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W-11 MOORING CHAINS AND ACCESSORIES FOR POSITIONING OF OFFSHORE INSTALLATIONS

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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.

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MOORING CHAINS AND ACCESSORIES FOR POSITIONING OF OFFSHORE INSTALLATIONS

1 Application

1.1 This Guideline is applicable to the products of mooring chains and accessories for the positioning of mobile offshore units, mooring of floating production units, mooring of offshore loading systems and mooring of gravity based structures, including common links, connecting common links, enlarged links, end links, Kenter shackles, swivels, swivel shackles, excluding studless mooring chains. Depending on the nominal tensile strength, chains are to be divided into five grades, i.e., OM3, OM3S, OM4, OM4S and OM5.

1.2 This Guideline is applicable to works approval and inspection of the above products.

2 Normative references

2.1 The requirements in Section 3, Chapter 10, PART ONE of CCS Rules for Materials and Welding.

3 Terms and definitions

3.1 For the purpose of this Guideline, the terms and definitions given in CCS Rules for Materials and Welding apply.

3.2 The term “mooring chains and accessories for positioning of offshore installations” are hereinafter referred to as “mooring chains and accessories”.

4 Plans and documents

4.1 A manufacturer intending for works approval of mooring chains and accessories is to submit the following documents to CCS.

4.2 The following documents 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.; Details of the products for approval; Quality management documents; Document of entering to the register of enterprise; Qualification certificate and/or production license; Specimen of products quality certificate; Quality control scheme (where applicable).

(2) Source of raw materials: information on the manufacturer and its approval.

(3) Production, inspection and test equipment: name/purpose, specification and capacity of chains manufacturing equipment, proof-load testing machines, forging equipment, mechanical properties and NDT equipment, together with copies of calibration certificates of the equipment.

(4) Manufacturing process: flow chart of manufacturing from the materials to the final products of mooring chains and accessories (including connecting common links), with main process and corresponding inspection points indicated, and the following details are to be provided:

- bar heating and bending including method, temperatures, temperature control and recording;
- flash butt welding, including current, force, time and dimensional variables as well as control and recording of parameters;
- burr removal, including method and inspection;
- stud insertion, including method and impression, plastic yielding after heating, measurements and recording of impression;
- heat treatment, including furnace types, means of specifying, controlling and recording of temperature, and chain speed and allowable limits, quenching bath and agitation;
- proof and break 1oading tests, including method and equipment, means of horizontal support (if applicable), method of measurement, recording;
- NDT procedure, including method, equipment, standard, and qualification of operators.

4.3 The following documents are to be submitted to CCS for approval:

(1) drawings giving detailed design of chains and accessories, including drawings showing the detailed design of the stud;

(2) design drawings of connecting common links;

(3) the type test program.

5 Approval of chain manufacturer and steelmaker

5.1 An approval of chain manufacturer is only restricted to a single manufacturer and to one type

and grade of chains made of materials from a designated or approved steelmaker. Where the materials are supplied by more than one steelmaker and used to make different types and grades of chains, the approval tests are to be carried out respectively.

6 Design and technical requirements

6.1 The requirements are given in the following Table 6.1.

Table of Mooring Chains and Accessories Technical Requirements **Table 6.1**

Number	Content	Requirements in CCS Rules for Materials and Welding	Remark
1	Steel for welded chain cables	10.3.3	
2	Forged steel	10.3.3	
3	Materials for studs	10.3.3	
4	Shape and dimension of chains	10.3.4 10.3.8	
5	Manufacture of chains	10.3.5	
6	Mechanical properties	10.3.8	
7	Proof and break tests	10.3.8	
8	Welding of studs	10.3.6 10.3.4	
9	Connecting common links	10.3.5.3 10.3.7	
10	Non-destructive examination	10.3.8.10 10.3.8.11	
11	Testing and inspection of chains	10.3.8 10.3.9 10.3.11	
12	Testing and inspection of accessories	10.3.11	
13	Marking	10.3.10	

7 Selection of typical samples

7.1 The largest product with maximum diameter is to be selected for each grade of chain cables or accessories for approval. The approval of enlarged links and end links are to be in accordance with the test items and requirements for links. The chain cables tested are to have adequate number of links for the items in the table.

7.2 In an initial approval, the capacity of different units to manufacture chains of maximum diameter is to be verified.

7.3 The added items, change and renewal of the works approval certificate are in principle to be in accordance with the requirements for the initial approval.

7.4 The test items for connecting common links are the same as those for links.

8 Type test

8.1 The test items and requirements are given in Table 8.1.

Table of Test Items **Table 8.1**

No.	Test items	Test requirements (corresponding paragraphs from CCS Rules for Materials and Welding)	Links	Accessories	Remark
1	Chemical composition	10.3.3	√	√	Materials for links and accessories
2	Tensile test	10.3.8.8	√	—	
		10.3.11 Specimens of swivels to be taken on the body and pin respectively.	—	√	
3	Impact test	10.3.8.8 Test temperatures to be -40℃, -20℃ and 0℃ respectively	√	—	The value at -40℃ for reference only
		10.3.11 Specimens of swivels to be taken on the body and pin respectively	—	√	
4	Break load test	10.3.8.5 (links)，10.3.11 (accessories)	√	√	
5	Proof load test	10.3.8.5 (links)，10.3.111 (accessories)	√	√	
6	Magnetic particles test	10.3.8.10 (links) 10.3.11.11 (accessories)	√	√	
7	Ultrasonic test	10.3.8.11	√	—	
8	Stud weld examination	10.3.6	√	—	
9	Dimensions	10.3.4 10.3.8 (links) 10.3.11.6 (accessories)	√	√	
10	Visual examination	10.3.8.3 (links)，10.3.11.2 (accessories)	√	√	
11	Stud impression examination	Specimen to be the section at the centerline of links, the depth of impression and radius of corner are to be measured, recorded and photographed	√	—	Applicable to stud chain cables
12	Micro-examination	Three micro-specimens to be taken to show flash weld, the impression corner and parent materials respectively. Corrosion of micro-specimens to be photographed (×100 magnification and ×500 magnification)	√	—	
		Three micro-specimens to be taken on the surface, at the center and 1/3r to the surface of the accessories. Specimens of swivels to be taken on the body and pin respectively. Corrosion of micro-specimens is to be photographed (×100 magnification and ×500 magnification)	—	√	
13	Macro-examination	Two macro-specimens, one of which is longitudinal section of links to show flash weld side stud impression area and two crown cross sections, the other is section at the centerline of links to show flash weld, stud impression depth and corner radius and stud weld (if applicable). Corrosion of macro section to be photographed (×1magnification). Impression area (×10 magnification) to be examined and free from cracks, laps or other defects	√	—	Macro-examination may be exempted where the compression ratio is not less than 7:1
		The macro-specimens to be cross sections of accessories. Corrosion of macro section to be photographed (×1magnification) and free from cracks, laps or other defects	—	√	
14	Hardness test	Vickers or Rockwell hardness tester to be adopted to measure hardness distribution through diameter. The maximum space between two measuring points to be 2.5mm. The distribution diagram to be submitted	√	√	

Continued Table 8.1

No.	Test items	Test requirements (corresponding paragraphs from CCS Rules for Materials and Welding)	Links	Accessories	Remark
15	Crack tip opening displacement (CTOD)	8 links to be selected for test. The CTOD specimens and impact test specimens to be taken from the 8 links. The CTOD specimen to be standard 2×1 specimen with one open side. Where the diameter of chain cable is less than 120mm, the minimum dimension of specimen is 50×25mm. Where the diameter of chain cable is over 120mm, the minimum dimension of specimen is 80×40mm. Two test samples to be taken at 1/3r on the surface of each link, one from non-welded area (opposite to the flash weld), the other from flash weld area with crack tip precisely on the weld. The value of CTOD not to be less than that specified in 8.2 of this Chapter. The test temperature to be -20℃	√	—	
16	Assessment of welding procedure	The welding procedure of studs to be assessed	√	—	At discretion of CCS

Note: "√" indicates "applicable"; "—" indicates "not applicable".

8.2 Specified value of CTOD

Grade / Place	OM3		OM3S		OM4		OM4S&OM5	
	link back	weld	link back	weld	link back	weld	link back	weld
With stud link	0.20mm	0.10mm	0.22mm	0.11mm	0.24mm	0.12mm	0.26mm	0.13mm
Without stud link	0.20mm	0.14mm	0.22mm	0.15mm	0.24mm	0.16mm	0.26mm	0.17mm

9 Unit/batch inspection

9.1 The test items and requirements are given in Table 9.1.

Table of Test Items **Table 9.1**

No.	Test items	Test requirements (corresponding paragraphs from CCS Rules for Materials and Welding)		Remark
		links	accessories	
1	Mechanical properties test (tensile and impact tests)	10.3.8.8	10.3.11	
2	Break load test	10.3.8.5	10.3.11	
3	Proof load test	10.3.8.5	10.3.11	
4	Magnetic particles test	10.3.8.10	10.3.11.11	
5	Ultrasonic test	10.3.8.11	———	
6	Stud weld examination	10.3.6	———	
7	Dimensions	10.3.4 10.3.8	10.3.11.6	
8	Visual examination	10.3.8.3	10.3.11.2	

9.2 The relevant records or reports submitted by the manufacturer is to contain the materials certificate, mechanical property test, breaking test, proof-load test, non-destructive test, stud weld

examination, dimensions, external quality, heat treatment, photograph, non-conforming links, repairs, number and location of connecting common links.