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Steel wire ropes — Fibre main cores — Specifications

Câbles en acier — Âmes centrales textiles — Spécifications

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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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 document 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).

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This document was prepared by Technical Committee ISO/TC 105, *Steel wire ropes*.

This third edition cancels and replaces the second edition (ISO 4345:1988), which has been technically revised.

The main changes are as follows:

— the tolerances for length and nominal diameter have been modified;

— the technical indicator and test method of moisture regain have been added;

— the test method and formula of water solution acid have been modified;

— the formula for calculating salt content has been added;

— the term "runnage" has been replaced by "linear density".

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.

Steel wire ropes — Fibre main cores — Specifications

1 Scope

This document specifies the construction and characteristics of fibre main cores for steel wire ropes using two types of fibre:

a) natural fibre;

b) man-made fibre.

This document is not applicable to ropes for mine hoisting purposes.

NOTE Fibre cores are adversely affected by high ambient temperatures. When selecting fibre cores, the limitation of specific fibres, in this respect, must be recognized.

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 139, *Textiles — Standard atmospheres for conditioning and testing*

ISO 1968, *Fibre ropes and cordage — Vocabulary*

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 terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
water soluble acid
amount of soluble acid in water that can be adequately extracted from the fibre cores, expressed as the volume of sodium hydroxide or potassium hydroxide solution (with a concentration of 0,1 mol/L) that is used to neutralize the soluble acid extracted from a sample of 100 g

3.2
moisture regain
mass of water in any form in the fibre core material, determined using prescribed methods and expressed as a percentage of the mass of water to the absolute dry mass of the fibre core material

3.3
lubricant content
mass of lubricant absorbed in the fibre core material, expressed as a percentage of the mass of lubricant to the absolute dry mass of the fibre core material

4 Material

4.1 Natural fibre cores

Natural fibre cores shall be made from new hard fibres or some specific soft fibres of the following types:

a) Sisal (Agave sisalana);

b) Abaca; Manila hemp (Musa textilis);

c) Jute.

4.2 Man-made fibre cores

Man-made fibre cores shall be made entirely from new fibres of the following types:

a) fibre-forming polyolefines (i.e. monofilament, film or fibrillated film of polyethylene, polypropylene, etc.);

b) any suitable alternative materials agreed between core purchaser and core supplier.

NOTE Mixed fibre cores are produced by mixing natural fibre and man-made fibre agreed between core purchaser and core manufacturer.

5 Construction

Main cores conforming to this document shall be laid up from at least three strands. Each coil shall be continuous throughout its length without core splices.

6 Core designation

The core shall be designated by its nominal diameter, nominal linear density, type of fibre main cores, construction and direction of twist. These shall be agreed between the core manufacturer and the steel wire rope manufacturer. The core manufacturer shall state whether the linear density is based on the lubricated or unlubricated core.

7 Tolerances

7.1 Tolerance on length

The length of core supplied shall be equivalent to the specified length subject to the following tolerances as given in Table 1.

Table 1 — Tolerance on length

Length, *L*	Tolerance
L≤400 m	+5 % 0
400 m< L≤1 000 m	+20 m 0
L>1 000 m	+2 % 0

7.2 Tolerance on nominal diameter

The tolerance on nominal diameter shall be as given in Table 2. Diameter shall be measured in accordance with the method specified in Annex A.

Table 2 — Tolerance on nominal diameter

Type of fibre		Tolerance on nominal diameter	
		≤7 mm	>7 mm
Natural fibre	Hard fibre (Sisal or Abaca)	+5 % 0	
	Soft fibre (Jute)	+5 % 0	+4 % 0
Man-made fibre		+4 % 0	+3 % 0

7.3 Tolerance on nominal linear density

The tolerance on nominal linear density shall be as given in Table 3. Linear density shall be measured in accordance with the method specified in Annex B.

Table 3 — Tolerance on nominal linear density

Type of fibre	Tolerance on nominal linear density	
	≤7 mm	>7 mm
Natural fibre	+5 % 0	
Man-made fibre	+4 % 0	+3 % 0

8 Core lubricants

Lubricants used for cores shall be acid-free and shall not contain moisture.

The lubricant content of pre-lubricated cores shall be agreed between the core purchaser and the core manufacturer. It shall be measured in accordance with the method specified in Annex C.

9 Moisture regain

The moisture regain of natural fibre cores shall meet the requirements given in Table 4. It shall be measured in accordance with the method specified in Annex C.

Table 4 — Moisture regain of natural fibre cores

Type of fibre	Moisture regain
Hard fibre (Sisal or Abaca)	≤14,0 %
Soft fibre (Jute)	≤13,0 %

Moisture regain is normally associated only with natural fibre cores and may not be applicable to man-made fibre cores.

10 Water soluble acids

The acidity of the core shall be not more than 2,0 mL of 0,1 mol/L acid solution per 100 g of core when tested in accordance with the method specified in Annex D.

Acidity is normally associated only with natural fibre cores and may not be applicable to man-made fibre cores.

11 Salt

The salt content (expressed as a percentage of sodium chloride) shall be not more than 0,3 % when tested in accordance with the method specified in Annex E.

Salt is normally associated only with natural fibre cores and may not be applicable to man-made fibre cores.

12 Packaging and marking

The cores shall be supplied unspliced in continuous length in coils or reels. Each package shall:

a) be suitably protected against damage and adverse climatic conditions in transit;

b) bear a label giving the name of the core supplier, the nominal diameter, the nominal linear density, the length and type of fibre.

All ends shall be whipped and tied to prevent unravelling.

Annex A
(normative)

Determination of core diameter

Prior to removal of sample from the reel, coil or pad, the out exposed side of the core shall be marked with chalk or other suitable substance over a distance of about 5 m.

With reference to this mark, the samples shall be selected and the measurements shall be carried out in such a way that no torsion is introduced and the lay is not disturbed.

Place the sample for measurement, at least 3 m long, under a reference tension, *F*, in Newton, calculated from the Formula (A.1):

$$F = \frac{D^2}{0,8} \quad \text{(A.1)}$$

where

F is a reference tension, in Newton;

D is the nominal core diameter, in millimetre.

Measure the core under tension using a sliding calliper having jaws wide enough to cover two strands of the core. Carry out the measurements at the two ends and the centre of the 3 m test length, measuring two mutually perpendicular diameters at each of these points.

Calculate the mean of these six measurements and record the results, in millimetre, rounded to the nearest 0,1 mm, as the core diameter.

The maximum difference between the highest and lowest of the six measurements shall not exceed 5 % of the nominal diameter.

This test shall only be used for cores before they have been put into a steel wire rope; it shall not be used for cores taken from steel wire ropes.

Annex B
(normative)

Determination of core linear density

Place the samples for measurement, at least 4 m long, under a reference tension calculated in accordance with the formula given in Annex A.

Mark the sample accurately with two marks at least 3 m apart, while under this reference tension, and cut at these marks when the tension is released.

Determine the mass of the cut length of rope to the nearest 0,1 g and express it in grams per metre.

The tester shall state whether the linear density refers to a lubricated or an unlubricated core, calculated from the Formula (B.1):

$$\rho = \frac{M}{L} \tag{B.1}$$

where

ρ is the core linear density (mass per unit length), in g/m;

M is the quantity of the sample, in gram;

L is the length of the sample under the reference tension, in metre.

This test shall only be used for cores before they have been put into a steel wire rope; it shall not be used for cores taken from steel wire ropes.

Annex C
(normative)

Determination of moisture regain and core lubricant content

C.1 Preparation of samples

From the centre of a length of steel wire rope core having a mass of at least 100 g, cut two specimens representing the complete cross-sectional area; the length of the pieces shall be chosen in such a way that the mass m_1 of the specimen to be used for determining the extractable content is between 20 g and 30 g and the mass m_2 of the specimen to be used for determining the water content is about 50 g.

Standard atmospheres for conditioning and testing shall be as specified in ISO 139.

C.2 Determination of moisture regain

For this determination, use the sample of mass m_2. Distil the water contained in the sample after the addition of xylene or an appropriate benzole fraction, and condense it in a graduated receiver, the experiment apparatus for extraction method showed in Figure C.1. From the mass of water m_3 obtained from the specimen of mass m_2, calculate the mass of water m_4 present in the specimen of mass m_1, using the Formula (C.1):

$$m_4 = \frac{m_1}{m_2} \times m_3 \tag{C.1}$$

where

m_4 is the mass of water present in the specimen for determining the extractable content, in gram;

m_1 is the mass of the specimen used for determining the extractable content, in gram;

m_2 is the mass of the specimen used for determining the water content, in gram;

m_3 is the mass of the water extracted from the specimen, in gram.

Calculate the moisture regain M_1, using the Formula (C.2):

$$M_1 = \frac{m_3}{m_2 - m_3} \times 100 \tag{C.2}$$

where

M_1 is the moisture regain of the fibre cores, in percentage;

m_2 is the mass of the specimen used for determining the water content, in gram;

m_3 is the mass of the water extracted from the specimen, in gram.

Express the result in % to the nearest 0,1 % (m/m).

C.3 Determination of extractable content (moisture-free)

Unravel the first sample, of mass m_1, weigh it to the nearest 0,1 g and put it into a new extraction sleeve, of known mass and not containing any substances soluble in methylene chloride and not dried. Ensure that the sample does not project over the edge of the sleeve.

Dry an extraction flask of nominal capacity 250 mL for at least 2 h in a drying cabinet at (105 ± 1) °C. Cool the flask in a desiccator for 2 h and determine its mass to the nearest 0,001 g.

Pour 150 mL of methylene chloride into the flask and extract the contents of the sleeve in a Twisselmann or Soxhlet apparatus shown in Figure C.2 until the extraction medium flows off in a colourless form, or, if colourless impregnating agents are present, until a specimen taken from the extract evaporates without residue.

WARNING — Methylene chloride is toxic. Safety precautions are necessary.

It is recommended that for routine determinations, 60/80° petroleum ether or other suitable solvent be substituted.

After extraction, evaporate the solvent, leaving a small quantity. Evaporate this residual quantity of the extraction agent in a drying cabinet at (105 ± 1) °C until constant mass is obtained. The drying process can be accelerated by placing the flask in an inclined position. Cool the flask for 2 h in a desiccator and weigh again to 0,001 g. Calculate, by difference, the mass m_5 of the extracted portion (moisture-free).

Calculate the extractable content, M_2, expressed as a percentage by mass, of the dry fibre material remaining after extraction, using the Formula (C.3):

$$M_2 = \frac{m_5}{m_1 - (m_4 + m_5)} \times 100 \qquad \text{(C.3)}$$

where

M_2 is the core lubricant content, in percentage;

m_1 is the mass of the specimen used for determining the extractable content, in gram;

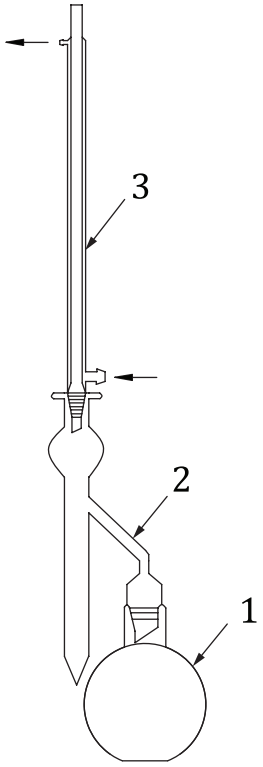
m_4 is the mass of the water in the specimen, as determined in accordance with C.1, in gram;

m_5 is the mass of the matter extracted from the specimen, in gram.

Express the result to the nearest 0,1 % (m/m).

This method shall only be used for cores before they have been put into steel wire ropes; it shall not be used for cores taken from steel wire ropes.

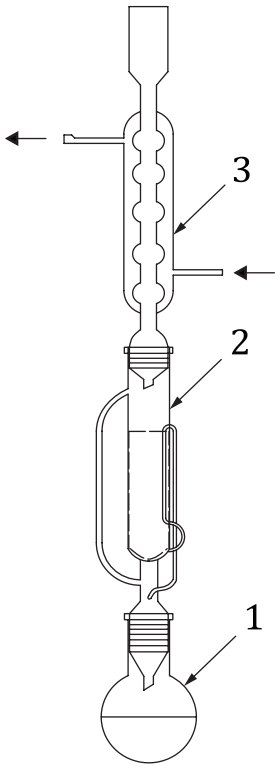
NOTE The extraction method is better used for arbitration. And the gravimetric method is used in routine test.



Key

1 round flask
2 water collecting pipe
3 reflux condensing tube

Figure C.1 — Experiment apparatus of extraction method



Key

1 round flask
2 extracting pipe
3 reflux condensing tube

Figure C.2 — Soxhlet apparatus for extracting lubricant