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W-12

STEEL WIRE ROPES

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Foreword

China Classification Society (hereinafter referred to as CCS) Product Inspection and Testing Guideline (hereinafter referred to as this Guideline) contains the technical requirements, inspection and testing criteria related to classification and statutory survey of marine products to be applied for CCS approval/inspection.

This Guideline frees the users to adopt other test methods and requirements which are equivalent to or are stricter than this Guideline.

This Guideline is published and updated by CCS, and is released at <http://www.ccs.org.cn>. Your comments or suggestions are welcomed and may be sent to our email addressed mp@ccs.org.cn.

Historical version and release date: W12(201510) October 20, 2015;

Main changes:

1. Modified the structure of the guide according to the requirements of procedure documents, add “Definitions” and “Main components and parts” etc. and adjust the relevant content and text format.
2. Revise the contents of drawings and delete "CCS approval" in "source of raw materials".
3. Revise the contents of the product quality certificate.

CONTENTS

1 Application.....4

2 Normative references4

3 Terms and definitions.....4

4 Drawings and documents4

5 Technical requirements5

6 Materials and components5

7 Type test.....6

8 Unit/batch inspection7

STEEL WIRE ROPES

1 Application

1.1 This Chapter is applicable to works approval and unit/batch inspection of steel wire ropes manufactured in accordance with the requirements of CCS Rules for Materials and Welding.

1.2 This Chapter is applicable to wire ropes in carbon steel intended for mooring lines, towlines, stream wires and lifting appliances of ships and offshore installations. For low-alloy and alloy steel wire ropes, reference may be made to this Chapter.

1.3 Steel wire ropes (galvanized, plain) intended for ships and offshore installations are to be subject to works approval by CCS.

2 Normative references

2.1 The basis for approval and inspection of steel wire ropes

- (1) CCS Rules for Materials and Welding;
- (2) Relevant national and international standards.

3 Terms and definitions

Nil.

4 Drawings and documents

4.1 The following documents are to be submitted to CCS for information.

- (1) Particulars of the manufacturer: the name, address and history, production capacity, type and specification of the products, qualification of the personnel.

Details of products: approved range of diameter for steel wires and wire ropes, the construction of wire ropes, grade of strength, grade of coating.

Source of raw materials: name of the manufacturer of wire rod or completed wires, delivery condition, type and specification, grade of material or designation.

Particulars of main production equipment, inspection and test equipment: name, type, manufacturer, manufacturing date, capacity, condition, quantity, calibration, model to be indicated.

Quality statistical analysis of products: quality statistical analysis and properties analysis of wires and wire ropes in recent years.

(2) Quality management and control documents: organizational structure, quality control points, responsibilities of the management departments and relationship in-between, quality system documents, quality manual, quality management-related procedural documents, operation guidance.

(3) Production technology: flow chart of production, internal control criteria of the manufacturer, operation procedures and operation guidance, mainly including:

- drawing, details of drawing equipment, pass design, size of each drawing pass;
- heat treatment, the type of furnace, parameters, dimension, temperature control, treatment system;
- galvanizing, kinds, equipment type, treatment capacity, temperature control, pre- and post-treatment, quality of zinc ingots;
- stranding (including fiber core);
- rope manufacturing.

5 Technical requirements

5.1 For steel wires before stranding or steel wires after unstranding for test, the tensile strength, twisting, repeated bending, knotting, drawing, wrapping and mass of coating are to comply with the requirements in Section 4, Chapter 10, PART ONE of CCS Rules for Materials and Welding and other relevant requirements.

5.2 Breaking test methods and requirements for steel wire ropes are to comply with the relevant recognized standards. Where the summation of the breaking load of individual wires is accepted as the breaking load of the rope, a conversion factor in recognized standards is to be applied.

6 Materials and components

The supplier of completed steel wires is to obtain works approval by CCS.

7 Type test

7.1 Determination of the type test program

The program may be proposed by the applicant and confirmed and approved by CCS, or proposed by CCS and confirmed by the applicant. The program is to contain:

- (1) the range of diameter of wire ropes and wires for approval, coating, construction, grade of strength;
- (2) the typical samples selected for approval;
- (3) place of test, laboratory, and the qualification of personnel.

7.2 Selection of typical samples

- (1) The selection requirements are to take into consideration the coverage of the range of diameter of wires and wire ropes, construction, grade of strength and coating.
- (2) In an initial approval, products with minimum steel wire diameter and 80% maximum wire rope diameter within product approval range and representative on such manufacturing process as construction, strength level and zinc coating thickness are to be selected.

7.3 The test items and requirements are to contain:

- (1) Chemical composition analysis: C, Si, Mn, P, S, Cr, Ni, Mo, Cu and Als to be analyzed. For low-alloy or alloy steels, relevant and added elements are to be analyzed.
- (2) Test items for steel wire, including:
 - ① tensile strength: tensile strength to be tested for wires before stranding and wires after unstranding;
 - ② twisting: the maximum twisting speed and minimum number of twists of the test machine to be in accordance with the rules requirements and relevant national standards;
 - ③ repeated bending: to be in accordance with the relevant national standards;
 - ④ knotting and drawing: may be used in lieu of bending and twisting for wires with diameter less than 0.5 mm;

- ⑤ metallographic examination: wires after heat treatment to be tested to examine the decarburized depth and grain size;
 - ⑥ wrapping test: to be tested for galvanized wires. The diameter of cylindrical mandrel is to be selected depending on the grade of coating and diameter of wires in accordance with relevant standards;
 - ⑦ mass of zinc coating: to be tested for galvanized wires, and in accordance with the standards acceptable to CCS or other recognized standards.
- (3) Breaking test of wires. The test is to be made on completed ropes. Where the test is on unstranded wires (completely unstranded in an initial approval), the summation of the tests of individual wires is calculated, then a conversion factor of equivalent construction is applied to the calculated breaking load.
- (4) Visual and dimensional examination. The examination is to be carried out for wires and wire ropes respectively, including:
- ① for wires: diameter, roundness, drawing cracks, split layers, scabs, drawing stamps, dent, laps, rust spots, ring, pock mark, zinc deficiency, zinc accumulation, in which no defects such as drawing cracks, split layers, scabs, drawing stamps, laps and rust spots are permitted, while the others are to be accepted according to the relevant standards;
 - ② for wires ropes: construction, stranding methods, diameter, wire arrangement, fracture, short of wire, transposition, irregular joining, slack of wire in strand, untwisting of wires in strand, variation in pitch, untwisting of strands, waviness, kinking, discovery of fiber core, irregular greasing, corrosion, in which no defects such as fracture, short of wire, untwisting of strands, waviness, kinking, corrosion are permitted, while the others are to be accepted according to the relevant standards.
- (5) Anti-rotating performance test: approved steel wire rope products include non-rotating steel wire ropes whose construction is to comply with standards accepted by CCS or recognized standards. Representative products are to be selected for anti-rotating performance test. Anti-rotating performance test is to be carried out for three-strand or four-strand non-rotating steel wire ropes designed by the manufacturers. Test methods are to comply with standards accepted by CCS or recognized standards.

8 Unit/batch inspection

8.1 After works approval by CCS, the marine steel wires 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 onboard ships only after satisfactory inspection.

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

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

- (1) Visual and dimensional examination;
- (2) Chemical composition analysis;
- (3) Mechanical properties and technical properties test of wires;
- (4) Mass test of zinc coating of wires (only for galvanized wire ropes);
- (5) Test of breaking load of completed ropes or aggregate breaking load of individual wires.

8.4 After satisfactory inspection of product, CCS Surveyor is to seal on the end of wire or mark on the nameplate with CCS stamp and issue a certificate of marine product or endorse the manufacturer's quality certificate.

8.5 The quality certificate of the manufacturer is to contain at least the following particulars:

- (1) Name of the purchaser and order number;
- (2) Construction, grade of tensile strength, diameter, gross mass, net mass and length of the wire ropes;
- (3) Maximum and minimum number of twisting of wires, maximum and minimum value of tensile strength;
- (4) Minimum breaking force of wire ropes (theoretical value), minimum breaking load of wire ropes (measured value) or the aggregate breaking load of individual wires (measured value);
- (5) Grade of coating for galvanized ropes;
- (6) Rope number or product number etc.;

(7) Anti-rotating performance test of steel wire ropes;

(8) If equivalent certificates is required to issued, space for stamp and endorsement by CCS Surveyor are needed.