full coverage of the item is achieved. PAUT of welds shall include a linear scan of the fusion face, together with other scans as defined in the specific test technique. Linear scan requirements are specified in 3.2.6.20.4.

3.2.11.4 The requirements for the procedure of the advanced non-destructive testing method TOFD shall be a minimum in accordance with 3.2.6.21. Depending on the complexity of the item under test and the access to surfaces, there may be a requirement for additional scans and/or complementary NDT techniques to ensure that full coverage of the item is achieved.

3.2.11.5 The requirements to the procedure of the advanced non-destructive testing method of digital radiography (RT-D) shall be as a minimum to section 3.2.5.13, where two RT-D techniques — DDA and CR — are specified.

Application of other digital radiography (RT-D) methods may be considered, provided their compliance with the requirements of 3.2.5.13.

3.2.12 Reporting of examination of welded joints using the advanced non-destructive testing (ANDT).

The test report shall include at least the following information:

a reference to standards of compliance;

information relating to the object under test:

identification of the object under test;

dimensions including wall thickness;

material type and product form;
geometrical configuration;
location of welded joint(s) examined;
reference to welding process and heat treatment;
surface condition and temperature;
stage of manufacture;
information relating to equipment (given in Table 3.2.12-1);

Table 3.2.12-1

Method	Information
All	Manufacturer and type of instrument, including with identification numbers if required.
PAUT	1. Manufacturer, type, frequency of phased array probes including number and size of elements, material and angle(s) of wedges with identification numbers if required, 2. details of reference blocks with identification numbers if required, 3. type of couplant used.
TOFD	1. Manufacturer, type, frequency, element size and beam angle(s) of probes with identification numbers if required, 2. details of reference block(s) with identification numbers if required, 3. type of couplant used.
RT-D	1. System of marking used, 2. radiation source, type and size of focal spot and identification of equipment used, 3. detector, screens and filters and detector basic spatial resolution.

d) information relating to test technology (given in Table 3.2.12-2):

Table 3.2.12-2

Method	Information
All	1. Testing level and reference to a written test procedure; 2. purpose and extent of test; 3. details of datum and coordinate systems; 4. method and values used for range and sensitivity settings; 5. details of signal processing and scan increment setting; 6. access limitations and deviations from standards, if any
PAUT	1. Increment (E-scans) or angular increment (S-scans); 2. element pitch and gap dimensions; 3. focus (calibration should be the same as scanning); 4. virtual aperture size, i.e. number of elements and element width; 5. element numbers used for focal laws; 6. documentation on permitted wedge angular range from manufacturer; 7. documented calibration; TCG and angle gain compensation; 8. scan plan
TOFD	1. Details of TOFD setups; 2. details of offset scans, if required.
RT-D	1. Detector position plan; 2. tube voltage used and current or source type and activity; 3. time of exposure and source-to-detector distance; 4. type and position of image quality indicators (IQI); 5. achieved and required SNR_N for RT-S (DDA) or achieved and required grey values and/or SNR_N for RT-CR (CR); 6. for RT-S (DDA): type and parameters such as: gain, frame time, frame number, pixel size, calibration procedure 7. for RT-CR (CR): scanner type and parameters such as pixel size, scan speed, gain, laser intensity; laser spot size; 8. image-processing parameters used; e.g. of the digital filters

".

19 **Table 3.3.1**. Throughought the text of the table the term "visual testing" is replaced by "visual and measurement testing".

20 **Para 3.3.1**. New second paragraph is introduced reading as follows:

"Block construction welds performed in the yards, or at subcontracted yards/facilities, shall be primarily considered in selecting checkpoints. For other marine and offshore structures the extent shall be agreed with the Register.".

21 **Para 3.3.5** is replaced by the following text:

"**3.3.5** Besides the structures specified in Tables 3.3.1, 3.3.3 and 3.3.4, such elements of machinery and gear as joints in cargo masts and posts, etc. are subject to non-destructive testing. The controlled weld lengths in these structures shall be established upon agreement with the surveyor in connection with the requirements of parts of the Rules specifying such structures.".

22 New p**ara 3.3.8** is introduced reading as follows:

"**3.3.8** Consideration may be given for reduction of inspection frequency for automated welds where quality assurance techniques indicate consistent satisfactory quality.

The number of checkpoints shall be increased if the proportion of non-conforming indications is abnormally high.".

23 **Existing para 3.3.8** is renumbered **3.3.9.**

24 Throughout the text of Chapter 3.4 (**para** and **Table 3.4.1.2, paras 3.4.1.3** and **3.4.1.4**) reference "ISO 5817" is replaced by "ISO 5817:2014".

25 **Para 3.4.1.3** is replaced by the following text:

"**3.4.1.3** Quality level requirements in compliance with ISO 5817:2014 for boilers, heat-exchangers and piping shall be assigned in accordance with Table 3.4.1.3. For welded joints of steel structures, components and machinery of cargo handling gear (in accordance with 3.2 of the Rules for the Cargo Handling Gear of Sea-Going Ships) the B quality level shall apply in compliance with ISO 5817:2014.".

26 **Para 3.4.1.4.** The reference "ISO 17635" is replaced by "ISO 17635:2016".

27 **Para 3.4.2** is replaced by the following text:

"**3.4.2 Assessment of the welded joints quality by the visual and measurement testing results.**

3.4.2.1 If otherwise is not agreed with the Register, assessment of the welded joints quality on the visual and measurement testing results shall be carried out in accordance with ISO 5817:2014 for external imperfections (refer to Table 3.4.2.1) for quality levels specified as per 3.4.1.2 or 3.4.1.3.

3.4.2.2 All imperfections detected on the visual and measurement testing results shall be removed and the location of corrections shall be tested again in compliance with 3.2.1

3.4.2.3 On the visual and measurement testing results the welded joints shall be considered fit/accepted if inadmissible imperfections are not detected for an acceptable level listed in Table 3.4.2.1.".

28 **Para** and **Table 3.4.3.1**. Reference "ISO 23278" is replaced by "ISO 23278:2015".

Table 3.4.3.1. Reference "ISO 232781" is replaced by "ISO 23278:2015".

29 **Para** and T**able 3.4.4.1**. Reference "ISO 23277" is replaced by "ISO 23277:2015".

Table 3.4.4.1. Reference "ISO 232771" is replaced by "ISO 23277:2015".

30 P**ara** and **Table 3.4.5.3**. Reference "ISO 10675-1" is replaced by "ISO 10675-1:2016".

31 P**ara** and **Table 3.4.6.1**. Reference "ISO 11666" is replaced by "ISO 11666:2018".

32 **Para 3.4.6.2**. Reference "ISO 23279" is replaced by "ISO 23279:2017".

33 **New para 3.4.6.3** is introduced reading as follows:

"**3.4.6.3** UT Acceptance Levels apply to the examination of full penetration ferritic steel welds, with thickness from 8 mm to 100 mm. The nominal frequency of probes used shall be between 2 MHz and 5 MHz. Examination procedures for other type of welds, material, thicknesses above 100 mm and examination conditions shall be submitted to the consideration of the Register.".

34 **New para 3.4.7** is introduced reading as follows:

"**3.4.7 Quality assessment of welded joints based on the results of the advanced non-destructive testing (ANDT).**

3.4.7.1 General.

Quality assessment of welded joints in steel structures shall be carried out based on the quality levels in compliance with the relevant requirements of agreed international and national standards and shall include, but not be limited to, the following advanced non-destructive testing methods: phased array ultrasonic testing (PAUT), time of flight diffraction (TOFD), digital radiography (RT-D).

Where necessary, these testing methods shall apply in combination for ease of result assessment in compliance with the accepted criteria.

3.4.7.2 Quality assessment of welded joints based on the results of phased array ultrasonic testing (PAUT).

The applicable levels of defect assessment in connection with the established quality levels shall comply with ISO 19285:2017 or other standard agreed with the Register.

The relationship between the acceptance levels, testing levels and quality levels is given in Table 3.4.7.2

Table 3.4.7.2

Quality levels according to ISO 5817:2014	Testing levels according to ISO 13588:2019	Acceptance levels according to ISO 19285:2017
C, D	A	3
B	B	2
Subject to approval	C	1
Special application	D	Subject to approval

3.4.7.3 Quality assessment of welded joints based on the results of time of flight diffraction (TOFD)

The applicable levels of defect assessment in connection with the established quality levels shall comply with ISO 15626:2018 or other standard agreed with the Register

The relationship between acceptance levels, testing levels and quality levels is given in Table 3.4.7.3

Table 3.4.7.3

Quality levels according to ISO 5817:2014	Testing levels according to ISO 10863:2011	Acceptance levels according to ISO 15626:2018
B	C	1
C	At least B	2
D	At least A	3

3.4.7.4 Quality assessment of welded joints based on the results of digital radiography (RT-D).

The applicable levels of defect assessment in connection with the established quality levels shall comply with ISO 10675 or other standard agreed with the Register.

The relationship between acceptance levels, testing levels and quality levels is given in Table 3.4.7.4

Table 3.4.7.4

Quality levels according to ISO 5817:2014 or ISO 10042:2018	**Testing techniques/level(class) according to ISO 17636-2:2013**	**Acceptance level according to ISO 10675-1:2016 and ISO 10675-2:2017**
B	B (class)	1
C	B* (class)	2
D	A (class)	3
* For circumferential weld testing, the minimum number of exposures may correspond to the requirements of ISO 17636-2:2013, class A		

".