
**Fibre ropes for offshore
stationkeeping —**

**Part 1:
General specification**

*Cordages en fibres pour le maintien en position des structures
marines —*

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Contents

	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Materials	3
4.1 Rope core material.....	3
4.1.1 Fibre tenacity.....	3
4.1.2 Marine grade.....	3
4.2 Rope cover material.....	3
4.3 Other materials.....	4
5 Requirements — Rope properties	4
5.1 Minimum breaking strength.....	4
5.2 Minimum core tenacity.....	4
5.3 Dynamic stiffness at end of bedding-in.....	4
5.4 Torque properties.....	4
5.4.1 Torque-neutral rope.....	4
5.4.2 Torque-matched rope.....	5
5.5 Cyclic loading performance.....	5
5.6 Particle ingress protection.....	5
6 Requirements — Rope layout and construction	5
6.1 General.....	5
6.2 Type of construction.....	5
6.3 Rope core.....	5
6.4 Protective cover.....	6
6.5 Terminations.....	6
6.6 Length of rope.....	6
7 Rope testing	7
7.1 Type test.....	7
7.1.1 General.....	7
7.1.2 Sampling and testing.....	7
7.1.3 Breaking strength, core tenacity and stiffness tests.....	7
7.1.4 Torque properties tests.....	7
7.1.5 Linear density test.....	7
7.1.6 Cyclic loading endurance test.....	8
7.1.7 Protective cover thickness.....	8
7.2 Testing of current production.....	8
7.2.1 Sampling and testing.....	8
7.2.2 Length measurement.....	8
8 Report	8
8.1 Prototype rope.....	8
8.2 Current production.....	9
9 Certification	9
10 Marking, labelling and packaging	9
10.1 Marking.....	9
10.2 Labelling.....	9
10.3 Packaging.....	10
Annex A (normative) Fibre qualification and testing	11
Annex B (normative) Rope testing	14
Annex C (informative) Guidance for rope handling care	25

Annex D (informative) Manufacturer declaration — Fibre ropes for offshore stationkeeping	39
Annex E (informative) Additional information and guidance	40
Bibliography	47

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 38, *Textiles*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This first edition of ISO 18692-1, together with ISO 18692-2, cancels and replaces the first edition of ISO 18692:2007, which has been technically revised.

A list of all parts in the ISO 18692 series can be found on the ISO website.

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Fibre ropes for offshore stationkeeping —

Part 1: General specification

1 Scope

This document specifies the main characteristics and test methods of new fibre ropes used for offshore station keeping.

Fibre ropes for stationkeeping can be manufactured from different rope core material.

This document provides general requirements applicable to all materials. The subsequent parts of the ISO 18692 series provide the specific requirements for each (rope core) material that are not addressed within this document.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1968, *Fibre ropes and cordage — Vocabulary*

ISO 2060, *Textiles — Yarn from packages — Determination of linear density (mass per unit length) by the skein method*

ISO 2062, *Textiles — Yarns from packages — Determination of single-end breaking force and elongation at break using constant rate of extension (CRE) tester*

ISO 7500-1, *Metallic materials — Verification of static uniaxial testing machines — Part 1: Tension/compression testing machines — Verification and calibration of the force-measuring system*

ASTM D 885, *Standard test methods for tire cords, tire cord fabrics, and industrial filament yarns made from manufactured organic-base fibers*

ASTM D 6611, *Standard test method for wet and dry yarn-on yarn abrasion resistance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1968 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1 breaking strength BS

maximum force applied in straight tension to a rope, which causes it to rupture

3.2

core

central part which is the load-bearing part of the rope

3.3

cover

braided cover or other protective layer, which is placed over the rope core

Note 1 to entry: The cover has no significant contribution to the rope strength.

3.4

dynamic stiffness

ratio of rope load to strain variations between the lower (trough) and upper (peak) stresses imposed during testing, normalized by the rope minimum breaking strength

Note 1 to entry: See [B.3.6.2](#).

3.5

fibre material declaration

document prepared by the fibre producer attesting the type and grade of fibre material and the properties of the fibre

3.6

marine finish

process and substance used on a fibre or yarn to improve the yarn-on-yarn abrasion performance of the product in a marine environment

3.7

marine grade fibre

fibre intended for use in a marine environment and that has demonstrated yarn-on-yarn abrasion performance

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3.8

minimum breaking strength

MBS

specified minimum value that the breaking strength of a rope shall achieve when tested following the procedure in this document

Note 1 to entry: In this document, the specified MBS is that of a terminated rope.

3.9

prototype rope

rope fully complying with the rope design specification made for the purpose of testing either before an order is placed or before regular rope production begins for an order

3.10

qualified rope

rope already certified by the manufacturer as complying with the requirements laid down in this document, including all the relevant prototype testing

3.11

recognized classification society

RCS

classification society being a member of the International Association of Classification Societies (IACS), with recognized and relevant competence and experience in fibre rope mooring, and with established rules/guidelines for related classification

3.12**rope construction**

manner in which the fibres, yarns and strands are assembled together in making the rope

Note 1 to entry: In some rope constructions, rope core is made of sub-ropes, i.e. laid or braided ropes, that are assembled together by laying, braiding, or in parallel.

3.13**rope design specification**

document which completely describes the design of the rope, including the numbers and arrangements of strands, the strand pitch, the material chemical composition and the manufacturing method

3.14**rope manufacturing specification**

document which completely describes the process of making the rope, including instructions for each step of the manufacturing process

3.15**rope production report**

document which completely describes the rope product, including rope design, termination design, and assembly length, and which includes the material certificates, material test results and the various checklists

3.16**rope termination**

method by which the rope is attached to the assembly interface

EXAMPLE Splice, potted socket, wedged socket.

3.17**termination specification**

document which completely describes the design of the termination and the process of making that termination, including materials and steps for making or assembling the termination

3.18**torque**

moment that produces or tends to produce a twisting or a rotating motion around rope axis,, when a tension is applied to the rope, or changed

4 Materials**4.1 Rope core material****4.1.1 Fibre tenacity**

The fibre used in the core of the rope shall be in accordance with the specific requirements of each respective part of the ISO 18692 series and shall be qualified and tested according to [Annex A](#).

4.1.2 Marine grade

The fibre used in the core of the rope shall be marine grade fibre. The yarn-on-yarn abrasion performance shall be verified by tests on wet yarn and it shall meet the requirements of [A.4.2](#).

4.2 Rope cover material

When polyester yarn is used in the protective cover, it shall be in accordance with [Annex A](#) and its minimum tenacity shall be 0,73 N/tex.

4.3 Other materials

Other materials employed in rope assembly shall be identified in the rope design/manufacturing specification.

For each material, the following shall be specified, as applicable:

- a) base material;
- b) size (e.g. linear density, mass per unit area);
- c) relevant strength properties (e.g. tenacity, stiffness).

5 Requirements — Rope properties

5.1 Minimum breaking strength

The minimum breaking strength of the rope, when tested according to [Clause 7](#) and [Annex B](#), shall conform to specific requirements of each respective part of the ISO 18692 series.

5.2 Minimum core tenacity

The rope minimum core tenacity, measured according to [Annex B](#), shall be in accordance with specific requirements of each respective part of the ISO 18692 series.

5.3 Dynamic stiffness at end of bedding-in

The dynamic stiffness at the end of the bedding-in sequence shall be measured on the prototype testing in step 8 of the rope test procedure in [B.3.1](#).

5.4 Torque properties

5.4.1 Torque-neutral rope

A rope is considered torque-neutral if it has a torque factor, Q , of less than 0,005, see [Formula \(1\)](#):

$$Q = \frac{T}{d \cdot F} \quad (1)$$

where

Q is the torque factor;

d is the rope diameter, expressed in millimetres (mm);

F is the force applied to the rope, expressed in kilonewtons (kN);

T is the torque generated by the rope, expressed in newton metres (N·m).

The test method to demonstrate torque-neutral behaviour is defined in [B.6.1](#).

Parallel construction ropes having braided sub-ropes or an equal number of left lay and right lay twisted sub-ropes which are all identical in every respect except for twist direction are inherently torque-neutral (see also [6.2](#)). These constructions does not need to have their torque generation verified.

5.4.2 Torque-matched rope

A rope is considered torque-matched if its torsional characteristic over the design load range is essentially the same as that of the wire rope to which it is to be connected.

When tested as described in [B.6.2](#), the angular rotation in the wire rope element shall not exceed 5° per rope lay.

5.5 Cyclic loading performance

The rope shall have demonstrated performance under cycling loading following the requirements of [7.1.6](#) and [B.5](#).

5.6 Particle ingress protection

Unless otherwise specified, the rope shall be constructed with a protection of the core against the ingress of particles having a size greater than 20 µm (microns) or as agreed between involved parties. Testing of the protection shall be performed in accordance with [B.7](#). The tests shall be performed on one rope size.

6 Requirements — Rope layout and construction

6.1 General

The typical section of a rope shall comprise a rope core, providing intended strength and stiffness, and a cover.

6.2 Type of construction

The rope shall be of one of the following types of construction:

- torque-neutral construction (type TF);
- torque-matched construction (type TM).

The type of rope shall be specified by the purchaser.

NOTE Torque-neutral ropes are intended for use in mooring systems together with chain or torque-neutral spiral strand wire ropes. Torque-matched ropes are intended for use in mooring systems together with six-strand wire ropes or other non torque-neutral wire ropes.

6.3 Rope core

6.3.1 The total number of yarns in the rope shall be at least the number specified in the rope design specification.

6.3.2 Splices are not allowed in the rope core nor in sub-ropes, except for those at the end terminations.

Strands shall be uninterrupted over the length of the rope, with no splice or strand interchange.

Yarns may be joined if necessary.

6.4 Protective cover

6.4.1 A protective cover shall be provided around the rope core to protect the rope core from mechanical damages (mainly abrasion) during handling and in service.

The protection shall be water-permeable.

6.4.2 A polyester braided protective cover shall have a minimum thickness, t , with:

- $t = 7,0$ mm, for a reference number RN equal or above 100;
- $t = 0,07 \times RN$, but not less than 4 mm, for a reference number RN less than 100.

Strand interchanges, i.e. the overlapping continuation of an interrupted strand with another identical strand following the same path, are permitted if they are properly staggered.

6.4.3 If an alternative protective cover is used, it shall demonstrate at least a level of protection equal to that of a polyester braided cover as per [4.2](#) and [6.4.2](#).

6.4.4 A braided cover shall include coloured strands forming a pattern so that rope twist during installation or in service can be identified. There shall be a minimum of one "S" coloured strand and one "Z" coloured strand to form a cross on the rope.

An alternative protective cover shall be fitted with an axial stripe of contrasting colour, or other means to identify rope twist during installation or in service.

6.5 Terminations

The terminations shall be made of an eye splice plus abrasion protection materials.

There may be other terminations provided that they do not jeopardize the rope performance.

The dimensions and arrangement of the eye shall match the diameter and groove shape of the thimble (or other interface piece) to be used for end connections, and shall be the same as for the rope prototype testing.

In the splice area, the integrity and the continuity of rope cover and particle-ingress protection, if fitted, shall be preserved or restored.

The eye and the splice area shall be further covered by an abrasion protection coating such as polyurethane.

Each termination shall be made according to the manufacturing practice as described in the termination specification.

6.6 Length of rope

The bedded-in lengths of the rope sections shall be calculated in accordance with [7.2.2](#), under 20 % of MBS, unless otherwise agreed on the purchase order or contract.

The calculated length of supplied rope shall be within ± 1 % of the specified length.

For each supplied rope, the actual length at the reeling tension or during manufacture shall be reported as an indicative value.

The length of short sections, if any, shall be mutually agreed between the purchaser and the manufacturer.

Adequate extra length shall be manufactured in order to prepare the samples for testing, which are considered to be part of the delivery.

7 Rope testing

7.1 Type test

7.1.1 General

Type tests demonstrate that ropes certified by the manufacturer as complying with the requirements laid down in this document possess the properties specified in this document. The purpose of these tests is to verify the design, material and method of manufacture of each size of finished rope, including protective cover and terminations.

All ropes to be type tested shall comply with all the other requirements laid down in this document. The tests specified below shall be carried out on a prototype rope for each size of rope, unless otherwise noted in this clause.

Any change in the design, material, method of manufacture, including protective cover and terminations, which may lead to a modification of the properties as defined in [Clause 5](#) shall require that the type tests specified in this document be carried out on the modified rope.

7.1.2 Sampling and testing

The number of rope samples to be tested shall be in accordance with the specific requirements of each respective part of the ISO 16892 series.

7.1.3 Breaking strength, core tenacity and stiffness tests

7.1.3.1 Samples shall be tested according to the procedure specified in [Annex B](#), and each shall be capable of meeting the specific requirements of each respective part of the ISO 18692 series.

7.1.3.2 The rope core tenacity and dynamic stiffness at end of bedding-in shall be calculated according to the methods defined in [B.3](#).

7.1.3.3 Measurement of the static stiffness and of the dynamic stiffness at other load levels shall be performed within the same tests. These measurements are, however, not required when results are available for another qualified rope of the same design, material and method of manufacture, with a reference number of not less than 150.

NOTE 1 These stiffness measurements are performed for design purposes only. There are no acceptance criteria on these parameters.

NOTE 2 These stiffness measurements can be also performed on a separate rope sample (see [B.3.5](#)).

7.1.4 Torque properties tests

Where applicable, torque properties tests shall be performed according to the procedure specified in [B.6](#).

These tests are, however, not required when results are available for another qualified rope of the same design, material, method of manufacture and termination, with a reference number of not less than 150.

7.1.5 Linear density test

The linear density shall be calculated from the measured weight and length according to the method defined in [B.4](#).

7.1.6 Cyclic loading endurance test

One sample shall be tested for cyclic loading. However, a cyclic loading (endurance) tests performed with one size of qualified rope having the same design, material and method of manufacture including protective cover and terminations, shall be enough to qualify all sizes with an MBS between 50 % and 200 % of the size tested. The test for cyclic loading (endurance) is not required if such data are available.

The cyclic loading endurance test shall be performed according to the procedure specified in [B.5](#).

A load range shall be selected by the manufacturer, and the rope shall withstand, without breaking, at least the number of cycles for that load range, as given in [Figure B.2](#).

7.1.7 Protective cover thickness

The thickness of the protective cover shall be verified.

The thickness of a braided cover shall be measured as twice the thickness of cover strands under the maximum braiding tension.

7.2 Testing of current production

7.2.1 Sampling and testing

For ropes that conform to the requirements of this document, based on type tests in accordance with [7.1](#), the following tests shall be performed on one sample taken from the manufacturing process, for each type and size of rope:

- a) breaking strength and core tenacity, according to the procedure in [Annex B](#);
- b) protective cover thickness verification. [ISO 18692-1:2018](#)

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7.2.2 Length measurement

The bedded-in length of each supplied rope section (other than short sections) shall be calculated from the linear density, ρ_t , using [Formula \(2\)](#):

$$L = \frac{(m_T - m_S) \cdot 1\,000}{\rho_{t,20}} \quad (2)$$

where

- L is the length of the rope in metres (m);
- m_T is the mass of the total rope length in kilograms (kg);
- m_S is the mass of the materials used to form the eyes and the splices in kilograms (kg);
- $\rho_{t,20}$ is the linear density of the rope, in ktex, obtained from the type test.

The length of short rope sections (i.e. sections of less than 20 m) shall be measured at a load of 2 % of MBS as the length between the centres of termination fittings (see [Figure B.1](#)).

8 Report

8.1 Prototype rope

A complete and detailed report of the prototype rope manufacturing shall be supplied, including the fibre manufacturer, the fibre type and finish and all rope characteristics that may influence the mechanical

properties, like design, material specifications, method of manufacture, including protective cover and terminations, with sketches or pictures.

A complete and detailed report of type tests, with sketches or pictures of the test set-up, shall also be provided.

8.2 Current production

The manufacturing report of supplied ropes shall be provided. A complete and detailed report of rope tests with sketches and pictures of the test set-up shall also be provided.

9 Certification

The certificate of approval and control, issued by a recognized classification society (RCS), shall be presented together with the ropes, in order to ensure that testing and fabrication are in accordance with the approved specifications.

The rope manufacturer shall issue a declaration or obtain a certificate including at least the following information:

- a) reference number;
- b) type of construction;
- c) rope core material;
- d) linear density;
- e) MBS;
- f) individual identification number; [ISO 18692-1:2018](https://standards.iteh.ai/catalog/standards/sist/6ffa01ce-3f7a-4995-8d12-0d3a41f55cb6/iso-18692-1-2018)
- g) length at a specified load; <https://standards.iteh.ai/catalog/standards/sist/6ffa01ce-3f7a-4995-8d12-0d3a41f55cb6/iso-18692-1-2018>
- h) length at the reeling handling tension.

NOTE A suggestion for manufacturer declaration can be found in [Annex D](#).

10 Marking, labelling and packaging

10.1 Marking

A tape of at least 3 mm wide printed with a reference identifying the manufacturer shall be incorporated into the rope. The maximum distance between two consecutive markings shall be 0,5 m.

10.2 Labelling

An identification plaque or alternative means shall be installed close to the splice with the following information, as a minimum:

- a) purchase identification;
- b) individual identification number;
- c) rope core material;
- d) a reference to the specific part of the ISO 18692 series;
- e) type of construction (TF or TM), in accordance with [6.2](#);