Guideline No.: A-02(201705)

A-02 FIBER ROPES

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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 .

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Main changes and effective date:

Update the reference standard version, and the type test content had been modified.

CONTENTS

FIBER ROPES

1 Application

1.1 This Guideline applies to synthetic fiber ropes for ships engaged on international voyages and domestic voyages:

(1) Ship securing, towing and towed;

(2) Goods securing, hoisting and lashing.

2 Normative references

2.1 Chapters 7, Part Two of China Classification Society Rules for Materials and Welding.

2.2 ISO2307-201005 Ropes — Determination of Certain Physical and Mechanical Properties.

2.3 ISO1346-201204 Performance and Specification of Polypropylene Rope Fibre Ropes-Polypropylene Split Film, Monofilament and Multifilament(PP2) and Polypropylene High-tenacity Multifilament(PP3)-3-,4-,8-and12-strand Ropes;

2.4 ISO1141-2012 04 Performance and Specifications of Polyester RopeFibre Ropes-polyester-3-,4-,8- and12-strand Ropes;

2.5 ISO1140-2012 04 Performance and Specifications of Polyamide Rope Fibre ropes-Polyamide-3-,4-,8- and 12-strand Ropes;

2.6 ISO10325-2009 Fibre Ropes-High Modulus Polyethylene-8-strand Braided Ropes,12-strand Braided Ropes and Covered Ropes

2.7 National standard, ISO standard and other standards accepted by CCS.

If the standards renewed above, CCS accept the latest effective version.

3 Terms and definitions

3.1 GB3291-82 Textile Terms and Terminology (General Parts of Textile Materials and Textile Products)

3.21 Linear density means the mass per unit length of fiber rope under pre-load, in ktex.

3.~~3~~2 Rated breaking ~~load~~force means the nominal value which is to be reached or exceeded during breaking test, and also used to verify the nominal diameters of fiber ropes, in kN.

3.~~4~~3 Actual breaking ~~load~~force means the actually measured value of fiber rope breaking load during breaking test, in kN.

3.~~5~~4 Pre-tension means load applied to determine nominal diameter and linear density of a fiber rope in accordance with recognized standards, which is generally defined as 1‰ of the minimum breaking force, in kN.

3.~~6~~5 Nominal diameter means generally recognized diameter (also named nominal diameter) to indicate rope specification and determine rated breaking strength and linear density, in mm.

3.~~7~~6 Measured diameter means the diameter measured under pre-load, in mm.

3.~~8~~7 Lay length means the length of same stranded rope with n complete strands for stranded rope and length of same twisted rope with n complete twists for plaited rope, in mm.

3.~~8~~9 Elongation means the ratio between the amount of elongation when the tensile force reaches 50% of the minimum breaking force and gauge length when rope under the reference tension. ~~Elo~~

4 ~~Plans and d~~Documents

4.1 The applicant is to submit the following documents to CCS for approval when applying for works approval to CCS:

(1) Technical requirements for acceptance or enterpriser’s standard;

(2) Type test program.

4.2 The applicant is to submit the following documents to CCS for information when applying for works approval to CCS:

(1) The standard applicable to rope;

(2) Source of raw materials and technical requirements for acceptance;

(3) Quality management and control documents;

(4) Particulars of manufacturer, history and relevant description of rope manufacturing;

(5) A list of main equipment for rope producing and inspection;

(6) Conditions of inspection personnel;

(7) Flow chart of manufacturing process and documents;

(8) Format of report for approval and delivery inspection test;

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

(10) Specimen of product quality certificate.

5 ~~Design and technical requirements~~ Materials and Parts

~~5.1 Raw materials are to be attached with a quality certificate by the supplier and be re-tested by the manufacturer incoming inspection.~~

5.1 The qualified supplier list of raw materials should be investigate by CCS, and the list includes raw materials' name, type/specification, control mode and supplier.

5.2 The raw materials should be re-tested by the manufacturer incoming inspection.

6 Selection of typical samples

6.1 Principles for sampling

6.1.1 Samples are to be taken from the fiber ropes with the same raw materials lot number, the same structure and sizes, and the same production procedure. Except as agreed otherwise, S samples are to be taken at random from the above mentioned fiber ropes for test. S is obtained by the following formula:

$$S = 0.4 \times \sqrt{N}$$ ~~S = 0.4 x N1/2~~ (Number)

where: S — number of samples, in number;

N — roll number of fiber ropes to compose of a batch, in roll.

Where S is not an integral number, the obtained value is to be rounded off to the nearest number. When S < 1, take one sample.

6.1.2 In the works type approval test, generally one maximum sized rope is to be taken, and samples must be taken from the complete rope rather than breaking strands.

6.1.3 Raw materials subject to sampling test: selecting samples in principle that the ropes of same color and same grade are regarded as a batch, while threads and lines of different materials are sampled respectively. Take 5 packages from a batch in a raw material warehouse and select 2 reels (hanks) from each package as specimen.

7 Type test

7.1 Inspection items for raw materials: to carry out test in accordance with raw materials acceptance technical requirements provided by the manufacturer.

7.1.1 Visual inspection: for the same batch of products, their color differences are generally in consistency, surface are smooth, no scratch, and no undrawn yarn is allowed.

7.1.2 For physical property, the following items are to be tested:

(1) nominal diameter measuring (only for single thread inspection);

(2) test for fiber breaking elongation;

(3) fiber breaking load;

(4) fiber linear density.

7.~~1~~ 2 Inspection items for ropes

7. ~~1~~2.1 Visual examination

(1) Visually inspect the strands evenness and smoothness, breaking strands, slack twists and to check if there is any wearing, scratch, cutting or other types of damage existing.

(2) Visually inspect any oil and color variance on rope surface.

7. ~~1~~2.2 Test methods and procedures for physical properties may be referred to in ISO2307-201~~005~~ or GB/T8834-2006 Ropes — Determination of Certain Physical and Mechanical Properties.

7. ~~1~~2.3 Physical property test items

(1) diameter measuring;

(2) linear density calculation;

(3) breaking force test; (test is to adopt completed rope instead of calculating by breaking strands).

~~7.2 Inspection items for raw materials: to carry out test in accordance with raw materials acceptance technical requirements provided by the manufacturer.~~

~~7.2.1 Visual inspection: for the same batch of products, their color differences are generally in consistency, surface are smooth, no scratch, and no undrawn yarn is allowed.~~

~~7.2.2 For physical property, the following items are to be tested:~~

~~(1) nominal diameter measuring (only for single thread inspection);~~

~~(2) test for fiber breaking elongation;~~

~~(3) fiber breaking load;~~

~~(4) fiber linear density.~~

7.3 Test procedure

~~7.3.1 Measure the original length, represented by L0; weigh the sample, represented by m0; and then take record. Sample rope buckles are to be completed by the manufacturer. According to Table 7.1.4.3(1), Part Two, Chapter 7 of the Rules, the minimum free length of the specimen between grips is 900 mm.~~

~~(1) At the same time of measuring initial length L0 , it is to determine the gauge length of specimen, represented by D0 before the specimen is installed on testing machine and flared out by manual. Two points symmetrical to the midpoint of specimen are to be marked, and the least length between the two gauge length points is 0.5 m. The ropes are to be marked.~~

~~(2) Turn on the tension machine to pull the ropes up to the selected pre-tension (rule specified as 1% of the minimum breaking load) and then stop pulling, measure the current gauge length, represented by Dp.~~

7.3.1 Take a new sample by drawing a length of rope of 2m or more plus the length.

(1)Tension the test length to the value required and main the tension for 1min. Place two marks on the rope 2m apart, then remove the tension and detach the sample from the parent length by cutting cleanly at the two marks. Determine the masss, m_0, of the test piece and calculate the mass per metre from the result.

(2) Measuring for actual diameter: the measured diameter may be obtained by measuring the circumferences of three positions on the gauge length by tape ruler under pre-tension;

(3) Tension the test length to the value required and draws a length of rope 400mm or more plus the length, determine the length l_1. The test shall be carried out at a speed of (250±50)mm/min. When the tensile force reaches 50% of the minimum breaking force, measure the distance between l_1 ,designate this distance as l_2, the gauge length, expressed in millimetres, for a tensile force equal to 50% of the specified minimum breaking force.

(4) Measuring for breaking force: turn on tension machine to start loading at the stretching speed of ~~75~~250 ~~±25mm~~50mm/min until ropes break. Record the breaking force and the place on the test piece where the break occurs.

If an unspliced breaking force is specified, the specimen shall be deemed to meet the requirement w~~W~~hen the breaking occurs between two gauge lengths of the specimen, the value displayed on tension machine is the breaking force of ropes; while breaking happens beyond two marks and lower than rated breaking force, the specimen may also be deemed to be compliable with breaking force index incase the breaking force displayed on tension machine is not less than 90% of the rated minimum breaking force index. If the specimen fails to pass the test, it is acceptable to re-select 2 specimens from the original ropes for re-test. The results will be accepted when both specimens pass the tests, while one of the specimen fails, such rope will be determined as unaccepted.

If a spliced minimum breaking force is specified, the specimen shall be deemed to meet the requirement if it breaks at a force equal to or higher than the value for ropes with eye-spliced terminations, as indicated in the relevant standard. If the specimen fails to pass the test, it is acceptable to re-select 2 specimens from the original ropes for re-test. The results will be accepted when both specimens pass the tests, while one of the specimen fails, such rope will be determined as unaccepted.

(5) Linear density calculation

Linear density may be obtained by formula (1):

~~ρX = mO/L~~ $\rho_X = \frac{m_o}{L}$ (1)

where: ρ_X —linear density, in ktex;

mo—is the mass,in grams, of the test piece; ~~specimen quality~~, ~~in g;~~

~~L— calculated by formula (2), the specimen length influenced by pre-tension, in m;~~

~~L=(Dp×LO)/DO (2)~~

~~where: DO— initial distance (at least 0.5 m) between measured marks according to 7.3.1(1), in m;~~

~~Dp— distance between marks measured under pre-tension according to 7.3.1(2), in m;~~

L_o— is the measured ~~initial overall length~~ length, in metres, of ~~specimen according to 7.3.1,~~ the test piece under the reference tension.

(6) Elongation

The value of the elongation, E, expressed as a percentage, is given by Equation:

$$E=\frac{(l_2-l_1)\times 100}{l_1}$$

Where

l_1 —is the gauge length, expressed in millimetres, under the reference tension;

l_2 —is the gague length, expressed in millimetres, for a tensile force equal to 50% of the specified minimum breaking force.

(7) Lay length

The lay, l_p, expressed in millimetres, is given be Equation:

$$l_p=\frac{l_n}{n}$$

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8 Unit/batch inspection

8.1 Take specimen in accordance with paragraph 6.1.1.

8.2 Test items and procedures are to be performed in test and inspections according to 7.1 and 7.3 of this Guideline.

8.3 Test reports are to contain the following items:

Test report

Rated force	**kN**	**Rope materials**	
Structure of rope	Strand	Specifications	(mm×m)
Model of tension machine		Period of validity	
Ambient temperature	(℃)	Relative humidity	(%)
Test No.		Measured diameter	(mm)
Lay length	(mm)	Breaking force	kN
Stretching speed	(mm/min)	Breaking position	
Rated linear density	(ktex)	Linear density	ktex
Results		Test date	

9 Mark and certificate

9.1 Each roll of finished fiber ropes subject to acceptance is to be obviously tied with a label indicating product name, serial number, materials, structure, specifications, manufacturer name and CCS mark.

9.2 The manufacturer is to provide the qualified fiber ropes with qualification certificate containing at least the following:

(1) product names, models and serial numbers;

(2) materials used for fab~~ir~~ricating fiber ropes;

(3) length of whole fiber rope roll and diameter of rope;

(4) linear density of fiber ropes;

(5) fabric of fiber ropes;

(6) rated breaking ~~load~~ force of fiber ropes (indicate the actual breaking ~~load~~ force where necessary).