

Rules for carrying out Non-Destructive Examinations of Welding

Effective from 1 January 2022

GENERAL CONDITIONS

Definitions:

"Administration" means the Government of the State whose flag the Ship is entitled to fly or under whose authority the Ship is authorised to operate in the specific case.

"IACS" means the International Association of Classification Societies.

"Interested Party" means the party, other than the Society, having an interest in or responsibility for the Ship, product, plant or system subject to classification or certification (such as the owner of the Ship and his representatives, the ship builder, the engine builder or the supplier of parts to be tested) who requests the Services or on whose behalf the Services are requested.

"Owner" means the registered owner, the ship owner, the manager or any other party with the responsibility, legally or contractually, to keep the ship seaworthy or in service, having particular regard to the provisions relating to the maintenance of class laid down in Part A, Chapter 2 of the Rules for the Classification of Ships or in the corresponding rules indicated in the specific Rules.

"Rules" in these General Conditions means the documents below issued by the Society:

- (i) Rules for the Classification of Ships or other special units;
- (ii) Complementary Rules containing the requirements for product, plant, system and other certification or containing the requirements for the assignment of additional class notations;
- (iii) Rules for the application of statutory rules, containing the rules to perform the duties delegated by Administrations;
- (iv) Guides to carry out particular activities connected with Services;
- (v) Any other technical document, as for example rule variations or interpretations.

"Services" means the activities described in Article 1 below, rendered by the Society upon request made by or on behalf of the Interested Party.

"Ship" means ships, boats, craft and other special units, as for example offshore structures, floating units and underwater craft.

"Society" or "TASNEEF" means Tasneef and/or all the companies in the Tasneef Group which provide the Services.

"Surveyor" means technical staff acting on behalf of the Society in performing the Services.

Article 1

1.1. The purpose of the Society is, among others, the classification and certification of ships and the certification of their parts and components. In particular, the Society:

- (i) sets forth and develops Rules;
- (ii) publishes the Register of Ships;
- (iii) issues certificates, statements and reports based on its survey activities.

1.2. The Society also takes part in the implementation of national and international rules and standards as delegated by various Governments.

1.3. The Society carries out technical assistance activities on request and provides special services outside the scope of classification, which are regulated by these general conditions, unless expressly excluded in the particular contract.

Article 2

2.1. The Rules developed by the Society reflect the level of its technical knowledge at the time they are published. Therefore, the Society, although committed also through its research and development services to continuous updating of the Rules, does not guarantee the Rules meet state-of-the-art science and technology at the time of publication or that they meet the Society's or others' subsequent technical developments.

2.2. The Interested Party is required to know the Rules on the basis of which the Services are provided. With particular reference to Classification Services, special attention is to be given to the Rules concerning class suspension, withdrawal and reinstatement. In case of doubt or inaccuracy, the Interested Party is to promptly contact the Society for clarification.

The Rules for Classification of Ships are published on the Society's website: www.tasneef.ae.

2.3. The Society exercises due care and skill:

- (i) in the selection of its Surveyors
- (ii) in the performance of its Services, taking into account the level of its technical knowledge at the time the Services are performed.

2.4. Surveys conducted by the Society include, but are not limited to, visual inspection and non-destructive testing. Unless otherwise required, surveys are conducted through sampling techniques and do not consist of comprehensive verification or monitoring of the Ship or of the items subject to certification. The surveys and checks made by the Society on board ship do not necessarily require the constant and continuous presence of the Surveyor. The Society may also commission laboratory testing, underwater inspection and other checks carried out by and under the responsibility of qualified service suppliers. Survey practices and procedures are selected by the Society based on its experience and knowledge and according to generally accepted technical standards in the sector.

Article 3

3.1. The class assigned to a Ship, like the reports, statements, certificates or any other document or information issued by the Society, reflects the opinion of the Society concerning compliance, at the time the Service is provided, of the Ship or product subject to certification, with the applicable Rules (given the intended use and within the relevant time frame).

The Society is under no obligation to make statements or provide information about elements or facts which are not part of the specific scope of the Service requested by the Interested Party or on its behalf.

3.2. No report, statement, notation on a plan, review, Certificate of Classification, document or information issued or given as part of the Services provided by the Society shall have any legal effect or implication other than a representation that, on the basis of the checks made by the Society, the Ship, structure, materials, equipment, machinery or any other item covered by such document or information meet the Rules. Any such document is issued solely for the use of the Society, its committees and clients or other duly authorised bodies and for no other purpose. Therefore, the Society cannot be held liable for any act made or document issued by other parties on the basis of the statements or information given by the Society. The validity, application, meaning and interpretation of a Certificate of Classification, or any other document or information issued by the Society in connection with its Services, is governed by the Rules of the Society, which is the sole subject entitled to make such interpretation. Any disagreement on technical matters between the Interested Party and the Surveyor in the carrying out of his functions shall be raised in writing as soon as possible with the Society, which will settle any divergence of opinion or dispute.

3.3. The classification of a Ship, or the issuance of a certificate or other document connected with classification or certification and in general with the performance of Services by the Society shall have the validity conferred upon it by the Rules of the Society at the time of the assignment of class or issuance of the certificate; in no case shall it amount to a statement or warranty of seaworthiness,

structural integrity, quality or fitness for a particular purpose or service of any Ship, structure, material, equipment or machinery inspected or tested by the Society.

3.4. Any document issued by the Society in relation to its activities reflects the condition of the Ship or the subject of certification or other activity at the time of the check.

3.5. The Rules, surveys and activities performed by the Society, reports, certificates and other documents issued by the Society are in no way intended to replace the duties and responsibilities of other parties such as Governments, designers, ship builders, manufacturers, repairers, suppliers, contractors or sub-contractors, Owners, operators, charterers, underwriters, sellers or intended buyers of a Ship or other product or system surveyed.

These documents and activities do not relieve such parties from any fulfilment, warranty, responsibility, duty or obligation (also of a contractual nature) expressed or implied or in any case incumbent on them, nor do they confer on such parties any right, claim or cause of action against the Society. With particular regard to the duties of the ship Owner, the Services undertaken by the Society do not relieve the Owner of his duty to ensure proper maintenance of the Ship and ensure seaworthiness at all times. Likewise, the Rules, surveys performed, reports, certificates and other documents issued by the Society are intended neither to guarantee the buyers of the Ship, its components or any other surveyed or certified item, nor to relieve the seller of the duties arising out of the law or the contract, regarding the quality, commercial value or characteristics of the item which is the subject of transaction.

In no case, therefore, shall the Society assume the obligations incumbent upon the above-mentioned parties, even when it is consulted in connection with matters not covered by its Rules or other documents.

In consideration of the above, the Interested Party undertakes to relieve and hold harmless the Society from any third party claim, as well as from any liability in relation to the latter concerning the Services rendered.

Insofar as they are not expressly provided for in these General Conditions, the duties and responsibilities of the Owner and Interested Parties with respect to the services rendered by the Society are described in the Rules applicable to the specific Service rendered.

Article 4

4.1. Any request for the Society's Services shall be submitted in writing and signed by or on behalf of the Interested Party. Such a request will be considered irrevocable as soon as received by the Society and shall entail acceptance by the applicant of all relevant requirements of the Rules, including these General Conditions. Upon acceptance of the written request by the Society, a contract between the Society and the Interested Party is entered into, which is regulated by the present General Conditions.

4.2. In consideration of the Services rendered by the Society, the Interested Party and the person requesting the service shall be jointly liable for the payment of the relevant fees, even if the service is not concluded for any cause not pertaining to the Society. In the latter case, the Society shall not be held liable for non-fulfilment or partial fulfilment of the Services requested. In the event of late payment, interest at the legal current rate increased by 1.5% may be demanded.

4.3. The contract for the classification of a Ship or for other Services may be terminated and any certificates revoked at the request of one of the parties, subject to at least 30 days' notice to be given in writing. Failure to pay, even in part, the fees due for Services carried out by the Society will entitle the Society to immediately terminate the contract and suspend the Services.

For every termination of the contract, the fees for the activities performed until the time of the termination shall be owed to the Society as well as the expenses incurred in view of activities already programmed; this is without prejudice to the right to compensation due to the Society as a consequence of the termination.

With particular reference to Ship classification and certification, unless decided otherwise by the Society, termination of the contract implies that the assignment of class to a Ship is withheld or, if already assigned, that it is suspended or withdrawn; any statutory certificates issued by the Society will be withdrawn in those cases where provided for by agreements between the Society and the flag State.

Article 5

5.1. In providing the Services, as well as other correlated information or advice, the Society, its Surveyors, servants or agents operate with due diligence for the proper execution of the activity. However, considering the nature of the activities performed (see art. 2.4), it is not possible to guarantee absolute accuracy, correctness and completeness of any information or advice supplied. Express and implied warranties are specifically disclaimed.

Therefore, except as provided for in paragraph 5.2 below, and also in the case of activities carried out by delegation of Governments, neither the Society nor any of its Surveyors will be liable for any loss, damage or expense of whatever nature sustained by any person, in tort or in contract, derived from carrying out the Services.

5.2. Notwithstanding the provisions in paragraph 5.1 above, should any user of the Society's Services prove that he has suffered a loss or damage due to any negligent act or omission of the Society, its Surveyors, servants or agents, then the Society will pay compensation to such person for his proved loss, up to, but not exceeding, five times the amount of the fees charged for the specific services, information or opinions from which the loss or damage derives or, if no fee has been charged, a maximum of AED5,000 (Arab Emirates Dirhams Five Thousand only). Where the fees charged are related to a number of Services, the amount of the fees will be apportioned for the purpose of the calculation of the maximum compensation, by reference to the estimated time involved in the performance of the Service from which the damage or loss derives. Any liability for indirect or consequential loss, damage or expense is specifically excluded. In any case, irrespective of the amount of the fees charged, the maximum damages payable by the Society will not be more than AED5,000,000 (Arab Emirates Dirhams Five Millions only). Payment of compensation under this paragraph will not entail any admission of responsibility and/or liability by the Society and will be made without prejudice to the disclaimer clause contained in paragraph 5.1 above.

5.3. Any claim for loss or damage of whatever nature by virtue of the provisions set forth herein shall be made to the Society in writing, within the shorter of the following periods: (i) THREE (3) MONTHS from the date on which the Services were performed, or (ii) THREE (3) MONTHS from the date on which the damage was discovered. Failure to comply with the above deadline will constitute an absolute bar to the pursuit of such a claim against the Society.

Article 6

6.1. These General Conditions shall be governed by and construed in accordance with United Arab Emirates (UAE) law, and any dispute arising from or in connection with the Rules or with the Services of the Society, including any issues concerning responsibility, liability or limitations of liability of the Society, shall be determined in accordance with UAE law. The courts of the Dubai International Financial Centre (DIFC) shall have exclusive jurisdiction in relation to any claim or dispute which may arise out of or in connection with the Rules or with the Services of the Society.

6.2. However,

- (i) In cases where neither the claim nor any counterclaim exceeds the sum of AED300,000 (Arab Emirates Dirhams Three Hundred Thousand) the dispute shall be referred to the jurisdiction of the DIFC Small Claims Tribunal; and
- (ii) for disputes concerning non-payment of the fees and/or expenses due to the Society for services, the Society shall have the

right to submit any claim to the jurisdiction of the Courts of the place where the registered or operating office of the Interested Party or of the applicant who requested the Service is located.

In the case of actions taken against the Society by a third party before a public Court, the Society shall also have the right to summon the Interested Party or the subject who requested the Service before that Court, in order to be relieved and held harmless according to art. 3.5 above.

Article 7

7.1. All plans, specifications, documents and information provided by, issued by, or made known to the Society, in connection with the performance of its Services, will be treated as confidential and will not be made available to any other party other than the Owner without authorisation of the Interested Party, except as provided for or required by any applicable international, European or domestic legislation, Charter or other IACS resolutions, or order from a competent authority. Information about the status and validity of class and statutory certificates, including transfers, changes, suspensions, withdrawals of class, recommendations/conditions of class, operating conditions or restrictions issued against classed ships and other related information, as may be required, may be published on the website or released by other means, without the prior consent of the Interested Party.

Information about the status and validity of other certificates and statements may also be published on the website or released by other means, without the prior consent of the Interested Party.

7.2. Notwithstanding the general duty of confidentiality owed by the Society to its clients in clause 7.1 above, the Society's clients hereby accept that the Society may participate in the IACS Early Warning System which requires each Classification Society to provide other involved Classification Societies with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and used to facilitate the proper working of the IACS Early Warning System. The Society will provide its clients with written details of such information sent to the involved Classification Societies.

7.3. In the event of transfer of class, addition of a second class or withdrawal from a double/dual class, the Interested Party undertakes to provide or to permit the Society to provide the other Classification Society with all building plans and drawings, certificates, documents and information relevant to the classed unit, including its history file, as the other Classification Society may require for the purpose of classification in compliance with the applicable legislation and relative IACS Procedure. It is the Owner's duty to ensure that, whenever required, the consent of the builder is obtained with regard to the provision of plans and drawings to the new Society, either by way of appropriate stipulation in the building contract or by other agreement.

In the event that the ownership of the ship, product or system subject to certification is transferred to a new subject, the latter shall have the right to access all pertinent drawings, specifications, documents or information issued by the Society or which has come to the knowledge of the Society while carrying out its Services, even if related to a period prior to transfer of ownership.

Article 8

8.1. Should any part of these General Conditions be declared invalid, this will not affect the validity of the remaining provisions.

RULES FOR CARRYING OUT NON-DESTRUCTIVE EXAMINATIONS OF WELDING

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CHAPTER 1 NON-DESTRUCTIVE TESTING OF SHIP HULL STEEL WELDS

1 General

1.1 Application

1.1.1 These Rules give minimum requirements on the methods and quality levels that are to be adopted for the non-destructive testing (NDT) of ship hull structure steel welds during new building ("hull structure" as defined in Pt A, Ch 3, Sec 1, [1.2.1] of the Rules for the Classification of Ships).

1.1.2 The quality levels given in these Rules refer to production quality and not to fitness-for-purpose of the welds examined.

1.1.3 The NDT is normally to be performed by the Shipbuilder or its subcontractors in accordance with these requirements. The Surveyor may require witnessing of the testing.

1.1.4 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 Society on the findings made by the NDT.

1.1.5 The extent of testing and the number of checkpoints are to be agreed between the Shipbuilder and the Society taking into consideration the requirements in Ch 2. For criticality of structure, reference is also to be made to Pt B, Ch 4, Sec 1, [2] and IACS CSR for Bulk Carriers and Oil Tankers.

1.1.6 Advanced non-destructive testing (ANDT) methods such as phased array ultrasonic testing (PAUT), time of flight diffraction (TOFD), digital radiography (RT-D), radiosopic testing (RT-S), and computed radiography (RT-CR) are covered by Chapter 3.

1.2 Terms and definitions

1.2.1 The following terms and definitions apply:

NDT : Non-Destructive Testing - the development and application of technical methods to examine materials or components in ways that do not impair their future usefulness and serviceability, in order to measure geometrical characteristics and to detect, locate, measure and evaluate flaws. NDT is also known as non-destructive examination (NDE), non-destructive inspection (NDI) and non-destructive evaluation (NDE).

RT : Radiographic Testing

UT : Ultrasonic Testing

MT : Magnetic Particle Testing

PT : Dye or Liquid Penetrant Testing

PWHT : Post Weld Heat Treatment

VT : Visual Testing

2 Application

2.1 Base Metals

2.1.1 These Rules apply to:

- fusion welds made in normal and higher strength hull structural steels in accordance with Pt D, Ch 2, Sec 1, [2] and [11] of the Rules for the Classification of Ships;
- high strength steels for welded structures in accordance with Pt D, Ch 2, Sec 1, [3] of the Rules for the Classification of Ships;
- connections welds with hull steel forgings in accordance with Pt D, Ch 2, Sec 3, [1] to [5] of the Rules for the Classification of Ships;
- hull steel castings in accordance with Pt D, Ch 2, Sec 4, [1] to [4] of the Rules for the Classification of Ships.

Base metal other than the above may be applied by the Society.

2.2 Welding processes

2.2.1 These Rules apply to fusion welds made using manual metal arc welding (shielded metal arc welding, 111), gas-shielded metal arc welding (gas metal arc welding, including flux cored arc welding, 13x), gas-shielded arc welding with non-consumable tungsten electrode (gas tungsten arc welding, 14x), submerged arc welding (12x), electro-slag welding (72x) and electro-gas welding processes (73). Terms and numbers according to ISO 4063:2009 ("x" indicates that relevant subgroups are included). These Rules may also be applied to welding processes other than the above at the discretion of the Society.

2.3 Weld joints

2.3.1 These Rules apply to butt welds with full penetration, tee, corner and cruciform joints with or without full penetration, and fillet welds.

2.4 Timing of NDT

2.4.1 NDT is to be conducted after welds have cooled to ambient temperature and after post weld heat treatment where applicable.

2.4.2 For high strength steels for welded structure with specified minimum yield stress in the range of 420 N/mm²

to 690 N/mm², NDT is not to be carried out before 48 hours after completion of welding. For steel with specified minimum yield greater than 690 N/mm² NDT is not to be carried out before 72 hours after completion of welding. Regardless of yield strength consideration is to be given to requiring a delayed inspection where evidence of delayed cracking has been observed in production welds.

At the discretion of the Surveyor, a longer interval and/or additional random inspection at a later period may be required, (for example in case of high thickness welds).

At the discretion of the Surveyor, the 72 hour interval may be reduced to 48 hours for RT or UT inspection, provided there is no indication of delayed cracking, and a complete visual and random MT or PT inspection to the satisfaction of the Surveyor is conducted 72 hours after welds have been completed and cooled to ambient temperature.

Where PWHT is carried out the requirement for testing after a delay period may be relaxed, at the discretion of the Surveyor.

2.5 Applicable methods for testing of weld joints

2.5.1 The methods mentioned in this document for detection of surface imperfections are VT, PT and MT. The methods mentioned for detection of internal imperfections are UT and RT.

2.5.2 Applicable methods for testing of the different types of weld joints are given in Tab 1.

Table 1 Applicable methods for testing of weld joints

WELD JOINT	PARENT MATERIAL THICKNESS	APPLICABLE TEST METHODS
Butt welds with full penetration	thickness < 8mm ¹	VT, PT, MT, RT
	thickness ≥ 8mm	VT, PT, MT, UT, RT
Tee joints, corner joints and cruciform joints with full penetration	thickness < 8mm ¹	VT, PT, MT, RT ³
	thickness ≥ 8mm	VT, PT, MT, UT, RT ³
Tee joints, corner joints and cruciform joints without full penetration and fillet welds	All	VT, PT, MT, UT ² , RT ³
Notes: 1) In cases of thickness below 8mm the Society may consider application of an appropriate advanced UT method. 2) UT may be used to check the extent of penetration in tee, corner and cruciform joints. This requirement is to be agreed with the Society. 3) RT may be applied however there will be limitations		

3 Qualification of personnel involved in NDT

3.1

3.1.1 The Shipbuilder or its subcontractors is responsible for the qualification and preferably 3rd party certification of its supervisors and operators to a recognised 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 Society. The Shipbuilder or its subcontractors written practice is to as a minimum, except for the impartiality requirements of a certification body and/or authorised body, comply with ISO 9712:2012.

The supervisors' and operators' certificates and competence are to comprise all industrial sectors and techniques being applied by the Shipbuilder or its subcontractors. Level 3 personnel is to be certified by an accredited certification body.

3.2

3.2.1 The Shipbuilder or its subcontractors is to 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 is to 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 item [3.1]. It is not permissible to appoint Level 3 personnel; they must be certified by an accredited certification body. It is recognised that a 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 is to be directly involved in review and acceptance of NDT Procedures, NDT reports, calibration of NDT equipment and tools. The supervisor is to on behalf of the Shipbuilder or its subcontractors re-evaluate the qualification of the operators annually.

3.3

3.3.1 The operator carrying out the NDT and interpreting indications, is to as a minimum, be qualified and certified to Level 2 in the NDT method(s) concerned and as described in item [3.1].

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 is to 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.

4 Surface condition

4.1

4.1.1 Areas to be examined are to 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 are to be in accordance with the accepted NDT procedures, and are to be to the satisfaction of the Surveyor. Surface conditions that prevent proper interpretation may be cause for rejection of the weld area of interest.

5 General plan of testing: NDT method selection

5.1

5.1.1 The extent of testing and the associated quality levels are to be planned by the Shipbuilder according to the ship design, ship type and welding processes used. For new construction survey reference is to be made to the NDT requirements of Pt A, Ch 3, Sec 1 of the Rules for the Classification of Ships and the applicable parts of Pt A, Ch 3, Sec 1, Tab 1, [1.8] to [1.11], [2.1], [2.2], [2.3], Tab 2, of the Rules for the Classification of Ships.

5.1.2 For each construction, the Shipbuilder is to submit a plan for approval by the Society, specifying the areas to be examined and the extent of testing and the quality levels, with reference to the NDT procedures to be used. Particular attention is to be paid to inspecting welds in highly stressed areas and welds in primary and special structure indicated in Pt B, Ch 4, Sec 1, [2]. The NDT procedure(s) is to meet the requirement stated in [6] and the specific requirements of the Society. The plan is to only be released to the personnel in charge of the NDT and its supervision.

In selecting checkpoints, emphasis is to be given to the following inspection locations:

- Welds in high stressed areas
- Fatigue sensitive areas
- Other important structural elements
- Welds which are inaccessible or very difficult to inspect in service
- Field erected welds
- Suspected problem areas

Block construction welds performed in the yards, or at subcontracted yards/facilities, are to be considered in selecting checkpoints.

For other marine and offshore structures the extent is to be agreed by the Society.

If an unacceptable level of indications are found the NDT extent is to be increased.

5.1.3 The identification system is to identify the exact locations of the lengths of weld examined.

5.1.4 All welds over their full length are to be subject to VT by personnel designated by the Shipbuilder, who may be exempted from the qualification requirements defined in [3].

5.1.5 As far as practicable, PT or MT are to be used when investigating the outer surface of welds, checking the intermediate weld passes and back-gouged joints prior to subsequent passes deposition. MT is to be performed in ferromagnetic materials welds unless otherwise agreed with the Society. Surface inspection of important tee or corner joints, using an approved MT or PT method, is to be conducted to the satisfaction of the Surveyor.

5.1.6 Welded connections of large cast or forged components (e.g. stern frame, stern boss, rudder parts, shaft brackets...) are to be tested over their full length using MT (MT is the preferred method) or PT, (PT is to be applied for non-ferrous metals) and at agreed locations using RT or UT.

5.1.7 As given in Tab 1, UT or RT or a combination of UT and RT may be used for testing of butt welds with full penetration of 8mm or greater. Methods to be used are to be agreed with the Society. The method used is to be suited for the detection of particular types and orientations of discontinuities. RT and UT are used for detection of internal discontinuities, and in essence they supplement and complement each other. RT is generally most effective in detecting volumetric discontinuities (e.g. porosity and slag) whilst UT is more effective for detecting planar discontinuities (e.g. laminations, lack of fusion and cracks). Although one method may not be directly relatable to the other, either one would indicate conditions of inadequate control of the welding process.

5.1.8 (1/1/2022)

In general start/stop points in welds made using automatic or fully mechanized welding processes are to be examined using RT or UT, except for internal members where the extent of testing is to be agreed with the attending Surveyor.

5.1.9 Where the Surveyor becomes aware that an NDT location has been repaired without a record of the original defect, the shipyard is to carry out additional examinations on adjacent areas to the repaired area to the satisfaction of the attending surveyor. Reference is made to Pt A, Ch 3, Sec 1 of the Rules for the Classification of Ships.

5.1.10 Welds in thick steels (>50mm) used in container carrier, deck and hatch coaming areas are to be inspected in accordance with the additional requirements in Pt D, Ch 2, Sec 1, [10].

6 Testing

6.1 General

6.1.1 The testing method, equipment and conditions are to comply with recognized National or International standards, or other documents to the satisfaction of the Society.

6.1.2 Sufficient details are to be given in a written procedure for each NDT technique submitted to the Society for acceptance.

6.1.3 The testing volume is to be the zone which include the weld and parent material for at least 10mm each side of the weld, or the width of the heat affected zone (HAZ), whichever is greater. In all cases inspection is to cover the whole testing volume.

6.1.4 Provision is to be made for the Surveyor to verify the inspection, reports and records (e.g. radiographs) on request.

6.2 Visual testing (VT)

6.2.1 The personnel in charge of VT is to confirm that the surface condition is acceptable prior to carrying out the inspection. VT is to be carried out in accordance with standards agreed between the Shipbuilder and the Society.

6.3 Liquid penetrant testing (PT)

6.3.1 PT is to be carried out in accordance to ISO 3452-1:2013 or a recognized accepted standard and the specific requirement of the Society.

6.3.2 The extent of PT is to be in accordance to the plans agreed with the attending Surveyor and to the satisfaction of the Surveyor.

6.3.3 The surface to be examined is to be clean and free from scale, oil, grease, dirt or paint so there are not contaminants and entrapped material that may impede penetration of the inspection media.

6.3.4 The temperature of parts examined is to be typically between 5°C and 50°C, outside this temperature range special low/high temperature penetrant and reference comparator blocks are to be used.

6.4 Magnetic particle testing (MT)

6.4.1 MT is to be carried out in accordance to ISO 17638:2016 or a recognized accepted standard and the specific requirement of the Society.

6.4.2 The extent of MT is to be in accordance to the plans agreed with the attending Surveyor and to the satisfaction of the Surveyor.

6.4.3 The surface to be examined is to be free from scale, weld spatter, oil, grease, dirt or paint and is to be clean and dry. In general, the inside and outside of the welds to be

inspected need to be sufficiently free from irregularities that may mask or interfere with interpretation.

6.5 Radiographic testing (RT)

6.5.1 RT is to be carried out in accordance to ISO 17636-1:2013 or an accepted recognized standard and any specific requirement of the Society

6.5.2 (1/1/2022)

The minimum inspected weld length for each checkpoint is to be specified in the approved NDT plan (see [5.1.2]) and is to follow the requirements of the Society. For hull welds the minimum length inspected by RT is typically 300mm.

The extent of RT is to be in accordance to the approved plans and to the satisfaction of the Surveyor.

Consideration may be given for reduction of inspection frequency for automated or fully mechanized welds where quality assurance techniques indicate consistent satisfactory quality. The number of checkpoints is to be increased if the proportion of non-conforming indications is abnormally high.

6.5.3 The inside and outside surfaces of the welds to be radiographed are to 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.

6.6 Ultrasonic testing (UT)

6.6.1 UT is to be carried out according to procedure based on ISO 17640:2018 (testing procedure), ISO 23279:2017 (characterization) and ISO 11666:2018 (acceptance levels) or accepted standards and the specific requirements of the Society.

6.6.2 The minimum inspected weld length for each checkpoint is to be specified in the approved NDT plan (see [5.1.2]) and is to follow the requirements of the Society.

The extent of UT is to be in accordance to the approved plans and to the satisfaction of the Surveyor.

A checkpoint is to consist of the entire weld length or a length agreed with the Society.

7 Acceptance Levels (criteria)

7.1 General

7.1.1 This Article details the acceptance levels (criteria) followed for the assessment of the NDT results. Techniques include but are not limited to: VT, MT, PT, RT and UT.

7.1.2 As far as necessary, testing techniques are to be combined to facilitate the assessment of indications against the acceptance criteria.

7.1.3 The assessment of indications not covered by these Rules is to be made in accordance with a standard agreed with the Society. Alternative acceptance criteria can be agreed with the Society, provided equivalency is established.

The general accepted methods for testing of welds are provided in Tab 2 and Tab 3 for surface and embedded discontinuities respectively. Refer to ISO 17635:2016.

Table 2 Method for detection of surface discontinuities (All type of welds including fillet welds)

Materials	Testing Methods
Ferritic Steel	VT
	VT, MT
	VT, PT

Table 3 NDT for detection of embedded discontinuities (for butt and T joints with full penetration)

Materials and type of joint	Nominal thickness (t) of the parent material to be welded (mm)		
	t < 8	8 ≤ t ≤ 40	t > 40
Ferritic butt-joints	RT or UT ¹	RT or UT	UT or RT ²
Ferritic T-joints	UT ¹ or RT ²	UT or RT ²	UT or RT ²

Notes:
 1) Below 8mm the Society may consider application of an appropriate advanced UT method.
 2) RT may be applied however there will be limitations.

7.2 Quality Levels

7.2.1 Testing requirements follows the designation of a particular quality level of imperfections in fusion-welded joints in accordance with ISO 5817:2014. Three quality levels (B, C and D) are specified.

In general Quality level C is to be applied for hull structure.

Quality level B corresponds to the highest requirement on the finished weld, and may be applied on critical welds.

This standard applies to steel materials with thickness above 0.5 mm. ISO 5817:2014 Table 1 provides the requirements on the limits of imperfections for each quality level. ISO 5817:2014 Annex A also provides examples for the determination of percentage of imperfections (number of pores in surface percent).

All levels (B,C and D) refer to production quality and not to the fitness for purpose (ability of product, process or service to serve a defined purpose under specific conditions). The correlation between the quality levels defined in ISO 5817:2014, testing levels/techniques and acceptance levels (for each NDT technique) will serve to define the purpose under specific conditions. The acceptance level required for examination is to be agreed with the Society. This will determine the quality level required in accordance with the non-destructive technique selected. Refer to Tables 4 to 9.

7.3 Testing Levels

7.3.1 The testing coverage and thus the probability of detection increases from testing level A to testing level C. The testing level is to be agreed with the Society. Testing level D is intended for special applications, this can only be used when defined by specification. ISO 17640:2018 Annex A tables A.1 to A.7 provide guidance on the selection of testing levels for all type of joints in relation to the thickness of parent material and inspection requirements.

7.3.2 The testing technique used for the assessment of indications is also to be specified.

7.4 Acceptance Levels

7.4.1 The acceptance levels are specified for each testing technique used for performing the inspection. The criteria applied is to comply with each standard identified in Tables 4 to 9 (or any recognized acceptable standard agreed with the Society).

7.4.2 Probability of detection (POD) indicates the probability that a testing technique will detect a given flaw.

7.5 Visual testing (VT)

7.5.1 The acceptance levels and required quality levels for VT are provided in IACS Rec 47 and Tab 4.

Table 4 Visual testing

Quality Levels (ISO 5817:2014 applies) ^a	Testing Techniques/ levels (ISO 17637:2016 applies) ^a	Acceptance levels ^b
B	Level not specified	B
C		C
D		D
Notes: ^a Or any recognized standard agreed with the Society and demonstrated to be acceptable ^b The acceptance levels for VT are the same to the quality levels requirements of ISO 5817:2014		

7.6 Penetrant testing (PT)

7.6.1 The acceptance levels and required quality levels for PT are provided in Tab 5

Table 5 Penetrant Testing

Quality Levels (ISO 5817:2014 applies) ^a	Testing Techniques/ levels (ISO 3452-1:2013 applies) ^a	Acceptance levels (ISO 23277:2015 applies) ^a
B	Level not specified	2X
C		2X
D		3X
Notes: ^a Or any recognized standard agreed with the Society and demonstrated to be acceptable		

7.7 Magnetic Particle testing (MT)

7.7.1 The acceptance levels and required quality levels for MT are provided in Tab 6

Table 6 Magnetic Particle Testing

Quality Levels (ISO 5817:2014 applies) ^a	Testing Techniques/ levels (ISO 17638:2016 applies) ^a	Acceptance levels (ISO 23278:2015 applies) ^a
B	Level not specified	2X
C		2X
D		3X
Notes: ^a Or any recognized standard agreed with the Society and demonstrated to be acceptable		

7.8 Radiographic testing (RT)

7.8.1 The acceptance levels and required quality levels for RT are provided in Tab 7. Reference radiographs for the

assessment of weld imperfections are to be provided in accordance to ISO 5817:2014 or acceptable recognized standard agreed with the Society.

Table 7 Radiographic Testing

Quality Levels (ISO 5817:2014 applies) ^a	Testing Techniques/ levels (ISO 17636-1:2013 applies) ^a	Acceptance levels (ISO 10675-1:2016 applies) ^a
B	B (class)	1
C	B ^b (class)	2
D	At least A (class)	3

Notes:

^a Or any recognized standard agreed with the Society and demonstrated to be acceptable

^b For circumferential weld testing, the minimum number of exposures may correspond to the requirements of ISO 17636-1:2013, class A

7.9 Ultrasonic testing (UT)

7.9.1 The acceptance levels and required quality levels for UT are provided in Tables 8 and 9:

Table 8 Ultrasonic Testing

Quality Levels (ISO 5817:2014 applies) ^{a,b}	Testing Techniques/ levels (ISO 17640:2018 applies) ^{a,b}	Acceptance levels (ISO 11666:2018 applies) ^{a,b}
B	at least B	2
C	at least A	3
D	at least A	3 ^c

Notes:

^a Or any recognized standard agreed with the Society and demonstrated to be acceptable

^b When characterization of indications is required, ISO 23279:2017 is to be applied

^c UT is not recommended but can be defined in a specification with same requirement as Quality Level C

Table 9 Recommended Testing and Quality Levels (ISO 17640)

Testing Level ^{a,b,c} (ISO 17640:2018 applies)	Quality Level (ISO 5817:2014 applies)
A	C, D
B	B
C	By agreement
D	Special application

Notes:

^a POD increases from testing level A to C as testing coverage increases

^b Testing Level D for special application is to be agreed with Society

^c Specific requirements for testing levels A to C, are provided for various types of joints in ISO 17460:2018 Annex A

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

and examination conditions are to be submitted to the consideration of the Society.

7.9.3 The acceptance levels for UT of welds are to be defined in accordance to ISO 11666:2018 requirements or any recognized acceptable standard agreed with the Society. The standard specifies acceptance levels 2 and 3 for full penetration welded joints in ferritic steels, corresponding to quality levels B and C (Refer to Tab 8).

Chapter 1

7.9.4 Sensitivity settings and levels. The sensitivity levels are set by the following techniques:

- Technique 1: based on 3mm diameter side- drilled holes
- Technique 2: based on distance gain size (DGS) curves for flat bottom holes (disk shaped reflectors)
- Technique 3: using a distance-amplitude-corrected (DAC) curve of a rectangular notch of 1mm depth and 1mm width
- Technique 4: using the tandem technique with reference to a 6mm diameter flatbottom hole (disk shaped reflector)

The evaluation levels (reference, evaluative, recording and acceptance) are specified in ISO 11666:2018 Annex A.

8 Reporting

8.1

8.1.1 Reports of NDT required are to be prepared by the Shipbuilder and are to be made available to the Society.

8.1.2 Reports of NDT are to include the following generic items:

- Date of testing
- Hull number, location and length of weld inspected
- Names, qualification level and signature of personnel that have performed the testing
- Identification of the component examined
- Identification of the welds examined
- Steel grade, type of joint, thickness of parent material, welding process
- Acceptance criteria
- Testing standards used
- Testing equipment and arrangement used
- Any test limitations, viewing conditions and temperature
- Results of testing with reference to acceptance criteria, location and size of reportable indications
- Statement of acceptance / non-acceptance, evaluation date, name and signature of evaluator
- Number of repairs if specific area repaired more than twice

8.1.3 In addition to generic items, reports of PT are to include the following specific items:

- Type of penetrant, cleaner and developer used
- Penetration time and development time

8.1.4 In addition to generic items, reports of MT are to include the following specific items:

- Type of magnetization
- Magnetic field strength
- Detection media
- Viewing conditions
- Demagnetization, if required

8.1.5 In addition to generic items, reports of RT are to include the following specific items:

- Type and size of radiation source (width of radiation source), X-ray voltage
- Type of film/designation and number of film in each film holder/cassette
- Number of radiographs (exposures)
- Type of intensifying screens
- Exposure technique, time of exposure and source-to-film distance as per below:
- Distance from radiation source to weld
- Distance from source side of the weld to radiographic film
- Angle of radiation beam through the weld (from normal)
- Sensitivity, type and position of IQI (source side or film side)
- Density
- Geometric un-sharpness
- Specific acceptance class criteria for RT

Examinations used for acceptance or rejection of welds are to be recorded in an acceptable medium. A written record providing following information: identification and description of welds, procedures and equipment used, location within recorded medium and results is to be included. The control of documentation unprocessed original images and digitally processes images is to be to the satisfaction of the Surveyor.

8.1.6 In addition to generic items, reports of UT are to include the following specific items:

- Type and identification of ultrasonic equipment used (instrument maker, model, series number), probes (instrument maker, serial number), transducer type (angle, serial number and frequency) and type of couplant (brand).
- Sensitivity levels calibrated and applied for each probe
- Transfer loss correction applied Type of reference blocks
- Signal response used for defect detection
- Reflections interpreted as failing to meet acceptance criteria

The method for review and evaluation of UT reports is required for adequate quality control and is to be to the satisfaction of the Surveyor.

8.1.7 The shipyard is to keep the inspection records specified in [8.1.2] to [8.1.6] for at least 5 years.

9 Unacceptable indications and repairs

9.1

9.1.1 Unacceptable indications are to be eliminated and repaired where necessary. The repair welds are to be examined on their full length using appropriate NDT method at the discretion of the Surveyor.

9.1.2 (1/1/2022)

When unacceptable indications are found, additional areas of the same weld length are to be examined unless it is agreed with the Surveyor and fabricator that the indication is isolated without any doubt. In case of automatic or fully mechanized welded joints, additional NDT is to be extended to all areas of the same weld length.

All radiographs exhibiting non-conforming indications are to be brought to the attention of the Surveyor. Such welds are to be repaired and inspected as required by the Surveyor. When non-conforming indications are observed at the end of a radiograph, additional RT is generally required to determine their extent. As an alternative, the

extent of non-conforming welds may be ascertained by excavation, when approved by the Surveyor.

9.1.3 The extent of testing can be extended at the Surveyor's discretion when repeated non acceptable discontinuities are found.

9.1.4 The inspection records specified in [8] are to include the records of repaired welds.

9.1.5 The Shipbuilder is to take appropriate actions to monitor and improve the quality of welds to the required level. The repair rate is to be recorded by the shipyard and any necessary corrective actions are to be identified in the builder's QA system.

CHAPTER 2 EXTENT OF NON-DESTRUCTIVE TESTING

1 Hull Structures

1.1

1.1.1

With respect to hull structures of new buildings, the non-destructive testing (NDT) requirements specific to the individual buildings are generally stipulated at the time of approval of the main classification drawings, or by the Surveyors in charge of survey.

1.1.2

As regards the VT and MT methods, the following generally applies.

The Manufacturer is to carry out and record:

- a) VT to a full extent
- b) MT or PT where necessary as a complement to VT.

The Surveyors may carry out checks and direct examinations as deemed appropriate.

1.1.3

Checks with the RT and UT methods are required for butt-welded joints of plating and stiffening members.

Such checks are generally to be performed with the RT method, while Tasneef reserves the right to require the UT method in addition to, or to admit it partially or wholly in lieu of, the former.

In particular, additional UT may be required where necessary to determine more precisely the position and size of a defect in the section.

The individual checks are to cover weld sections of length not less than 200÷480 mm or approximately 1 m, for the RT and UT, respectively.

In general, the number "n" of checks to be subjected to the RT is to be not less than that resulting from the following formula:

$$n = \frac{L \cdot (B + D)}{46}$$

where L, B and D are the principal dimensions of the ship, in metres, as defined in Pt B, Ch 1, Sec 2 of the Rules for the Classification of Ships.

Checks are to be carried out as indicated in the following items a) to e), to the satisfaction of the Surveyors, unless otherwise stated.

Additional checks may be required as deemed necessary by the Surveyors in charge of the survey.

- a) Shell and strength deck plating within 0,6 L amidships (including, for the deck and sheerstrake if appropriate, the zone of the break of the poop within 0,35 L aft of amidships):
 - all "4-way" crossings of butt-joints of panels or strakes of strength deck, bottom and bilge, welded

practically at the same time (i.e. assembled when all still unwelded), regardless of the type of welding process used

- a sufficient number of lengths of butts (transverse butt-joints) welded by special welding processes, such as "one side", "single pass" SAW and similar; the lengths are generally to be located on the butt in way of the T-crossing so as to also include the seam (longitudinal butt-joint) for a sufficient length
 - at least one examination in each butt of a round gunwale plate. The locations of the films will be distributed among the various butts such that different positions of the joints are examined, with particular reference to the central curved portion
 - spot examinations on joints of strakes in Class III structures in accordance with Part B, Ch 4, Sec 1 of the Rules for the Classification of Ships or made of steel types E/EH and higher
 - spot examinations of butt-joints, with the purpose of checking the workmanship. Within the scope of these examinations, butts beyond 0,6 L amidships may be required to be examined.
- b) Spot examinations of butt-joints of insert plates around openings in the shell and strength deck, with particular regard to the zones including the rounded corners. In the case of inserts at the corners of large openings in the strength deck, at least one examination is required for each insert
 - c) Spot examinations on highly stressed butt-joints, such as those of the plating of rudder horns, the connection to the hull and adjacent plating, as well as those of cast pieces involved in the construction of sternposts and sternframes (in relation to the thickness of the material to be examined, gamma-ray examination may be substituted for radiographic examination)
 - d) Spot examinations on butt-joints of longitudinals of the strength deck, bottom and bilge, when realized without doubler
 - e) Spot examinations on welded joints of the plating of light alloy superstructures.

1.1.4

Tasneef may modify the normal extent of the NDT checks, as deemed necessary, taking into account the level of quality of the welds resulting from production, the welding processes in use and the Manufacturer's quality control methods.

1.1.5

The plan of the positions examined, validated by the Manufacturer, is to be enclosed together with the report for first entry survey.

2 Pressure Vessels And Piping

2.1

2.1.1

For welded joints of pressure vessels, boilers and piping, the requirements regarding the extent of the NDTs are given in Part C of the Rules for the Classification of Ships.

In the absence of requirements as to the method to be adopted for internal NDTs, it is understood that the RT is to be used while Tasneef reserves the right to require the UT method in addition to, or to admit it partially or wholly in lieu of, the former.

Moreover, specific requirements may be stipulated at the time of approval of the drawings as well as during construction in accordance with the provisions in the recognized standards used for the design and testing of pressure vessel or piping.

2.1.2

The plan of the positions examined, validated by the Manufacturer, is to be enclosed together with the test report.

3 Non-Conforming Results

3.1

3.1.1

Where, in a weld area checked with NDT by a method which is applied to an extent less than 100%,

discontinuities are found exceeding the acceptable limits applicable to the welding concerned, as a rule the procedure is as follows:

- a) the defective area is to be repaired
- b) contiguous areas are to be suitably examined with the same method or a method of equivalent reliability
- c) where the outcome of the extended examination is also negative, the examination is further extended to similar joints (as regards manufacturing conditions, welding time and other circumstances), at the discretion of the Surveyors
- d) any further repairs and checks are stipulated by Tasneef depending on the findings

3.1.2

Where there is a recurrence of non-conforming findings, Tasneef may require:

- a) modification of the welding procedures prior to proceeding further with production and/or
- b) implementation of appropriate NDT checks, also to a full extent, until satisfactory results are obtained.

3.1.3

Any repairs judged necessary by the Surveyors are to be carried out with procedures approved by Tasneef.

Parts repaired are to be checked using NDTs appropriate for the evaluation of the repairs, to the satisfaction of Tasneef.

CHAPTER 3 ADVANCED NON-DESTRUCTIVE TESTING OF MATERIALS AND WELDS

1 General

1.1

1.1.1 This Chapter gives minimum requirements on the methods and quality levels that are to be adopted for the advanced non-destructive testing (ANDT) of materials and welds during new building of ships. The advanced methods intended for use under this Chapter are listed in [2].

1.1.2 The ANDT is to be performed by the shipbuilder, manufacturer or its subcontractors in accordance with these requirements. The Society's Surveyor may require witnessing testing.

1.1.3 It is the shipbuilder's or manufacturer's responsibility to ensure that testing specifications and procedures are adhered to during the construction, and the report is to be made available to the Society on the findings made by the ANDT.

1.1.4 The extent and method of testing, and the number of checkpoints are normally agreed between the shipyard and the Society.

1.2 Terms and definitions

1.2.1 The following terms and definitions apply:

- ANDT : Advanced non-destructive testing
- RT-D : Digital Radiography
- RT-S : Radioscopic testing with digital image acquisition (dynamic.12bit)
- 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.

2 Applicability

2.1 Materials

2.1.1 The requirements in this Chapter apply to the following materials and manufactured products:

- Material and welding for gas tankers in accordance with Pt D and Pt E, Ch 9, Sec 6 of the Rules for the Classification of Ships
- Normal and higher strength hull structural steels in accordance with Pt D, Ch 2, Sec 1, [2] of the Rules for the Classification of Ships
- High strength steels for welded structures in accordance with Pt D, Ch 2, Sec 1, [3] of the Rules for the Classification of Ships
- Hull and machinery steel forgings in accordance with Pt D, Ch 2, Sec 3, [1] to [5] of the Rules for the Classification of Ships
- Hull and machinery steel castings in accordance with Pt D, Ch 2, Sec 4, [1] to [4] of the Rules for the Classification of Ships
- Extremely Thick Steel Plates in Container Ships in accordance with Pt D, Ch 2, Sec 1, [10] of the Rules for the Classification of Ships
- Cast Copper Alloy propellers in accordance with Pt D, Ch 4, Sec 2, [1] of the Rules for the Classification of Ships
- Aluminium alloys for hull construction in accordance with Pt D, Ch 3, Sec 2 of the Rules for the Classification of Ships
- Cast Steel Propellers in accordance with Pt D, Ch 4, Sec 2, [3] of the Rules for the Classification of Ships
- YP47 Steels and Brittle Crack Arrest Steels in accordance with Pt D, Ch 2, Sec 1, [11] of the Rules for the Classification of Ships
- Marine steel castings in accordance with IACS Rec 69

2.2 Welding processes

2.2.1 The requirements in this Chapter apply to welding processes specified in Tab 1. ANDT of welding process unspecified in Tab 1 is to be to the satisfaction of the Society.

Table 1 Applicable welding process

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)	131
	(2) Metal Active Gas welding (MAG)	135, 138
	(3) Flux Cored Arc Welding (FCAW)	136
TIG welding	Gas Tungsten Arc Welding (GTAW)	141
Automatic welding	(1) Submerged Arc Welding (SAW)	12
	(2) Electro-gas Welding (EGW)	73
	(3) Electro-slag Welding (ESW)	72

2.3 Weld joints

2.3.1 The requirements in this Chapter apply to butt welds with full penetration. Variations of joint design, for example, tee, corner and cruciform joints (with or without full penetration) can be tested using PAUT. The constraints of joint design with respect to testing are to be recognized, documented, and agreed with the Society before application.

2.4 Timing of ANDT

2.4.1 ANDT are to be conducted after welds have cooled to ambient temperature and after post weld heat treatment where applicable.

2.4.2 Timing of ANDT on ship hull welds on steels with specified minimum yield stress in the range of 420 N/mm² to 690 N/mm² is to be in accordance with Ch 1, [2.4.2].

2.5 Testing methods

2.5.1 The methods mentioned in this chapter for detection of imperfections are PAUT (only automated / semi-automated PAUT), TOFD, RT-D.

2.5.2 Applicable methods for testing of the different types of materials and weld joints are given in Tab 2.

Table 2 Applicable methods for testing of materials and weld joints

MATERIALS AND WELD JOINTS	PARENT MATERIAL THICKNESS	APPLICABLE METHODS
Ferritic butt welds with full penetration	thickness < 6mm	RT-D
	6 mm ≤ thickness ≤ 40 mm	PAUT, TOFD, RT-D
	thickness > 40mm	PAUT, TOFD, RT-D*
Ferritic tee joints and corner joints with full penetration	thickness ≥ 6mm	PAUT, RT-D*
Ferritic cruciform joints with full penetration	thickness ≥ 6mm	PAUT*
Austenitic stainless steel butt welds with full penetration ¹	thickness < 6mm	RT-D
	6 mm ≤ thickness ≤ 40 mm	RT-D, PAUT*
	thickness > 40mm	PAUT*, RT-D*
Austenitic stainless steel tee joints, corner joints with full penetration ¹	thickness ≥ 6mm	PAUT*, RT-D*
Aluminum tee joints and corner joints with full penetration	thickness ≥ 6mm	PAUT*, RT-D*
Aluminum cruciform joints with full penetration	thickness ≥ 6mm	PAUT*
Aluminum butt welds with full penetration	thickness < 6mm	RT-D
	6 mm ≤ thickness ≤ 40 mm	RT-D, TOFD, PAUT
	thickness > 40mm	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	thickness < 6mm	RT-D
	6 mm ≤ thickness ≤ 40 mm	PAUT, TOFD, RT-D
	thickness > 40mm	PAUT, TOFD, RT-D*

Notes:

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

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.

3 Qualification of personnel involved in ANDT

3.1

3.1.1 The Shipbuilder, manufacturer or its subcontractors is responsible for the qualification and preferably 3rd party certification of its supervisors and operators to a recognised 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, manufacturer or its subcontractors written practice is reviewed and found acceptable by the Society. The Shipbuilder, manufacturer or its subcontractors written practice is to as a minimum, except for the impartiality requirements of a certification body and/or authorised body, comply with ISO 9712:2012.

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

Level 3 personnel is to be certified by an accredited certification body.

3.1.2 The Shipbuilder, manufacturer or its subcontractors is to 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, manufacturer or its subcontractors is to employ, on a full-time basis, at least one supervisor independently certified to Level 3 in the method(s) concerned as per the requirements in [3.1.1]. It is not permissible to appoint Level 3 personnel; they must be certified by an accredited certification body. It is recognised that a Shipbuilder, manufacturer 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, manufacturer or its subcontractors.

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

3.1.3 The operator carrying out the NDT and interpreting indications, is to as a minimum, be qualified and certified to Level 2 in the NDT method(s) concerned and as described in [3.1.1].

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

4 Technique and procedure qualification

4.1

4.1.1 General

The shipbuilder or manufacturer has to submit to the Society the following documentation for review:

- The technical documentation of the ANDT
- The operating methodology and procedure of the ANDT according to [7].
- Result of software simulation, when applicable.

4.1.2 Software simulation

Software simulation may be required by the Society, 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.

4.1.3 Procedure qualification test

The procedure qualification for ANDT system is to 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 programme¹ which including onsite demonstration.
- Documentation of results from the repeatability and reliability test programs.

Note 1: The data from the repeatability and reliability test program is to be analyzed with respect to comparative qualification block test report and onsite demonstration. The qualification block is to be in accordance with ASME V Article 14 MANDATORY APPENDIX II UT PERFORMANCE DEMONSTRATION CRITERIA or agreed by the Society, and at least the intermediate level qualification blocks is to be used. The high level qualification blocks is to be used when sizing error distributions and an accurate POD need to be evaluated. The demonstration process onsite is to be witnessed by the Society's Surveyor.

4.1.4 Procedure approval

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

4.1.5 Onsite review

For the test welds, supplementary NDT is to 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 are to be performed in accordance with the above activities. Probability of Detection (PoD) and sizing accuracy is to be established when applicable.

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

When a significant nonconformity is found, the Society has the right to reject the results of such activities.

5 Surface condition

5.1

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

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

5.1.3 The requirement for acceptable test surface finish is to 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 is to be ground or machined.

6 General plan of testing: NDT method selection

6.1

6.1.1 The extent of testing is to be planned by the shipbuilder or manufacturer according to the ship design, ship or equipment type and welding processes used. Particular attention is to be paid to highly stressed areas. The extent of testing is to be in accordance with UR or REC applicable with material of weld examined.

7 Testing requirements

7.1 General

7.1.1 The shipyard or manufacturer is to ensure that personnel carrying out NDT or interpreting the results of NDT are qualified to the appropriate level as detailed in [3].

7.1.2 Procedures

- a) All NDT are to be carried out to a procedure that is representative of the item under inspection.
- b) Procedures are to identify the component to be examined, the NDT method, equipment to be used and the full extent of the examinations including any test restrictions.
- c) Procedures are to 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.
- d) Procedures are to include the method and requirements for equipment calibrations and functional checks, together with specific technique sheets / scan plans, for the component under test
- e) Procedures are to be approved by personnel qualified to Level III in the appropriate technique in accordance with a recognised standard
- f) Procedures are to be reviewed by the Society's Surveyor.

7.1.3 The methods considered within the application of this Chapter are defined in [2.5.1].

7.1.4 PAUT techniques are to conform as a minimum to [7.2]. 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.

7.1.5 PAUT of welds is to include a linear scan of the fusion face, together with other scans as defined in the specific test technique. Refer to linear scan requirements in [7.2.6].

7.1.6 TOFD techniques are to conform as a minimum to [7.3]. 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.

7.1.7 RT-D techniques are to conform as a minimum to [7.4]. For the purpose of this UR, RT-D comprises of two main RT methods; RT-S and RT-CR. Other methods may be included (e.g. radioscopy systems), however, then must conform to this Chapter as applicable, and any specific requirements is to demonstrate equivalence to these requirements.

7.1.8 In all RT-D methods, in addition to specific requirements, detector output quality control methods are to be described within the procedure. The procedure is to define the level of magnification, post-processing tools, image/data security and storage, for final evaluation and reporting.

7.2 Phased array ultrasonic testing

7.2.1 PAUT is to be carried out according to procedures based on ISO 13588:2019, ISO 18563-1:2015, ISO 18563-2:2017, ISO 18563-3:2015 and ISO 19285:2017 or recognized standards and the specific requirements of the Society.

7.2.2 Information required prior to testing

A procedure is to be written and include the following information as in minimum shown in Tab 3. When an essential variable in Tab 3 is to change from the specified value, or range of values, the written procedure is to require requalification. When a nonessential variable is to 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 are to require revision of, or an addendum to, the written procedure.

Table 3 Requirements of a PAUT Procedure

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

7.2.3 Testing levels

The testing levels specified in the testing procedure are to be in accordance with recognized standards accepted by the Society. Four testing levels are specified in ISO 13588:2019, each corresponding to a different probability of detection of imperfections.

7.2.4 Weld Examinations

The weld examinations are to be in accordance with ISO 13588:2019 and the additional special requirements of this Chapter.

7.2.5 Material Examinations

Material examinations are to conform to [2.1] as a minimum.

7.2.6 Volume to be inspected

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

A scan plan is to be provided. The scan plan is to show the beam coverage, the weld thickness and the weld geometry.

If the evaluation of the indications is based on amplitude only, it is a requirement that an 'E' scan (or linear scan) is to be utilized to scan the fusion faces of welds, so that the sound beam is perpendicular to the fusion face $\pm 5^\circ$. This requirement may be omitted if an 'S' (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 is to utilize reference blocks containing suitable reflectors in location of fusion zone).

7.2.7 Reference blocks

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

7.2.8 Indication assessment

Indications detected when applying testing procedure are to be evaluated either by length and height or by length and

maximum amplitude. Indication assessment is to be in accordance with ISO 19285:2017 or recognized standards and the specific requirements of the Society. The sizing techniques include reference levels, Time Corrected Gain (TCG), Distance Gain Size (DGS) and 6 dB drop. 6 dB drop method is to only be used for measuring the indications larger than the beam width.

7.3 Time of flight diffraction

7.3.1 TOFD is to be carried out according to procedure based on ISO 10863:2011, and ISO 15626:2018 or recognized standards and the specific requirements of the Society.

7.3.2 Information required prior to testing

A procedure is to be written and include the following information as shown in Tab 4. When an essential variable in Tab 4 is to change from the specified value, or range of values, the written procedure is to require requalification. When a nonessential variable is to 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 are to require revision of, or an addendum to, the written procedure.

Table 4 Requirements of a TOFD Procedure

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 is to be performed	X	...
Angle(s) of wave propagation in the material	X	...
Search unit type(s), frequency(ies), 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

7.3.3 Testing levels

The testing levels specified in the testing procedure are to be in accordance with recognized standards accepted by the Society. Four testing levels are specified in ISO 10863:2011, each corresponding to a different probability of detection of imperfections.

7.3.4 Volume to be inspected

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

A scan plan is to be provided. The scan plan is to show the locations of the probes, beam coverage, the weld thickness and the weld geometry.

7.3.5 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 are to be applied to ensure full inspection coverage.

7.4 Digital radiography

7.4.1 Digital radiography is to be performed per procedure(s) based on ISO 17636-2:2013 and standards referenced therein, or recognized standards and additional specific requirements of the Society.

Any variation to applying the standard (e.g. IQI placement) is to be agreed with Society.

A procedure is to be written and include the following information as shown in Tab 5.

Table 5 Requirements of a 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

Regarding choice of testing level per ISO 17636-2:2013 this is referred to in [8.4].

8 Acceptance Levels

8.1 General

8.1.1 This section details the acceptance levels followed for the assessment of the NDT results. Methods include but are not limited to: Phased array ultrasonic testing (PAUT), Time of flight diffraction (TOFD), Digital radiography (RT-D).

8.1.2 It may be necessary to combine testing methods to facilitate the assessment of indications against the acceptance criteria.

8.1.3 Acceptance criteria for each material and weld joint are to be in accordance with [2.1.1].

8.2 Phased array ultrasonic testing

8.2.1 Weld Examinations

The relationship between acceptance levels, testing levels and quality levels is given in Tab 6.

Quality levels and acceptance levels for PAUT of welds are to be in accordance with ISO 19285:2017 or recognized standard agreed with the Society.

Table 6 Acceptance levels for PAUT

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

8.2.2 Material Examinations

Quality levels and acceptance levels for PAUT of material testing are to be in accordance to recognized standard agreed with the Society.

The acceptance levels for material examinations are to conform as a minimum to the requirements of the Tasneef Rules applicable to the material.

8.3 Time of flight diffraction

8.3.1 The relationship between acceptance levels, testing levels and quality levels is given in Tab 7. Quality levels and acceptance levels for TOFD of welds are to be in accordance to ISO 15626:2018 or recognized standard agreed with the Society.

Table 7 Acceptance levels for TOFD

Quality levels according to ISO 5817:2014	Testing level according to ISO 10863:2011	Acceptance levels according to ISO 15626:2018
B (Stringent)	C	1
C (Intermediate)	At least B	2
D (Moderate)	At least A	3

8.4 Digital radiography

8.4.1 The relationship between acceptance levels, testing levels and quality levels is given in Tab 8. Quality levels and

acceptance levels for Digital Radiography of welds are to be in accordance with ISO 10675 or standard agreed with the Society.

Table 8 Acceptance levels for Digital radiography

Quality levels according to ISO 5817:2014 or ISO 10042:2018	Testing techniques/level(class) according to ISO 17636-2:2013	Acceptance levels according to ISO 10675-1:2016 & ISO 10675-2:2017
B (Stringent)	B (class)	1
C (Intermediate)	B* (class)	2
D (Moderate)	A (class)	3

Notes:
 * For circumferential weld testing, the minimum number of exposures may correspond to the requirements of ISO 17636-2:2013, class A

9 Reporting

9.1

9.1.1 The test report is to include at least the following information:

- a) a reference to standards of compliance
- b) information relating to the object under test:
 - 1) identification of the object under test
 - 2) dimensions including wall thickness
 - 3) material type and product form
 - 4) geometrical configuration
 - 5) location of welded joint(s) examined
 - 6) reference to welding process and heat treatment
 - 7) surface condition and temperature
 - 8) stage of manufacture
- c) information relating to equipment (see Tab 9)
- d) information relating to test technology (see Tab 10)
- e) information relating to test results (see Tab 11)

Table 9 Information relating to equipment

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 block(s) 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

Table 10 Information relating to test technology

Method	Information
All	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 1) details of TOFD setups 2) details of offset scans, if required
RT-D	<ol style="list-style-type: none"> 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 5) achieved and required SNR_N for RT-S or achieved and required grey values and/or SNR_N for RT-CR 6) for RT-S: type and parameters such as gain, frame time, frame number, pixel size, calibration procedure 7) for RT-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

Table 11 Information relating to test results

Method	Information
All	<ol style="list-style-type: none"> 1) acceptance criteria applied 2) tabulated data recording the classification, location and size of relevant indications and results of evaluation 3) results of examination including data on software used 4) date of test 5) reference to the raw data file(s) 6) date(s) of scan or exposure and test report 7) names, signatures and certification of personnel
PAUT	<ol style="list-style-type: none"> 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 2) reference points and details of the coordinate system
TOFD	TOFD images of at least those locations where relevant TOFD indications have been detected

9.1.2 Results of NDT are to be recorded and evaluated by the shipbuilder or manufacturer on a continual basis. These records are to be available to the Surveyor

9.1.3 The shipbuilder or manufacturer is to be responsible for the review, interpretation, evaluation and acceptance of the results of NDT. Reports stating compliance or otherwise with the criteria established in the inspection procedure are to be issued

9.1.4 In addition to the above general reporting requirements, all specified NDT methods will have particular requirements and details that are to be listed in the report. Refer to the applicable method standards for specific requirements

9.1.5 The shipbuilder or manufacturer is to keep the inspection records for the appropriate period deemed by Societies.

10 Unacceptable indications and repairs

10.1

10.1.1 All indications (discontinuities) exceeding the applicable acceptance criteria are to be classed as defects, and are to be eliminated and repaired according to the applicable Tasneef Rules.