



RUSSIAN MARITIME REGISTER OF SHIPS

HEAD OFFICE

CIRCULAR LETTER

No. 314-53-1026c

dated

06.07.2017

Re:

amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E in connection with coming into force of IACS Unified Requirement (UR) W22 (Rev.6 June 2016) "Offshore Mooring Chain"

Item of technical supervision:

hull structural steel

Implementation 01.07.2017

Valid: till -

Validity period extended till

Cancels / amends / supplements Circular Letter No. - dated -

Number of pages: 1+17

Appendices: amendments to the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E

Director General

K.G. Palnikov

Amends Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E

We hereby inform that in connection with coming into force on 1 July 2017 of a new revision of IACS UR W22 (Rev.6 June 2016) "Offshore Mooring Chain", the Rules for the Classification and Construction of Sea-Going Ships, 2017, ND No. 2-020101-095-E shall be amended with regard to the requirements applied to the materials, design, manufacture and testing of mooring chain and accessories intended to be used for mobile offshore drilling units (MODU) and fixed offshore platforms (FOP) as specified in the Appendix to the Circular Letter. The above amendments shall be implemented on MODU and FOP contracted for construction on or after 1 July 2017.

The original text of IACS UR W22 (Rev.6 June 2016) is posted on the RS internal website in the Section "External Normative Documents" and on the IACS official website www.iacs.org.uk

The above amendments will be introduced in the Rules for the Classification and Construction of Sea-Going Ships at republication.

It is necessary to do the following:

1. Apply provisions of the Circular Letter during review and approval of technical documentation.
2. Bring the content of the Circular Letter to the notice of the RS surveyors, interested organizations and persons in the area of the RS Branch Offices' activity.

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**RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS,
2017, ND No. 2-020101-095-E**

PART XIII. MATERIALS

7.2 MOORING CHAIN AND ACCESSORIES

Para 7.2.1.1. The third paragraph shall be amended to read:

“The accessories covered are common stud and studless links, connecting common links (splice links), enlarged links, end links, detachable connecting links (shackles), end shackles, subsea connectors, swivels and swivel shackles.”.

Para 7.2.1.2. The third paragraph shall be amended to read:

“Each grade shall be individually approved. Approval for a higher grade does not constitute approval of a lower grade. If it is demonstrated that the higher and lower grades are produced to the same manufacturing procedure using the same chemistry and heat treatment, consideration will be given to qualification of a lower grade by a higher. The parameters applied during qualification shall not be modified during production under the Register technical supervision.”.

Para 7.2.1.3.2. The third paragraph shall be amended to read:

“flash welding including current, force, time and dimensional variables as well as control and recording of parameters, maintenance procedure and programme for welding machine;”.

The para shall be supplemented with the following text:

“the manufacturer's procedure for removing and replacing defective links without heat treatment of the entire chain.”.

Paras 7.2.1.3.3 and 7.2.1.3.4 shall be amended to read:

“7.2.1.3.3 For initial approval *CTOD* tests shall be carried out on the particular mooring chain material. *CTOD* tests shall be performed in accordance with a recognized standard such as BS 7448, Part 1 and BS EN ISO 15653:2010.

The *CTOD* specimen shall be a standard 2 x 1 single edge notched bend specimen, test location as shown in Fig. 7.2.1.3.3. The notch of the *CTOD* specimen shall be located as close to the surface as practicable. The minimum cross section of the test specimen shall be 50 x 25 mm for chain diameters less than 120 mm, and 80 x 40 mm

for diameters 120 mm and above. *CTOD* specimens shall be taken from both the side of the link containing the weld and from the opposite side. Three links shall be selected for testing, a total of six *CTOD* specimens. The tests shall be taken at $-20\text{ }^{\circ}\text{C}$ and the lowest *CTOD* of each set of 3 specimens shall meet the minimum values indicated in Table 7.2.1.3.3.

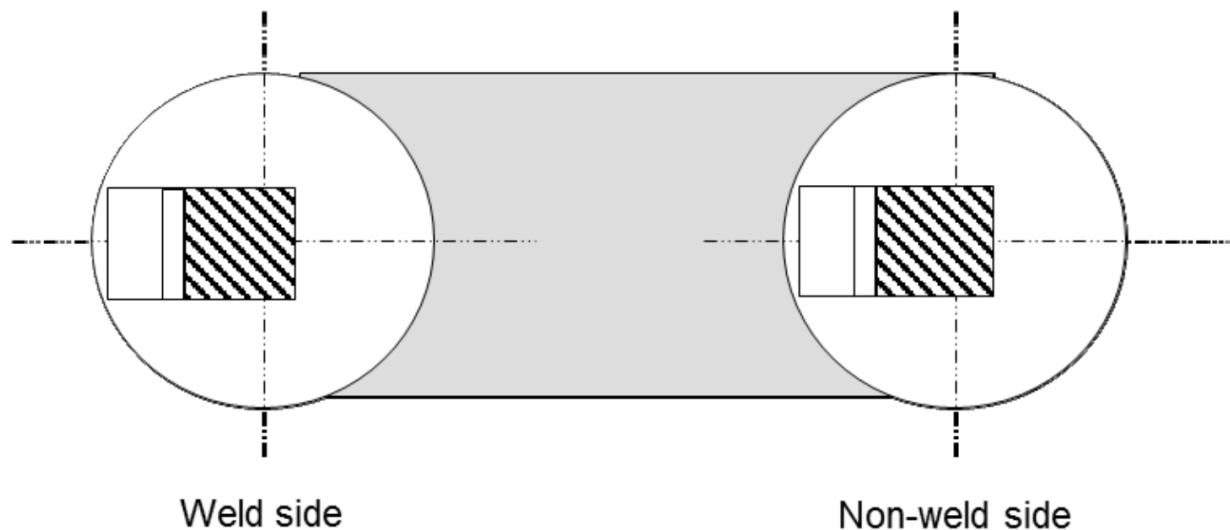


Fig. 7.2.1.3.3

7.2.1.3.4 Calibration of furnaces shall be verified by measurement and recording of a calibration specimen with dimensions equivalent to the maximum size of link manufactured. The manufacturer shall submit a procedure for furnace temperature surveys which shall include the following requirements:

- .1 the temperature uniformity of furnaces shall be surveyed whenever approval of manufacturer is requested and at least annually during normal operating conditions;
- .2 furnaces shall be checked by conveying a monitoring link instrumented with two thermocouples through the furnaces at representative travel speed;
- .3 one thermocouple shall be attached to the surface of the straight part and one thermocouple shall be imbedded in a drilled hole located at the mid thickness position of the straight part of the calibration block;
- .4 the time-temperature curves shall show that the temperatures throughout the cross section and the soaking times are within specified limits as given in the heat treatment procedure.”.

Paras 7.2.1.5.2 and 7.2.1.5.3 shall be amended to read:

“7.2.1.5.2 The Recognition Certificate for Manufacturer may be issued to a rolled products supplier only after successful testing of the completed chain. Each grade shall be individually approved. Approval for a higher grade does not constitute approval of a lower grade. If it is demonstrated that the higher and lower grades are produced to the same manufacturing procedure using the same chemistry and heat treatment, consideration will be given to qualification of a lower grade by a higher. The parameters applied during qualification shall not be modified during production under the Register

technical supervision. The Recognition Certificate for Manufacturer will normally be limited up to the maximum diameter equal to that of the chain diameter tested. The rolling reduction ratio shall be recorded in the Recognition Certificate for Manufacturer and shall be at least 5:1 for R3, R3S, R4, R4S and R5. The rolling reduction ratio used in production can be higher, but shall not be lower than that qualified.

7.2.1.5.3 The steelmaker shall submit a specification of the chemical composition of the bar material, which shall be approved by the Register and by the chain manufacturer. The steel maker shall confirm by analysis and testing that the specification is met. For grade R4, R4S and R5 chain the steel shall contain a minimum of 0,20 per cent molybdenum.”.

Paras 7.2.1.6.2 and 7.2.1.6.3 shall be amended to read:

“7.2.1.6.2 The Recognition Certificate for Manufacturer may be issued to a supplier of forgings and castings only after the successful testing of the completed accessory. Approval for a higher grade does not constitute approval of a lower grade. If it is demonstrated that the higher and lower grades are produced to the same manufacturing procedure using the same steel specification, supplier and heat treatment, lower grade may be approved by a higher.

The Recognition Certificate for Manufacturer shall normally be limited to the type of accessory and the designated mooring grade of material up to the maximum diameter or thickness equal to that of the completed accessory used for qualification unless otherwise agreed by the Register. However for the different accessories that have the same geometry, the tests for initial approval shall be carried out on the one having the lowest reduction ratio. Qualification of accessory pins to maximum diameters shall also be specified in the Recognition Certificate for Manufacturer..

7.2.1.6.3 Forgings.

Forgings shall have wrought microstructure and the minimum reduction ratio shall be 3 to 1. The forging reduction ratio, used in the qualification tests, from cast ingot/slab to forged component shall be recorded. The forging reduction ratio used in production can be higher, but shall not be lower than that qualified. The degree of upsetting during qualification shall be recorded and maintained during production. Heat cycling during forging and reheating shall be monitored by the manufacturer and recorded in the forging documentation. The manufacturer shall have a maintenance procedure and schedule for dies and tooling which shall be submitted to the Register.“.

Paras 7.2.1.6.6 and 7.2.1.6.7 shall be amended to read:

“7.2.1.6.6 For initial approval *CTOD* tests shall be carried out on the particular mooring grade of material. Three *CTOD* tests shall be carried out in accordance with a recognized standard such as BS 7448, Part 1 & BS EN ISO 15653:2010. For rectangular accessories, the *CTOD* test piece shall be a standard 2 x 1 single edge notched bend specimen of thickness equal to full thickness of material to be tested. For circular geometries, the minimum cross section of the test specimen shall be 50 x 25 mm for accessory diameters less than 120 mm, and 80 x 40 mm for diameters

120 mm and above. The notch of the *CTOD* specimen shall be located as close to the surface as practicable. *CTOD* specimens shall be taken from both the side of the link containing the weld and from the opposite side. Three links shall be selected for testing, a total of six *CTOD* specimens. The tests shall be taken at $-20\text{ }^{\circ}\text{C}$ and the results submitted for review. The minimum value of each set of three specimens shall at least meet the requirements as indicated in Table 7.2.1.3.3 for the base metal.

The geometry of accessories can vary. Fig. 7.2.1.6.6 shows the *CTOD* location for circular and rectangular cross sections such as those of the D-shackle and accessories fabricated from rectangular sections. The orientation of the specimen shall consider the direction of the grain flow. Fig. 7.2.1.6.6, b shows two possible sampling positions for *CTOD* test specimens with notch orientation for rectangular type accessories. The grain flow is considered in the longitudinal direction X.

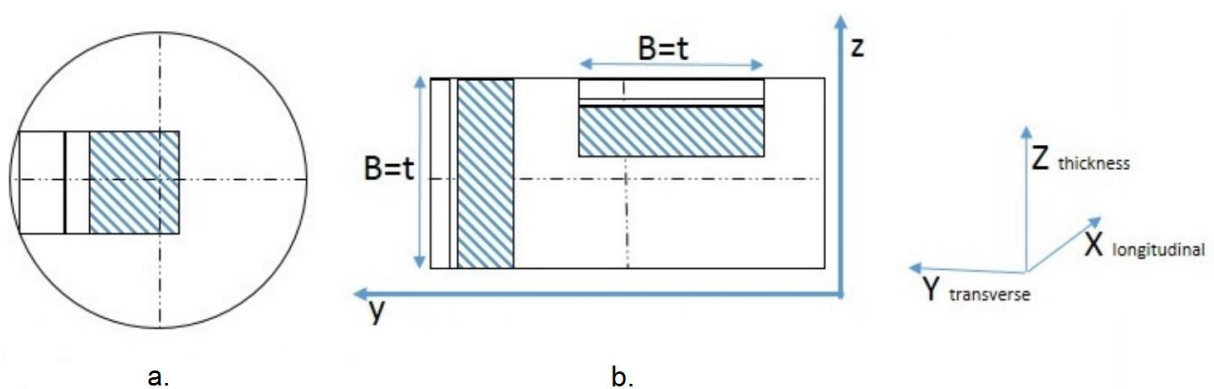


Fig. 7.2.1.6.6

Location of *CTOD* test specimens:

a – circular type accessory;

b – rectangular type accessory

7.2.1.6.7 Calibration of furnaces shall be verified by measurement and recording of a calibration specimen with dimensions equivalent to the maximum size of link manufactured. Thermocouples shall be placed both on the surface and in a drilled hole located to the mid thickness position of the calibration block. The furnace dimensions shall be such as to allow the whole furnace charge to be uniformly heated to the necessary temperature. Temperature uniformity surveys of heat treatment furnaces for forged and cast components shall be carried out according to API Spec 6A/ISO 10423, Annex M or ASTM A991. The initial survey shall be carried out with maximum charge (load) in the furnace. Subsequent surveys shall be carried out annually and may be carried out with no furnace charge.

The quench bath maximum temperature and the maximum heat treatment transfer times from furnace to quench shall be established and documented. During production the established quenching parameters shall be followed and records shall be maintained of bath temperatures and transfer times.”.

Paras 7.2.2.2.1.1 and 7.2.2.2.1.2 shall be amended to read:

“7.2.2.2.1.1 The steels shall be manufactured by basic oxygen, electric furnace or such other process approved by the Register. All steels shall be killed and fine grain treated. The austenitic grain size for R3, R3S and R4 shall be 6 or finer (refer to ASTM E112, GOST 5639 or equivalent grain size index in accordance to ISO 643). Measurements for circular sections shall be taken at 1/3 radius.

7.2.2.2.1.2 Steel for bars intended for R4S and R5 chain shall be vacuum degassed. The austenitic grain size shall be 6 or finer (refer to ASTM E112, GOST 5639 or equivalent grain size index in accordance to ISO 643). Measurements for circular sections shall be taken at 1/3 radius.”.

Para 7.2.2.2.1.3.1 shall be amended to read:

“.1 each heat shall be examined for non-metallic inclusions. The level of micro inclusions shall be quantified and assessed in accordance with the national and international standards; to be sure inclusion levels are acceptable for the final product;”.

Para 7.2.2.2.3.2 shall be amended to read:

“7.2.2.2.3.2 Each batch of grade R3S, R4, R4S and R5 shall be tested for hydrogen embrittlement. In case of continuous casting, test specimens representing both the beginning and the end of the charge shall be taken. In case of ingot casting, test samples representing two different ingots shall be taken.”.

Fig. 7.2.2.2.3.3 shall be amended:

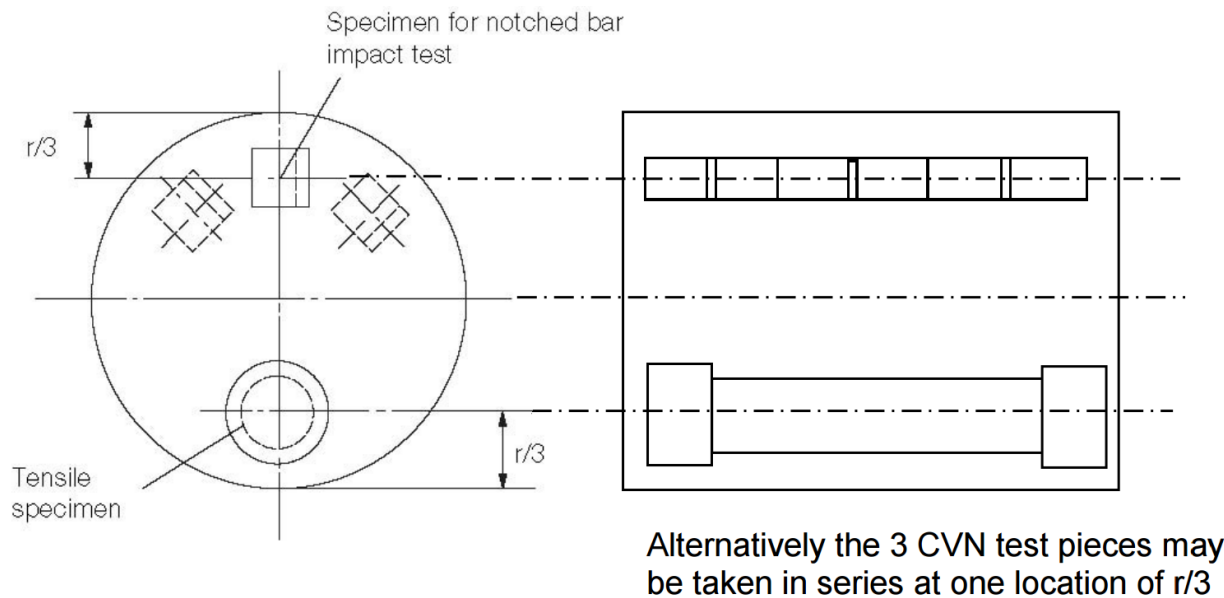


Fig. 7.2.2.2.3.3

Location of specimens.
Steel bar, forging, casting

Table 7.2.2.2.4.1. In the first column the value “210” shall be replaced with “222”.

Paras 7.2.2.2.5.1 – 7.2.2.2.5.4 shall be amended to read:

“7.2.2.2.5.1 Non-destructive testing shall be performed in accordance with the standards recognized by the Register such as those indicated below or equivalent:

ASTM E1444 and ISO 9934 – magnetic particle testing (MT) of bars;

JIS Z2319 – magnetic leakage flux testing (MLFT);

ISO 15549 – eddy current testing (ET) of bars.

Non-destructive testing procedures, together with rejection/acceptance criteria shall be submitted to the Register for agreement.

7.2.2.2.5.2 Manufacturers shall prepare written procedures for non-destructive testing. Non-destructive testing personnel shall be qualified and certified according to ISO 9712, ACCP or equivalent. Personnel qualification to an employer or responsible agency based qualification scheme as SNT-TC-1A may be accepted if the employer's written practice is reviewed and found acceptable and the level III is ASNT level III, ISO 9712 level III or ACCP professional level III and certified in the applicable method. Non-destructive testing operators shall be qualified to at least level II.

7.2.2.2.5.3 The manufacturer shall ensure that 100 per cent of bar material intended for either chain or fittings is subjected to ultrasonic testing at an appropriate stage of the manufacture to procedures approved by the Register and to the acceptance criteria required. The bars shall be free of pipe, cracks and flakes. If the end length of the delivered bars is not subjected to ultrasonic testing then it shall be agreed between the bar supplier and the chain manufacturer of what length of bar shall be removed from the ends. The details shall be documented in the approval of each bar supplier. Phased array ultrasonic testing procedures may be applied, subject to approval by the Register.

7.2.2.2.5.4 100 per cent of the bar material shall be tested by magnetic particle (MT) or eddy current (ET) or Magnetic magnetic leakage flux testing (MLFT) methods. The bars shall be free of injurious surface imperfections such as seams, laps and rolled-in mill scale. Provided that their depth is not greater than 1 per cent of the bar diameter, longitudinal discontinuities may be removed by grinding and blending to a smooth contour.

All bars supplied in a machined (peeled) condition shall be 100 per cent visually inspected. The Register shall also require: 10 per cent inspected with magnetic particle testing (MT) or eddy current testing (ET) or magnetic leakage flux testing (MLFT), for longitudinal imperfections. The maximum depth of peeling shall be agreed and documented in the approval of each supplier by the Register.”.

Para 7.2.2.2.5.6 shall be introduced reading as follows:

“7.2.2.2.5.6 Weld repair of bars is not permitted.”.

Paras 7.2.2.3.1.1 and 7.2.2.3.1.2 shall be amended to read:

“7.2.2.3.1.1 Forged steels used for the manufacture of accessories shall be in compliance with the requirements of the Register-approved documentation with specifications and test reports. Steel shall be manufactured by basic oxygen, electric furnace or such other process as may be specially approved by the Register. All steel shall be killed and fine grain treated. The austenitic grain size for R3, R3S and R4 shall be 6 or finer (refer to ASTM E112, GOST 5639 or equivalent grain size index in accordance to ISO 643). Measurements for circular sections shall be taken at 1/3 radius. Measurements for non-circular sections shall be taken at 1/4 t .

7.2.2.3.1.2 Steel for forgings intended for R4S and R5 chain shall be vacuum degassed. The austenitic grain size shall be 6 or finer (refer to ASTM E112, GOST 5639 or equivalent grain size index in accordance to ISO 643). Measurements for circular sections shall be taken at 1/3 radius. Measurements for non-circular sections shall be taken at 1/4 t .”.

Para 7.2.2.3.1.3.1 shall be amended to read:

“.1 each heat shall be examined for non-metallic inclusions. The level of micro inclusions shall be quantified and assessed in accordance with the recognized standards; to be sure inclusion levels are acceptable for the final product;”.

Para 7.2.2.3.1.3.3 shall be amended to read:

“.3 hardenability data, according to ASTM A255 or national equivalent, shall be provided with each heat.”.

Paras 7.2.2.3.5.2, 7.2.2.3.5.2.1 – 7.2.2.3.5.2.5 shall be introduced reading as follows:

“7.2.2.3.5.2 Each heat of grade R3S, R4, R4S and R5 shall be tested for hydrogen embrittlement. In case of continuous casting, test samples representing both the beginning and the end of the charge shall be taken. In case of ingot casting, test samples representing two different ingots shall be taken.

7.2.2.3.5.2.1 Two tensile test specimens shall be taken from the central region of forged material which has been subjected to the heat treatment cycle intended to be used in production. A specimen with a diameter of 20 mm is preferred (consideration will be given to a diameter of 14 mm).

7.2.2.3.5.2.2 One of the specimens shall be tested within a maximum of 3 h after machining (for a 14 mm diameter specimen, the time limit is 1½ h). Where this is not possible, the specimen shall be immediately cooled to – 60 °C after machining and kept at that temperature for a maximum period of 5 days.

7.2.2.3.5.2.3 The second specimen shall be tested after baking at 250 °C for 4 h, alternatively 2 h for 14 mm diameter specimen.

7.2.2.3.5.2.4 A slow strain rate < 0,0003 s⁻¹ shall be used during the entire test, until fracture occurs (this is approximately 10 min for the 20 mm diameter specimen). Tensile strength, elongation and reduction of area shall be reported.

7.2.2.3.5.2.5 The acceptance requirement for the test is $Z_1/Z_2 \geq 0,85$, where Z_1 is reduction of area without baking, Z_2 is reduction of area after baking.

If the requirement $Z_1/Z_2 \geq 0,85$ is not achieved, the bar material may be subjected to a hydrogen degassing treatment after agreement with the Register. New tests shall be performed after degassing.”.

Para 7.2.2.3.6 shall be amended to read:

“7.2.2.3.6 Non-destructive testing and repair.”.

Paras 7.2.2.3.6.1 – 7.2.2.3.6.3 shall be amended to read:

“7.2.2.3.6.1 Non-destructive testing shall be performed in accordance with the standards recognized by the Register such as those indicated below or equivalent:

EN 10228-1, ASTM A275 and ISO 9934 – magnetic particle testing (MT) of forgings: using wet continuous magnetization technique;

EN 10228-3, ASTM A388 and ISO 13588 – ultrasonic testing (UT) of forgings.

7.2.2.3.6.2 Manufacturers shall prepare written procedures for non-destructive testing. Non-destructive testing personnel shall be qualified and certified according to ISO 9712, ACCP or equivalent. Personnel qualification to an employer or responsible agency based qualification scheme as SNT-TC-1A may be accepted if the employer's written practice is reviewed and found acceptable and the level III is ASNT level III, ISO 9712 level III or ACCP professional level III and certified in the applicable method. NDT operators shall be qualified to at least level II.

7.2.2.3.6.3 The forgings shall be subjected to 100 per cent ultrasonic testing at an appropriate stage of the manufacture and in compliance with the specification approved by the Register.”.

Paras 7.2.2.3.6.4 and 7.2.2.3.6.5 shall be introduced reading as follows:

“7.2.2.3.6.4 Defects on non-machined surfaces may be removed by grinding to a depth of 5 per cent of the nominal diameter. Grinding is not permitted on machined surfaces, except for slight inspection grinding on plane surfaces to a maximum depth of 0,8 mm in order to investigate spurious indications.

7.2.2.3.6.5 Welding repairs are not permitted.”.

Paras 7.2.2.4.1.1 – 7.2.2.4.1.3 shall be amended to read:

“7.2.2.4.1.1 Cast steel used for the manufacture of accessories shall be in compliance with the requirements of the Register-approved documentation with specifications and test reports. Steel shall be manufactured by basic oxygen, electric furnace or such other process as may be specially approved by the Register. All steel shall be killed and fine grain treated. The austenitic grain size for R3, R3S and R4 shall be 6 or finer (refer to ASTM E112, GOST 5639 or equivalent grain size index in accordance to ISO 643).

Measurements for circular sections shall be taken at 1/3 radius. Measurements for non-circular sections are to be taken at 1/4t.

7.2.2.4.1.2 Steel for castings intended for R4S and R5 accessories shall be vacuum degassed. The austenitic grain size shall be 6 or finer (refer to ASTM E112, GOST 5639 or equivalent grain size index in accordance to ISO 643). Measurements for circular sections shall be taken at 1/3 radius. Measurements for non-circular sections shall be taken at 1/4t.

7.2.2.4.1.3 For steel intended for R4S and R5 accessories the following information shall be supplied by the steel manufacturer to the accessory manufacturer and the results included in the accessory documentation:

- .1 each heat shall be examined for non-metallic inclusions. The level of micro inclusions shall be quantified and assessed in accordance to the recognized national and international standards; to be sure inclusion levels are acceptable for the final product;
- .2 a sample from each heat shall be macro etched according to ASTM E381 or national equivalent, to be sure there is no injurious segregation or porosity;
- .3 hardenability data, according to ASTM A255 or national equivalent, shall be supplied with each heat.”.

Para 7.2.2.4.6 shall be amended to read:

“**7.2.2.4.6** Non-destructive testing and repair.”.

Paras 7.2.2.4.6.1 – 7.2.2.4.6.3 shall be amended to read:

“**7.2.2.4.6.1** Non-destructive testing shall be performed in accordance with the standards recognized by the Register such as those indicated below, or equivalent:

ASTM E709 – magnetic particle testing (MT) of castings, using wet continuous magnetization technique;

ASTM A609, ISO 13588 – ultrasonic testing (UT) of castings.

7.2.2.4.6.2 Manufacturer shall prepare written procedures for non-destructive testing. Non-destructive testing personnel shall be qualified and certified according to ISO 9712, ACCP or equivalent. Personnel qualification to an employer or responsible agency based qualification scheme as SNT-TC-1A may be accepted if the employer's written practice is reviewed and found acceptable and the level III is ASNT level III, ISO 9712 level III or ACCP professional level III and certified in the applicable method. Non-destructive testing operators shall be qualified to at least level II.

7.2.2.4.6.3 The castings shall be subjected to 100 per cent ultrasonic testing at an appropriate stage of the manufacture and in compliance with the specification approved by the Register.”.

Paras 7.2.2.4.6.4 – 7.2.2.4.6.9 shall be introduced reading as follows:

“**7.2.2.4.6.4** Defects on non-machined surfaces may be removed by grinding to a depth of 5 per cent of the nominal diameter. Grinding is not permitted on machined surfaces,

except for slight inspection grinding on plane surfaces to a maximum depth of 0,8 mm in order to investigate spurious indications.

7.2.2.4.6.5 Where the repair entails removal of more than 5 per cent of the diameter or thickness, the defective area shall be repaired by welding. The excavations shall be suitably shaped to allow good access for welding. The resulting grooves shall be subsequently ground smooth and complete elimination of the defective material shall be verified by non-destructive testing.

7.2.2.4.6.6 Weld repairs are classified as major or minor. A weld repair is considered major when the depth of the groove prepared for welding exceeds 25 per cent of the diameter or thickness or 25 mm, whichever is smaller. All other weld repairs are considered minor.

7.2.2.4.6.7 Major weld repairs require approval before the repair is commenced. Proposals for major repairs shall be accompanied by sketches or photographs showing the extent and positions of the repairs. A grain refining heat treatment shall be given to the whole casting prior to major repairs. A post weld heat treatment or repeat of original heat treatment of castings shall be carried out.

7.2.2.4.6.8 Minor and major weld repairs shall be recorded on sketches or photographs showing the extent and positions of the repairs.

7.2.2.4.6.9 All weld repairs shall be done by qualified welders using qualified procedures. Welders shall be qualified according to ISO 9606, ASME IX, ASTM A488 or equivalent. Procedures shall be qualified according to ISO 15614, ASME IX, ASTM A488 or equivalent with the following additional requirements: Charpy V notch impact tests with notch locations in weld metal, fusion line and heat affected zone + 2 mm and + 5 mm from fusion line, respectively. Test results shall meet the requirements of the Rules specified for the parent metal.”.

Para 7.2.3.2.1.1 shall be amended to read:

“**7.2.3.2.1.1** Offshore mooring chains shall be manufactured in continuous lengths by flash butt welding and shall be heat treated in a continuous furnace. Batch heat treatment is not permitted, except in special circumstances where short lengths of chain are delivered, such as chafing chain.”.

Paras 7.2.3.2.3.1 and 7.2.3.2.3.2 shall be amended to read:

“**7.2.3.2.3.1** Bars for links shall be heated by electric resistance, induction or in a furnace.

7.2.3.2.3.2 For electric resistance heating, the heating phase shall be controlled by an optical heat sensor. The controller shall be checked at least once every 8 h and records made.”.

Para 7.2.3.2.3.3 shall be introduced reading as follows:

“7.2.3.2.3.3 For furnace heating, the heat shall be controlled and the temperature continuously recorded using thermocouples in close proximity to the bars. The controls shall be checked at least once every 8 h and records made.”.

Para 7.2.3.2.5.4 shall be introduced reading as follows:

“7.2.3.2.5.4 Grain determination shall be made for the final product. The austenitic grain size for R3, R3S, R4, R4S and R5 shall be 6 or finer (refer to ASTM E112 or equivalent grain size index in accordance to ISO 643). Measurements for circular sections shall be taken at surface, 1/3 radius and centre for the base material, HAZ and weld.”.

Paras 7.2.3.2.9.2.1 and 7.2.3.2.9.2.2 shall be amended to read:

“.1 the negative tolerance on the nominal diameter measured at the crown:

- up to 40 mm nominal diameter – 1 mm;
- over 40 up to 84 mm nominal diameter – 2 mm;
- over 84 up to 122 mm nominal diameter – 3 mm;
- over 122 up to 152 mm nominal diameter – 4 mm;
- over 152 up to 184 mm nominal diameter – 6 mm;
- over 184 up to 222 mm nominal diameter – 7,5 mm.

Note. The cross sectional area at the crown shall have no negative tolerance. For diameters of 20 mm or greater, the plus tolerance may be up to 5 percent of the nominal diameter. For diameters less than 20 mm the plus tolerance shall be agreed with the Register at the time of approval.

The cross sectional area at the crown shall be calculated using the average of the diameters with negative tolerance and plus tolerance, measurements shall be taken from at least 2 locations approximately 90° apart.

.2 diameter measured at locations other than the crown:

- the diameter shall have no negative tolerance;
- the plus tolerance may be up to 5 per cent of the nominal diameter except at the butt weld where it shall be in accordance to manufacturer's specification, which shall be agreed with the Register.

For diameters less than 20 mm, the plus tolerance shall be agreed with the Register at the time of approval.”.

Para 7.2.4.1.2 shall be amended to read:

“7.2.4.1.2 All chain shall be subjected to proof load tests, sample break load tests and sample mechanical tests after final heat treatment in the presence of the Register representative. Where the manufacturer has a procedure to record proof loads and the Register representative is satisfied with the adequacy of the recording system, he need not witness all proof load tests. The Register representative shall satisfy himself that the testing machines are calibrated and maintained in a satisfactory condition. Prior to inspection the chain shall be free from scale, paint or other coating and shall have a suitably prepared surface as per the applied non-destructive testing standard. The chain shall be sand- or shot blast to meet this requirement.”.

Table 7.2.4.2.2 shall be amended:

“Table 7.2.4.2.2

Frequency of break and mechanical tests

Nominal chain diameter, mm	Maximum sampling interval, m
≤ 48	91
49 – 60	110
61 – 73	131
74 – 85	152
86 – 98	175
99 – 111	198
112 – 124	222
125 – 137	250
138 – 149	274
150 – 162	297
163 – 175	322
176 – 186	346
187 – 198	370
199 – 210	395
211 - 222	420”

Para 7.2.4.2.4 shall be amended to read:

“**7.2.4.2.4** If the loading capacity of the testing machine is insufficient, an alternative load testing machine shall be used that does have sufficient capacity (e.g. two loading machines in parallel), provided the testing and calibration procedure are agreed with the Register.”.

Para 7.2.4.3.2 shall be amended to read:

“**7.2.4.3.2** The entire chain shall be checked for the length, five links at a time. By the five link check the first five links shall be measured. From the next set of five links, at least two links from the previous five links set shall be included. This procedure shall be followed for the entire chain length. The measurements shall be taken preferably while the chain is loaded to 5 to 10 per cent of the minimum proof load. The tolerances for the 5 link measurements are indicated in Table 7.2.3.2.7.1, any deviations from the 5 link tolerances shall be agreed by the manufacturer and the Register. The links held in the end blocks may be excluded from this measurement.”.

Para 7.2.4.3.3 shall be introduced reading as follows:

“**7.2.4.3.3** Chain dimensions shall be recorded and the information retained on file.”.

Para 7.2.4.4.4 shall be introduced reading as follows:

“**7.2.4.4.4** Hardness tests shall be carried out on finished chain. The frequency and locations shall be agreed with the Register. The recorded values are for information only

and used as an additional check to verify that the heat treatment process has been stable during the chain production.”.

Para 7.2.4.5 shall be amended to read:

“7.2.4.5 Non-destructive testing after proof load testing.”.

Paras 7.2.4.5.1 – 7.2.4.5.3 shall be amended to read:

“7.2.4.5.1 All surfaces of every link shall be visually tested. Burrs, irregularities and rough edges shall be contour ground. Links shall be free from mill defects, surface cracks, dents and cuts, especially in the vicinity where gripped by clamping dies during flash welding. Studs shall be securely fastened. Chain shall be positioned in order to have good access to all surfaces. In order to allow optimal access to the surface area it is recommended that chain be hung in the vertical position, however access to inspect the interlink area may only be possible with the chain in the horizontal position.

7.2.4.5.2 Non-destructive testing shall be performed in accordance with recognized standards and procedures, together with the Register-approved acceptance/rejection criteria. Manufacturers shall prepare written procedures for non-destructive testing. Non-destructive testing personnel shall be qualified and certified according to ISO 9712, ACCP or equivalent. Personnel qualification to an employer or responsible agency based qualification scheme as SNT-TC-1A may be accepted if the employer's written practice is reviewed and found acceptable and the level III is ASNT level III, ISO 9712 level III or ACCP professional level III and certified in the applicable method. Non-destructive testing operators shall be qualified to at least level II.

7.2.4.5.3 Magnetic particle testing approved by the Register shall be employed to examine the flash welded area including the area gripped by the clamping dies. Procedures shall be submitted to the Register for approval. Frequency of examination shall be every link. The relevant procedures and equipment shall be agreed with the Register. Additionally, 10 per cent of links shall be tested on all accessible surfaces. Link surfaces and the surface at the flash weld shall be free from cracks, lack of fusion and gross porosity. Testing shall be performed in accordance with ASTM E709 or another recognized standard (e.g. ISO 9934) using wet continuous fluorescent magnetization technique. Non fluorescent techniques can be accepted where the standard inspection procedures are impractical.

Links shall be free from relevant linear indications exceeding 1,6 mm in transverse direction, relevant linear indications exceeding 3,2 mm in longitudinal direction and relevant non-linear indications exceeding 4,8 mm.”.

Paras 7.2.4.5.4 and 7.2.4.5.5 shall be introduced reading as follows:

“7.2.4.5.4 Ultrasonics shall be employed to examine the flash weld fusion. Procedures shall be submitted to the Register for approval. Procedures and equipment in

accordance with those approved shall be used. On-site calibration standards for chain configurations shall be approved. Frequency of examination shall be every link.

The flash weld shall be free from defects causing ultrasonic back reflections equal to or greater than the calibration standard. The flash butt welds shall be ultrasonic tested (UT) in accordance with ASTM E587 or another recognized standard using single probe, angle-beam shear waves in the range from 45 to 70°. Single probe technique has limitations as far as testing of the central region is concerned and the flash weld imperfections such as flat spots may have poor reflectivity. Where it is deemed necessary, detectability of imperfections may need to be carried out by using a tandem technique, TOFD or phased array.

7.2.4.5.5 Stud welds, if used, shall be visually inspected. The toes of the fillets shall have a smooth transition to the link with no undercuts exceeding 1,0 mm. Additionally, at least 10 per cent of the stud welds distributed through the length shall be dye penetrant tested according to ASTM E1417 or magnetic particle tested according to ASTM E1444 or equivalent. Cracks, lack of fusion or gross porosity are not acceptable. If defects are found, testing shall be extended to all stud welds in that length.”.

Para 7.2.4.6.2 shall be amended to read:

“**7.2.4.6.2** If single links are found to be defective or not meet other applicable requirements, defective links may be cut out and a connecting common link inserted in their place. The individual heat treatment and insertion procedure of connecting common links are to be approved by the Register. Other methods for repair are subject to the written approval of the Register and the end purchaser. Weld repair of chain is not permitted.”.

Paras 7.2.4.6.7 and 7.2.4.6.8 shall be amended to read:

“**7.2.4.6.7** If a proof load test fails, the Register representative carrying out technical supervision shall be informed in a timely manner, the case shall be recorded and the relevant explanations shall be submitted to the Register representative. In the event that two or more links in the proof loaded length fail, that section of proof loaded length shall be rejected. The above failure investigation shall be carried out especially with regard to the presence in other lengths of factors or conditions (refer to Table 7.2.4.2.2) thought to be causal to failure.

7.2.4.6.8 In addition to the above failure investigation, a break test specimen shall be taken from each side of the one failed link, and subjected to the breaking test. Where multiple chains are produced simultaneously, it is recognised that the preceding flash butt welded link and subsequent flash butt welded link will be on an alternative chain length or the other end of the chain length. In such cases the Register require that two additional break tests shall be taken from the lengths of chain that include the preceding and subsequent welded links. Based upon satisfactory results of both break tests and the results of the failure investigation, it may be decided what length of chain can be considered for acceptance. Failure of either or both breaking tests will result in rejection of the same proof loaded length. Replacement of defective links shall be in accordance with 7.2.4.6.2. If the investigation identifies defects in the flash butt weld or a lower

strength flash weld “a glue-weld” is found, additional non-destructive testing such as phased array ultrasonic testing shall be carried out to identify if other links are affected. A full assessment of the flash butt welding machine shall be carried out, together with assessment of the condition of the bar ends prior to welding.”.

Para 7.2.5.1.1 shall be amended to read:

“**7.2.5.1.1** This Section applies to but is not limited to mooring equipment accessories such as detachable connecting links (shackles), detachable connecting plates (triplates), end shackles and swivel shackles, and subsea connectors.”.

Para 7.2.5.1.3 shall be introduced reading as follows:

“**7.2.5.1.3** For accessory production a Manufacturing Procedure Specification (MPS) shall be submitted to the Register that details all critical aspects of accessory production, casting, forging, heat treating (including arrangement and spacing of components in the heat treatment furnaces), quenching, mechanical testing, proof and break loading and non-destructive testing.”.

Para 7.2.5.2.2 shall be amended to read:

“**7.2.5.2.2** Chain accessories shall be tested at the break load prescribed for the grade and size of chain for which they are intended. At least one accessory out of every batch or every 25 accessories, whichever is less, shall be tested. For individually produced, individually heat treated, accessories or accessories produced in small batches (less than 5), alternative testing shall be approved by the Register. Alternative testing shall be approved by the Register and the following additional conditions may apply:

.1 alternative testing is described in a written procedure and manufacturing procedure specification (MPS);

.2 a finite element analysis is provided at the break load and demonstrates that the accessory has a safety margin over and above the break load of the chain;

.3 strain age testing (as per procedure approved by the Register) is carried out on the material grade produced to the same parameters at the time of qualification;

.4 if an accessory is of a large size that will make heat treating in batches unfeasible or has a unique design, strain gauges shall be applied during the proof and break load tests during initial qualification and during production. The strain gauge results from production shall be comparable with the results from qualification.”.

Paras 7.2.5.2.5.3 and 7.2.5.2.5.4 shall be introduced reading as follows:

“**.3** strain age properties have been carried out on the material grade produced to the same parameters.

.4 strain gauges have been applied during the break load test in the high stress locations to monitor that the strains stay within allowable limits.”.

Para 7.2.5.4.1 shall be amended to read:

“7.2.5.4.1 Accessories shall be subjected to mechanical testing as described in 7.2.2.3 and 7.2.2.4. The specimens shall be taken from proof loaded full size accessories that have been heat treated with the production accessories they represent.

At least one accessory out of every batch or every 25 accessories, whichever is less, shall be tested. Hardness tests shall be carried out on finished accessories. The frequency and locations shall be agreed with the Register. The recorded values are for information only and used as an additional check to verify that the heat treatment process has been stable during the accessory production.

The use of separate representative coupons is not permitted except as indicated in 7.2.5.4.4.”.

Paras 7.2.5.4.4 and 7.2.5.4.5 shall be amended to read:

“7.2.5.4.4 The locations of mechanical tests of other accessories with complex geometries shall be agreed with the Register. For non-circular sections, $1/4t$ (thickness) from the surface is considered appropriate. Rolled plates shall be tested to the standard to which they are produced.

7.2.5.4.5 For individually produced (heat treated) accessories or accessories produced in small batches (less than 5), alternative testing can be proposed to the Register. Each proposal for alternative testing shall be detailed by the manufacturer in a written procedure and submitted to the Register. The following additional conditions may apply:

.1 if separately forged or cast coupons are used, they shall have a cross-section and, for forged coupon, a reduction ratio similar to that of the accessories represented, and shall be heat treated in the same furnace and quenched in the same tank at the same time, as the actual forgings or castings. Thermocouples shall be attached to the coupon and to the accessories;

.2 if separately forged or cast coupons are agreed, it shall be verified by procedure test that coupon properties are representative of accessory properties.”.

Para 7.2.5.5 shall be amended to read:

“7.2.5.5 Non-destructive testing and proof load testing.”.

Paras 7.2.5.5.1 – 7.2.5.5.3 shall be amended to read:

“7.2.5.5.1 All chain accessories shall be subjected to a close visual testing. Special attention shall be paid to machined surfaces and high stress regions. Prior to inspection, chain accessories shall have a suitably prepared surface as per the applied non-destructive testing standard. All non-machined surfaces shall be sand or shot blasted to permit a thorough examination. Where applicable, accessories shall be dismantled for inspection of internal surfaces. All accessories shall be checked by magnetic particles, dye penetrant or ultrasonic testing. The acceptance/rejection criteria of ultrasonic testing established for the design shall be met.

7.2.5.5.2 Testing shall be performed in accordance with the documents, such as those indicated below, or equivalent:

EN 10228-1, ASTM A275, ISO 4986, IACS Rec 69 – magnetic particle testing (MT) of forgings;

EN 10228-3, ASTM A388 and ISO 13588 – ultrasonic testing (UT) of forgings;
ASTM E709 – magnetic particle testing (MT) of castings, using wet continuous magnetization technique;

ASTM A609, ISO 13588 – ultrasonic testing (UT) of castings.

The procedures recognized by the Register, including acceptance/rejection criteria, shall be submitted to the Register for review.

Manufacturers shall prepare written procedures for non-destructive testing. Non-destructive testing personnel shall be qualified and certified according to ISO 9712, ACCP or equivalent. Personnel qualification to an employer or responsible agency based qualification scheme as SNT-TC-1A may be accepted if the employer's written practice is reviewed and found acceptable and the level III is ASNT level III, ISO 9712 level III or ACCP professional level III and certified in the applicable method. Non-destructive testing operators shall be qualified to at least level II.

7.2.5.5.3 The manufacturer shall provide a statement that non-destructive testing has been carried out with satisfactory results. This statement shall include a brief reference to the techniques and to the operator's qualification.”.

Para 7.2.5.5.4 shall be introduced reading as follows:

“**7.2.5.5.4** Weld repairs of finished accessories are not permitted.”.

Para 7.2.5.8.1 shall be amended to read:

“**7.2.5.8.1** A complete inspection and testing report in booklet form shall be provided by the manufacturer for each order. This booklet shall include all dimensional checks, test and inspection reports, non-destructive testing reports, process records and example photographs of components positioned in furnaces, as well as any nonconformity, corrective action and repair work.”.

Para 7.2.6.4.6 shall be introduced reading as follows:

“**7.2.6.4.6** The requirements specified in this Chapter are also applicable to other diameter chafing chains, such as 84 and 96 mm, subject to compliance with the proof and break load requirements specified for the chain grade and diameters in Table 7.2.3.2.7.1.”.