# RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

## Part M Welding

**2020 AMENDMENT NO.2**

Rule No.112 24 December 2020

Resolved by Technical Committee on 5 August 2020

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

Rule No.112 24 December 2020
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Rules for the survey and construction of steel ships" has been partly amended as follows:

# Part M WELDING

Amendment 2-1

## Chapter 4 WELDING PROCEDURE AND RELATED SPECIFICATIONS

### 4.1 General

### 4.1.4 Range of Approval*

Sub-paragraph -1(4) has been amended as follows.

**1** The scope of approval of the welding procedure and related specifications of rolled steels for hull and high strength rolled steels for offshore structures are in accordance with the following **(1)** through **(6)**, on the condition that other welding conditions are same. However, the range of approval differing from the requirements specified in this Chapter may be accepted that it is deemed appropriate by the Society.
((1) to (3) are omitted.)
(4) Kinds of base metal
- (a) Rolled steels for hull
  - i) Within the same strength level, the welding procedures are considered applicable to lower toughness grade (material with higher specified impact test temperature).
  - ii) In addition to the requirement in **i)**, within the same and below toughness grades, the welding procedures are considered applicable to the one and two lower strength levels (material with the one and two lower specified yield strength).
- (b) High strength rolled steels for offshore structures
  - i) Within the same strength level, the welding procedures are considered applicable to lower toughness grade.
  - ii) In addition to the requirement in **i)**, within the same and below toughness grades, the welding procedures are considered applicable to the one lower strength levels.
- (c) Notwithstanding the requirement given in **(a)** and **(b)**, for the large heat input welding specified in **Note (5) of Table M4.2**, the welding procedures are considered applicable to that toughness grade tested and one strength level below.
- (d) Notwithstanding the requirements given in **(a)** to **(c)**, welding procedures for *KE*47 within the same and below toughness grades are considered applicable to one lower strength level. However, for the large heat input welding specified in **Note (5) of Table M4.2**, the welding procedures are considered applicable to that toughness grade tested and the same strength level.

((5) and (6) are omitted.)

## 4.2 Tests for Butt Welded Joints

### 4.2.9 Hardness Test

Table M4.12 has been amended as follows.

Table M4.12 Requirements of Hardness Test

| Kinds of test assembly | | Vickers hardness (*HV*10) |
|---|---|---|
| Rolled steels for hull | *KA*36, *KD*36, *KE*36, *KF*36<br>*KA*40, *KD*40, *KE*40, *KF*40 | 350 max |
| | *KE*47 | ~~380~~350 max(1) |
| (Omitted) | | |

Note:

(1) Steels considered to have brittle crack arrest properties specified in **3.12, Part K** are to be 380 max.

# Chapter 6 WELDING CONSUMABLES

## 6.2 Electrodes for Manual Arc Welding for Mild and High Tensile Steels and Steels for Low Temperature Service

### 6.2.7 Deposited Metal Impact Test

Table M6.6 has been amended as follows.

Table M6.6 Impact Test Requirements for Deposited Metal

| Grade of electrode | Testing temperature (℃) | Minimum mean absorbed energy (*J*) |
|---|---|---|
| (Omitted) | | |
| *KMW63Y47* | -20 | ~~53~~64 |
| (Omitted) | | |

### 6.2.10 Butt Weld Impact Test

Table M6.8 has been amended as follows.

TableM6.8 Impact Test Requirements for Butt Weld

| Grade of electrode | Testing temperature (℃) | Minimum mean absorbed energy (*J*) | |
|---|---|---|---|
| | | Flat, Horizontal, Overhead | Vertical upward, Vertical downward |
| (Omitted) | | | |
| *KMW63Y47* | -20 | ~~53~~64 | |
| (Omitted) | | | |

## 6.3 Automatic Welding Consumables for Mild Steels, High Tensile Steels and Steels for Low Temperature Service

### 6.3.7 Deposited Metal Impact Test with Multi-run Technique

Table M6.18 has been amended as follows.

Table M6.18 Impact Test Requirements for Deposited Metal

| Grade of Welding consumable | Testing temperature (℃) | Minimum mean absorbed energy (*J*) |
|---|---|---|
| (Omitted) | | |
| *KAW63Y47* | -20 | ~~53~~64 |
| (Omitted) | | |

## 6.4 Semi-automatic Welding Consumables for Mild Steels, High Tensile Steels and Steels for Low Temperature Service

### 6.4.7 Deposited Metal Impact Test

Table M6.25 has been amended as follows.

Table M6.25 Impact Test Requirements for Deposited Metal

| Grade of welding consumable | Testing temperature (℃) | Minimum mean absorbed energy (*J*) |
|---|---|---|
| (Omitted) | | |
| *KSW*63*Y*47 | -20 | ~~53~~64 |
| (Omitted) | | |

### 6.4.10 Butt Weld Impact Test

Table M6.27 has been amended as follows.

Table M6.27 Impact Test Requirements for Butt Weld

| Grade of welding consumable | Testing temperature (℃) | Minimum mean absorbed energy (*J*) | |
|---|---|---|---|
| | | Flat, Horizontal, Overhead | Vertical upward, Vertical downward |
| (Omitted) | | | |
| *KSW*63*Y*47 | -20 | ~~53~~64 | |
| (Oimtted) | | | |

## 6.5 Electro-slag and Electro-gas Welding Consumables

### 6.5.8 Impact Test

Table M6.34 has been amended as follows.

TableM6.34 Impact Test Requirement

| Grade of welding consumable | Testing temperature (℃) | Minimum mean absorbed energy (*J*) |
|---|---|---|
| (Omitted) | | |
| *KEW*63*Y*47 | -20 | ~~53~~64 |

## EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

**1.** The effective date of the amendments is 1 January 2021.

**2.** Notwithstanding the amendments to the Rules, the current requirements apply to steels being used on ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

### IACS PR No.29 (Rev.0, July 2009)

**1.** The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

**2.** The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

**3.** If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

**4.** If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.

Amendment 2-2

Chapter 9 has been added as follows.

# Chapter 9 Advanced Non-Destructive Testing

## 9.1 General

### 9.1.1 General

**1** The requirements in this chapter are applied when Advanced Non-Destructive Testing (hereinafter referred to as "*ANDT*") is used in lieu of radiographic tests or ultrasonic tests for materials and welded joints during construction of ships, etc. specified in the Rules. For the welded joints of liquefied gas cargo tanks specified in **Part N** and liquefied gas fuel tanks specified in **Part GF**, the radiographic tests are not to be completely replaced by Phase Array Ultrasonic Testing (hereinafter referred to as "*PAUT*") or Time of Flight Diffraction (hereinafter referred to as "*TOFD*")

**2** *ANDT* is to be performed by the shipbuilder, manufacturer or its subcontractors (hereinafter referred to as the "supplier") in accordance with these requirements. The Surveyor is, in principle, to be present during the test.

**3** Suppliers are to adhere to *ANDT* specifications and procedures. Reports on *ANDT* findings are to be made available to the Society.

**4** *ANDT* methods, structural members to be subjected to testing, locations to be tested and the number of tests are to be agreed on between the supplier and the Society. *ANDT*, however, need not be performed in addition to that required for the structural members and locations to be tested as well as the number of tests specified in the Rules.

**5** Notwithstanding the requirements specified in **8.1.2-5**, *ANDT* for the welded joints of hull structures specified in **Chapter 8** of this Part is to be in accordance with **9.5**. Approved *ANDT* in accordance with **9.5** may be applied to all locations to be tested specified in the non-destructive inspection plan.

### 9.1.2 Definitions

The terms used in this chapter are defined as follows in **Table M9.1**.

Table M9.1 Definitions

| | |
|---|---|
| *ANDT* | Advanced Non-Destructive Testing |
| *RT-D* | Digital Radiography Testing |
| *RT-S* | Radioscopic Testing with Digital Image Acquisition, (Dynamic ≥12 bit) |
| *RT-CR* | Testing with Computed Radiography using storage phosphor imaging plates |
| *PAUT* | Phased Array Ultrasonic Testing |
| *TOFD* | Time of Flight Diffraction |
| *AUT* | Automated Ultrasonic Examinations. 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. |
| *SAUT* | Semi-Automated Ultrasonic Examinations. 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. |

## 9.2 Application

### 9.2.1 Material

The requirements in this chapter are applied to the materials specified in **Part K of the Rules**.

### 9.2.2 Welding Procedure

The requirements in this chapter are applied to the welding procedures specified in **Table M9.2**. *ANDT* for other welding procedures may be in accordance with the requirements in this chapter, upon approval by the Society.

Table M9.2 Welding procedures

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

### 9.2.3 Welded Joints

The requirements in this chapter, in principle, are applied to welded joints with full penetration. Other welded joints (e.g. T, corner and cruciform joints) may be tested using *PAUT*. Welded joints to which *ANDT* is applied are to be confirmed by the Society before application.

### 9.2.4 Timing

**1** *ANDT* is to be performed after welds have cooled to an appropriate temperature and after post weld heat treatment (where applicable) has been performed.

**2** The timing of *ANDT* is to be in accordance with **8.1.4** when it is applied to the welds of hull structures using high tensile steels for which the minimum yield stress is more than 420 $N/mm^2$.

## 9.3 Testing Method

### 9.3.1 General

The *ANDT* specified in this chapter, in principle, includes *PAUT* (only automated or semi-automated), *TOFD* and *RT-D*. Other *ANDT* may be applied in accordance with the requirements of this chapter provided that it is deemed appropriate by the Society.

### 9.3.2 Testing Methods for Welded Joint Types

The testing methods for the *ANDT* subject to the requirements of this chapter are specified according to material and welded joint type as shown in **Table M9.3**.

Table M9.3 Testing Method According to Material and Welded Joint

| Material and Welded Joint | Base Metal Thickness ($t$) | Testing Method |
|---|---|---|
| Carbon steel butt welded joints | $t < 6$ *mm* | *RT-D* |
| | 6 *mm* $\le t \le$ 40 *mm* | *PAUT*, *TOFD*, *RT-D* |
| | $t >$ 40 *mm* | *PAUT*, *TOFD*, *RT-D*(2) |
| Carbon steel *T*-joints and corner joins with full penetration | $t \ge 6$ *mm* | *PAUT*, *RT-D*(2) |
| Carbon steel cruciform joints with full penetration | $t \ge 6$ *mm* | *PAUT*(2) |
| Austenitic stainless steel(1) butt welded joints | $t < 6$ *mm* | *RT-D* |
| | 6 *mm* $\le t \le$ 40 *mm* | *RT-D*, *PAUT*(2) |
| | $t >$ 40 *mm* | *PAUT*(2), *RT-D*(2) |
| Austenitic stainless steel(1) *T*-joints and corner joins with full penetration | $t \ge 6$ *mm* | *PAUT*(2), *RT-D*(2) |
| Aluminium alloy butt welded joints | $t < 6$ *mm* | *RT-D* |
| | 6 *mm* $\le t \le$ 40 *mm* | *RT-D*, *TOFD*, *PAUT* |
| | $t >$ 40 *mm* | *TOFD*, *PAUT*, *RT-D*(2) |
| Aluminium alloy *T*-joints and corner joins with full penetration | $t \ge 6$ *mm* | *PAUT*(2), *RT-D*(2) |
| Aluminium alloy cruciform joints with full penetration | $t \ge 6$ *mm* | *PAUT*(2) |
| Copper alloy castings | — | *PAUT*, *RT-D*(2) |
| Steel forgings | — | *PAUT*, *RT-D*(2) |
| Steel castings | — | *PAUT*, *RT-D*(2) |
| Rolled steels and aluminium alloy forgings | $t < 6$ *mm* | *RT-D* |
| | 6 *mm* $\le t \le$ 40 *mm* | *PAUT*, *TOFD*, *RT-D* |
| | $t >$ 40 *mm* | *PAUT*, *TOFD*, *RT-D*(2) |

Notes:

(1) Where deemed necessary by the Society, either special specifications, supplementary devices (using angle compression waves, creep wave probes or a combination of both for detecting defects close to the surface) or a combination of both

may be required when *PAUT* or *TOFD* are applied to anisotropic materials.

(2) Where the supplier has special qualifications for each type of *ANDT* and is agreed to by the Society, said *ANDT* may be applied.

## 9.4 *ANDT* Personnel Qualifications

### 9.4.1 *ANDT* Personnel Qualifications and Certification

**1** Supplier supervisors and operators are to be recognised by a certification scheme based on *ISO* 9712:2012 or *JIS Z* 2305. The aforementioned standards, in principle, refer to the most recent version published.

**2** The supplier is to be responsible for the preceding **1**.

**3** Personnel qualification by an employer based on standards deemed acceptable or recommended by the Society (e.g. *SNT-TC-1A*, 2016 or *ANSI/ASNT CP*-189, 2016) may be accepted if the supplier's written practice is reviewed and found acceptable by the Society. In such cases, the supplier's written practice, except for the impartiality requirements of a certification body or authorised body, is to at a minimum comply with *ISO* 9712:2012.

**4** Supervisor and operator certificates and competence are to comprise all industrial sectors and techniques being applied by the supplier.

### 9.4.2 Supervisors

**1** Suppliers are to have a supervisor or supervisors who are responsible for the appropriate execution of *ANDT* operations and for the professional standard of the operators and their equipment, including the professional administration of the working procedures.

**2** Supervisors are to be independently certified to Level 3 by a third party based on **9.4.1** and deemed acceptable by the Society.

**3** In relation to the preceding **2**, suppliers are to employ, on a full-time basis, at least one supervisor for all *ANDT* methods which are carried out by the supplier, except in cases where it is recognised that it is difficult for the supplier to directly employ a Level 3 certified supervisor for all the stated *ANDT* methods.

**4** Supervisors are to be directly involved in the review and acceptance of *ANDT* specifications and procedures, test records, inspection records and the calibration of *ANDT* equipment and tools.

**5** Supervisors are to evaluate operator skills and qualifications at least every 12 months.

### 9.4.3 Operators

**1** Operators are, in principle, to be at least qualified and certified to Level 2 for the *NDT* method(s) concerned and as described in **9.4.1**, except in cases where **9.4.1-3** is applied.

**2** Operators who are qualified and certified as Level 1 are to only undertake the gathering of data and the using of *ANDT* methods. They are not, however, to perform data interpretation or data analysis.

**3** Operators are to have adequate knowledge of materials, welds, structures or components as well as of *ANDT* equipment and its limitations that is sufficient to apply the relevant *ANDT* method for each application appropriately.

## 9.5 *ANDT* Specification Verification

### 9.5.1 General

Suppliers are to submit the documents listed in the following **(1)** through **(3)**:

(1) *ANDT* technical documents;

(2) The *ANDT* specifications specified in **9.8**; and

(3) The results of the software simulations specified in **9.5.2**, when applicable.

**9.5.2 Software Simulations**

**1** Software simulation may be required by the Society, when *PAUT* or *TOFD* are applied.

**2** Software simulation may include initial test set-up, scan plan, volume coverage and result image of artificial flaws, etc.

**3** Where deemed necessary by the Society, artificial defect modeling/simulation may be required.

**9.5.3 *ANDT* Specification Verification Tests***

**1** Verification tests for *ANDT* specifications are to include the following **(1)** through **(4)**:

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

(2) Identification and evaluation of significant parameters and their variability;

(3) Planning and execution of verification tests using qualification blocks and onsite testing for the purpose of confirmation for a repeatability and reliability for inspection systems; and

(4) Making out of test reports for the verification tests specified in the preceding **(3).**

**2** The data with respect to the repeatability and reliability obtained by the verification tests specified in the preceding **1(3)** is to be analyzed by comparing test reports for qualification blocks with those for onsite testing. Qualification blocks are to be manufactured in accordance with a recognized standard deemed appropriate by the Society. Onsite verification test plans are to be confirmed by the Society.

**9.5.4 *ANDT* Specification Approval**

Test reports for the verification tests specified in **9.5.3** are to be submitted to the Society for the purpose of *ANDT* specification approval.

**9.5.5 Onsite Verification Tests**

**1** After *ANDT* specifications are approved in accordance with the requirements specified in **9.5.4**, a supplemental *NDT* is to be performed at locations to be tested agreed to by the Society among those for which *ANDT* is performed for the purpose of verifying the validity of ANDT results.

**2** Notwithstanding the preceding **2**, the aforementioned supplemental *NDT* may be reduced or omitted at the discretion of the Society provided that *ANDT* results can be appropriately compared with technical documents submitted by the supplier and the validity of *ANDT* results can be verified.

**3** Documents with respect to probability of detection (*POD*) and sizing accuracy are to be created where deemed necessary by the Society.

**4** When the surveyor in attendance judges that the *ANDT* is not being carried out in accordance with its approved specifications, the *ANDT* is to be suspended immediately. In such cases, the supplier is to conduct an additional investigation and is to re-verify the validity of the *ANDT* specifications in order to determine the cause of the failure.

**5** When a significant nonconformity is found, the Society has the right to reject the *ANDT* results.

## 9.6 Surface Condition

**9.6.1 Surface Condition**

**1** Locations to be tested are to be free from scales, loose rust, weld spatter, oil, grease, dirt or

paint that may affect *ANDT* detection sensitivity.

**2** Where *PAUT* or *TOFD* are to be performed on painted surfaces, the suitability and sensitivity of the test are to be confirmed in accordance with an appropriate transfer correction method defined in the specifications. In all cases, the reasons for transfer losses exceeding 12 *dB* are to be examined, and further preparation of the scanning surfaces is to be conducted so that transfer losses do not exceed 12 *dB*.

**3** Where *ANDT* is to be performed on painted surfaces, the relevant procedures are to be qualified on a painted surface in accordance with **9.5.3**.

**4** Requirements for acceptable test surface finishes are to ensure accurate and reliable detection of defects. For the testing of welded joints, the weld is to be ground or machined in cases where the test surface is irregular or has other features likely to interfere with the interpretation of *ANDT* results.

## 9.7 *ANDT* Selection

### 9.7.1 *ANDT* Selection

**1** The locations to be tested and the number of *ANDT* tests are to be planned by the supplier according to ship design, ship or equipment type and welding processes used.

**2** Particular atTENSION is to be paid to highly stressed areas.

**3** The locations to be tested by *ANDT* are to be ones deemed appropriate by the Society according to material of the welded joints to which *ANDT* is applied.

## 9.8 *ANDT* Requirements

### 9.8.1 General

**1** Suppliers are to ensure that personnel performing A*NDT* or interpreting A*NDT* results are qualified to the appropriate level specified in **9.4**.

**2** All *ANDT* is to be performed in accordance with *ANDT* specifications.

**3** *ANDT* specifications are to be in accordance with the requirements provided below and those specified in **9.8.2**, **9.8.3** or **9.8.4**.

(1) *ANDT* specifications are to identify the members to be subjected to inspections, the *ANDT* method, the equipment to be used and the full extent of the examinations including any test restrictions.

(2) *ANDT* specifications are to specify requirements for the clear identification of those locations to be tested as well as for a data system or marking system to be applied to ensure repeatability of testing.

(3) *ANDT* specifications are to include the method and requirements for equipment calibration and functional checks, together with specific technique sheets or scan plans, for the component under tests.

(4) *ANDT* specifications are to be approved by personnel qualified to Level III in the appropriate technique in accordance with **9.4**.

(5) *ANDT* specifications are to be approved by the Society.

### 9.8.2 Phased Array Ultrasonic Testing (*PAUT*)

**1** *PAUT* is to be performed according to procedures based on *ISO* 13588 and *ISO* 19285 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

**2** *PAUT* for base metals of metallic materials and non-metallic materials is to be as deemed

appropriate by the Society.

**3** The equipment used for *PAUT* is to conform to *ISO* 18563-1, *ISO* 18563-2, *ISO* 18563-3 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

**4** Depending on the complexity of the location to be tested and the access to surfaces, there may be a requirement for additional scans or a supplementary *NDT* to ensure that full coverage of locations to be tested is achieved.

**5** Where a special scan plan is applied, it is to be included in *PAUT* specifications for welds together with other representative scans.

**6** *PAUT* specifications are, at a minimum, to include the following information shown in **Table M9.4**. When an essential variable given in **Table M9.4** is to be changed from its specified value or range of values, the verification of the validity for the *PAUT* specifications specified in **9.5.3** is to be performed according to the details of the change and then be approved by the Society.

**7** When a nonessential variable given in **Table M9.4** is to be changed from its specified value or range of values, the verification of validity of the *PAUT* specifications specified in **9.5.3** may be omitted. In such cases, the *PAUT* specifications are to be rewritten and then approved by the Society.

**8** All changes of essential or nonessential variables are to be written in the most recent approved *PAUT* specifications specified in the preceding **6** and **7**.

**9** The testing levels specified in the *PAUT* specifications are to be in accordance with *ISO* 13588 or equivalent recognized standards accepted by the Society. The aforementioned standards, in principle, refer to the most recent version published.

**10** The purpose of the testing is to be specified in the *PAUT* specifications. Based on this, the volume coverage is to be determined.

**11** Scan plans (including volume coverage, base metal thickness and weld geometry) are to be submitted to the Society. Where *PAUT* is applied as the *NDT* specified in **Chapter 8**, such plans may be included in the non-destructive inspection plan.

**12** Where indication evaluations are only based on amplitude, *E* scans (or linear scans) are to be utilized to scan the fusion faces of welds so that the sound beam is perpendicular to the fusion face ±5º. This, however, does not apply to cases where the Society finds the existence and size of discontinuities at fusion faces are able to be appropriately detected by *S* (sectorial) scans using the *PAUT* specifications. Where the *POD* of an *S* scan is verified, reference blocks containing suitable reflectors in fusion zone locations are to be used.

**13** The reference blocks used are to be appropriate for the testing level. The design and manufacture of reference blocks are to be in accordance with *ISO* 13588 or recognized equivalent standards deemed by the Society. The aforementioned standards, in principle, refer to the most recent version published.

**14** Indications detected are to be evaluated either by length and height or by length and maximum amplitude. Indication assessment is to be in accordance with *ISO* 19285 or recognized equivalent standards deemed acceptable by the Society. The 6 *dB* drop method is only to be used as sizing technique for measuring indications that are larger than the beam width. The aforementioned standards, in principle, refer to the most recent version published.

## Table M9.4 *PAUT* Specification Requirements

| | Item | Essential Variables |
|---|---|---|
| 1 | Material type or weld configuration to be inspected, including thickness dimensions and material product form (castings, forgings, pipes, plates, etc.) | X |
| 2 | Scanning surfaces of locations to be tested (one surface, one side; one surface, both sides) | X |
| 3 | Technique(s) (straight beam, angle beam, contact, or immersion) | X |
| 4 | Scan plan (probe position according to base metal thickness, and groove shape and dimensions) | X |
| 5 | Angle(s) and mode(s) of wave propagation in the material (compressional wave or shear wave) | X |
| 6 | Search unit and wedge type, frequency, element size and number, element pitch and gap dimensions, and element shape | X |
| 7 | Focal range (identify plane, depth, or sound path) | X |
| 8 | Virtual aperture size (number of elements, effective height(1) and element width) | X |
| 9 | Focal laws for *E*-scans and *S*-scans (range of element numbers used, angular range used, element or angle increment change) | X |
| 10 | Special search units, wedges, shoes, or saddles (when used) | X |
| 11 | *PAUT* instrument(s) | X |
| 12 | Calibration (calibration block(s) and technique(s)) | X |
| 13 | Directions and extent of scanning | X |
| 14 | Scanning method (manual, semi-automatic or automatic scanning) | X |
| 15 | Methods for sizing indications and for distinguishing geometric indications from flaw indications | X |
| 16 | Methods for checking the effects of grating lobes and for treatment after checking said effects | X |
| 17 | Computer enhanced data acquisition (when used) | X |
| 18 | Scan overlap | X(2) |
| 19 | Supervisor and operator performance requirements (skill and qualifications) | X |
| 20 | Testing levels, acceptance levels and/ or recording levels | X |
| 21 | Supervisor and operator qualification level requirements | — |
| 22 | Surface condition (surface of location to be tested, reference block for calibration) | — |
| 23 | Couplant (brand name or type) | — |
| 24 | Post-inspection cleaning technique | — |
| 25 | Automatic alarm or recording equipment (when used) | — |
| 26 | Records, including minimum calibration data to be recorded (instrument settings) | — |
| 27 | Environmental and safety issues | — |
| 28 | Scan increment for recording *PAUT* data | — |
| 29 | Method for associating the locations to be tested, tests result and *PAUT* data | — |

Notes:

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

(2) To be treated as an essential variable only in cases where the range of scan overlap decreases.

### 9.8.3 Time of Flight Diffraction (*TOFD*)

**1** *TOFD* is to be performed according to procedures based on *ISO* 10863 and *ISO* 15626 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

**2** Depending on the complexity of the location to be tested and the access to surfaces, there may be a requirement for additional scans or a supplementary *NDT* to ensure that full coverage of the locations to be tested is achieved.

**3** *TOFD* specifications are, at a minimum, to include the following information shown in **Table M9.5**. When an essential variable given in **Table M9.5** is to be changed from its specified value or range of values, the verification of validity for the *TOFD* specifications specified in **9.5.3** is to be performed according to the details of the change and then is to be approved by the Society.

**4** When a nonessential variable given in **Table M9.5** is to be changed from its specified value or range of values, the verification of validity for the *TOFD* specifications specified in **9.5.3** may be omitted. In such cases, the *TOFD* specifications are to be rewritten and then approved by the Society.

**5** All changes of essential or nonessential variables are to be written in the most recent approved *TOFD* specifications specified in the preceding **3** and **4**.

**6** The testing levels specified in *TOFD* specifications are to be in accordance with *ISO* 10863 or recognized standards accepted by the Society. The aforementioned standards, in principle, refer to the most recent version published.

**7** The purpose of the testing is to be specified in the *TOFD* specifications. Based on this, the volume coverage is to be determined.

**8** Scan plans (including probe position, volume coverage, base metal thickness and weld geometry) are to be submitted to the Society. Where *TOFD* is applied to the *NDT* specified in **Chapter 8**, such plans may be included in the non-destructive inspection plan.

**9** Where *TOFD* is not appropriately performed in dead zones, additional scans or supplementary *NDT* is to be performed to ensure that full coverage of the locations to be tested is achieved (Generally, either surfaces, back walls, or both may be dead zones).

Table M9.5 *TOFD* Specifications Requirements

| | Item | Essential Variables |
|---|---|---|
| 1 | Material type or weld configuration to be inspected, including thickness dimensions and material product form (castings, forgings, pipes, plates, etc.) | *X* |
| 2 | Scanning surfaces of locations to be tested (one surface, one side; one surface, both sides) | *X* |
| 3 | Angle(s) of wave propagation in the material (compressional wave or shear wave) | *X* |
| 4 | Search unit and wedge type, frequency, element size and shape | *X* |
| 5 | Special search units, wedges, shoes, or saddles (when used) | *X* |
| 6 | *TOFD* instrument(s) and software(s) | *X* |
| 7 | Calibration (calibration block(s) and technique(s)) | *X* |
| 8 | Directions and extent of scanning | *X* |
| 9 | Scanning method (manual, semi-automatic or automatic scanning) | *X* |
| 10 | Scan increment for recording *TOFD* data | *X*(1) |
| 11 | Methods for sizing indications and distinguishing geometric indications from flaw indications | *X* |
| 12 | Computer enhanced data acquisition (when used) | *X* |
| 13 | Scan overlap | *X*(2) |
| 14 | Supervisor and operator performance requirements (skill and qualifications) | *X* |
| 15 | Testing levels, acceptance levels or recording levels | *X* |
| 16 | Supervisor and operator qualification level requirements | — |
| 17 | Surface condition (surface of location to be tested, reference block for calibration) | — |
| 18 | Couplant (brand name or type) | — |
| 19 | Post-inspection cleaning technique | — |
| 20 | Automatic alarm and/or recording equipment (when used) | — |
| 21 | Records, including minimum calibration data to be recorded (instrument settings) | — |
| 22 | Environmental and safety issues | — |

Notes:

(1) To be treated as an essential variable only in cases where the range of scan increment for recording *TOFD* data increases.

(2) To be treated as an essential variable only in cases where the range of scan overlap decreases.

### 9.8.4 Digital Radiography (*RT-D*)

**1** *RT-D* is to be performed according to procedures based on *ISO* 17636-2 and *JIS Z* 3110 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

In cases where other standards, however, are to be applied (e.g. those related to *IQI* placement), the Society approval is required in advance.

**2** When an *RT-D* technique other than *RT-S* and *RT-CR* is applied, it is to be in accordance with the requirements of this chapter. In such cases, the RT-D specifications are to be demonstrated as equivalent to the requirements of this chapter and approved by the Society.

**3** *RT-D* specifications are, at a minimum, to include the following information shown in **Table M9.6**. When the content of approved *RT-D* specifications are changed, the verification of validity for the *RT-D* specifications specified in **9.5.3** is to be performed according to the details of the change, and then is to be approved by the Society.

**4** All content changes are to be written in the most recent approved *RT-D* specifications specified in the preceding **3**.

**5** For all *RT-D* techniques, detector (*IP* or digital detector array (*DDA*)) output quality control methods are to be specified in the *RT-D* specifications in addition to the other required information.

**6** *RT-D* specifications are to specify the level of magnification, post-processing tools, image/data security and storage for final evaluation and reporting.

**7** The testing levels specified in *RT-D* specifications are to be in accordance with *ISO* 13588

and *ISO* 19285 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

Table M9.6 *RT-D* Specification Requirements

| | Item |
|---|---|
| 1 | Material type or weld configuration to be inspected, including thickness dimensions and material product form (castings, forgings, pipes, plates, etc.) |
| 2 | Digitizing System Description:<br>(1) Manufacturer and model no. of digitizing system<br>(2) Physical size of the usable area of the image monitor<br>(3) Film size capacity of the scanning device<br>(4) Spot size(s) of the film scanning system (when applying *RT-CR*)<br>(5) Image display pixel size as defined by the vertical/horizontal resolution limit of the monitor<br>(6) Illuminance of the video display<br>(7) Data storage medium |
| 3 | Digitizing Technique:<br>(1) Digitizer spot size (in microns) to be used (when applying *RT-S*)<br>(2) Loss-less data compression technique, if used<br>(3) Method of image capture verification<br>(4) Image processing operations<br>(5) Time period for system verification |
| 4 | Spatial resolution used:<br>(1) Contrast sensitivity (density range obtained)<br>(2) Dynamic range used<br>(3) Spatial linearity of the system<br>(4) Material type and thickness range<br>(5) Source type or maximum *X*-ray voltage used<br>(6) Detector type<br>(7) Detector calibration (when applying *DDA*)<br>(8) Minimum source-to-object distance<br>(9) Distance between the test object and the detector<br>(10) Source size<br>(11) Test object scan plan (when applied)<br>(12) Image Quality Measurement Tools<br>(13) Image Quality Indicator (*IQI*)<br>(14) Wire Image Quality Indicator<br>(15) Duplex Image Quality Indicator<br>(16) Image Identification Indicator<br>(17) Testing levels, acceptance levels and/or recording levels<br>(18) Personnel qualification requirements<br>(19) Surface condition<br>(20) Records, including minimum calibration data to be recorded<br>(21) Environmental and Safety issues |

## 9.9 Acceptance Level

### 9.9.1 General

**1** This section specifies the acceptance criteria for the assessment of *PAUT*, *TOFD* and *RT-D* results.

**2** It may be necessary to combine testing methods to facilitate accurate assessments. In such cases, the acceptance criteria for each test method used are to be applied.

### 9.9.2 Phased Array Ultrasonic Testing (*PAUT*)

**1** Quality levels, testing level and acceptance level are to be in accordance with **Table M9.7**.

**2** Quality levels and acceptance levels for welded joints are to be in accordance with *ISO* 19285 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

**3** Acceptance level for the base metals of metallic materials and non-metallic materials are to be in accordance with the Rules or as deemed appropriate by the Society.

Table M9.7 *PAUT* acceptance level

| Quality level<br>*ISO* 5817 | Testing level<br>*ISO* 13588 | Acceptance level<br>*ISO* 19285 |
|---|---|---|
| *C, D* | *A* | 3 |
| *B* | *B* | 2 |
| By agreement | *C* | 1 |
| Special application | *D* | By agreement |

### 9.9.3 Time of Flight Diffraction (*TOFD*)

**1** Quality levels, testing level and acceptance level are to be in accordance with **Table M9.8**.

**2** Quality levels and acceptance levels for welded joints are to be in accordance with *ISO* 15626 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

Table M9.8 *TOFD* acceptance level

| Quality level<br>*ISO* 5817 | Testing level<br>*ISO* 10863 | Acceptance level<br>*ISO* 15626 |
|---|---|---|
| *B* | *C* | 1 |
| *C* | At least *B* | 2 |
| *D* | At least *A* | 3 |

### 9.9.4 Digital Radiography (*RT-D*)

**1** Quality levels, testing level and acceptance level are to be in accordance with **Table M9.9**.

**2** Quality levels and acceptance levels for welded joints are to be in accordance with *ISO* 10675-1, *ISO* 10675-2 or recognized equivalent standards deemed acceptable by the Society. The aforementioned standards, in principle, refer to the most recent version published.

Table M9.9 *RT-D* acceptance level

| Quality level<br>*ISO* 5817 or *ISO* 10042 | Testing level<br>*ISO* 17636-2 | Acceptance level<br>*ISO* 10675-1 or *ISO* 10675-2 |
|---|---|---|
| *B* | *B* | 1 |
| *C* | *B*(1) | 2 |
| *D* | *A* | 3 |

Note:

(1) For circumferential weld testing, the minimum number of exposures may correspond to the requirements of *ISO* 17636-2 class *A*.

## 9.10 Test Records

### 9.10.1 General

In addition to the reference standards for the test, test records are to include at least the information specified in this section.

### 9.10.2 Test Object Information

Test records are to include the following test object information

(1) Test object identification
(2) Dimensions (including wall thickness)
(3) Material type and product form
(4) Geometrical configuration,
(5) Locations tested
(6) Welding process and heat treatment method
(7) Surface condition and temperature
(8) Manufacturing stage
(9) NK Rules referenced

### 9.10.3 Equipment Information

Test records are to include the equipment information specified in **Table M9.10**.

Table M9.10 Equipment information

| Method | Information |
|---|---|
| All | Manufacturer and type of instrument, including identification numbers |
| *PAUT* | (1) Manufacturer, type, frequency of phased array probes including number and size of elements, material and angle(s) of wedges with identification numbers<br>(2) Details of reference block(s) with identification numbers<br>(3) Type of couplant used |
| *TOFD* | (1) Manufacturer, type, frequency, element size and beam angle(s) of probes with identification numbers<br>(2) Details of reference block(s) with identification numbers<br>(3) Type of couplant used |
| *RT-D* | (1) System of marking used<br>(2) Radiation source, type and size of focal spot and identification of equipment used<br>(3) Detector, screens and filters and detector basic spatial resolution |

### 9.10.4 Test Method Information

Test records are to include the test method information specified in **Table M9.11**.

Table M9.11 Test method information

| Method | Information |
|---|---|
| All | (1) Testing level and reference to written *ANDT* specifications<br>(2) Test length<br>(3) Reference points and coordinate system details<br>(4) Method and values used for range and sensitivity settings<br>(5) Signal processing details and scan increment settings<br>(6) Access limitations and deviations from standards (if any) |
| *PAUT* | (1) Increment (*E*-scans) or angular increment (*S*-scans)<br>(2) Element pitch and gap dimensions<br>(3) Focus (calibration should be the same as scanning)<br>(4) Virtual aperture size (number of elements and element width)<br>(5) Element numbers used for focal laws<br>(6) Documentation on permitted wedge angular range from manufacturer<br>(7) Calibration documentation, *TCG* and *ACG* (angle gain compensation)<br>(8) Scan plan |
| *TOFD* | (1) *TOFD* setup details<br>(2) Offset scan details ( if required) |
| *RT-D* | (1) Detector position plan<br>(2) Tube voltage used and current, or source type and activity<br>(3) Time of exposure and source-to-detector distance<br>(4) Type and position of image quality indicators<br>(5) Achieved and required $SNR_N$ for *RT-S*<br>(6) Achieved and required grey values or $SNR_N$ for *RT-CR*<br>(7) For *RT-S*, type and parameters such as gain, frame time, frame number, pixel (size, calibration procedure)<br>(8) For *RT-CR*, scanner type and parameters such as pixel size, scan speed, (gain, laser intensity, laser spot size)<br>(9) Image-processing parameters used (e.g. digital filters) |

### 9.10.5 Test Result Information

Test records are to include the test result information specified in **Table M9.12**.

Table M9.12 Test result information

| Method | Information |
|---|---|
| All | (1) Acceptance criteria applied<br>(2) Tabulated survey records (including location and size of relevant indications and assessment results)<br>(3) Test results (including data on software used)<br>(4) Test date<br>(5) References to the raw data used<br>(6) Date(s) of scan or exposure and test report<br>(7) Operator names, signatures and certification levels |
| *PAUT* | (1) Phased array images of at least those locations where relevant indications have been detected on hard copy, all images or data available in soft format<br>(2) Reference points and coordinate system details |
| *TOFD* | *TOFD* images of at least those locations where relevant *TOFD* indications have been detected |

### 9.10.6 Other

**1** *ANDT* results are to be recorded and evaluated by the supplier on a continual basis. Where deemed necessary by the surveyor, these records are to be submitted to the surveyor.

**2** The supplier is responsible for the review, interpretation, evaluation and acceptance of the *ANDT* results. Test records are to include information related to test results in accordance with the acceptance criteria specified in the *ANDT* specifications.

**3** Where a special *ANDT* is applied, the particular requirements and details are to be included in the test records in accordance with the recognized standards for each *ANDT*.

**4** The supplier is to keep the inspection records specified in **9.10** for a period of time deemed appropriate by the Society.

## 9.11 Unacceptable Indications and Repairs

### 9.11.1 General

All indications (discontinuities) exceeding the applied acceptance criteria are to be classed as defects, and are to be eliminated and repaired according to surveyor instructions. *NDT* for repaired parts is to be performed in accordance with the Rules or surveyor instructions.

EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

**1.** The effective date of the amendments is 1 July 2021.

**2.** Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

**1.** The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

**2.** The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

**3.** If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

**4.** If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.

# GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

## Part M Welding

**2020 AMENDMENT NO.2**

Notice No.61 24 December 2020
Resolved by Technical Committee on 5 August 2020

Notice No.61 24 December 2020
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

# Part M WELDING

Amendment 2-1

## M1 GENERAL

Section M1.1 has been added as follows.

### M1.1 General

#### M1.1.1 Application

With respect to the provisions of **1.1.1-3, Part M of the Rules**, in the case of partial weldings such as repairing, a welding method according to the standards different from **Part M of the Rules** (e.g. underwater welding according to *AWS D*3.6) may be applied when deemed to be appropriate by the Society after considering the degree and scope of application. In such cases, the welding procedure and related specifications related to the intended welding are to be submitted to the Society for confirmation in advance.

EFFECTIVE DATE AND APPLICATION (Amendment 2-1)

**1.** The effective date of the amendments is 24 December 2020.

Amendment 2-2

# M2 WELDING WORKS

## M2.2 Work Scheme

Paragraph M2.2.1 has been amended as follows.

### M2.2.1 Welding Application Plan

**1** In **2.2.1(2)**, **Part M of the Rules**, for steels considered to have the brittle crack arrest properties specified in **3.12**, **Part K of the Rules**, the welding procedures and related specifications approved for the steels excluding "*BCA*6000" or "*BCA*8000" given in **Table K3.40** or **Table K3.41, Part K of the Rules,** may be applied except for the large heat input welding specified in **Note (5) of Table M4.2, Part M of the Rules**.

**2** With regard to corrosion resistant steel for cargo oil tanks, the wording "other items considered necessary by the Society" stipulated in **2.2.1(3), Part M of the Rules** means brands of welding consumables and brands of corrosion resistant steel listed in "Particulars of Approval Conditions" of corrosion resistant steel.

Paragraph M2.2.2 has been amended as follows.

### M2.2.2 Welding Procedure and Related Specification

**1** For **2.2.2-2(2)**, **Part M of the Rules**, suffixes added to the grades specified in **Table K3.40** or **Table K3.41, Part K of the Rules** (e.g. "-*BCA*6000") need not be included except for the large heat input welding specified in **Note (5) of Table M4.2, Part M of the Rules**.

**2** For **2.2.2-2(2), Part M of the Rules**, suffixes added to the grades specified in **Table K3.4~~0~~2, Part K of the Rules** (e.g. "-*RCU*") need not be included.

Table M2.4.3-1 has been amended as follows.

Table M2.4.3-1 Control Standards for the Processing and Welding of Rolled Steels for Hulls and Rolled Steels for Low Temperature Service

| Items for control standard | | Mild steel | | High tensile steels(1)(14) | | | | | | | | Rolled steels for low temperature service(13) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Conventional type(2) | | | *TMCP* type | | | | | | | |
| | | Grade | Control standard | Grade | Control standard | | Grade | Carbon equivalent for steel $C_{eq}$(3)(4)(5) | Control standard | | | Carbon equivalent for steel $C_{eq}$(3)(4)(5) | Control standard | |
| Length of short bead (6) | Tack and repair weld of scar | *KE* | 30 *mm* or over | *KA*32<br>*KD*32<br>*KE*32 | 50 *mm* or over(12) | | *KA*32<br>*KD*32<br>*KE*32 | 0.36% or below(7) | 10 *mm* or over(8) | | | More than 0.36% | 50 *mm* or over | |
| | | | | | | | | | | | | 0.36% or below | 10 *mm* or over | |
| | Repairing of welded bead | | | *KA*36<br>*KD*36<br>*KE*36 | | | *KA*36<br>*KD*36<br>*KE*36 | | 30 *mm* or over | | | More than 0.36% | 50 *mm* or over | |
| | | | | | | | | | | | | 0.36% or below | 30 *mm* or over | |
| Preheating in working | Temperature need preheating (9) | *KA*<br>*KB*<br>*KD*<br>*KE* | -5°C or below | *KA*32<br>*KD*32<br>*KE*32<br>*KA*36 | 5°C or below(10)(12) | | *KA*32<br>*KD*32<br>*KE*32<br>*KA*36 | 0.36% or below(7) | 0°C or below (10) | | | More than 0.36% | 5°C or below | |
| | | | | | | | | | | | | 0.36% or below | 0°C or below | |
| | Preheating temperature | | 20°C or over | *KD*36<br>*KE*36 | 50°C or over | | *KD*36<br>*KE*36 | | 20°C or over | | | More than 0.36% | 50°C or over | |
| | | | | | | | | | | | | 0.36% or below | 20°C or over | |
| Line heating (Thermal fairing) | Maximum heating temperature of steel Surface | *KA*<br>*KB*<br>*KD*<br>*KE* | (11) | *KA*32<br>*KD*32<br>*KE*32<br>*KA*36 | Water cooling just after heating | 650°C or below | *KA*32<br>*KD*32<br>*KA*36<br>*KD*36 | 0.38% or below | Water cooling just after heating | 1000°C or below | | — | Air cooling after heating | 900°C or below |
| | | | | *KD*36<br>*KE*36 | Air cooling after heating | 900°C or below | | | Air cooling after heating | | | | | |
| | | | | | Air cooling and subsequent water cooling after heating | 900°C or below (Starting temperature of water cooling is to be 500°C or below) | *KE*32<br>*KE*36 | 0.38% or below | Water cooling just after heating | 900°C or below | | More than 0.36% | Air cooling and subsequent water cooling after heating | 900°C or below (Starting temperature of water cooling is to be 500°C or below) |
| | | | | | | | | | Air cooling after heating | | | 0.36% or below | | 900°C or below (Starting temperature of water cooling is to be 550°C or below) |

Notes:

((1) to (13) are omitted.)

(14) For steels considered to have brittle crack arrest properties specified in **3.12, Part K of the Rules,** the control standards for the steels excluding "*BCA*6000" or "*BCA*8000" given in **Table K3.40** or **Table K3.41, Part K of the Rules**, are to be applied.

## EFFECTIVE DATE AND APPLICATION (Amendment 2-2)

**1.** The effective date of the amendments is 1 January 2021.

**2.** Notwithstanding the amendments to the Guidance, the current requirements apply to steels being used on ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

### IACS PR No.29 (Rev.0, July 2009)

**1.** The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

**2.** The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

**3.** If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

**4.** If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.

Amendment 2-3

M9 has been added as follows.

## M9 Advanced Non-Destructive Testing

### M9.5 *ANDT* Specification Verification

#### M9.5.3 *ANDT* Specification Verification Tests

"Qualifications block are to be manufactured in accordance with a recognized standard deemed appropriate by the Society" specified in **9.5.3-2, Part M of the Rules**, means the "Intermediate Level" qualification blocks specified in *ASME V Article 14 MANDATORY APPENDIX II UT PERFORMANCE DEMONSTRATION CRITERIA* or qualification blocks deemed equivalent by the Society. Where sizing error distributions and an accurate *POD* are evaluated, the "High Level" qualification blocks specified in *ASME V Article 14 MANDATORY APPENDIX II UT PERFORMANCE DEMONSTRATION CRITERIA* or qualification blocks deemed equivalent by the Society are to be used.

EFFECTIVE DATE AND APPLICATION (Amendment 2-3)

**1.** The effective date of the amendments is 1 July 2021.

**2.** Notwithstanding the amendments to the Guidance, the current requirements apply to ships for which the date of contract for construction* is before the effective date.

* "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.

IACS PR No.29 (Rev.0, July 2009)

**1.** The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

**2.** The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.
For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:
(1) such alterations do not affect matters related to classification, or
(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.
The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

**3.** If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

**4.** If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Note:
This Procedural Requirement applies from 1 July 2009.