Guideline No.: W-08 (201610)

W-08 ROLLED STEEL BARS FOR ANCHOR CHAIN CABLES AND ACCESSORIES

Issued date: October 20,2016

Foreword:

This Guide is a part of CCS Rules, which contains technical requirements, inspection and testing criteria related to classification and statutory survey of marine products.

This Guide is published and updated by CCS and can be found through http://www.ccs.org.cn. Comments or suggestions can be sent by email to ps@ccs.org.cn .

Historical versions and release date :

W08(201510) release date 20th oct.2015；

Main changes and effective date:

1. In accordance with the IACS UR W22,the requirement “After satisfactory tests, steel bars are sent to make finished mooring chain for type tests. The materials suppliers may be approved after all satisfactory tests.” is added.

2. In accordance with the Rules of material and wedding 2015, the grades of the rolled bars for anchor chain cable and accessories are modified.

3. In accordance with the IACS UR W22, the range of the steel for chain cables within different grades.
4. In accordance with the IACS UR W22 and < The instruction for publish of the guideline of the marine productions>, the requirement of the approval documents submitted by the manufacture is modified and added.
5. In accordance with the IACS UR W22, the welding property test is deleted.
6. In accordance with the IACS UR W22, the non-metallic inclusions test is added.
7. In accordance with the IACS UR W22, the non-detective test during the type test is modified.
8. In accordance with the IACS UR W22, the work approval for the rolled steel is modified.
9. The definition of the “Marine anchor chain cable , Mooring chains, anchor chain cables” is added.
   In accordance with < The instruction for the publish of the guideline of the marine productions>, the original guideline is modified.

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ROLLED STEEL BARS FOR ANCHOR CHAIN CABLES AND ACCESSORIES

1 Application

1.1 This Guideline applies to the works approval and inspection of rolled steel bars both for anchor chain cables and accessories onboard ships and for mooring chain cables and accessories onboard offshore installations and accessories and materials, which are manufactured in accordance with the requirements of CCS Rules for Classification of Sea-Going Steel Ships and CCS Rules for Materials and Welding. Reference may be made to rolled steel bars for other purposes (such as directly used for manufacturing marine shafting).

1.2 Rolled steel bars for anchor chain cables, mooring chain cables and accessories as well as hot rolled steel bars directly used for manufacturing (only mechanically processing) marine shafting are to be manufactured by works approved by CCS.

1.3 This Guideline applies to the works approval and inspection of anchor chain steels, which are manufactured by electric arc furnace (RP, HP, or UHP), direct current furnace, top and bottom blown converter including secondary refining (LF, VD, CAS, RH), cast in moulds or made by a continuous casting process to be square or rectangular materials, and delivered in the condition of AR or CR.

2 Normative references

(1) CCS Rules for Classification of Sea-Going Steel Ships;

(2) CCS Rules for Materials and Welding;

(3) Relevant national and international standards;

Technical specifications or descriptions of order, where necessary.

3 Terms and definitions

Marine anchor cables: The products mentioned in Section 2, Chapter 10, Part 1 of the CCS Rules for material and welding.
Mooring chain: The products mentioned in Section 3 Chapter 10, Part 1 of the CCS Rules for material and welding.
Anchor cables: The general name for the marine anchor cables and mooring cables.

4 Plans and documents

4.1 A manufacturer intending for approval by CCS is to submit an application to CCS for works approval.

4.2 The documents as following are to be submitted to CCS for information.

(1) Particulars of the manufacturer ,including the name ,address, history ,production capacity, technical and inspection personnel, main products, subordinate relationship, trademark etc.;

(2) Details for the products for approval;

(3) Main production equipment;

(4) Main test equipment;

(5) The chemical composition rang of the products for approval;

(6) Brief production technology of the products for approval;

(7) Quality management documents;

(8) Document of entering to the register of enterprise;

(9) Qualification certificate and/or production license;

(10) Specimen of products quality certificate;

(11) Quality control scheme(where applicable);

(12) Qualified supplier list(where applicable);

(13) A heat treatment sensitivity study simulating chain production conditions shall be applied in order to verify mechanical properties and establish limits for temperature and time combinations. All test details and results are to be submitted.

(14) The bar manufacturer is to provide evidence that the manufacturing process produces

material that is resistant to strain ageing, temper embrittlement and for R3S, R4, R4S and R5,

hydrogen embrittlement. All test details and results are to be submitted.4.3 The type test program

is to be submitted to CCS for approval.

5 Technical requirement

5.1 The rolled steel bars intended for chain cables are subdivided into eight grades, i.e. M1, M2 and M3 for chain steels and MR3, MR3S, MR4, MR4S AND MR5 for offshore mooring chain steels, depending on the nominal tensile strength and applicable product types.
5.2 The rolling reduction ratio of steel intended for mooring chains is to be at least 5:1.
5.3 All the products mentioned in this guideline ,its technical and performance requirements meets the requirements of CCS Rules for Classification of Sea-Going Steel Ships and CCS Rules for Materials and Welding and relative national and international standards.
5.4 The classification of rolled steel bars for other purposes may be carried out according to relevant standards.

6 Materials and parts

For steel mills where the materials are purchased, the materials suppliers are to be approved by CCS.

7 Type test

7.1 Determination of the Type test program

Prior to type test, CCS and the applicant are to determine the type test program through negotiation. The program may be proposed by the applicant and examined and approved by CCS, or proposed by CCS and confirmed by the applicant. The program is to include:

7.1.1 The type, specification and delivery condition of the products for approval (indicating the deoxidation, grain refining elements and delivery condition for each steel grade);

7.1.2 Steel grade, specification, and heat treatment of the selected products for test;

7.1.3 The test items and the standards or rules adopted;

7.1.4 Sampling scheme and descriptions;

7.1.5 Place of test and qualification of the laboratory (if applicable, the qualification of the subcontractor and the agreement).

7.2 Selection of typical samples

The typical samples for type test are to be selected according to the following requirements:

7.2.1 The typical samples are to be taken for type test from the largest products of rolled steel bars for each grade individually. If it is demonstrated to the satisfaction of the CCS 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 are not to be modified during production. The products with the maximum specification are to be selected respectively for continuous casting and mould casting. Where electric furnace and converter are for smelting, the products with the maximum specification are to be selected accordingly. CCS may require additional approval test for the smallest or medium products as the case may be.

7.2.2 Depending on the resources of the manufacturer, the sampling process may be confirmed by tracking sampling or production process or by tracing relevant information through production control computer.

7.2.3 The materials (billets, ingots) for rolled steel bars for test are to be designated by the Surveyor. The test samples are to be taken from the top and bottom of the bars.

7.3 Where the selected typical samples are adopted as the samples for approval, the manufacturer is also to provide the following information on the products:

(1) the steel making , continuous casting procedure and the material requirement including the chemical composition, mechanical properties and non-destructive test requirements.

(2) Rolling procedure and the rolling reduction ratio;

(3) The heat treatment.

7.4 Type test items and requirements

7.4.1 The type test items and requirements are as follows:

(1) Chemical composition analysis: compositions of ladle sample and finished products to be analyzed respectively. The elements to be analyzed are C, Si, Mn, P, S, Cr, Ni, Mo, Cu, Als, Nb, V, Ti, N, H, O and other added ones (Als not required for M1).

(2) Tensile test: To determine the upper yield strength ReH, tensile strength Rm and elongation A, and the yield to tensile ratio to be calculated.

(3) Bend test

①Test specimens: For diameter not exceeding 40 mm, to be taken as a cylindrical bar with full cross-section or a cylindrical bar of 25 mm in diameter with one rolled surface; for diameter exceeding 40 mm, to be taken from the bars in longitudinal direction with center line at a position of 1/6 diameter from the surface or as close as possible to this position;

② Bending angle of 180°: d= a for M1, d=1.5a for M2 and M3; for diameter not less than 25 mm (uncut test specimens), d=2a for M1, d=2.5a for M2 and M3.

(4) Charpy V-notch impact test

① The test is to determine the energy with a set of three test specimens, and the individual value and average value of energy to be provided. Impact test is not required for grade M1 steel.

② The temperature requirements for impact test: Normal temperature, 0℃ and -20℃ for M2, normal temperature, 0℃, -20℃ and -40℃ for M3, MR3 and MR3S, normal temperature, 0℃, -20℃, -40℃ and -60℃ for MR4, MR4S and MR5.

③The fracture photos and side expansion value are to be provided.

(5) Hardness test: Steels for each grade are to be subject to hardness test. Specimens may be prepared individually or apply residual samples (parts without deformation) of tensile and impact tests. Hardness of MR4S steel is not to be greater than 330HBW, and hardness of MR5 steel is not to be greater than 340HBW

(6) Sulphur prints: Sulphur prints to be taken with full cross-section (or 1/2) of the material; for bars, sulphur prints to be taken with a full cross-section or a longitudinal section through axis (length of specimen/diameter ≧1.2). The photos of sulphur prints are to be provided.

(7) Hydrogen embrittleness test of MR3S, MR4, MR4S and MR5 round steel bars: test requirements and methods and result assessment are to comply with CCS Rules for Materials and Welding.

(8) Macrostructure: The requirements for position and length of the specimen for the materials and finished products are the same as those for sulphur prints.

(9) Microstructure and grain size: Microstructure (×100 magnification) to be prepared in at a position of 1/6 diameter from the surface or as close as possible to this position to determine actual austenite grain size and non-metallic inclusions (or ×500 magnification as the case may be)and the metallography should be submitted..

(10) Welding property test: Rolled steel bars for anchor chain cables and mooring chain cables are to be subject to welding property test in an initial approval. The sampling material is to be welded by actual production technology of those chain cables, and the welds (after heat treatment) are to be subject to mechanical property tests (tensile, impact, hardness) and technological test (bend), in which, the hardness test is to determine the maximum hardness and hardness distribution in heat affected zones of welding.

(11) Visual and dimensional examination: Each bars are to be examination. The diameter, roundness, the curvature per meter and the total curvature are to be examined for each piece. The diameter tolerance and roundness tolerance are to comply with the requirements of CCS Rules for Materials and Welding.

(12) Non-destructive test: Bar material intended for typical samples of either chains is to be subjected to ultrasonic examination, magnetic particles, eddy current of an equivalent method at an appropriate stage of the manufacture. The non-destructive examination is to be performed in accordance with CCS Rules for material and welding and recognized standards. Non-destructive test procedures together with rejection/acceptance criteria are to be submitted to CCS for information.

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(13) Other test items as deemed necessary by CCS (ie thermal transformation curve for austenite, tower type test, etc.).

(14) After all the type test are carried out and are matched, the steel bar should be manufacture to the finish mooring chain , the relative type test for the mooring chain should be carried out and are got the satisfactory, the approval of the steel bar for the mooring chain could be issued.

7.4.2 For steel mills where the materials are purchased, the materials suppliers are to be approved by CCS and subject to sulphur prints/macrostructure examination, chemical composition analysis, visual and dimensional examination. Qualified materials are sent to mills to make steel bars and subject to test according to the above-mentioned requirements. After satisfactory tests, steel bars are sent to make finished chain for type tests. The materials suppliers may be approved after all satisfactory tests.

8Unit/batch inspection

8.1 After works approval by CCS, the rolled steel bars as manufactured according to the approved conditions (including equipment, process, etc.) are to be applied by the manufacturer for

unit/batch inspection by CCS, which can be used only after satisfactory inspection.

8.2 The detailed requirements for unit/batch inspection after approval are to be notified in written form to the works when CCS issues a certificate of works approval.

8.3 The unit/batch inspection is to be carried out according to the approved test program. The test program is to contain the test items for witness, review and on-site examination. The items are at least to include:

(1) Visual and dimensional examination;

(2) Review of the result of chemical analysis;

(3) Mechanical property test;

(4) Austenitic grain size examination (for offshore mooring chain rolled steel bars);

(5) Non-destructive test (for offshore mooring chain rolled steel bars);

(6) Hydrogen embrittlement test (for MR3S, MR4, MR4S and MR5 for offshore mooring chain rolled steel bars);

(7) Macro acid corrosion examination (for MR4S and MR5 for offshore mooring chain rolled steel bars);

(8) Non-metallic inclusion examination (for MR4S and MR5 for offshore mooring chain rolled steel bars);

(9) Quenching degree test (for MR4S and MR5 for offshore mooring chain rolled steel bars);

(10) Other test items as deemed necessary by CCS.

8.4 After satisfactory inspection of products, CCS Surveyor is to issue a certificate of marine products or endorse the manufacturer’s quality certificate.

8.5 The quality certificate is to contain at least: acceptance criteria (rules, standard, technical agreements, etc.), cast number/batch number, steel grade, specification, weight, quantity, delivery condition, chemical composition, mechanical properties, description of identifications. For MR4S and MR5 rolled steel bars for mooring chain cables, results of hydrogen embrittleness test and non-destructive test as well as results of austenitic micro grain size, non-metallic intrusions and

hardenability test are also to be listed. The space for stamp and endorsement by CCS Surveyor is to be reserved.

8.6 The format of the manufacturer’s quality certificate is to be approved by CCS.