Guideline No.: W-09(201510)

W-09 ANCHOR CHAIN CABLES AND ACCESSORIES FOR SHIPS

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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.

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 :

CONTENS

ANCHOR CHAIN CABLES AND ACCESSORIES FOR SHIPS

1 Application

This Guideline applies to the works approval and inspection of flash welded stud and studless anchor chain cables and accessories made of forged steel for all types of ships.

Electro-welded anchor chains (including forged accessories) are to be classified into three grades, depending on the nominal tensile strength, i.e. 1, 2 and 3 for stud cables, BM1 and BM2 for studless cables. The detailed class is given in Table 1:

Class of the electro-welded anchor chains (including forged accessories)

Table 1

Name	Grade	Nominal diameter of link (mm)
Class I stud	1	11-162
Class II stud	2	
Class III stud	3	
Class I studless	BM1	6-50
Class II studless	BM2	

2 Normative references

2.1 The following rules and standards are the basis for approval and inspection of anchor chain cables and accessories.

2.2 Requirements in the following rules and standards quoted are part of this Chapter. For quoted documents marked with the date, their subsequent amendments (except corrigenda) or revisions will be inapplicable. However it is encouraged that parties concerned agreed with this Chapter may discuss whether the latest edition of these documents can be adopted:

CCS Rules for Materials and Welding

IACS W18 Anchor Chain Cables and Accessories (Rev.5 May 2004)

ISO1704 Shipbuilding Stud Link Anchor Chains

3 Terms and definitions

For the purpose of this Chapter, the terms and definitions in CCS Rules for Materials and Welding

apply.

4 Plans and technical documents

A manufacturer intending for approval by CCS is to submit an application to CCS with the following plans and technical documents for product approval:

4.1 Particulars of the manufacturer: the name, address, lay-out plan, production history, production capacity, main products, superior department, legal person, registered trademark, business license, ISO 9000 certificate, the number and qualification certification/experience of the personnel engaged in inspection, test, welding, non-destructive test and in major technical management.

4.2 Details of the products for approval: types, specifications, steel grades, delivery condition.

4.3 A list of raw materials: information on the anchor chain steel and steel forging manufacturers with their approval by CCS.

4.4 Particulars of main production equipment and inspection/test equipment: name/purpose, type and capacity of anchor chains manufacturing equipment, forging equipment, stud equipment, heat treatment furnace, proof-load testing machines, universal materials testing machines, impact testing machines, chemical composition analysis instruments, welding equipment, non-destructive testing machines, as to ensure that all equipment of the manufacturer are to satisfy the requirements for production, test and examination of chain cables and accessories. The inspection/test equipment is to be within the validity of calibration and the valid measurement certificates are to be provided.

4.5 Manufacturing process and inspection: flowchart of manufacturing chain cables and accessories from the stock of raw materials to the final products, with main process and corresponding inspection points indicated; major technological documents and inspection/test guidance notes.

The manufacturer is to provide the following detailed requirements for manufacturing process and inspection.

4.5.1 Bar heating and bending: including heating method, heating temperature, heating time, weld center tolerance, dislocation control and recording.

4.5.2 Flash welding: including link temperature before welding, amperage, voltage, heating time, flash speed, upsetting pressure as well as control and recording of these parameters.

4.5.3 Trimming: including methods and acceptance criteria.

4.5.4 Stud setting: including stud insertion method, annular ring measurement, stud dimension and tolerance measurement recording after stud assembly.

4.5.5 Examination of surface quality and dimensions: acceptance criteria of surface quality, dimension and tolerance, measures of repairs of defects.

4.5.6 Stud welding of grade 3 chain cables: welding method, welding equipment, consumables; qualification certificate of welder, acceptance criteria, grinding recording.

4.5.7 Heat treatment: including control of parameters such as heating temperature, heating time and holding times, as well as heat treatment methods for chain cables of different grades and accessories.

4.5.8 Proof-load test and breaking test: test load, test equipment, test methods, measurement of five links, measurement of a whole length of chain cables, measurement of single links and accessories, and their recording.

4.5.9 Mechanical test: grade and specification of chain cables and accessories, the sampling position, number and dimension of specimens, test temperature, acceptance criteria and recording.

4.5.10 Non-destructive test: NDT method, equipment, acceptance criteria, qualification certificate of operational personnel.

4.6 Acceptance conditions for delivery: products acceptance for chain cables and accessories, including visual and dimension examination, proof-load and breaking-load test, mechanical test, and delivery criteria (including non-destructive test, package, identification and qualification certificate).

4.7 Instructions for use of products: specifications, grade, delivery condition, standard satisfied, method of connection of chain cables and anchors onboard ships, instructions for use and operation.

4.8 Qualified products: recent quality statistics analysis (including qualified rate, unqualified rate, reasons and measures taken) of chains and accessories, described in the form of table or diagram; users' comments, including feedbacks from customers both at home and abroad.

4.9 The quality/qualification certificate of the manufacturer for satisfactory chain cables and accessories when delivery is to contain at least:

4.9.1 name, grade and specification of chain cables and accessories;

4.9.2 CCS certificate No. of works approval and approval no. of drawing;

4.9.3 CCS Rules and relevant standards based for manufacturing and acceptance;

4.9.4 handwritten signature of inspector and manager of quality department and the date;

4.9.5 serial No. and quantity of chain cables or accessories, weight of chain cables, a single length and the total length;

4.9.6 proof loads and breaking loads;

4.9.7 heat treatment condition for delivery;

4.9.8 marks on chain cables or accessories;

4.9.9 mechanical properties of chain cables or accessories (if applicable);

4.9.10 non-destructive test report (if applicable).

4.10 Quality management documents: including currently valid quality assurance manual, procedures and system for quality control.

4.11 Where defects of chain cables or accessories need to be repaired by welding before heat treatment, the weld repair procedure is to be submitted to CCS for examination and approval.

4.12 Drawings of chain cables and accessories: general arrangement (including the whole length of chain cables and tolerance, heat treatment condition for delivery, proof-load/breaking load test, mechanical property test, non-destructive test, method of connection of chain cables and anchors); components and parts drawings (including dimension and tolerance of a single link and accessories, pin hole size of accessories, grade 3 chain cables welded stud structure).

4.13 Type test program of chain cables and accessories: property test of links (including tensile test, bend test, impact test, metallographic examination, macro-examination, sulphur prints, hardness test), property test of accessories (including tensile test, impact test, metallographic examination, macro-examination, sulphur prints, hardness test), test items for finished chain cables and accessories (including proof-load test, breaking test, visual examination, dimension examination, non-destructive test).

5 Materials and components

Steels and steel forgings intended for chain cables and accessories are to be furnished with CCS certificate of marine products or equivalent documents, and are to be manufactured at steelmakers approved by CCS. Steel and steel forgings intended for chain cables and accessories without CCS product certificates or equivalent documentation are to be fabricated at steelmakers approved by CCS, and subject to CCS inspection.

6 Stud welding procedure approval for grade 3 chain cables

In the initial approval of grade 3 chain cables, the stud welding procedure is to be subject to an approval test in accordance with the requirements in Welding Procedure Tests for Fillet Weld Joints of Section 3, Chapter 3, PART THREE of CCS Rules for Materials and Welding. The test items of welding procedure include hardness test, dye penetration/magnetic particle test, fracture test, macro-examination, and the test results are to comply with the relevant requirements in 3.3.4, Chapter 3, PART THREE of CCS Rules for Materials and Welding.

7 Design and technical requirements

The design of chain cables and accessories as well as relevant technical requirements are to comply with relevant requirements of CCS Rules for Materials and Welding.

8 Selection of typical samples

8.1 The typical samples for works approval are to be, in respect to property, characteristics and manufacturing quality, capable of representing or covering the products or product series to be approved. The chain cables and accessories with maximum specification are to be selected for each grade. Where grade 2 and grade 3 chain cables with the same specifications are to be approved, approval of grade 3 is enough. Samples of accessories for approval may be of different constructions such as Kenter type shackles (KS), swivels (SW), end shackles (ES) (or joining shackles (JS)).

8.2 For the first approval, chain cables with maximum diameters by different chain making equipment are to be selected as samples respectively.

8.3 For renewal, change or adding items of works approval certificate, CCS may consider the reduction of test items.

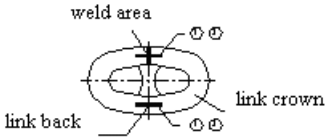
8.4 Approval of enlarged links and end links are to be in accordance with the test items and

requirements for accessories.

9 Test items for works approval are given in Table 9.

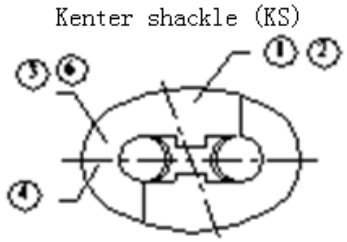
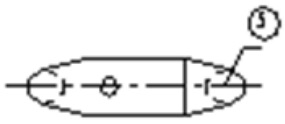
Test items for works approval of chain cables and accessories

Table 9

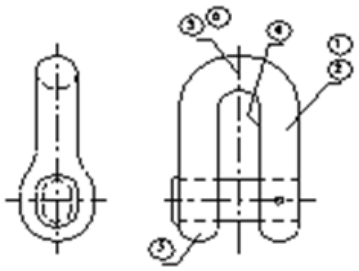
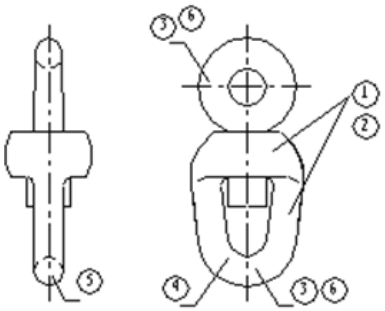
<table>
<tr><th colspan="2">Test items</th><th>Quantity</th><th>Specimen preparation</th><th>Test requirements</th></tr>
<tr><td rowspan="6">property test of links</td><td>① tensile test</td><td>2</td><td rowspan="6"> 

(1) A tensile specimen to be taken from the link back and welded zone respectively on the center of weld or at a position of 1/6 diameter from the surface as shown in the figure
(2) Bending specimen to be taken from the surface of welded zone. The diameter of former is 2 times the thickness of specimen. the bending angle is 180 °
(3) 3 sets of impact specimens to be taken in the welded zone and link back respectively on the center of weld or at a position of 1/6 diameter from the surface (The test temperature to be -20℃, 0℃ and +20℃ respectively) .
(4) A metallographic specimen to be taken from the link back and welded zone respectively on the center of weld or at a position of 1/6 diameter from the surface as shown in the figure
(5) Macro-specimens to be taken in longitudinal direction
(6) Sulphur prints to be taken from the longitudinal section of links</td><td>10.2.7.5
For bending specimen, no cracks or other open defects exceeding 3 mm in dimension on the outside of the bend portion</td></tr>
<tr><td>② bend test</td><td>1</td></tr>
<tr><td>③ impact test</td><td>6 sets</td></tr>
<tr><td>④ metallographic examination</td><td>2</td><td>Photos (×100 magnification) of ferritic elements and austenitic grain size to be taken and free from any defects</td></tr>
<tr><td>⑤ macro-examination</td><td>1</td><td>Photos (×1 magnification) to be taken to determine the defects and inclusions of chain steels and their size, distribution and shape</td></tr>
<tr><td>⑥ sulphur prints</td><td>1</td><td>Photos (×1 magnification) to be taken to determine the distribution and segregations of the sulphur in chain steels</td></tr>
</table>

Continued Table 9

Test items		Quantity	Specimen preparation	Test requirements
property test of links	⑦ hardness test	2	(7) The hardness test to be carried out on parent metal and welded zone respectively. The locations to be suitably spaced and the distribution diagram to be provided	1 is not less than 120(HB) 2 is not less than 145(HB) 3 is not less than 207(HB) The above data for reference only
property test of accessories	① tensile test	1	(1) A tensile specimen to be taken as shown in the figure (2) 3 sets of impact specimens to be taken as shown in the figure (the test temperature to be -20℃, 0℃ and +20℃ respectively). (3) A metallographic specimen to be taken as shown in the figure. (4) Macro-specimen may be semi-circular (5) Sulphur prints to be taken from the longitudinal section of links (6) The hardness test to be carried out as shown in the figure. The locations to be suitably spaced and the distribution diagram to be provided Kenter shackle (KS)  	10.2.8.4 10.2.7.5
	② impact test	3 sets		
	③ metallographic examination	1		Photos (×100 magnification) of ferritic elements and austenitic grain size to be taken and free from any defects.
	④ macroexamination	1		Photos (×1 magnification) to be taken to determine the defects and inclusions of steel forgings and their size, distribution and shape.
	⑤ sulphur prints	1		Photos (×1 magnification) to be taken to determine the distribution and segregations of the sulphur in steel forgings.

Continued Table 9

Test items		Quantity	Specimen preparation	Test requirements
property test of accessories	⑥ hardness test	1	End shackle (ES) Joining shackle (JS)  Swivel (SW) 	2 is not less than 145(HB) 3 is not less than 207(HB) The above data for reference only
Test of finished chain cables and accessories	① proof-load test	1	A length of finished chain cables; one of KS, SW, ES or JS respectively	10.2.7.1-10.2.7.4 10.2.8.1-10.2.8.3
	② breaking-load test	1	The breaking load specimen and the chain cables and accessories for proof load test are to be made in a single manufacturing cycle and heat treated together. One specimen of chain cables; one specimen of KS, SW, ES or JS respectively	
	③ Visual examination	1	Visual examination	10.2.4-10.2.5
	④ dimension examination	1	(1) Size of every link, length of five links, the total length of chain, stud position. (2) Size of accessories	
	⑤ non-destructive test	1	Dye penetration/magnetic particle test is usually carried out on the crown, in the plane and at the side (diameter of link is less than 80 mm); ultrasonic test is usually carried out in the plane and at the side for links of diameter greater than 80 mm	CCS accepts relevant standards on non-destructive test

Notes:

① The content in the Table is from section 2, chapter 10, PART ONE of CCS Rules for Materials and Welding.

② For swivels, specimens are to be taken from link body and bolt respectively for tensile, impact tests, metallographic examination and hardness test. Macro-specimen is to be located in the position where the change of body section is significant.

③ Where the tensile and impact specimens can not be cut due to smaller size of forged accessories, metallographic examination and hardness test are to be carried out.

10 Delivery test items for chain cables and accessories are given in Table 10.

Delivery test items for chain cables and accessories

Table 10

Test items	Specimen requirements
① visual examination	(1) measurement of single link, five links, total length of chain, stud position;
② dimension examination	(2) measurement of chain cables and accessories 10.2.4-10.2.5
③ proof load test	10.2.7.1-10.2.7.4;
④ break load test	10.2.8.1-10.2.8.3
⑤ mechanical test	10.2.7.5; 10.2.8.4
⑥ heat treatment record	10.2.6

Note: The content in the Table is from Section 2, Chapter 10, PART ONE of CCS Rules for Materials and Welding.