

इंटरनेट

मानक

### Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 2197 (2000): Aerospace Textiles - Braided (Plaited) Linen (flax) Lacing Cord [TXD 13: Textile Materials for Aerospace Purposes]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”



BLANK PAGE



भारतीय मानक

वायुआकाशीय वस्त्रादि — गुम्फित (सिलवट युक्त) लिनन  
(सन) लेसिंग कोर्ड — विशिष्टि  
(दूसरा पुनरीक्षण)

*Indian Standard*

AEROSPACE TEXTILES — BRAIDED (PLAITED)  
LINEN (FLAX) LACING CORD — SPECIFICATION  
(*Second Revision*)

ICS 49.025.60

© BIS 2000

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

## FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Textile Materials for Aerospace Purposes Sectional Committee had been approved by the Textile Division Council.

This standard originally published in 1962 was revised in 1986. The standard has been revised again to incorporate the changes on the basis of experience gained during its use. In the revised version the requirements of residual alkali solubility, yarn lea breaking strength, coefficient of variation and turns per metre have been modified.

There is no International Standard on the subject.

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 rounded 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

# AEROSPACE TEXTILES — BRAIDED (PLAITED) LINEN (FLAX) LACING CORD — SPECIFICATION ( Second Revision )

### 1 SCOPE

This standard specifies the constructional and other particulars of braided (plaited) linen (flax) lacing cord for aerospace purposes.

### 2 REFERENCES

The Indian Standards given in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, 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 standards given in Annex A.

### 3 ATMOSPHERIC CONDITIONS FOR TESTING

Unless otherwise provided for in an agreement between the buyer and the seller, all tests shall be carried out in the standard atmosphere at  $65 \pm 2$  percent relative humidity and  $27 \pm 2^\circ\text{C}$  temperature (see also IS 6359), or within a period of 5 min of the removal of the test specimen from the standard atmosphere.

### 4 CONDITIONING OF TEST SPECIMENS

4.1 Unless otherwise provided for in an agreement between the buyer and the seller, the test sample or the test specimens shall be conditioned to moisture equilibrium in the standard atmosphere (see 3).

4.2 When the test sample or the test specimens have been left in the standard atmosphere for 24 hours in

such a way as to expose, as far as possible, all portions of the test sample or the test specimen to the standard atmosphere, it shall be deemed to have reached moisture equilibrium.

### 5 GENERAL REQUIREMENTS

#### 5.1 Yarn

5.1.1 The cord shall be manufactured from flax fibre (*linum usitatissimum*). The yarn used in manufacture of braided (Plaited) linen cords shall be evenly spun and shall be reasonably clean and free from leaf particles, neps, snarls, slubs and other defects.

5.2 The cord shall be firmly and uniformly braided. It shall be smooth and free from knots, broken or loose ends projecting from the cord and other manufacturing imperfections which will affect its appearance or serviceability.

### 6 CONSTRUCTIONAL AND OTHER REQUIREMENTS

6.1 Single yarns as specified in Table 1 shall be used as base yarns in the manufacture of final braided cord.

6.2 The cord shall comply with the requirements given in Table 2 and the braid interlacing shall be one under two over two. The number of strands in the braid shall be so adjusted that the nominal resultant count of the braid meets the requirement given in Table 2.

6.2.1 The number of strands in the braid may be tested as prescribed in B-1.

**Table 1 Constructional Requirements of Single Yarn**

(Clause 6.1)

Sl No.	Nominal Count in Tex (Linen Count)	Minimum Average Single Yarn Breaking Strength at 25 cm Gauge Length N(kgf)	CV percent of Breaking Strength, Max	Turns per Metre
i)	66 (25)	14 (1.4)	20	$380 \pm 20$
ii)	61 (27)	12 (1.2)	20	$420 \pm 20$
iii)	55 (30)	11 (1.1)	25	$450 \pm 25$
Method of Test	IS 1315	IS 1671	—	IS 832

**Table 2 Constructional Requirements of Braided Linen Lacing Cord**  
(Clause 6.2)

Nominal Resultant Count in Tex (Denier)	Number of Yarns per Strand	Plaits per Metre	Length/ Mass of Unproofed Cord (m/kg)	Breaking Load of Rot-Proofed Cord, Min (See Note)	
				Unwaxed N(kgf)	Waxed N(kgf)
(1)	(2)	(3)	(4)	(5)	(6)
900 (8 100)	1	350 ± 40	1100 ± 100	220(22.4)	180 (18.4)
Method of Test	—	B-3	B-2	B-4	

NOTE — Breaking load values pertain to final product irrespective of whether it is undyed or dyed.

### 6.3 Residual Alkali Solubility

6.3.1 The residual alkali solubility of the cord when tested according to the method prescribed in B-5 shall not exceed 10 percent.

## 7 FINISH

### 7.1 General

The cord shall be supplied in one of the following conditions:

- Undyed and rot-proofed;
- Undyed, rot-proofed and wax finished;
- Dyed and rot-proofed; and
- Dyed, rot-proofed and wax finished.

### 7.2 Rot-Proofing

7.2.1 The cord shall be rot-proofed with pentachlorophenyl laurate (PCPL) from aqueous emulsions in accordance with IS 11662. However, if agreed to between the buyer and the seller, any other rot proofing chemical may also be used.

### 7.3 Dyeing

7.3.1 In case of dyed cord, the colour and shade shall be as agreed to between the buyer and the seller. However, sulphur dyes shall not be used.

7.3.2 Dyes known to accelerate actinic damage shall not be used.

NOTE — The following dyestuffs are known to accelerate actinic damage.

- C.I. Vat yellow 2, 3, 4, 9, 11, 14, 18, 21, 26 and 28
- C.I. Vat orange 1, 2, 5 and 9
- C.I. Vat red 1, 2, 42, 47 and 48
- C.I. Vat brown 5
- C.I. Vat violet 2

7.3.3 The dyed cord shall be fast to artificial light and washing and shall comply with the requirements given in Table 3.

**Table 3 Colour Fastness Requirements of Linen Braided Cords**  
(Clause 7.3.3)

Sl No.	Agency	Minimum Colour Fastness Rating	Method of Test, Ref to
i)	Artificial light (Change in colour)	5	IS 2454
ii)	Washing Test 4 (change in colour and staining of adjacent fabrics)	4	IS 765

### 7.4 Wax Finishing

7.4.1 In case of wax finishing of the cord, microcrystalline hydrocarbon wax (a substitute of bees wax) shall be used and the increase in mass shall be + 5 to - 10 percent.

7.4.1.1 Prior to waxing, the cord shall have been rot-proofed in accordance with 7.2.

### 7.5 Surface Finish

7.5.1 Undyed and dyed rot-proofed cord shall have a soft, smooth finish. However, the substances which may promote microbiological growth such as starch or modified starch shall not be applied.

## 8 SEALED SAMPLE

8.1 If, in order to illustrate or specify the type of finish and feel of braided (plaited) cord, a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in respect of finish and feel.

8.2 The custody of the sealed sample shall be a matter of prior agreement between the buyer and the seller.

## 9 IDENTIFICATION

The cord shall be identified for ordering purposes by

the number of this Indian Standard together with the finish and, if required as dyed, then the colour.

NOTE — The identification may be codified. For example, cord required as dyed khaki, rot-proof and wax finished may be identified as IS 2197 khaki/PCPL/wax finished.

## 10 PACKAGING

Braided (plaited) linen cord shall be compactly wound in the form of reels, cheeses, etc, as agreed to between the buyer and seller, in lengths of 500 m. Short length pieces, if any, contained in the reel or cheese shall be not less than 50 m.

## 11 MARKING

11.1 All packages shall be wrapped in kraft paper and marked with the following information:

- a) Name of the material;
- b) Length of cord;
- c) Net weight of package;
- d) Identification code;
- e) Manufacturer's name, initials or trade-mark;
- f) Month and year of manufacture; and
- g) Colour fastness ratings in the case of dyed cord.

### 11.2 BIS Certification Marking

The packages may also be marked with the Standard Mark.

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

## 12 PACKING

The packages shall be packed in cardboard or wooden cases of suitable size. The weight of cardboard or wooden case when packed shall not exceed 50 kg.

## 13 SAMPLING AND CRITERIA FOR CONFORMITY

### 13.1 Lot

The quantity of braided (plaited) linen (flax) lacing

cord of a definite-quality delivered to a buyer against one despatch note shall constitute a lot.

13.1.1 The conformity of a lot to the requirements of this standard shall be determined on the basis of the test carried out on the samples selected from the lot.

13.2 Unless otherwise agreed to between the buyer and the seller, the number of reels, cheeses, etc, be selected at random from the lot shall be in accordance with col 2 of Table 4.

**Table 4 Sample Size**

(Clause 13.2)

Lot Size	Sample Size
(1)	(2)
Up to 150	3
151 to 300	5
301 to 500	7
501 to 1 000	10

13.3 The reels, cheeses, etc, selected according to 13.2 shall constitute the test sample for all requirements except for colour fastness. One test specimen shall be selected from each of the reels, cheeses, etc, in the test sample.

13.4 The number of test specimens to be selected at random for testing colour fastness from the test sample shall be 3.

### 13.5 Criteria for Conformity

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

- a) All pieces selected according to 13.3 or 13.4 satisfy the relevant requirements for each of the characteristics specified in this standard.
- b) From the test results of breaking load the average  $\bar{X} - 0.6 R$  is greater than or equal to the value specified in this standard.

NOTE — Average  $\bar{X}$  is the value obtained by dividing the sum of the observed values by the number of tests and  $R$ , the range, is the difference between the maximum and the minimum in a set of observed values.



## ANNEX A

(Clause 2)

## LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
296 : 1986	Sodium carbonate, anhydrous (third revision)		cotton system (first revision)
765 : 1979	Method for determination of colour fastness of textile materials to washing : Test 4 (second revision)	1671 : 1977	Method for determination of yarn strength parameters of yarn spun on cotton systems (first revision)
832 : 1985	Method for determination of twist in yarn (first revision)	2454 : 1985	Methods for determination of colour fastness of textile materials to artificial light (Xenon lamp) (first revision)
1070 : 1992	Reagent grade water (third revision)	6359 : 1971	Method for conditioning of textiles
1315 : 1977	Method for determination of linear density of yarn spun on	11662 : 1986	Preservative treatment of textiles

## ANNEX B

(Clauses 6.2.1 and 6.3.1 and Table 2)

## METHODS OF TEST

**B-1 NUMBER OF STRANDS IN THE BRAID****B-1.1 Test Specimens**

For the purpose of this test, one length measuring approximately 15 cm, cut from each piece in the test sample (see 13.3) shall constitute the test specimen.

**B-1.2 Procedure**

Take one test specimen. From one of its ends remove the interlacings and count the number of strands forming the braid.

**B-1.3** Repeat the test (see B-1.2) with the remaining test specimens.

**B-1.4 Report**

Report the lot to be in conformity with the requirements of 6.2, if none of the observed values for the number of strands in the braid (see B-1.2 and B-1.3) is less than the applicable value prescribed in Table 2.

**B-2 LENGTH IN METRES PER KILOGRAM****B-2.1 Test Specimens**

For the purpose of this test, one length measuring approximately 120 cm, cut from each piece in the test sample (see 13.3) shall constitute the test specimen.

**B-2.2 Procedure**

Suspend vertically one test specimen from a gripping clamp and attach to its lower free end a 60 g weight. After about 10 min, measure accurately one metre length of the test specimen still under suspension. Cut out the length so measured. In a similar manner, cut out one-metre lengths from the remaining test specimens, weigh all the pieces so obtained together and calculate the length in metres per kilogram.

**B-2.3 Report**

Report the lot to be in conformity with the requirements of 6.2, if the value so obtained does not vary from the applicable value specified in Table 2 by more than the tolerance prescribed in Table 2.

**B-3 PLAITS PER METRE****B-3.1 Test Specimens**

For the purpose of this test, one length measuring approximately 50 cm, cut from each piece in the test sample (see 13.3) shall constitute the test specimen.

**B-3.2 Apparatus****B-3.2.1 Twist Tester**

Provided with two clamps, one of which shall be capable of sliding and capable of being adjusted at a

maximum distance of 30 cm from the other.

**B-3.2.2** The twist tester shall also be provided with a tensioning device.

### **B-3.3 Procedure**

**B-3.3.1** Take a dark coloured thread approximately of the same count as the strands in the cord. Tie one end of the coloured thread to the end of any one of the strands of a test specimen (*see B-3.1*). Catch hold of the other end of the tied strand and pull it out of the cord.

**B-3.3.2** Set the clamps of the twist tester 30 cm apart.

**B-3.3.3** Mount one test specimen, prepared as in **B-3.3.1** in the clamps applying a tension equal to one percent of the specified breaking load (*see Table 2*). Count the number of floats of the coloured thread on the surface of the cord in a straight line parallel to the axis of the cord.

NOTE — The number of times a strand turns round the cord, while interlacing with other strands, shall be taken as the number of plaits in the cord. The turns of a strand round the cord shall be determined by counting the floats of the strand on the surface of cord in a straight line parallel to the axis of the cord.

**B-3.3.4** Repeat the test with the remaining test specimens.

**B-3.3.5** Calculate the average of the values obtained as in **B-3.3.3** and **B-3.3.4**.

### **B-3.4 Report**

Report the lot to be conformity with the requirements of **6.2**, if the average value does not vary from the specified value of the number of plaits per metre by more than the tolerance prescribed in Table 2.

## **B-4 BREAKING LOAD AND ELONGATION OF CORD**

### **B-4.1 Test Specimens**

For the purpose of this test, one length measuring approximately 40 cm, cut from each piece in the test sample (*see 13.3*) shall constitute the test specimen.

### **B-4.2 Apparatus**

#### **B-4.2.1 Strength Tester**

A constant rate-of-traverse, pendulum type, yarn strength testing machine recording simultaneously the breaking load and the corresponding elongation of the cord shall be used.

#### **B-4.3 Procedure**

Mount one test specimen on the strength tester keeping the distance between the clamps to 25 cm.

Operate the machine so that the moving clamp traverses at the rate of 30 cm per minute. Note (a) the breaking load, and (b) the elongation of the specimen at the time of break.

**B-4.4** Repeat the test with the remaining test specimens.

**B-4.5** Calculate the average of the observed breaking load values. Also express each observed elongation value in terms of percentage of the original length and calculate their average.

### **B-4.6 Report**

Report the lot to be in conformity with the requirements of **6.2** in regard to the breaking load if the average of the observed values for the breaking load (*see B-4.5*) is not less than the applicable value prescribed in Table 2.

## **B-5 DETERMINATION OF RESIDUAL ALKALI SOLUBILITY**

### **B-5.1 Test Specimens**

**B-5.1.1** Take a untreated (or uncoated) test specimen weighing about 10g of cord from each package in the test sample.

### **B-5.2 Apparatus**

**B-5.2.1** *Buchner Funnel*, About 15 cm diameter.

**B-5.2.2** *Reflux Condenser*

**B-5.2.3** *Flask, 500 ml Capacity*, with ground glass joint

**B-5.2.4** *Filter Paper Hardened*

**B-5.2.5** *Stoppered Weighing Bottles*, three, tared and dry.

### **B-5.3 Reagents**

#### **B-5.3.1 Quality of Reagents**

Unless otherwise specified, pure chemicals shall be employed in tests and distilled water (*see IS 1070*) shall be used where the use of water or distilled water as a reagent is intended.

NOTE — Pure Chemicals' shall mean chemicals that do not contain impurities which affect the experimental results.

#### **5.3.2 Sodium Carbonate**

Anhydrous, conforming to IS 296.

### **B-5.4 Procedure**

**B-5.4.1** Divide one test specimen into approximately three equal portions. Weigh them separately in dry stoppered weighing bottles. Take 250 ml of a five percent solution of anhydrous sodium carbonate in

distilled water, in a 500 ml conical flask fitted with a reflux condenser and bring to boil. Add the first portion of the test specimen kept in one of the weighing bottles to the boiling solution and continue the boiling gently for two and a half hours. Pour out the liquid and filter it through a hardened filter paper on Buchner funnel. Wash the test specimen four times by decantation with 200 ml of hot distilled water and filter the washings through the filter. Transfer the test specimen to the filter. Wash three times with 200 ml of distilled water and dry in a water heated oven at 98°C for about an hour. Transfer the test specimen along with any fragment of fibre detachable from the filter paper to the weighing bottle and dry to constant mass in an oven at 105 to 110°C.

**B-5.4.2** Treat the second portion of the test specimen in the same way as the first portion excepting that distilled water shall be used instead of sodium carbonate solution.

**B-5.4.3** Dry the third portion to constant mass in an oven at 105 to 110°C.

**B-5.4.4** Calculate the percentage loss in mass produced by the carbonate boil and distilled water boil on the basis of oven dry mass. The difference between these two expressed as percentage of oven dry mass is the percentage alkali solubility of the test specimen.

**B-5.4.5** Determine similarly the alkali solubility of the remaining test specimens.

## Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

### Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

### 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 Handbook' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc : No. TX 13 (0410).

### Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

## BUREAU OF INDIAN STANDARDS

### Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002  
Telephones : 323 01 31, 323 33 75, 323 94 02

Telegrams : Manaksanstha  
(Common to all offices)

### Regional Offices :

Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg  
NEW DELHI 110 002

{ 323 76 17  
323 38 41

Eastern : 1/14 C. I.T. Scheme VII M, V. I. P. Road, Kankurgachi  
CALCUTTA 700 054

{ 337 84 99, 337 85 61  
337 86 26, 337 91 20

Northern : SCO 335-336, Sector 34-A, CHANDIGARH 160 022

{ 60 38 43  
60 20 25

Southern : C. I. T. Campus, IV Cross Road, CHENNAI 600 113

{ 235 02 16, 235 04 42  
235 15 19, 235 23 15

Western : Manakalaya, E9 MIDC, Marol, Andheri (East)  
MUMBAI 400 093

{ 832 92 95, 832 78 58  
832 78 91, 832 78 92

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE.  
FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. KANPUR.  
LUCKNOW. NAGPUR. PATNA. PUNE. RAJKOT. THIRUVANANTHAPURAM.