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(चौथा पुनरीक्षण)

Indian Standard

STEEL WIRE ROPES — FIBRE MAIN CORES — SPECIFICATION

(Fourth Revision)

ICS 77.140.65

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

May 2004

Price Group 4

FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Cordage Sectional Committee had been approved by the Textile Division Council.

This standard was originally published in 1961 and subsequently revised in 1976, 1982 and 1996. The present revision has been taken up to harmonize it with corresponding International Standard, ISO 4345 : 1988 'Steel wire ropes — Fibre main cores — Specification'. In this standard following changes have been made :

a) Use of oil based lubricants for the lubrication of fibre core confirming to IS 9182 (Part 1) has been specified.
b) Requirement of lay length of fibre main core has been modified to express range of tolerances in place of specific tolerance limit.
c) Provision has been made for use of identification tape or marker yarn in the fibre core.

In the preparation of this standard considerable assistance has also been derived from BS 525 : 1991 'Fibre core for wire ropes' issued by the British Standards Institution.

The composition of the Committee responsible for formulation of this standard is given in Annex F.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounding off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

STEEL WIRE ROPES — FIBRE MAIN CORES — SPECIFICATION

(Fourth Revision)

1 SCOPE

1.1 This standard specifies the construction particulars and other requirements of fibre main cores for steel wire ropes using two types of fibre:

a) Natural, and
b) Man-made.

1.2 This standard is not applicable to ropes for mine hoisting purposes.

NOTE — Fibre cores may be adversely affected by high ambient temperatures and as such when selecting fibre cores, the limitation of specific fibres in this respect should be taken into consideration.

2 REFERENCES

The following standards contain provisions which through reference in the text constitute provisions of this standard. At the time of publications, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
2 : 1960	Rules for rounding off numerical values (*revised*)
3256 : 1980	Code for inland packaging of ropes and cordages (*first revision*)
7071(Parts 1 to 3) : 1989	Ropes and cordages — Methods of physical test (*first revision*)
9182 (Part 1) :1993	Lubricants for wire ropes and fibre cores — Specification : Part 1 Lubricants for fibre core of wire ropes
9560 :1980	Colour code for identification of ropes and cordages

3 MATERIAL

3.1 Natural Fibre Cores

Natural fibre cores shall be made from virgin long fibres of the following types:

a) Soft Fibres, for example — Jute, and
b) Hard Fibres — Sisal (*Agave* sisalana), or Manila (abaca) (*Musa textilis*).

3.2 Man-Made Fibre Cores

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

a) Fibre forming polyolefins (that is monofilament, film or fibrillated film of polyethylene, polypropylene, etc); and
b) Any suitable alternative material agreed to between the purchaser and the supplier.

4 CONSTRUCTION

4.1 General

Main cores complying with this standard shall be laid up from at least three strands. In case of four strands fibre core support shall be provided. Each coil shall be continuous throughout its length without core splices.

4.2 Yarn Sizes

The maximum size of yarn used in the manufacture of soft and hard fibre main core shall be as given in Tables 1 and 2 respectively.

Table 1 Maximum Yarn Sizes for Soft Fibre Main Cores
(*Clause* 4.2)

Sl No.	Nominal Diameter, *D* mm	Nominal Yarn Size k tex
(1)	(2)	(3)
i)	$D < 4.5$	0.41
ii)	$4.5 \leq D < 6.0$	0.83
iii)	$6 \leq D \leq 8$	1.66
iv)	$D > 8$	3.31

Table 2 Maximum Yarn Sizes for Hard Fibre Main Cores
(*Clause* 4.2)

Sl No.	Nominal Diameter, D mm	Nominal Yarn Size k tex
(1)	(2)	(3)
i)	$D \leq 4.5$	1.6
ii)	$4.5 < D \leq 7.0$	2.8
iii)	$7 < D \leq 12$	3.7
iv)	$D > 12$	4.6

NOTE — These sizes are based on the fibre mass of the yarn, exclusive of the effect of any dressing. Yarn sizes of man-made fibres are not specified.

5 PHYSICAL REQUIREMENTS

5.1 Core Lubrication

Lubricants used to facilitate the preparation of natural fibres prior to, and/or in, the process of spinning shall meet the requirements of IS 9182 (Part 1). The water content and core lubricant content shall be determined in accordance with the method specified in Annex A.

NOTES

1 Lubricants are not normally used in the spinning of man-made fibres.

2 The lubricant content of pre-lubricated cores should be agreed to between the core manufacturer and the wire rope manufacturer.

5.2 Lay Length

The lay length of fibre main cores, when determined in accordance with IS 7071(Parts 1 to 3) shall conform to the following requirements:

Type of Fibre	*Lay Length*
Natural fibre	
Soft fibre — Jute	between 3.0D and 3.5D
Hard fibre — Sisal and Manila	between 2.8D and 3.2D
Man-made fibre	between 3.7D and 5.0D

where

D is the diameter of fibre main cores.

6 CHEMICAL CONTENTS

6.1 Water Soluble Acids

The acidity of the core shall not be more than 2 ml of a 0.1 mol/l acid solution per 10 g of core when tested in accordance with the method specified in Annex B.

6.2 Salt

The salt content (expressed as a percentage of sodium chloride) shall not be more than 0.3 percent when tested in accordance with the method specified in Annex C.

NOTE — Acidity and salt content are normally associated only with natural fibre cores and may not be applicable to man-made fibre cores.

7 TOLERANCES

7.1 Ordered Length

The tolerances on the ordered length, l, shall be as follows :

$l \leq 400$ m : + 5 percent, − 0

$l > 400$ m : + 20 m for each 1 000 m or part, − 0 thereof.

7.2 Nominal Diameter and Nominal Runnage

The manufacturer shall declare the nominal diameter and runnage and it shall be subjected to the tolerances given in Table 3. The core diameter and core runnage shall be determined in accordance with method given in Annex D and Annex E respectively.

NOTE — The test for core runnage shall be conducted before it has been put into core rope. It shall not be used for cores taken from wire ropes.

Table 3 Tolerances on Nominal Diameter and Nominal Runnage
(*Clause* 7.2)

Sl No.	Type of Fibre	Total Tolerance Range on	
		Nominal Diameter, D, Percent	Nominal Runnage, Percent
(1)	(2)	(3)	(4)
i)	Natural fibres :		
	All sizes	+5 −0	+5 −0
ii)	Man-made fibre :		
	a) 4 mm $\leq D \leq$ 7 mm	+4 −0	+4 −0
	b) $D \geq 7$ mm	+3 −0	+3 −0

8 CORE DESIGNATION

The core shall be designated by its nominal diameter and nominal runnage (mass per unit length). These shall be agreed to between the core manufacturer and the wire rope manufacturer. The core manufacturer shall state

whether the nominal runnage is based on the lubricated or unlubricated core. The core diameter and core runnage shall be determined in accordance with the methods specified in Annex D and Annex E respectively.

9 IDENTIFICATION

9.1 If agreed to between the core manufacturer and wire rope manufacturer, fibre core shall be marked for identification in accordance with the procedure laid down in IS 9560.

9.1.1 The 'Marker' Yarn shall take the place of one of the white yarns. Jute yarn provided it is not coarser than 1654 tex (48 gist) may be used but it shall not be taken as a substitute for one of the white yarns in the strand and shall be additional.

10 PACKING

The cores shall be supplied unspliced in continuous length in coils or reels. No coil shall contain more than one length. Each package shall be suitably protected against damage and adverse climatic conditions in transit. All ends shall be whipped and tied to prevent unraveling.

NOTE — IS 3256 may be followed for packing fibre cores intended for use within the country.

11 MARKING

11.1 Each coil/reel shall have a label attached to it on which following shall be clearly and legibly marked :

a) Indication of the source of manufacture;
b) Type of fibre;
c) Nominal diameter in mm;
d) Nominal runnage in mass/length; and
e) Length of the core in m.

11.2 BIS Certification Marking

The coils of fibre cores may also be marked with the Standard Mark.

11.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from Bureau of Indian Standards.

12 SAMPLING AND CRITERIA FOR CONFORMITY

12.1 The coils of core of the same size shall constitute a lot. Each sample taken shall be representative of the lot.

12.2 The conformity of the lot shall be determined on the basis of tests carried out on the samples selected from it.

12.3 Sampling shall be as representative as possible of the lot. Draw the samples at random at the rate shown by the following formula:

$$S = 0.4\sqrt{N}$$

where

S = the number of the coil in the sample, and
N = the size of the lot expressed as number of coils.

When S is calculated is not a whole number, round off the value obtained to a whole number in accordance with IS 2. In case where S is less than 1 draw one coil as sample.

12.4 The test sample shall be taken from the coil in such a manner that the lay is not disturbed. The piece of core upon which the tests are carried out shall be at least 5 m from the outer end of the coil. In case of dispute, the coil shall be placed upon a turntable for the purpose of obtaining the sample.

12.5 The sample shall be at least 4 m long.

12.6 Criteria for Conformity

The lot shall be declared conforming to this standard, if the following conditions are satisfied:

a) Length of each coil in the sample shall satisfy the declared length.
b) Samples tested for core diameter and runnage, core lubricant, water soluble acids and salt content shall meet the specified/declared requirements.
c) The sample shall also meet all other requirements.

ANNEX A
(*Clause* 5.1)

DETERMINATION OF WATER CONTENT AND CORE LUBRICANT CONTENT

A-1 PREPARATION OF SAMPLES

From the centre of a length of 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 a mass m_1 of the specimen to be used for determining the extractable content is between 20 and 30 g and the mass m_2 of the specimen to be used for determining the water content is about 50 g.

A-2 DETERMINATION OF WATER CONTENT

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. From the mass of water m_4 obtained from the specimen of mass m_2 calculate the mass of water m_5 present in the specimen of mass m_1 using the formula:

$$m_5 = \frac{m_1}{m_2} \times m_4$$

m_1 = mass of the specimen used for determining the extractable content, in g;

m_2 = specimen of mass, in g;

m_4 = mass of water, in g; and

Express the result, in grams, to the nearest 0.001 g.

A-3 DETERMINATION OF EXTRACTABLE CONTENT (MOISTURE-FREE)

A-3.1 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 . Ensure that the sample does not project over the edge of the sleeve.

A-3.2 Dry an extraction flask of nominal capacity 250 ml for at least 2 h in a drying cabinet at 105 °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 Soxhlet apparatus 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.

After extraction, evaporate the solvent, leaving a small quantity. Evaporate this residual quantity of the extraction agent in a drying cabinet at 105°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_3 of the extracted portion (moisture-free).

A-3.3 Calculate the extractable content, M, expressed as a percentage by mass of the dry fibre material remaining after extraction, using the formula :

$$M = \frac{m_3}{m_1(m_3 + m_5)} \times 100$$

where

m_1 = mass, of the specimen used for determining the extractable content, in g;

m_3 = mass, of the matter extracted from the specimen, in g; and

m_5 = mass, of water in the specimen, in g; as determined in accordance with **A-2.**

Express the result to the nearest 0.1percent (*m/m*).

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

ANNEX B
(*Clause* 6.1)

DETERMINATION OF WATER-SOLUBLE ACIDS

B-1 Take a sample of core, approximately 20 to 30 g in mass, from the core to be tested, and weigh to the nearest 0.1 g. Unravel the specimen and transfer it to a Soxhlet apparatus.

Boil for 30 min at least with 100 ml of distilled water.

Filter through a filter paper, and wash the residue successively three times with hot distilled water. After washing, the total quantity of the water extract should not exceed 175 ml.

Add a few drops of phenolphthalein to the extract and titrate with a 0.1 mol/l standard volumetric sodium hydroxide or potassium hydroxide solution to a permanent red colour.

B-2 Calculate the water-soluble acid content, Z, in mm/10 g, as follows:

$$Z = \frac{V}{m_0}$$

where

m_0 = mass, of the sample; and

V = volume of 0.1 mol/l sodium hydroxide or potassium hydroxide solution, in mm.

Express the result to the nearest 0.1 ml/10 g.

ANNEX C

(Clause 6.2)

DETERMINATION OF SALT CONTENT

C-1 SAMPLING

At least one bale in every 20 or part thereof of raw fibre shall be sampled, but in no case shall fewer than three bales be sampled; three samples of fibre shall be taken from different sections of each selected bale.

The selected sample shall be laid with the fibres parallel alternately head-to-tail, and a central cross-section, 230 mm long, shall be taken. This central section shall be mixed by rolling to form a bundle with parallel fibres.

A sample of fibre shall then be selected at random from various parts of the bundle and cut into two lengths of approximately 115 mm. The samples so obtained shall be stored in a wide-mouthed, glass stoppered bottle until testing.

C-2 PROCEDURE

Place 10 g of the fibre, sampled as above, in a platinum or silica basin, moisten it with 40 ml of 50 g/l sodium carbonate solution, then evaporate to dryness and ignite at a temperature not exceeding dull redness (or just high enough to give a product sufficiently charred to yield a colourless filtrate on extraction with water).

Extract the residue with hot water, filter and wash. Return the residue to the platinum or silica basin and incinerate completely.

Dissolve the ash in 20 percent(*v/v*) nitric acid, filter, wash the residue, and add this solution and washings to the aqueous extract.

Add to the combined extract, rendered acidic with dilute nitric acid, a known volume of a 0.1 mol/l standard volumetric silver nitrate solution in slight excess, stir well, filter and wash the silver chloride precipitate. Add to the combined filtrates and washings 5 ml of saturated solution of ammonium iron (III) sulphate, and titrate the excess silver nitrate with a 0.1 mol/l standard volumetric potassium thiocyanate solution until a permanent light brown colour develops.

C-3 EXPRESSION OF RESULTS

Calculate the percentage by mass of sodium chloride from the amount of silver nitrate converted into silver chloride, on the basis that 1 ml of 0.1 mol/l silver nitrate solution is equivalent to 0.005 85 g of sodium chloride.

Express the result to the nearest 0.1 percent (*m/m*) of sodium chloride.

ANNEX D

(Clauses 7.2 and 8)

DETERMINATION OF CORE DIAMETER

D-1 Prior to removal of sample from the reel or coil the outer 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.

D-2 Place the sample for measurement, at least 3 m long under the reference tension, F, in newtons, calculated from the formula

$$F = \frac{D^2}{0.8}$$

where

D = nominal core diameter in mm.

D-3 Measure the core diameter under tension using a sliding caliper 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 diameter at each of these points.

D-4 Calculate the mean of these six measurements and record the result, in millimetres, 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 percent of the nominal diameter. This test shall only be used for cores before they have been put into a wire rope. It shall not be used for cores taken from wire ropes.

ANNEX E
(*Clauses* 7.2 *and* 8)

DETERMINATION OF CORE RUNNAGE (MASS PER UNIT LENGTH)

E-1 Place the samples for measurement, at least 4 m long, under a reference tension calculated in accordance with the formula given in Annex D. Mark the sample accurately with two marks at least apart, while under this reference tension, and cut of these marks when the tension is released.

E-2 Determine the mass of the cut length of rope to the nearest 0.1 g and express it in mass/length.

The tester shall declare whether the runnage refers to a lubricated or an unlubricated core.

ANNEX F
(*Foreword*)

COMMITTEE COMPOSITION

Cordage Sectional Committee, TX 09

Organization	*Representative(s)*
Jayashree Fibre Products, Kolkata	SHRI N. K. SOMANI (***Chairman***)
Balaji Ropes Manufacturering Co Pvt Ltd, Kolkata	SHRI SANDEEP AGARWAL
C A Polycare Pvt Ltd, Kolkata	SHRI U. S. CHAKRABORTY
Calcutta Port Trust, Kolkata	SHRI P. L. NAG SHRI S. K. CHATTERJEE (*Alternate*)
Coir Board, Alleppey	SHRI P. T. JOSEPH SHRI K. G. RAGHAVAN (*Alternate*)
Directorate General of Supplies & Disposals (Inspection Wing), New Delhi	SHRI A. K. SEHGAL SHRI SUNDER LAL (*Alternate*)
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Indian Institute of Technology, Delhi	DR R. CHATTOPADHYAY
Indian Jute Industries' Research Association, Kolkata	DR D. SUR DR D. K. MUKHOPADHYAY (*Alternate*)

Organization	*Representative(s)*
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Jayashree Fibre Products, Kolkata	SHRI M. K. BIYANI
M. Best Cotton Rope Manufacturing Co, Mumbai	SHRI KANTILAL G. THANAWALA SHRI HEMAL M. THANAWALA (*Alternate*)
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United Rope Works, Kolkata	SHRI S. N. AGARWAL SHRI A. AGARWAL (*Alternate*)
BIS Directorate General	SHRI P. BHATNAGAR, DIRECTOR & HEAD (TXD) [Representing Director General (*Ex-officio*)]

Member Secretary
SHRI B. L. BHARATI
Joint Director (TXD), BIS

Bureau of Indian Standards

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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AMENDMENT NO. 1 JUNE 2004
TO
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(Fourth Revision)

(*Page* 5, *clause* **B-2**) — Substitute the following for the existing clause:

'**B-2** Calculate the water-soluble acid content, Z, in ml/10 g, as follows:

$$Z = \frac{V}{m_0}$$

where

m_0 = mass, in g, of the sample; and

V = volume of 0.1 mol/l sodium hydroxide or potassium hydroxide solution, in millilitre.

Express the result to the nearest 0.1 ml/10 g.'

(TX 09)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 NOVEMBER 2005
TO
IS 1804 : 2004 STEEL WIRE ROPES — FIBRE MAIN CORE — SPECIFICATION

(Fourth Revision)

(*Page* 4, *clause* **A-3.3**) — Substitute the following formula for the existing:

$$M = \frac{m_3}{m_1 - (m_3 + m_5)} \times 100$$

(TX 09)

Reprography Unit, BIS, New Delhi, India