

Notice No.1

Rules for the Manufacture, Testing and Certification of Materials July 2017

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: October 2017

Amendments to	Effective date	Mandatory Instrument
Chapter 2, Sections 1 & 4	Corrigenda	N/A
Chapter 3, Sections 1, 2, 3, 6 & 8	Corrigenda	N/A
Chapter 4, Sections 1, 2, 3, 4, 5, 6, 7 & 8	Corrigenda	N/A
Chapter 5, Sections 1, 2, 3, 4 & 6	Corrigenda	N/A
Chapter 7, Section 1	Corrigendum	N/A
Chapter 9, Section 1	Corrigendum	N/A
Chapter 10, Sections 1 & 2	Corrigenda	N/A
Chapter 11, Sections 1, 5, 6 & 7	Corrigenda	N/A
Chapter 12, Sections 2, 3 & 5	Corrigenda	N/A
Chapter 13, Section 1, 2 & 4	Corrigenda	N/A
Chapter 14, Section s 1, 2, 3, 4 & 5	Corrigenda	N/A

Chapter 2

Testing Procedures for Metallic Materials

■ Section 1

General requirements for testing

1.4 Re-testing procedures

1.4.5 The additional tests detailed in *Ch 2, 1.4 Re-testing procedures 1.4.1* and *Ch 2, 1.4 Re-testing procedures 1.4.2* are, where possible, to be made on material adjacent to the original samples. For castings, where insufficient material remains in the original test samples, the additional test may be made on other test samples representative of the castings. See also *Ch 2, 1.3 Discarding of test specimens* for discarding of test specimens.

■ Section 4

Ductility tests for pipes and tubes

4.4 Flanging tests

4.4.3 The first stage of flanging is to be carried out with a conical angled mandrel having an included angle of approximately 90°, see *Figure 2.4.2 Flanging test(a)*. The completion of the test is achieved with a second forming tool as shown in *Figure 2.4.2 Flanging test(b)*. The mandrels are to be lubricated and there is to be no rotation of the tube or mandrels during the test. The test is to continue until the drifted portion has formed a flange perpendicular to the axis of the test specimens. The percentage increase in the external diameter of the end of the specimens is to be not less than the value given in the specific requirements for boiler and superheater tubes, see *Ch 6 Steel Pipes and Tubes*. The cylindrical and flanged portion of the tube is to be free from cracks or other flaws.

Chapter 3

Rolled Steel Plates, Strip, Sections and Bars

■ Section 1

General requirements

1.1 Scope

1.1.4 Plates, strip, sections and bars are to be manufactured and tested in accordance with the requirements of *Ch 1 General Requirements* and *Ch 2 Testing Procedures for Metallic Materials*, the general requirements of this Section and the appropriate specific requirements given in Sections *Ch 3, 2 Normal strength steels for ship and other structural applications* to *Ch 3, 10 High strength quenched and tempered steels for welded structures*.

1.3 Corrosion resistant steels for cargo oil tanks of crude oil tankers

1.3.7 The weldability of corrosion resistant steels is similar to conventional normal and higher strength steels. Therefore the welding requirements specified in *Ch 11 Approval of Welding Consumables* to *Ch 13 Requirements for Welded Construction* are to be adhered with the exception that each corrosion resistant steel is approved with a specified brand of welding consumable and associated welding process.

1.6 Dimensional tolerances

1.6.4 Class C of ISO 7452 may be applied in lieu of *Ch 3, 1.6 Dimensional tolerances 1.6.3*. Where this standard is applied, both the requirements in *Ch 3, 1.6 Dimensional tolerances 1.6.11* and the portion of the footnote of Table B.2 in ~~ISO 7542~~ **ISO 7452**, that reads; 'Also a minus side of thickness of 0,3 mm is permitted', are not applicable. Additionally, if ISO 7452 is applied, the steel mill is to ensure that the number of measurements and measurement distribution is appropriate to establish that the plates produced are greater than or equal to the specified nominal thickness.

1.8 Test materials and mechanical tests

1.8.4 Test material is to be taken from the following positions:

- (a) At the square cut end of plates and flats greater than 600 mm wide, approximately one-quarter width from an edge, see *Figure 3.1.2 Position of test material(a)*.
- (b) For flats 600 mm or less in width, bulb flats and other solid sections, at approximately one-third of the width from an edge, see *Figure 3.1.2 Position of test material(b)*, *Figure 3.1.2 Position of test material(c)* and *Figure 3.1.2 Position of test material(d)*. Alternatively, in the case of channels, beams or bulb angles, at approximately one-quarter of the width from the centreline of the web, see *Figure 3.1.2 Position of test material(c)*.
- (c) For rectangular hollow sections, at approximately the centre of any side, see *Figure 3.1.2 Position of test material(e)*. For circular hollow sections, at any position on the periphery.
- (d) For bars intended for purposes as detailed in *Ch 3, 2 Normal strength steels for ship and other structural applications*, *Ch 3, 3 Higher strength steels for ship and other structural applications*, *Ch 3, 5 Steels for machinery fabrications* and *Ch 3, 9 Bars for welded chain cables*, at approximately one-third of the radius or half-diagonal from the outer surface, see *Figure 3.1.2 Position of test material(f)*. For smaller bars, the position of the test material is to be as close as is possible to the above.
- (e) For bars intended for the applications detailed in *Ch 3, 4 Steels for boilers and pressure vessels*, *Ch 3, 6 Ferritic steels for low temperature service* and *Ch 3, 7 Austenitic and duplex stainless steels* at approximately 12,5 mm below the surface. For bars up to 25 mm diameter, the test specimens may be machined coaxially.
- (f) For plates and flats with thicknesses in excess of 40 mm, full thickness specimens may be prepared, but when instead a machined round specimen is used then the axis is to be located at a position lying one-quarter of the product thickness from the surface as shown in *Figure 3.1.2 Position of test material(g)*.

■ Section 2 Normal strength steels for ship and other structural applications

2.4 Mechanical tests

2.4.14 Where standard subsidiary Charpy V-notch test specimens are necessary, see *Ch 2, 2.3 Procedure for testing at ambient temperature* *2.3.4 Ch 2, 3.2 Testing procedures 3.2.4*.

■ Section 3 Higher strength steels for ship and other structural applications

3.6 Mechanical tests

Table 3.3.6 Mechanical properties for acceptance purposes (see Note 1)

Note 2. For full thickness tensile test specimens with a width of 25 mm and a gauge length of 200 mm, see <i>Ch 2, 2.1 Dimensions of test specimens 2.1.6 Figure 2.2.4 Test specimen dimensions for plates, strip and sections - II</i> in Chapter 2, the minimum elongation is to be:

■ Section 6 Ferritic steels for low temperature service

6.3 Heat treatment

Table 3.6.2 Supply conditions

Grade	Plates
9Ni	Double normalised and tempered or Quenched and tempered

■ Section 8 Plates with specified through thickness properties

8.7 Certification of materials

8.7.2 Steel grade requirements are to comply with *Ch 3, 1 General requirements* to *Ch 3, 7 Austenitic and duplex stainless steels*.

Chapter 4

Steel Castings

■ Section 1 General requirements

1.1 Scope

1.1.2 Where required by the relevant Rules dealing with design and construction, castings are to be manufactured and tested in accordance with ~~Chapters Ch 1 General Requirements~~ *Ch 1 General Requirements* and *Ch 2 Testing Procedures for Metallic Materials*, together with the general requirements given in this Section and the appropriate specific requirements given in ~~Sections Ch 4, 2 Castings for ship and other structural applications~~ *to Ch 4, 9 Steel castings for container corner fittings*.

1.6 Test material and test specimens

1.6.1 Test material sufficient for the tests specified in Sections *Ch 4, 2 Castings for ship and other structural applications* *to Ch 4, 9 Steel castings for container corner fittings* and for possible re-test purposes is to be provided for each casting. The test samples are to be either integrally cast or gated to the casting and are to have a thickness of not less than 30 mm.

1.9 Rectification and dressing of castings

1.9.6 All welding is to be carried out by an approved welder and in accordance with an approved welding procedure which includes the features referred to in *Ch 4, 1.9 Rectification and dressing of castings* *1.9.6 to Ch 4, 1.9 Rectification and dressings of castings 1.9.13*.

1.9.12 After welding is completed, the castings are to be given the heat treatment specified in ~~Sections Ch 4, 2 Castings for ship and other structural applications~~ *to Ch 4, 9 Steel castings for container corner fittings*, or a stress relieving heat treatment at a temperature of not less than 550°C. The type of heat treatment required will be dependent on the chemical composition of the casting and the dimensions, positions and nature of the repairs.

1.9.14 On completion of heat treatment, all welds and adjacent material are to be ground smooth and examined by magnetic particle, or liquid penetrant testing, ultrasonic or radiographic examination. The Surveyor is to attend at these inspections, to witness the results of magnetic particle or liquid penetrant examination and to examine any radiographs. Satisfactory results are to be obtained from all forms of non-destructive examination used. The acceptance criteria for the NDE of welds are to be in accordance with subsequent Sections of this Chapter or where these do not exist, *Table 13.2.4 Acceptance criteria for visual testing, magnetic particle and liquid penetrant testing* *to Table 13.2.6 Acceptance criteria for ultrasonic testing* in Chapter 13, as appropriate.

■ Section 2 Castings for ship and other structural applications

2.5 Non-destructive examination

2.5.2 The extent and methods of non-destructive examination to be applied to typical hull steel castings are shown in *Figure 4.2.1 Extent of non-destructive evaluation for stern frame castings* *to Figure 4.2.6 Extent of non-destructive evaluation for rudder (lower part) castings* in addition to the areas specified in *Ch 4, 1.7 Visual and non-destructive examination 1.7.9* and *Ch 4, 1.7 Visual and non-destructive examination 1.7.10*.

2.6.1 Acceptance levels for surface crack detection

2.6.3 The following quality levels recommended for magnetic particle testing (MT) and/or dye penetrant testing (PT) are;

(b) Level MT2/PT2 – other locations indicated on *Figure 4.2.1 Extent of non-destructive evaluation for stern frame castings* *to Figure 4.2.6 Extent of non-destructive evaluation for rudder (lower part) castings*.

2.6.5 Level UT1 is applicable to the following:

(d) Castings subject to cyclic bending stresses, e.g. rudder horn, rudder castings and rudder stocks, the outer one third of thickness in the zones shown in *Figure 4.2.1 Extent of non-destructive evaluation for stern frame castings* *to Figure 4.2.6 Extent of non-destructive evaluation for rudder (lower part) castings*.

2.6.6 Level UT2 is applicable to the following:

- (a) For locations which are not specified in *Ch 4, 2.6 Acceptance levels for surface crack detection* 2.6.5, nominated for ultrasonic testing in *Figure 4.2.1 Extent of non-destructive evaluation for stern frame castings* to *Figure 4.2.6 Extent of non-destructive evaluation for rudder (lower part) castings* or on the inspection plan.
- (c) Castings subject to cyclic bending stresses, at the central one third of thickness in the zones shown in *Figure 4.2.1 Extent of non-destructive evaluation for stern frame castings* to *Figure 4.2.6 Extent of non-destructive evaluation for rudder (lower part) castings*.

2.6.7 Ultrasonic acceptance criteria for casting areas not nominated in *Figure 4.2.1 Extent of non-destructive evaluation for stern frame castings* to *Figure 4.2.6 Extent of non-destructive evaluation for rudder (lower part) castings* will be subject to special consideration based on the anticipated stress levels and the type, size and position of the discontinuity.

■ Section 3 Castings for machinery construction

3.1 Scope

3.1.1 This Section gives the material requirements for carbon-manganese steel castings intended for use in machinery construction and which are not within the scope of ~~Sections~~ *Ch 4, 4 Castings for crankshafts* to *Ch 4, 7 Ferritic steel castings for low temperature service*.

■ Section 4 Castings for crankshafts

4.7 Rectification of defective castings

4.7.12 Welds are to be dressed smooth by grinding. The surfaces of the welds and adjacent parent steel are to be proven by magnetic particle and, where appropriate, ultrasonic inspection, see ~~*Ch 4, 1.9 Rectification and dressing of castings 1.9.15*~~ *Ch 4, 1.9 Rectification and dressing of castings 1.9.14* and *Ch 4, 1.9 Rectification and dressing of castings 1.9.15*.

■ Section 6 Castings for boilers, pressure vessels and piping systems

6.5 Non-destructive examination

6.5.1 The non-destructive examination of castings is to be carried out in accordance with the appropriate requirements of *Ch 4, 1.7 Visual and non-destructive examination 1.7.7* to *Ch 4, 1.7 Visual and non-destructive examination 1.7.11* and additionally as agreed between the manufacturer, purchaser and Surveyor.

■ Section 7 Ferritic steel castings for low temperature service

7.5 Non-destructive examination

7.5.1 The non-destructive examination of castings is to be carried out in accordance with the appropriate requirements of *Ch 4, 1.7 Visual and non-destructive examination 1.7.7* to *Ch 4, 1.7 Visual and non-destructive examination*, and additionally agreed between the manufacturer, purchaser and Surveyor.

■ Section 8 Stainless steel castings

8.6 Non-destructive examination

8.6.1 The non-destructive examination of castings is to be carried out in accordance with the appropriate requirements of *Ch 4, 1.7 Visual and non-destructive examination 1.7.7* to *Ch 4, 1.7 Visual and non-destructive examination* and additionally agreed between the manufacturer, purchaser and Surveyor.

Chapter 5

Steel Forgings

■ Section 1

General requirements

1.1 Scope

1.1.2 When required by the relevant Rules dealing with design and construction, forgings are to be manufactured and tested in accordance with ~~Chapters Ch 1 General Requirements~~ Chapters *Ch 1 General Requirements* and *Ch 2 Testing Procedures for Metallic Materials*, together with the general requirements given in this Section and the appropriate specific requirements given in Sections *Ch 5, 2 Forgings for ship and other structural applications* to *Ch 5, 9 Stainless steel forgings*.

1.5 Heat treatment

1.5.1 At an appropriate stage of manufacture, after completion of all hot working operations, forgings are to be suitably heat treated to refine the grain structure and to obtain the required mechanical properties. Acceptable heat treatment procedures are to be such as to avoid the formation of hair-line cracks and are detailed in Sections *Ch 5, 2 Forgings for ship and other structural applications* to *Ch 5, 9 Stainless steel forgings*.

1.6 Test material

1.6.3 Except for components which are to be carburised, test material is not to be cut from a forging until the heat treatment detailed in Sections *Ch 5, 2 Forgings for ship and other structural applications* to *Ch 5, 9 Stainless steel forgings* has been completed. The testing procedure for components which are to be carburised is to be in accordance with the details given in *Ch 5, 5 Forgings for gearing*.

1.7 Mechanical tests

1.7.1 Specimens for mechanical tests are to be prepared as required by ~~Sections Ch 5, 2 Forgings for ship and other structural applications~~ to *Ch 5, 9 Stainless steel forgings*.

■ Section 2

Forgings for ship and other structural applications

2.4 Mechanical tests

2.4.6 For rudder stocks, pintles, and rudder coupling keys and bolts, the minimum specified yield strength is not to be less than 200 N/mm², see *Table 13.2.1 Rudder material factor, k* in *Ch 13, 2 Rudders*.

■ Section 3

Forgings for shafting and machinery

3.1 Scope

3.1.1 Detailed in this Section are the requirements for carbon-manganese steel forgings for shafting and other items of machinery which are not within the scope of ~~Sections Ch 5, 4 Forgings for crankshafts~~ to *Ch 5, 8 Ferritic steel forgings for low temperature service*.

- **Section 4**
Forgings for crankshafts

- 4.3 **Chemical composition**

Table 5.4.3 Mechanical properties for acceptance purposes: alloy steel forgings for crankshafts – Quenched and tempered

Tensile strength N/mm ²	Yield stress N/mm ² minimum	Elongation on 5,65 $\sqrt{S_0}$ % minimum		Hardness Brinell
		Long.	Tang.	
900-1150 1100	690	13	9	260-320

- **Section 6**
Forgings for turbines

- 6.5 **Mechanical tests**

6.5.4 For the tests required by *Ch 5, 6.5 Mechanical tests 6.5.1* to *Ch 5, 6.5 Mechanical tests 6.5.3*, sufficient test material is to be left on each forging and is not to be removed until all heat treatment, including stress relieving, has been completed. In this connection, a thermal stability test does not form part of the heat treatment of a turbine forging. Any excess test material is not to be completely severed from a forging until all the mechanical tests have been completed with satisfactory results.

Chapter 7 Iron Castings

- **Section 1**
General requirements

- 1.1 **Scope**

1.1.2 Where required by the relevant Rules dealing with design and construction, castings are to be manufactured and tested in accordance with *Ch 1 General Requirements* and ~~*Ch 7, 2 Grey iron castings*~~ *Ch 2, Testing Procedures for Metallic Materials*, together with the requirements given in this Section and either *Ch 7, 2 Grey iron castings* for grey iron castings, *Ch 7, 3 Spheroidal or nodular graphite iron castings* for spheroidal graphite iron castings or *Ch 7, 4 Compacted or vermicular graphite iron castings* for compacted graphite iron castings. Castings for crankshafts are additionally to comply with the requirements detailed in *Ch 7, 5 Iron castings for crankshafts*.

Chapter 9 Copper Alloys

- **Section 1**
Castings for propellers

- 1.9 **Rectification of defective castings**

1.9.1 The rectification of defective propeller and propeller blade castings is to be carried out in accordance with the requirements given in *Ch 9, 1.9 Rectification of defective castings 1.9.2* to *Ch 9, 1.9 Rectification of defective castings 1.9.12*.

Chapter 10

Equipment for Mooring and Anchoring

■ Section 1 Anchors

1.9 Proof test of anchors

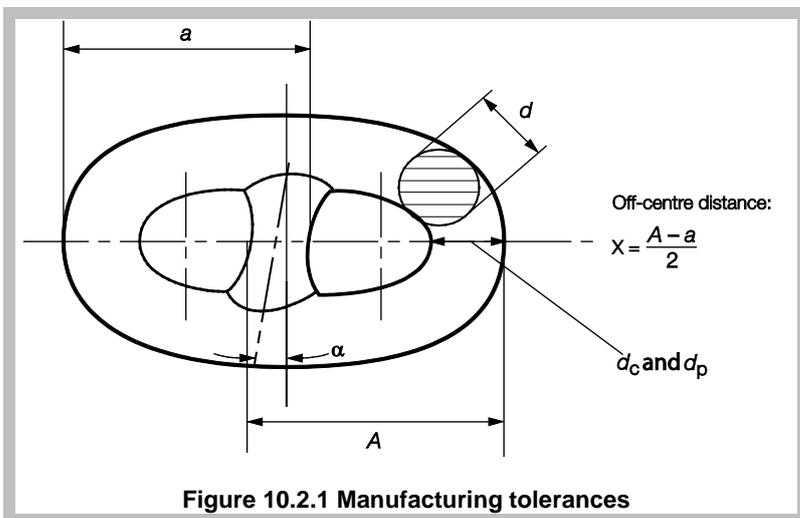
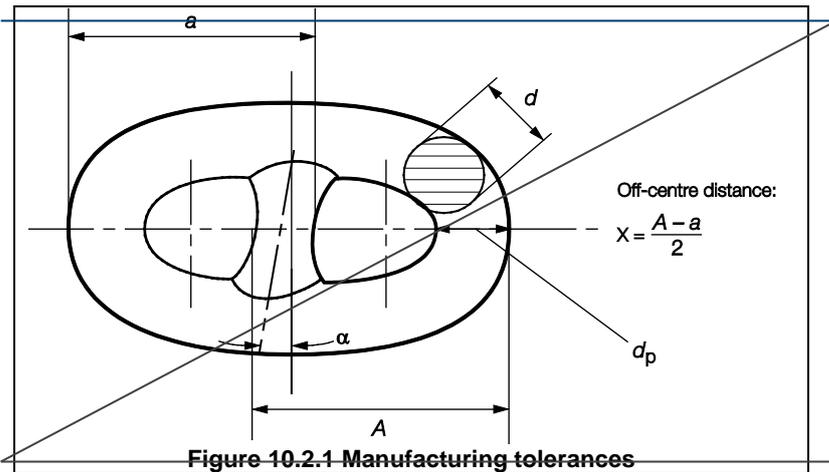
1.9.3 As required by ~~Ch 10, 1.8 Assembly 1.8.1~~ **Ch 10, 1.9 Proof test of anchors**, each anchor is to be subjected to a proof loading test in an approved testing machine and is to withstand the load given in **Table 10.1.1 Proof load tests for anchors** (see *Notes 1 and 2*) for the appropriate mass of the anchor. The proof load is to be applied on the arm or on the palm at a spot which, measured from the extremity of the bill, is one-third of the distance between it and the centre of the crown. For stocked anchors, each arm is to be tested individually. For stockless anchors, both arms are to be tested at the same time, first on one side of the shank, then reversed and tested on the other.

■ Section 2 Stud link chain cables for ships

2.5 Forged chain cables

2.5.3 The completed forgings are to be heat treated in accordance with ~~Ch 10, 2.3 Flash butt welded chain cable~~ **Table 10.2.3 Condition of supply and scope of mechanical tests for finished chain cables and fittings**.

2.11 Dimension inspection



Chapter 11

Approval of Welding Consumables

■ Section 1 General

1.1 Scope

1.1.1 Provision is made in this Chapter for the approval by Lloyd's Register (hereinafter referred to as 'LR') of electrodes, wires, fluxes and other consumables intended for use in the welding of the following types of materials:

- (a) Steel of various grades as represented by Grade A through to Grade FH69, see *Ch 11, 3 Electrodes for manual and gravity welding to Ch 11, 7 Consumables for use in one-side welding with temporary backing materials.*
- (b) A wide range of low-temperature service steels, see *Ch 11, 3 Electrodes for manual and gravity welding to Ch 11, 7 Consumables for use in one-side welding with temporary backing materials.*

■ Section 5 Wires and wire-gas combinations for manual, semi-automatic and automatic welding

5.2 Approval tests for manual and semi-automatic multi-run welding

5.2.3 For Y47 grades, as an alternative to *Figure 11.3.1 Deposited metal test assembly* to *Figure 11.3.4 Fillet weld test assembly*, the thickness of the plate used for the test assembly may be taken as 50 mm.

5.3 Approval tests for multi-run automatic welding

5.3.3 For Y47 grades, as an alternative to *Figure 11.4.1 Deposited metal test assembly* and *Figure 11.4.2 Butt weld test assembly (multiple run technique)*, the thickness of the plate used for the test assembly may be taken as 50 mm.

■ Section 6 Consumables for use in electro-slag and electro-gas welding

6.3 Annual tests

6.3.2 The assembly is to be prepared and tested in accordance with *Ch 11, 6.2 Butt weld test assemblies* except that only the following tests are required:

- (d) Two sets of three Charpy V-notch impact tests; one set with the notch at the centre of the weld (*Figure 11.6.2 Position of Charpy V-notch impact test specimens, (1) In the centre of the weld metal*), and one set with the notch in the weld metal 2 mm from the fusion line (*Figure 11.6.2 Position of Charpy V-notch impact test specimens, (2) In the weld metal, 2 mm from the fusion line*).

■ Section 7 Consumables for use in one-side welding with temporary backing materials

7.2 Approval tests for manual (m), semi-automatic (S) and automatic multi-run (M) techniques

Figure 11.7.1 Butt weld test assembly and specimens for all techniques

Note see *Ch 11, 7.2 Approval tests for manual (m), semi-automatic (S) and automatic multi-run (M) techniques* 7.2.4 *Figure 11.7.2 Position of Charpy V-notch impact tests for one-side automatic welding*

7.2.4 Test specimens are to be prepared as shown in *Figure 11.7.1 Butt weld test assembly and specimens for all techniques* and *Figure 11.7.2 Position of Charpy V-notch impact tests for one-side automatic welding*:

- (e) Two sets of three Charpy impact test specimens positioned and notched in accordance with *Figure 11.7.2 Position of Charpy V-notch impact tests for one-side automatic welding(a)*.

7.3 Approval tests for high heat input automatic (A) techniques

7.3.4 Test specimens as follows are to be prepared as shown in *Figure 11.7.1 Butt weld test assembly and specimens for all techniques* and *Figure 11.7.2 Position of Charpy V-notch impact tests for one-side automatic welding*:

- (e) From assembly 20 to 25 mm thick, two sets of three impact test specimens positioned and notched in accordance with *Figure 11.7.2 Position of Charpy V-notch impact tests for one-side automatic welding(a)*.
- (f) From assembly 35 to 40 mm thick, three sets of three impact test specimens positioned and notched in accordance with *Figure 11.7.2 Position of Charpy V-notch impact tests for one-side automatic welding(b)*.
- (g) From assembly of thickness 50 mm or more, three sets of three impact test specimens positioned and notched in accordance with *Figure 11.7.2 Position of Charpy V-notch impact tests for one-side automatic welding(b)*. The second set positioned in the mid-thickness of test assembly.

Chapter 12 Welding Qualifications

■ Section 2 Welding procedure qualification tests for steels

2.3 Steel test assemblies

2.3.3 Typical test assemblies are shown in *Figure 12.2.1 Butt weld test assembly in plate* to ~~Ch 12, 2.3 Steel test assemblies 2.3.3~~ *Figure 12.2.3 Fillet weld test assembly in plate*. These are a minimum requirement to permit the removal of all the necessary mechanical test specimens. Where impact tests or other toughness tests are required, the total width is not to be less than 8 times the material thickness of the thicker material being joined.

2.3.6 The test assembly is to be placed in one of the welding positions shown in *Figure 12.2.4 Plate butt weld test positions* to ~~Ch 12, 2.3 Steel test assemblies 2.3.6~~ *Figure 12.2.7 Pipe fillet weld test positions*, as specified in the test Welding Procedure Specification (pWPS) and the specified level of preheat applied prior to the start of welding.

■ Section 3 Specific requirements for stainless steels

3.3 Duplex stainless steels

3.3.4 Where the test weld is between a grade of carbon steel and duplex stainless steel, the test requirements of *Ch 12, 3.3 Duplex stainless steels 3.3.3(a)* and *Ch 12, 3.3 Duplex stainless steels 3.3.3(c)* are not required and the ferrite content of the weld and the duplex heat affected zone are to be reported for information.

■ Section 5 Welder qualification tests

5.2 Welder qualification test assemblies

5.2.3 The inspection length of the test weld is to be such as to permit the removal of all the necessary test specimens and for plate tests, but in no case is to be less than 250 mm. The test assembly is to be set in one of the positions as shown in *Figure 12.2.4 Plate butt weld test positions* to *Figure 12.2.7 Pipe fillet weld test positions* appropriate to the welding positions to be approved.

5.3 Examination and testing

5.3.7 When bend tests are required, 2 root and 2 face bends are to be tested and where the test thickness exceeds 12 mm, these may be substituted by 4 side bends specimens. The diameter of former to be used is to be in accordance with that specified for welding procedure qualification testing given in *Ch 12, 2.7 Destructive tests for steel butt welds 2.7.6(a)*.

Chapter 13

Requirements for Welded Construction

■ Section 1 General welding requirements

1.3 Materials

1.3.2 Materials are to be supplied and certified in accordance with the requirements of *Ch 1 General Requirements* to *Ch 10 Equipment for Mooring and Anchoring* of these Rules.

1.4 Requirements for manufacture and workmanship

1.4.1 The welding workshops are to be assessed by the Surveyor for their capability to produce work of the required quality in accordance with the requirements specified for the type of construction, see *Ch 13, 2 Specific requirements for ship hull structure and machinery* to *Ch 13, 5 Specific requirements for pressure piping*.

1.13 Rectification of material defects

1.13.4 Surface defects, which cannot be repaired by the above method, may be repaired by welding where permitted by *Ch 3 Rolled Steel Plates, Strip, Sections and Bars* to *Ch 9 Copper Alloys*. Such repairs are to be performed in accordance with the requirements of this Section and those specified in *Ch 3 Rolled Steel Plates, Strip, Sections and Bars* to *Ch 9 Copper Alloys*.

■ Section 2 Specific requirements for ship hull structure and machinery

2.9 Fillet welds

2.9.3 The calculated fillet leg length may be reduced by 20 per cent, provided that in addition to the requirements of *Ch 13, 2.9 Fillet welds 2.9.2(a)* and *Ch 13, 2.9 Fillet welds 2.9.2(b)*, the manufacturer is able to consistently meet the following additional requirements:

■ Section 4 Specific requirements for fusion welded pressure vessels

4.8 Mechanical requirements

Figure 13.4.2 Routine weld tests – Test specimens for Class 2/2 and Class 3

Note 4. Charpy V-notch impact test specimens (if required by *Ch 13, 4.2 Cutting and forming of shells and heads 4.2.5 Table 13.4.1 Impact test requirements*).

4.8.3 **Longitudinal tensile test for weld metal.** An all-weld metal longitudinal tensile test is required. For thicknesses in excess of 20 mm, where more than one welding process or type of consumable has been used to complete the joint, additional longitudinal tests are required from the respective area of the weld. This does not apply to the welding process or consumables used solely to deposit the root weld. Specimens are to be tested in accordance with the following requirements:

- The diameter and gauge length of the test specimen is to be in accordance with *Ch 11, 2.1 Dimensions of test specimens 2.1.1*.
- For carbon and carbon-manganese steels the tensile strength of the weld metal is to be not less than the minimum specified for the plate material and not more than 145 N/mm² above this value. The percentage elongation, *A*, is to be not less than that given by:

$$A = (980 - R) / 21,6 \text{ but not less than 80 per cent of the minimum elongation specified for the plate}$$

where

= *R* is the tensile strength, in N/mm², obtained from the all weld metal tensile tests.

- For other materials the tensile strength and percentage elongation is not to be less than that specified for the base materials welded.

4.13 Extent of NDE for Class 1 pressure vessels

4.13.4 In addition to the acceptance limits stated in *Table 13.2.4 Acceptance criteria for visual testing, magnetic particle and liquid penetrant testing* to *Table 13.2.6 Acceptance criteria for ultrasonic testing*, no cracks, lack of fusion, or lack of penetration is permitted.

■ **Section 5**
Specific requirements for pressure piping

5.5 Non-destructive examination

5.5.3 Butt welds in Class II pipes are to be subjected to at least 10 per cent random volumetric inspections when the outside diameter is ~~greater than 100 mm~~ 100 mm and greater.

5.6 Repairs to pipe welds

5.6.1 Where non-destructive examinations reveal unacceptable defects in a weld, the defects are to be removed and repaired in accordance with ~~Ch 13, 1.1 Scope~~ Ch 13, 1.15 Rectification of welds defects. Completed repairs are to be shown by further non-destructive examination to have eliminated the defects.

Chapter 14

Plastics Materials and other non-Metallic Materials

■ **Section 1**
General requirements

1.1 Scope

1.1.1 Provision is made in this Chapter for the manufacture and testing of ~~plastics~~ plastic pipes, together with approval requirements for base materials used in the construction or repair of composite vessels, other marine structures, piping and any associated machinery components and fittings which are to be certified or are intended for classification.

1.1.5 Specific material requirements relating to the design and manufacture of ~~plastics~~ plastic pipes and fittings are indicated in Ch 14, 4 Plastic pipes and fittings, with the material requirements for hull structures contained in Ch 14, 5 Control of material quality for composite construction.

■ **Section 2**
Tests on polymers, resins, reinforcements and associated materials

2.4 Reinforcements

2.4.6 Additionally, tests in Ch 14, 2.4 Reinforcements 2.4.4 (c) and (f) are to be repeated, in one direction only, after immersion in fresh water at 35°C for 28 days with the exception of Ch 14, 2.4 Reinforcements 2.4.4(k)(j).

2.5 Reinforced thermoplastic polymers

2.5.1 Thermoplastic polymers intended for use with reinforcements are to be tested in accordance with Ch 14, 2.2 Thermoplastic polymers 2.2.1 to Ch 14, 2.2 Thermoplastic polymers 2.2.3.

2.6 Reinforced thermosetting resins

2.6.1 Thermosetting resins intended for use with reinforcements are to be tested in accordance with Ch 14, 2.3 Thermosetting resins 2.3.1 to Ch 14, 2.3 Thermosetting resins 2.3.4.

■ **Section 3**
Testing procedures

3.8 Structural core materials

3.8.5 The following requirements apply to synthetic felt type materials:

- (d) The specified tests on the laminate (see *Ch 14, 2.10 Synthetic felt type materials with or without microspheres 2.10.1 2.10.3*) are to be conducted according to the requirements of *Table 14.3.3 Tests on laminate specimens*.

■ *Section 4* **Plastic pipes and fittings**

4.7 Testing

4.7.5 Where the resin manufacturer mixes batches, both the original batches and the mixed batch are to be tested in accordance with *Ch 14, 4.7 Testing 4.7.1 to Ch 14, 4.7 Testing 4.7.3* as appropriate. The mixed batch is then to be given a unique batch number.

■ *Section 5* **Control of material quality for composite construction**

5.1 Scope

5.1.2 For composite craft built under the Rules, the survey of materials is to be conducted in accordance with the requirements of *Ch 14, 1 General requirements to Ch 14, 3 Testing procedures* and this Section.

5.7 Material testing

5.7.1 Where so required, the material manufacturer is to provide the purchaser with certificates of conformity for each batch of material supplied, indicating the relevant values specified in *Ch 14, 5.7 Material testing 5.7.4 to Ch 14, 5.7 Materials testing 5.7.8*. These values are to comply with those specified by the approved construction documentation.

5.7.2 Where the Builders do not conduct verification testing of the information indicated in *Ch 14, 5.7 Material testing 5.7.4 to Ch 14, 5.7 Materials testing 5.7.8*, they are to ensure that copies of all certificates of conformity (which must indicate the actual tested values) are obtained for all batches of materials received, and maintain accurate records. The Surveyor may at any time select a sample of a material for testing by an independent, where applicable, source and should such tests result in the material failing to meet the specification, then that batch will be rejected.

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