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BUREAU OF INDIAN STANDARDS

(*New Delhi*)

AGENDA

Textile Materials for Aeronautical and Related Products Sectional Committee, TXD 13 **16th Meeting**

Date (Day)	Time	Venue
11 July 2023 (Tuesday)	1100 h	ADRDE, Agra

Chairman: Dr. Manoj Kumar, Director, ADRDE, Agra

Member Secretary: Shri Ranga Banothu BIS, New Delhi

Item 0 WELCOME & INTRODUCTORY REMARKS OF CHAIRPERSON

Item 1 CONFIRMATION OF THE MINUTES OF THE PREVIOUS MEETING

1.1 The minutes of the 15th meeting of the Committee held on 11 November 2022 through Webex Video Conferencing were circulated vide BIS DG letter no TXD 13/A2.15 dated 29 November 2022 and no comments have been received.

1.1.1 The Committee may **APPROVE.**

Item 2 PROCESS REFORMS IN STANDARDIZATION ACTIVITY OF BIS

2.1 Presentation on process reforms in standardization activity of BIS has been attached as **Annex A**.

2.1.1 Annual Meeting Calendar As per guidelines, every Sectional Committee is required to meet once per quarter (Wherever work items are available). In this regard, each committee needs to prepare the annual meeting calendar in the beginning of every financial year. The draft Annual Meeting Calendar for the consideration of Textile Material for aeronautical and Related Products Sectional Committee is as given below:

Quarter	Q2 July-Sept 2023	Q3 Oct-Dec 2023	Q4 Jan-Mar 2024	Q1 Apr-June 2024
Tentative Date	11th July 2023, Tuesday	23rd Oct 2023, Monday	23rd Jan 2024, Tuesday	25th April 2023 Thursday

2.1.2 The Committee may **DELIBERATE** and **DECIDE**.

Item 3 SCOPE AND COMPOSITION OF TXD 13

3.1 The present scope and composition of the Committee is given in **Annex 1 (Pages 5 & 6).**

3.1.1 The Committee may **DECIDE.**

Item 4 ISSUES ARISING OUT OF PREVIOUS MEETING OF TXD 13

4.1 Summary of actions taken on the various decisions of the 15th meeting is given in **Annex 2 (Page 8 & 9).**

4.1.1 The Committee may **NOTE**.

Item 5 FORMULATION OF INDIAN STANDARDS ON NEW SUBJECTS

5.1 In the previous meeting, the committee has decided to formulate a new Indian standard on 'Nylon tapes for Aircraft Arrester Barrier'. Accordingly, the working draft on the new subject has been received from ADRDE, Agra and the same is given at **Annex 3 (Page 10 to 31)**.

5.1.1 The Committee may **DELIBERATE** and **DECIDE**.

Item 6 DRAFT STANDARDS FOR FINALIZATION

6.1 As per the decision taken by the committee in the previous meeting the following revision draft of the Indian standards have been circulated as given in **Annex 4 (a) (Page 32 to 38)** and **Annex 4 (b) (Page 39 to 46)** for the period of 60 days. No comments have been received.

a) TXD 13 (21136) Textiles — Braided Cotton Cord for Aerospace Purposes — Specification (*Second Revision* of IS 1402).

b) TXD 13(21155) (IS 3255: 1979) Scoured or Dyed Cotton Tapes for Aerospace Purposes — Specification (*Second Revision* of IS 3255).

6.1.1 The committee may **DECIDE**.

Item 7 COMMENTS ON PUBLISHED INDIAN STANDARDS

7.1 As per the Decision taken by the committee in the previous meeting the following Pre 2000 standards have been allocated to the respective organization and status of same is as follows:

Sl No.	IS No.	Title	Allocation to the experts for technical inputs	Status
1.	IS 514 : 1992	Textiles — Mercerized cotton fabrics for covering aircrafts and gliders — Specification (*third revision*)	M/s Ordnance Parachute Factory, Kanpur	Inputs are yet to be received.
2.	IS 1376 : 1998	Textiles — Cotton sewing threads for aerospace purposes — Specification (*third revision*)	M/s Ordnance Parachute Factory, Kanpur	Inputs are yet to be received.

3.	IS 3449 : 1984	Specification for cotton webbing for parachutes (*second revision*)	M/s MLDC, Kanpur	Inputs has been received and same is given at **Annex 5 (a) (Page 47 to 59).**
4.	IS 3846 : 1984	Specification for rot-proofed cotton tapes for aerospace purposes (*first revision*)	M/s MLDC, Kanpur	Inputs has been received and same is given at **Annex 5 (b) (Page 60 to 72).**
5.	IS 6349 : 1981	Specification for tape, nylon, tubular for aerospace applications (*first revision*)	M/s ADRDE, Agra	Inputs has been received and same is given at **Annex 5 (c) (Page 73).**
6.	IS 4726 : 1984	Specification for light weight nylon fabric for parachutes	M/s ADRDE, Agra	Inputs has been received and same is given at **Annex 5 (d) (Page 74 to 92)**.

7.1.1 The Committee may **DECIDE**.

Item 8 REVIEW OF PUBLISHED STANDARDS

8.1 As per procedure of BIS, standards which were published/reaffirmed five years ago are required to be reviewed to assess adequacy of the requirements specified. Review is carried out keeping in view the changes in technology, current industrial practices and the needs/expectations of the consumers/users so as to decide regarding further reaffirmation/ revision/withdrawal/amendment of the standards under review.

Presently, there are no Indian standards under the domain of TXD 13 is due for five yearly review.

8.2 The status of Indian standards prior to 2000 under the domain of TXD 13 are as follows:

SI. No.	IS No.	Title	Status
1.	IS 514 : 1992	Textiles – Mercerized cotton fabrics for covering aircrafts and gliders – Specification (*third revision*)	ARP Awaited.
2.	IS 714 : 1992	Textiles – Cotton reinforcing tapes for aerospace purposes – Specification (*third revision*)	Committee may DECIDE.
3.	IS 1376 : 1998	Textiles – Cotton sewing threads for aerospace purposes – Specification (*third revision*)	ARP Awaited.
4.	IS 1402 : 1992	Textiles – Braided cotton cord for aerospace purposes – Specification (*second revision*)	Under WC.
5.	IS 2196 : 1985	Specification for linen (flax) sewing thread for aeronautical purposes (*second revision*)	Committee may DECIDE.

6.	IS 3255 : 1979	Specification for scoured or dyed cotton tapes for aerospace purposes (*first revision*)	Under WC.
7.	IS 3449 : 1984	Specification for cotton webbing for parachutes (*second revision*)	ARP received.
8.	IS 3846 : 1984	Specification for rot-proofed cotton tapes for aerospace purposes (*first revision*)	ARP received.
9.	IS 4227 : 1998	Textiles – Braided nylon cords for aerospace purposes – Specification (*second revision*)	Under WC.
10.	IS 4228 : 1979	Specification for nylon tapes for aerospace purposes (*first revision*)	F-draft
11.	IS 4229 : 1992	Textiles – Nylon sewing threads for aerospace purposes – Specification (*second revision*)	Under WC.
12.	IS 4719 : 1984	Specification for wire-woven rayon fabric for aerospace purposes (*second revision*)	Committee may DECIDE.
13.	IS 4726 : 1984	Specification for light weight nylon fabric for parachutes	ARP received.
14.	IS 5746 (Part 1) : 1987	Specification for woven glass fibre fabrics for plastic laminates for aerospace purposes - Part 1 Loom-state fabrics (*second revision*)	Committee may DECIDE.
15.	IS 5746 (Part 2) : 1987	Woven glass fibre fabrics for plastic laminates for aerospace purposes - Part 2 Desized fabrics (*second revision*)	Committee may DECIDE.
16.	IS 5746 (Part 3) : 1987	Woven glass fibres fabric for plastic laminates for aerospace purposes - Part 3 Finished fabrics for use with polyester resin systems (*second revision*)	Committee may DECIDE.
17.	IS 6349 : 1981	Specification for tape, nylon, tubular for aerospace applications (*first revision*)	ARP received.
18.	IS 10476 : 1983	Specification for woven roving glass fabric for polyester - glass laminates for aerospace purposes	Committee may DECIDE.
19.	IS 11326 : 1985	Specification for nylon fabrics for coating with natural or synthetic elastomers	Committee may DECIDE.
20.	IS 11367 : 1985	Glossary of terms relating to textile materials for aerospace purposes	Committee may DECIDE.
21.	IS 14564 : 1998	Textiles - Cotton tapes for personnel parachutes - Specification	Committee may DECIDE.

8.1.1 The Committee may **DECIDE.**

Item 9 ANY OTHER BUSINESS

ANNEX 1
(*Clause* 2.1)

Scope and Composition of Textile Materials for Aeronautical and Related Products TXD 13

Scope: To formulate Indian standards for terminology and specifications for textile materials for aeronautical and related products.

Meetings held	Date and Place
13th Meeting	29 June 2021 through WebEx video conference
14th meeting	22 February 2022 through WebEx video conference
15th meeting	11 November 2022 through WebEx video conference

Sl No.	Organization Represented	Name of The Representative Principal/ (Alternate)	Attendance
1.	Aerial Delivery Research & Development Estt. Agra	Dr. Manoj Kumar (***Chairperson***)	3/3
2.	Aerial Delivery Research and Development Establishment (DRDO), Agra	Shri Puneet Gupta Shri Prasanta Kumar Mallik	3/3
3.	Defence Materials and Stores Research a Development Establishment, Kanpur	Shri Biswa Ranjan Das Smt Priyanka Katiyar	1/3
4.	Directorate General of Aeronautical Quality Assurance, Ministry of Defense, New Delhi	Shri Daljeet Singh Dr. Subash	2/3
5.	Directorate General of Civil Aviation, Ne Delhi	Shri Hillol Biswas Shri Lalit Gupta	1/3
6.	Directorate General of Quality Assurance Ministry of Defense, New Delhi	Shri Col. Vijay Maurya Shri SS Kashyap	2/3
7.	Garware Technical Fibres Limited, Pune	Shri Kishor J Darda Shri Satish J Chitnis	3/3
8.	Kusumgar Corporates Private Limited, Vapi	Dr M. K. Talukdar Shri Siddharth Y Kusumgar	3/3

9.	Indian Space Research Organization - Vikram Sarabhai Space Centre, Thiruvananthapuram	Dr Santhosh B Shri Anil Painuly	2/3

Sl No.	Organization Represented	Name of The Representative Principal/ (Alternate)	Attendance
10.	Motilal Dulichand Private Limited, Kanpur	Shri Shailendra Misra Shri Sunil Prahladka	3/3
11.	Office of the Textile Commissioner, Mumbai	Shri Humayun K Shri Jamil Ahmed	2/3
12.	Ordnance Parachute Factory, Kanpur	Shri K K Toppo Shri Sachin Khoria	3/3
13.	Oriental Synthetic & Rayon Mills Pvt Ltd, Na Mumbai	Smt Smita Yeole Shri Satish Kumar P Nikam	0/3
14.	RCMA, Kanpur	Shri P K Shukla Shri Alok Kumar	2/3
15.	SRF Private Limited, Chennai	Ms Angelina Divya Shri Ankur Sharma	2/3
16.	Spica Elastic Limited, Pune	Shri Manish Rajnikant Jaitha Shri Sohrab Bharucha	0/3
17.	Thanawala and Company, Mumbai	Shri Hemal M Thanawala Shri Vivaan Thanawala	3/3
18.	The Synthetic and Art Silk Mills Resear Association, Mumbai	Dr. Manisha Mathur Smt. Ashwini Sudam	2/3
19.	Todi & Company Ltd, Mumbai	Shri S P Todi Shri Adarsh Todi	2/3
20.	Universal Yarns & Tex Private Limited, Kanp	Shri Rajiv K Bhartiya	2/3
21.	Uttar Pradesh Textile Technology Institu Kanpur	Prof. Mukesh Kumar Singh	2/3
22.	Urja Products Private Limited, Ahmedabad	Shri Anshul Nanavaty	3/3

23.	Vardhaman Yarn and Threads Limited, Gurga	Shri Anu Handa	2/3
24.	Viraj Syntex Pvt Ltd, Kanpur	Shri Amit Singh Shri Jai Singh	1/3

ANNEX 2

(*Item 4.1*)

SUMMARY OF ACTIONS TAKEN ON THE MINUTES OF THE LAST MEETING

Item No.	Decision	Action taken
2.1	Changes in scope and composition of TXD 13	Updated scope and composition are given in Annex 1.
4	**DRAFT STANDARDS FOR FINALIZATION** a) TXD 13 (19707) Textiles — Nylon tapes for aerospace purposes — Specification	Final draft has been prepared and same is issued under publication**.**
5	**COMMENTS RECEIVED ON PUBLISHED INDIAN STANDARDS** a) IS 4227 : 1992 Textiles — Braided nylon cords for aerospace purposes Specification (*second revision*)	The document has been wide circulated as TXD 13 (22121).
	b) IS 4229 : 1998 Textiles — Nylon sewing threads for aerospace purposes Specification (*second revision*)	The document has been wide circulated as TXD 13 (22872).
6	**REVIEW OF PUBLISHED STANDARDS** **1.** IS 514:1992 Textiles — Mercerized cotton fabrics for covering aircrafts and gliders — Specification (*third revision*)	Inputs are yet to be received.
	2. IS 1376 : 1998 Textiles — Cotton sewing threads for aerospace purposes — Specification (*third revision*)	Inputs are yet to be received.
	3. IS 3449:1984 Specification for cotton webbing for parachutes (second revision)	Inputs have been received from M/s MLDC, Kanpur and same is coming under ***Item 7.1***.
	4. IS 3846:1984 Specification for rot-proofed cotton tapes for aerospace purposes (first revision)	Inputs have been received from M/s MLDC, Kanpur and same is coming under ***Item 7.1***.
	5. IS 6349:1981 Specification for tape, nylon, tubular for aerospace applications (first revision)	Inputs have been received from M/s ADRDE, Agra and same is coming under ***Item 7.1***.
	6. IS 4726:1984 Specification for light weight nylon fabric for parachutes	Inputs have been received from M/s ADRDE, Agra and same is coming under ***Item 7.1***.

8.	**ANY OTHER BUSINESS** Nylon Tapes for Aircraft Arrester Barrier	 Inputs have been received from M/s ADRDE, Agra and same is coming under ***Item 5.1***.

ANNEX 3
(*Item 5.1***)**

TAPE WOVEN NYLON UNTREATED, U.V.R. TREATED BLACK & W.R. - U.V.R. TREATED BLACK

0. FOREWORD

0.1 This specification has been prepared by a special committee at ADRDE and approved by the Director, ADRDE, Agra.

0.2 This specification would be used for manufacture, inspection and procurement of Tape Woven Nylon Untreated, U.V.R. Treated Black & W.R. - U.V.R. Treated Black against Defence requirements.

0.3 In case of any discrepancy between this specification and any sample or pattern, this specification shall be taken as correct.

0.4 Enquiries regarding this specification in relation to any contractual conditions should be addressed to the Inspection Authority named in tender or contract. Other enquiries will be referred to the issuing authority, Director,
ADRDE, Agra.

0.5 Whenever a reference to any other specification occurs in this specification, it shall be taken as a reference to the latest version of that specification.

0.6 Copies of this specification can be obtained on payment from:

i. The Director,
A.D.R. & D.E.,
P.B. No. 51, Station Road,
Agra Cantt. - 282 001

ii. Concerned Inspectors and Inspection Authority.

0.7 IS specifications quoted in this specification may be obtained directly from B.I.S., Manak Bhawan, 9, Bahadur Shah Zafar Marg, New Delhi - 110 002 or its offices located in different parts of the country.

1. SCOPE

1.1 This specification covers the requirement of the following varieties of 26 mm & 30 mm Nylon Tape:

(i) Tape Nylon 26 mm Untreated (variety-1)
(ii) Tape Nylon 26 mm UVR (Ultra Violet Resistant) Treated, Black (variety-2)
(iii) Tape Nylon 26 mm WR (Water Repellent)- UVR Treated, Black (variety-3)
(iv) Tape Nylon 30 mm Untreated (variety-4)
(v) Tape Nylon 30 mm UVR Treated, black (variety-5)
(vi) Tape Nylon 30 mm WR- UVR Treated, black (variety-6)

used in the manufacture of Multi Element Net Assembly (MENA) of Aircraft Arrester Barrier System (AABS) and can also be used in other Aerial Delivery Applications considering the suitability.

2. RELATED SPECIFICATIONS

2.1 Reference is made in this specification to:

i. IS:2 Rules for rounding off numerical values

ii.	IS:6359	Methods for conditioning of textiles
iii.	IS:1954	Methods for determination of length and width of fabrics
iv.	IS:7702	Method for determination of thickness of woven and knitted fabrics.
v.	IS: 1963	Method for determination of threads per unit length in woven fabrics.
vi.	IS:4727	Method for determination of weight per meter (APP - A).
vii.	IS:1969	Methods for determination of breaking load and elongation at break of woven textile fabrics.
viii.	IS:3442	Determination of crimp and count of yarn removed from fabric.
ix.	IS: 832	Method for determination of twist in yarn
x.	IS:1390	Method for determination of pH value of aqueous extracts of Textiles (cold method).
xi	IS:7151	Specification for corrugated fibre board boxes for para dropping of supplies.
xii.	IS:9738	Polythene bags.
xiii	IS: 5762	Methods for the determination of Melting point and Melting Range.

2.2 All specifications referred to in this specification for any tender or contract, shall mean the current edition on the date of such tender or contract.

3. **MATERIAL**

3.1 The basic material shall be of bright, high tenacity (9.5 gpd and more), light and heat stabilized, multifilament nylon 66 yarn, suitably twisted as per Appendix 'A' to meet the requirements stipulated at clause 12. Manufacturer/ Supplier shall issue a certificate that the quality of yarn as mentioned above (clause 3.1) especially light and heat stabilized variety has been used to manufacture the stipulated variety of tape. **One spool of about 200 metre of the basic yarn along with its test results should be provided by the firm for testing/approval from Inspection Officer/AHSP before starting the production of Advance sample.**

4. **MANUFACTURE**

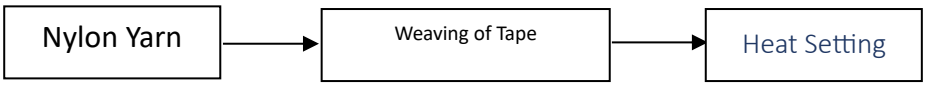
4.1 The Tape shall be evenly woven under suitable tension. The selvedges of Tape shall be firm and regular. The tension given to the yarn during weaving shall be intimated along with the processing/manufacturing details. **A piece of ten metre sample along with the test results shall be forwarded as an advance sample for approval from Inspection Officer/AHSP.**

4.2 The tape shall not be more than one year old from the date of manufacture to the date of delivery. A certificate to this effect shall be provided by the manufacturer/supplier at the time of delivery.

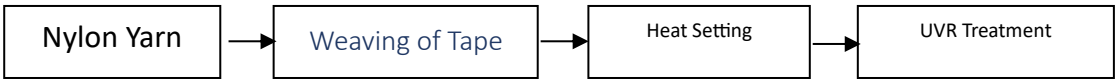
5. **SEQUENCE**

5.1 Broad sequence of manufacture for the respective varieties of tape is given below:

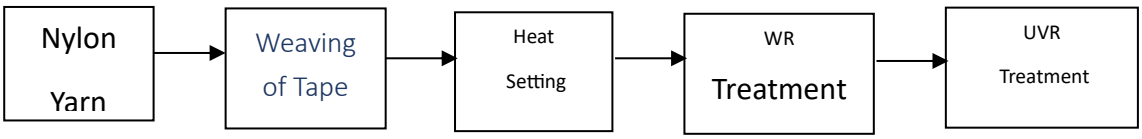
5.1.1 Sequence for variety no. 1 & 4:



5.1.2 Sequence for variety no. 2 & 5:



5.1.3 Sequence for variety no. 3 & 6:



6. **UNTREATED TAPE**

6.1 The sequence of manufacture of untreated tape should comply with that given under clause no. 5.1.1 of this specification.

6.2 The Tape Nylon, 26mm & 30 mm untreated (i.e. variety no. 1 & 4) should conform to the requirements as per clause no. 12 of this specification.

7. UVR TREATED TAPE

7.1 The sequence of manufacture of UVR treated tape should comply with that given under clause no. 5.1.2 of this specification.

7.2 The Tape Nylon, 26 mm. & 30 mm, UVR treated (i.e. variety no. 2 & 5) should conform to the requirements as per clause no. 12 of this specification.

7.3 **UVR Treatment:**

The resin used to treat the tape shall consist of polyvinyl butyral, plasticized with butyl recinoleate applied by alcohol dispersion. The fine carbon black shall be added to the resin emulsion to produce uniform black colour. Any change either in the prescribed formulation or the process of application to provide specified U.V. resistance may be adopted with prior approval of the competent authority. Suggested procedure of UVR treatment with chemical composition is given in the Appendix-E of this specification.

7.4 **Extractable Material:** The tape after the resin treatment and curing when extracted by the method prescribed in Appendix-E of IS:4727 shall give 4-5 % extractable material on the dry weight of tape.

8. WR-UVR TREATED TAPE

8.1 The sequence of manufacture of WR- UVR treated tape should comply with that given under clause no. 5.1.3 of this specification.

8.2 The Tape Nylon, 26 mm. & 30 mm, WR-UVR treated (i.e. variety no. 3 & 6) should conform to the requirements as per clause no. 12 of this specification.

8.3 The WR-UVR treated tape should show:

8.3.1 maximum 15% water absorbency of the dry weight of Tape Nylon, 26mm, WR-UVR treated black and

8.3.2 maximum 18% water absorbency of the dry weight of Tape Nylon, 30mm, WR-UVR treated black when tested in accordance with the water repellency test method stipulated in Appendix- D of this specification.

8.4 Suggested procedure of WR- UVR treatment is given in Appendix - F of this specification.

8.5 **Extractable Material**

The WR – UVR treated nylon tape when extracted by the method given in Appendix 'E' of IS:4727 shall give maximum 6.5% extractable material to the dry weight of tape.

9. RESISTANCE TO ACCELERATED AGEING:

a) The UVR treated tape & WR-UVR treated tape after carbon arc exposure, as per Appendix-C, Test method-1 of this specification, shall have not less than 95% of the original breaking strength of treated counterpart.

OR

b) The UVR treated tape & WR-UVR treated tape after UV-B light exposure, as per Appendix-C, Test method-2 of this specification, shall have not less than 93% of the original breaking strength of treated counterpart.

10. **STIFFNESS:**

The drop angle of the UVR treated tape & WR-UVR treated tape when tested as per method stipulated in Appendix- G of this specification should not be greater than 35°.

11. **FINISH**

11.1 The tape shall be suitably heat set (if required) under already approved conditions of temperature, time & stretch. The supplier should primarily get approved the sequence of processes which is supposed to enable the manufacturer to achieve the specified properties.

11.2.1 The untreated, UVR treated & WR-UVR treated tape should be finished according to the clauses 6,7 & 8 respectively of this specification.

11.3 The tape shall have minimum weaving defects. The tape when laid on a flat even surface shall be in a straight line without application of any tension. For detailed classification of defects, Appendix 'B' of this specification may be consulted.

12. **REQUIREMENTS**

12.1 The untreated, UVR treated & WR-UVR tape shall conform to the particulars given in Appendix 'A', when tested in accordance with the methods mentioned in Related Specifications under clause 2.

12.2 pH Value : pH value of the finished tape shall be within the range or 5.5 to 8.5, for both treated and untreated, when tested as per the relevant method.

12.3 Melting Point: The melting point of Nylon 6,6 yarn used in the manufacture of the Tapes shall be not less than 247 °C.

12.3.1 The melting point of the nylon yarn shall be determined according to method stipulated in IS: 5762

12.4 Sealed Sample: If, in order to illustrate or specify the un measurable characteristics like general appearance, feel, etc of the tape, sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects.

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

13. **MARKING**

13.1 Each piece, prior to being offered for inspection, shall legibly be marked by the supplier with his name, initials or recognized trade mark, the year of manufacture, brief nomenclature, DS Cat. number of the store and length of the roll along with the number of flags contained in the roll.

14. **QUALITY**

14.1 On examination of sample taken from any portion of consignment, shall show that the tape conforms to the requirements of clause 12.

15. **PRE-INSEPCTION OF STORES/CONSIGNMENT**

15.1 Manufacturers / contractors must satisfy themselves that the stores are in accordance with the terms of the contract and fully conform to the required specification by carrying out a thorough pre- inspection of each lot before actually tendering the same for inspection to the inspecting officer nominated under the terms of the contract. A declaration by the contractor that necessary pre-inspection has been carried out on the stores tendered, will be submitted along with the challan. The declaration will also indicate the method followed in carrying out pre-inspection showing the features checked/tested and will have the test certificate attached to the challan/declaration. A certificate should also be produced by the manufacturer that sequence of the manufacture has been followed as per clause no. 5. The manufacturer should also certify that during manufacture of the variety no. 3 & 6, the extractable WR content after curing has been checked and found to be with in the specified range i.e. 1-1.5 % of the dry weight of the tape.

15.2 If the Inspecting officer finds that pre-inspection of the consignment as required above has not been carried out, the consignment is liable for rejection.

16. **ROLL LENGTH**

16.1 Unless other wise specified the roll length of varieties of tape from 1 to 6 should be as follows:

16.1.1 Variety no.1: Each roll shall be of 156 mts in continuous length without any joint. Roll of 85 mts. length (in one piece) of 5% of any particular supply (lot) can be accepted.

16.1.2 Variety no 2&3: Each roll shall be of 146 mts in continuous length without any joint. Roll length of 80 mts (in one piece) of 5% of any particular supply (lot) can be accepted.

16.1.3 Variety no. 4: Each roll shall be of 111 mts in continuous length without any joint. Roll of 62 mts. length (in one piece) of 5% of any particular supply (lot) can be accepted.

16.1.4 Variety no. 5&6: Each roll shall be of 101 mts in continuous length without any joint. Roll of 57 mts. length (in one piece) of 5% of any particular supply (lot) can be accepted.

17. **SAMPLING**

17.1 The manufacturer / supplier shall tender stores duly numbered and arranged in such a way that all the units are easily accessible to the Inspector.

17.2 The samples shall be drawn lot wise for carrying out tests specified in this specification. Unless otherwise agreed to between the buyer and the seller, the lot shall be defined under respective sampling plans as detailed below.

17.3 **SAMPLING PLAN 'A'**

17.3.1 LOT - The total length of the Tape manufactured from same type of yarn purchased from the same supplier/ manufacturer and of same weave and finish/treatment, delivered to a buyer against one dispatch note shall constitute a lot.

17.3.2 Each roll of the lot shall be measured for its length.

17.3.3 One sample of three metres length and of full width shall be drawn from each roll of the lot for carrying out the **Breaking load and Extension at break**

17.4 **SAMPLING PLAN 'B'**

17.4.1 LOT - All the rolls of Tape manufactured from same type of yarn purchased from the same supplier / manufacturer and of same weave and finish/treatment, delivered to a buyer against one dispatch note shall constitute a lot.

17.4.2 Five samples or 10 % of the lot, whichever is more, shall be drawn for the following tests. Each sample shall be of three metres length and of full width:

a) Width
b) Thickness
c) Mass

17.5 SAMPLING PLAN 'C'

17.5.1 LOT - The quantity of Tape manufactured from the same type of yarn purchased from the same supplier / manufacturer and of the same weave and finish/treatment, delivered to a buyer against one dispatch note shall constitute a lot.

17.5.2 Two samples or 2 % of the lot, whichever is more, should be drawn for the following tests; one sample of four metre length and of full width shall be drawn from each roll:

a) Weave
b) No. of threads/dm (warp & weft)
c) Linear density of yarn
d) pH value
e) Type of basic material
f) Twist of yarn
g) Melting point of yarn
h) Extractable material (for variety no.2,3 & 5,6)
i) Water repellency test (for variety no. 3 & 6)
j) Stiffness (drop angle) (for variety no.2,3 & 5,6)

17.6 SAMPLING PLAN 'D'

17.6.1 LOT - The quantity of Tape manufactured from the same type of yarn purchased from the same supplier / manufacturer and of the same weave and finish/treatment, delivered to a buyer against one dispatch note shall constitute a lot.

17.6.2 In case of UVR & WR-UVR treated tape (variety no.2,3 &5,6), three samples or 3% of the lot, whichever is more, should be drawn for the accelerated ageing test; one sample of three meters length and of full width shall be drawn from each roll.

18. **CRITERIA FOR CONFORMITY**

18.1 All the sample units drawn as per clause 17 above, shall be tested/examined to the relevant requirement / specification. The lot shall be considered to be in conformity if the requirements given in clause 12 are satisfied.

19. **INSPECTION**

19.1 If, on examination, 20 percent of those examined, are found not to conform to this specification in any respect, the whole consignment may be rejected.

20. **WARRANTY**

20.1 The stores supplied, shall be deemed to bear a warranty of the contractor against defective material, poor workmanship and performance for a period of twelve months from the date of receipt of the stores at consignee's depot.

20.2 If, during the period, the stores supplied are found by the consignee to be defective, the same shall be replaced immediately with serviceable stores by the contractor at site, free of any charge or cost.

21. **PACKAGING**

21.1 Each roll / piece shall be wrapped with suitable size of polythene bag as per IS: 9738 and secured by cotton thread/cord (0.32 cm) to form a unit pack. Suitable number of such unit packs shall then be wrapped with paper craft wrapping and placed in corrugated fibre board box as per IS 7151 of suitable size provided with water proof bag. The gross mass of the box shall not exceed 40 kg. The empty spaces if any shall be filled in with cushioning material to prevent any movement of the contents inside the corrugated fibre board box and the top lid of box shall be properly fixed with adhesive Tape. The box packing shall be made secured by fastening with suitable tape/cord.

21.2 Packing material used, should be approved by Inspecting Officer. If ordered for delivery to a local inspection depot, the store shall be delivered in the same fashion as stated in clause no. 21.1. After inspection, the accepted supplies shall be packed by the inspection depot concerned as indicated in para 21.1.

21.3 Before dispatch, each box of corrugated fibre board packing, shall be legibly and indelibly marked, showing following details:

a) Nomenclature and D S Cat number.
b) Quantity packed in each corrugated fibre board box.
c) Serial no. of the corrugated fibre board box.
d) Month and year of packing.
e) Name and trade mark of the manufacturer.
f) Gross mass of each corrugated fibre board box in Kg.
g) Name and address of the consignee.
h) Inspection Note number and date.

22. **DEFENCE STORES CATALOGUE NUMBER**

22.1 Not yet allotted.

23. **SUGGESTION FOR IMPROVEMENT**

23.1 Any suggestion for improvement of this document may be forwarded to the Director, ADRDE, P.B. no. 51, Agra Cantt - 282 001.

Appendix A

Technical Particulars of Tape Nylon 26 mm (Variety 1,2 &3) And Tape Nylon 30 mm (Variety 4,5 & 6)

S. No.	Technical Particular	Variety no. 1	Variety no. 2	Variety no. 3	Variety no. 4	Variety no. 5	Variety no. 6
1.	Width, mm	26 ±1	26 ±1	26 ±1	30 ± 1	30 ±1	30 ±1
2.	Thickness under a pressure of 200 g/cm^2 ,mm, max	3.0	3.0	3.0	4.0	4.0	4.0
3.	Weight, g/m, max	45	50	51	68	75	76
4.	Breaking strength on full width × 20 cm between grips, kgf, min	2150	2040	2040	3300	3135	3135
5.	Weave	Double Plain, 2 ends working as 1, 2 picks/shed	Double Plain, 2 ends working as 1, 2 picks/shed	Double Plain, 2 ends working as 1, 2 picks/shed	Double Plain, 2 ends working as 1, 2 picks/shed	Double Plain, 2 ends working as 1, 2 picks/shed	Double Plain, 2 ends working as 1, 2 picks/shed
6.	Constructional Particulars a) No. of ends in full width, min						
	Ground (face+back)	170	170	170	260	260	260
	Binder	20	20	20	34	34	34
	II) No. of weft threads per dm, min	160	160	160	134	134	134
	III) Denier of Yarn×Ply						
	a) Warp	1680×1	1680×1	1680×1	1680×1	1680×1	1680×1
	b) Binder	840×1	840×1	840×1	840×1	840×1	840×1
	c) Weft	840×1	840×1	840×1	840×1	840×1	840×1
	IV) Yarn twist/m						
	a) Warp	100, min	100, min	100, min	100, min	100, min	100, min
	b) Binder	Nil\ Intermingled	Nil \ Intermingled	Nil \ Intermingled	Nil \ Intermingled	Nil \ Intermingled	Nil \ Intermingled
	c) Weft	Nil\ Intermingled	Nil\ Intermingled	Nil\ Intermingled	Nil\ Intermingled	Nil\ Intermingled	Nil\ Intermingled

Note:

1. (-)5% to (+)10% tolerance shall be provided in linear density of yarn. In case of UVR and WR – UVR treated webbings additional 5% relaxation shall be provided.
2. In case of UVR and WR – UVR treated webbings, manufacturer shall submit a certification mentioning that specified twist has been given to warp, binder and weft yarn.

APPENDIX 'B'

CLASSIFICATION OF DEFECTS

B-1. The following defects found in metre-by-metre examination are classified as major / minor.

a) Major defects detectable visually during inspection

Defects	Description	Major
Abrasion	Abrasion resulting in broken filaments, rupture of individual yarn and distortion in the orientation of threads	X
Broken and Missing threads (ends/picks)	Two or more, regardless of length	X
Coarse or Light filling bar	Extending for more than 13 mm in the length direction or more than 50 % of width resulting in visible differences in thickness	X
Floats or skips	Single float or skip over 1 cm or more in length	X
	Continuous float, the sequence of which measures 0.5 cm or more in length	X
	Any multiple float 5 mm square or more	
Jerked-in filling	Any jerked-in filling occurring 4 times within 25 cm	X

Edge cut, torn or frayed	Complete separation of one or more yarns with-in 3 mm of the edge or at any adjoining point	X
Mispick or double pick	Two or more additional picks across full width	X
Slack end	Two or more for a minimum of 13 mm in length	X
Loose, Irregular and uneven selvedges	Clearly noticeable waviness along selvedge edge when no tension is on selvedge	X
Selvedge tight	Any clearly noticeable roll of edge or edges when tension is released.	X
Spot, stain	Single thread 40 cm or more in length	X
	Double threads 20 cm or more in length	X
	Over two threads 12 cm or more in length or clearly noticeable area more than 6 mm^2, whichever is greater	X
Slubs or strip back*	More than 5 over 1 cm in length	X
	Two to five over 2 cm in length	X
	One over 5 cm in length	X
Smash	Any smash	X
Wrong draw	Extending for more than 25 cm	X

* A strip back in defined as a broken filament(s) wrapped around the remaining yarns forming an enlarged area resembling a slub.

b) **Minor defects detectable visually during inspection**

The classification of the defects defined under clause ‘a’ above, may be considered minor, if it exists to a lesser degree than that given under the column 'Description'.

B-2. **Acceptance of rolls with defects**

2.1 Each roll shall be visually examined for defects as described in a) and b) above. No roll shall contain more than 5 major defects per 100 m or 18 minor defects per 100 m. For this purpose, all the rolls shall be visually examined metre by metre and the defects classified in accordance with a) and b) of Appendix 'B'. The unit of product for examination shall be one linear metre. For each unit of product, the defects shall be counted as follow:

i) One major defect and one minor defect shall be counted as one major defect.

ii) Three or more minor defects shall be counted as one major defect.

iii) A continuous major defect shall be counted as one major defect for each unit of product or fraction thereof in which it occurs.

2.3 Each major defect shall be flagged by a red string sewn in the selvedge. Each minor defect shall be flagged by a blue string sewn in the selvedge. Three or more minor defects occurring per linear metre shall be flagged by a red string sewn in the selvedge.

2.4 An allowance of 50 cm shall be claimed for each major defect flagged except for continuous defects, which shall be given an allowance of one metre for each metre in which it occurs. An allowance of 16 cm shall be claimed for each minor defect flagged.

Appendix C

METHOD FOR ACCELERATED AGEING OF TREATED TAPE

TEST METHOD-1: Carbon arc exposure

C-1: Test Specimen: For the purpose of the test, all the treated tape rolls drawn as per clause no. 17.6.2 shall constitute the test specimen.

C-2: Equipment: The equipment shall be the same as given in clause D-2 under appendix- D of IS: 4727.

C-3: Procedure: Take 3 test specimens of treated tape from each roll selected for accelerated ageing. Place them 2.5 cm. apart side by side in the rack. Expose the specimen to carbon arc light source for a total of 100 hrs maintaining the exposure cycle stipulated under clause D-2.1.d of IS: 4727. Remove the test specimen at the end of the exposure period and condition them to standard atmospheric condition for 24 hrs. When the test specimens have been conditioned, test them for breaking strength by the relevant test method given under clause 2 (Related Specifications) of this specification.

TEST METHOD-2: UV-B light exposure

C-1: Test Specimen: For the purpose of the test, all the treated tape rolls drawn as per clause no. 17.6.2 shall constitute the test specimen.

C-2: Equipment: The equipment shall be as given in clause 6 of ASTM:G154-04.

C-3: Test conditions:

1. Lamp: UVB-313 nm
2. Typical Irradiance: 0.63 $W/m^2/nm$ at approximate 310nm wavelength
3. Exposure Cycle: 8 hour UV at 60 (±3) °C Black panel Temperature and 4 hour Condensation Cycle at 50 (±3) °C Black Panel Temperature
4. Exposure Time: 100 hours (8 complete Exposure cycle + 4 hour only UV cycle)

Procedure: Take at least 5 test specimens of treated tape from each roll selected for accelerated ageing. Expose the specimen as per clause 9 of ASTM 154-04 for a total of 100 hrs. Remove the test specimen at the end of the exposure period and condition them to standard atmospheric conditions for 24 hrs. When the test specimens have been conditioned, test them for breaking strength by the relevant test method given under clause 2 (Related Specifications) of this specification.

APPENDIX- D

Method for Water Repellency Test – Immersion Absorption Test

D-1 Test Specimen Length: 20 cm×full width

D-2 Apparatus Used:

a) **Immersion Tank:** Tank of at least 30 cm depth for immersion of specimen in the distilled water to check the water repellency of test specimen.

b) **Sinker:** Sinker is attached to specimen for keeping the specimen submerged. It should be a rigid inverted L- Shaped metal hook (or any metallic mass tied with thread) of non-corrosive metal fastened to a weight sufficient to sink the specimen into the water up to 5 cm hydrostatic head of the water above the top of the specimen undergoing test. In testing narrow fabric, the horizontal end of the sinker hook shall be of sufficient length so that the portion of the specimens attached thereon may be spread out to permit full contact with water.

c) **Laboratory Balance:** Laboratory balance with an accuracy of ±5 mg.

D-3 Procedure: Following steps are to be followed to test the water repellency of narrow fabric:

(a) The specimen shall be conditioned for 24 hrs at 27±2°C and 65±2% RH and weighed to the nearest 5 mg.

(b) The specimen shall be attached to the sinker and immersed for a period of 60 minutes in the immersion tank filled with distilled water at a temperature of 27±2°C. The depth of the water shall be so regulated that, with the sinker resting on the bottom of the tank, the top of the specimen held in a vertical position should be under a 5 cm head of water.

(c) After the immersion period, the specimen shall be removed from the tank and the sinker is detached. The specimen shall be hold out in a vertical manner without any jerks/shakes, etc.

(d) Hold the specimen in vertical manner for 1 minute and then immediately weigh the specimen in closed container to the nearest 5 mg. Care shall be taken to keep evaporation of moisture from the specimen to a minimum.

(e) Minimum 3 specimens should be tested.

D-4 Calculation of Results: The immersion absorption shall be calculated as follows:

$$\text{Immersion absorption, percent} = \frac{F-O}{O} \times 100$$

Where:

F=Final weight of the specimen, as described in D-3 (d)

O=Original conditioned weight of the specimen as described in D-3 (a)

Water absorption shall be reported as percentage of original conditioned weight of the specimen based on the average value (minimum 3- determinations) of F & O.

APPENDIX -E

SUGGESTED METHOD OF TREATMENT OF NYLON TAPES TO OBTAIN U.V. RESISTANT FINSIH COATING FOR SATISFACTION OF THE PROVISIONAL SPECIFICATION NO. ADRDE/SPECN/70

E-1 PREPARATION OF SOLUTION

a) Composition

1. Rectified Spirit	:	100 Parts
2. Synpol B-30 (Butyral Resin)	:	10 Parts
3. Carbon black (ISAF N220)	:	5 Parts
4. Butyl Recinoleate	:	10 Parts
5. Dynasylon (MEMO)	:	0.05 Parts

b) Method

10 Parts of Synpol B-30 (Butyral Resin) should be added gradually in 50 parts of rectified spirit while stirring. Stirring should continue till a homogenous solution is obtained. To facilitate dissolution of the resin the container may be slightly warmed while the stirring is on. Put the prepared solution in a Jar Mill and add 5 parts of Carbon Black and 10 parts of Butyl Recinoleate and run the Mill f or 48 hours. After this take out the solution in a suitable container and added 50 parts of the remaining rectified spirit add 0.05 parts of Dynasylon (Memo) before the solution is used for treatment. The solution should be kept in a closed container to avoid evaporation of rectified spirit.

E-2 TREATMENT METHOD

a) U.V.R Treatment of Tapes

U.V.R Treatment of nylon tapes is done by pad mangle machine. The solution should be kept in the reservoir of machine and nylon tapes passed through the solution and then through the solution and then through rollers which are duly adjusted for squeezing out the surplus solution. The squeezing and viscosity of the solution used to treat the tapes shall be maintained to obtain desired extraction % after drying and curing. The tapes are to be dried over night at room temperature or tapes are to be passed through a chamber for 45 minutes having temperature of 50°C to 60°C.

E-3 CURING

The dried tapes should be cured at 140°C to 150°C for 6 minutes in a chamber having the facility of air circulation and temperature control.

E-4 SAFETY PRECAUTION

During the presentation of solution or during UVR treatment on tapes there should be no naked flame nearby otherwise the solvent i.e. rectified spirit will catch fire.

E-5 EQUIPMENT/MACHINE REQUIRED FOR UVR TREATMENT

1. Stirrer - Desired RPM 5000
2. Jar Mill - of suitable capacity
3. Pad Mangle Machine – A suitable mangle which can be adjusted to give necessary pressure to obtain desired extraction %.
4. Curing Chamber – The chamber should have arrangements to raise the temperature to the desired level and control the same during the treatment period. The temperature of the chamber should be uniform throughout with the help of air circulation/thermostat control device.

E-6 LIKEKY SOURCES OF SUPPLY FOR CHEMICALS

1. Butyral Resin (Synpol B-30) : M/S Synthetic & Polymers (P) Ltd.,
   77, G.V.M.S., Audyogic Vasahat Ltd.
   Distt: Ahmedabad
2. Rectified Spirit : i) Distilleries through Excise Commissioner
   ii) Market
3. Butyl Recinoleate : M/S Amrut Industrial Products,
   Chemical House, Amrut Nagar, L.B.S. Marg,
   Post Box No. 46
   Thana- 400601 (Maharastra)
4. Carbon Black : i) M/S Gunny Tex (P) Ltd.
   2658, Naya Bazar
   Delhi- 110006
   ii) M/S Amrut Industrial Products
   Gandhi Marg, P.B. No. 2445
   Bombay – 400002
5. Dynasylon Meme : M/S Dynamit Nobel Aktiengesel Schat
   Work Rhinnielden 7888, Rhein
   Felden/Baden,
   West Germany

   Indian representative:
   M/S Chika Ltd.
   Vohra House, 25/1, Asaf Ali Road
   New Delhi – 110002

APPENDIX- F

SUGGESTED PROCEDURE OF WR _ UVR TREATMENT

F-1 **Preparation of Solution for WR treatment:**

Aquateq- SPL, a Perfluoroalkyl based Fluorocarbon Compound (source of supply given below) should be used as WR (Water Repellent) on tape nylon. 30-50 g of Aquateq-SPL should be added gradually in 1 liter of cold water. Stirring should continue till a homogenous solution is obtained. It is imperative to ensure pH of substrate between 5 to 7 before treatment with Aquateq- SPL, to get optimum results.

F-2 W.R treatment on nylon tape is done by pad mangle machine through pad-dry-cure method. The suitable amount of solution should be kept in the reservoir of the machine and nylon tape should pass through the solution and then through rollers which are duly adjusted for squeezing out the surplus solution. The tapes are to be dried by passing through a chamber having a temperature of 40°c to 50°cfor 45 minutes.

F-3 **Curing:** The Tape after WR treatment and drying shall be cured so as to form a firmly adhered and evenly distributed deposit or coating on the Tape. The curing after WR treatment and drying shall be done in the temperature range of 130°-150°c for 5 minutes.

F-4 After complete WR treatment (i.e. after curing), manufacturer must check the extractable material as a controlling measure to finalize the WR processing parameters (mangle pressure, expression percentage etc.). The prescribed range of extractable material of tape after WR treatment is 1-1.5% of the weight of dry WR treated tape, when extracted as per the method stipulated in Appendix 'E' of IS:4727. After WR treatment, UVR treatment should be done according to the clause no. 7.3 of this specification.

F-5 SOURCE OF SUPPLY FOR AQUATEQ- SPL

The AQUATEQ- SPL can be procured from the source mentioned below:

Associated Processing Aids,
A/103, Gurudev Apts.Opposite Telephone Exchange,
Chembur Naka, P.O. Box- 7219
R.C. Marg, Mumbai-400071
Fax: 022- 25277841
E- Mail: assochem@bom4.vsnl.net.in

Appendix G

METHOD FOR DETERMINATION OF STIFFNESS (DROP ANGLE) OF TAPES

G-1 TEST SPECIMEN

For the purpose of this test, all the UVR treated tapes rolls in the lot shall constitute the test specimen.

G-2 ATMOSPHERIC CONDITION FOR CONDITINING AND TESTING

Prior to the test, the tape shall be conditioned to moisture equipment and tested in standard atmospheric conditions 65 ± 2% RH and 27 ± 2°C temperature.

G-3 PROCEDURE

900 mm length of the tape shall be preconditioned by placing the tape on a horizontal surface and placing sufficient weight on the table to remove any longitudinal curvature. Immediately after the pre-conditioning period under the same atmospheric conditions, the same shall be extended 400 mm beyond the edge of the horizontal surface. The tape shall be sufficiently weighed to keep it flat on the horizontal surface. At the end of 4 hours period, measurements shall be made to determine the drop angle as shown below: -

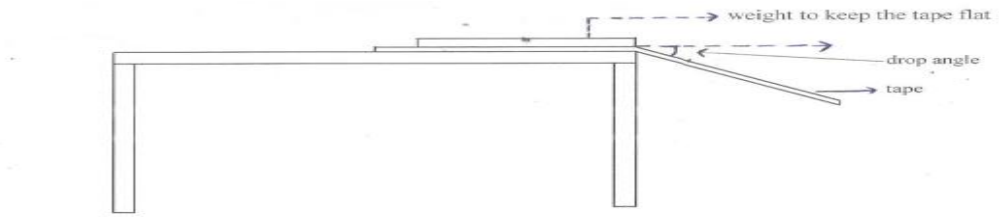


FIG: SHOWING MEASUREMENT OF DROP ANGLE

Appendix H

METHOD FOR DETERMINATION OF EXTRACTABLE MATERIAL AFTER WR & UVR TREATMENT

H-1 In case of WR-UVR treated tapes; firstly the UVR treatment is to be extracted as per the method stipulated in Appendix – E of IS: 4727

H-2 After the complete extraction of UVR treatment, WR treatment should be extracted as per the method stipulated in Appendix-E of IS: 4727 with a deviation i.e. using ethyl alcohol in the place of methyl ethyl ketone.

H-3 Calculation:

The total WR-UVR extractable material, %= (X+Y).

Where: $X = (T-U)/T \times 100$

and $Y = (U-W)/T \times 100$

T = wt. of WR-UVR treated tape in g
U = wt. of tape in g after extraction as per method given in H-1
W= wt. of tape in g after extraction as per method given in H-2

ANNEX 4 (a)

(Item 6.1)

Wide Circulation Draft IS 1402 Textiles – Braided Cotton Cord For Aerospace Purposes – Specification

For comments only Doc: TXD/13 (21136)

भारतीय मानक ब्यूरो

भारतीय मानक मसौदा

वस्त्रादि – वायु आकाशिय प्रयोजनों के लिए गुँथी हुई सूती डोरी – विशिष्टि

(*तीसरा पुनरीक्षण*)

BUREAU OF INDIAN STANDARDS

Draft *Indian Standard*

TEXTILES – BRAIDED COTTON CORD FOR AEROSPACE PURPOSES – SPECIFICATION

(*Third Revision* of IS 1402)

ICS : 59.060.10:49.025.60

Last date for receipt of comment is 01 January 2023

FORWORD

(*formal clause to be added later*)

This standard was first published in 1959 and subsequently revised in 1979 and 1992. This revision has been made in the light of experience gained since its last revision and to incorporate the following major changes:

a) Requirement for linear density of braided cotton cord has been modified.
b) New annex for determination of plaits has been incorporated.
c) Packing and Marking clauses have been modified.

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 : 2022 ‘Rules for rounding off numerical values

(*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

1.1 This standard specifies the constructional particulars and other requirements of braided cotton cord of **1.5** mm diameter for use in aerospace application.

2 REFERENCES

The standards listed 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 the standards indicated in Annex A.

3 MANUFACTURE

3.1 Yarn

Cord shall be manufactured from 2-ply, mercerized cotton yarn of suitable count so as to achieve the requirements specified in this standard.

3.2 Cord

The braided cord shall be firm and free from knots, kinks, broken or loose projecting ends, etc.

3.3 Finish

3.3.1 *General*

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

a) Scoured, rot-proofed; or
b) Scoured, dyed, rot-proofed.

3.3.2 *Dyeing*

If dyeing is required, the colour shall-be as stated in the contract or order. Sulphur dyes or dyes known to accelerate actinic damage shall not be used.

3.3.3 *Rot-Proofing*

The cord shall be rendered rot-proof by treatment with pentachlorophenyl laurate (PCPL) in accordance with IS 11662 (normal process).

4 REQUIREMENTS

4.1 The cord shall meet the requirement specified in Table 1.

Table 1 Physical Requirements of Braided Cotton Cord for Aerospace Purposes
(*Clause* 4.1)

Sl No.	Characteristic	Requirement	Method of Test
(1)	(2)	(3)	(4)
i)	Diameter, mm	2 to 4	IS 7071
ii)	No. of yarns per strand	3 or 4	Annex B
iii)	No. of strands in braid of cord	16	Annex B
iv)	Plaits per 30 cm	75 ± 5	Annex C
v)	Linear density, Tex, *Max*	1240	IS 7071
vi)	Breaking load on 50 cm test specimen, N(kgf), *Min*	196 (20)	-do-
vii)	Elongation at break, percent, *Min*	15	-do-

4.2 Length

4.2.1 Unless otherwise specified in the contract or order, the length per package shall be not less than 450 metres.

4.2.2 Short lengths of cord of not less than 50 metres shall not exceed 10 percent of the total length of the consignment.

4.3 Scouring Loss

The scouring loss of the cord when determined in accordance with the severe method specified in IS 1383 shall not exceed 1.5 percent.

4.4 Colour Fastness

In case of dyed cords, colour fastness towards light shall be 5 or better and towards washing [Test C (3)] shall be 4 or better, when determined in accordance with IS/ISO 105-B02 and IS/ISO 105-C10 respectively.

5 PACKING

Braided cord shall be compactly wound to form reels, cheeses, etc, which shall be adequately wrapped in waterproof material and packed in boxes or cartons, as specified in the contract or order.

6 MARKING

6.1 Each package (reels, cheeses, etc) of the cord shall bear a securely attached label with the following information:

a) Name of material;
b) Length;
c) Condition (*see* **3.3.1**);
d) Indication of the source of manufacturer; and
e) Date of manufacture.

6.2 The boxes or cartons shall be marked with the consignment details provided in the contract or order, in ‘addition to the information given in **6.1**.

6.3 BIS Certification Marking

The Braided cotton cords conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the Braided cotton cords may be marked with the Standard Mark

7 SAMPLING

7.1 Lot

The quantity of cord of one definite quality (*see* **3.3.1**) delivered to a buyer against one despatch note, shall constitute the lot.

7.2 The conformity of the lot to the requirements of this standard shall be determined on the basis of tests carried out on the sample selected from the lot.

7.3 Unless otherwise agreed to between the buyer and the seller, the number of packages to be selected at random from the lot shall be in accordance with co1 3 of Table 2. These packages shall be selected from at least 10 percent of the boxes or cartons and equal number of packages, as far as possible, shall be drawn at random from each box or carton.

Table 2 Number of Packages to be selected in the Sample
(*Clause* 7.3)

Sl No.	No. of Packages in the Lot	No. of Packages in the sample
(1)	(2)	(3)
i)	Up to 100	3

ii)	101 to 300	4
iii)	301 to 500	5
iv)	501 to 1000	7
v)	1001 to Above	10

7.4 For evaluating the requirement specified in Table 1 and **4.2**, **4.3** and **4.4** the number of packages selected under **7.3** shall constitute the test sample. The required test specimens shall be drawn from each of the package and subjected to the corresponding tests.

7.5 Criteria for Conformity

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

a) From the observed values of linear density, the average, X and the range R are calculated and the values of the expressions ($X \pm 0.4\ R$) lie within the specified limits,

b) From the observed values of breaking load and length on package, the average X and the range R are calculated and the value of the expression ($X - 0.4\ R$) is greater than or equal to the specified minimum value,

c) All the test specimens satisfy the colourfastness ratings for the various agencies as specified, and

d) From the observed values of scouring loss, percent, and elongation at break, percent, the average X and the range R are calculated and value of the expression ($X + 0.4$ R) is less than or equal to the specified maximum value.

NOTES

1 Average X is the value obtained by dividing the sum of the observed values by the number of tests.

2 Range R is the difference between the maximum and the minimum in a set of observed values.

ANNEX A
(*Clause* 2)

LIST OF REFFERED INDIAN STANDARDS

IS No.	*Title*
1383 : 1977	Methods for determination of scouring loss in grey and finished cotton textile materials (*first revision*)
6359 : 1971	Method for conditioning of textiles
7071 : 2021	Fibre ropes — Determination of certain physical and mechanical properties *(second revision)*
11662 : 1986	Specification for preservative treatments of textiles
IS/ISO 105-B02 : 2014	Textiles — Tests for colour fastness Part B02 Colour fastness to artificial light : Xenon arc fading lamp test
IS/ISO 105-C10 : 2006	Textiles — Tests for colour fastness Part C10 Colour fastness to washing with soap or soap and soda

ANNEX B

[*Table 1, Sl No.* (ii) and (iii)]

DETERMINATION OF STRANDS IN BRAID

B-1 GENERAL

B-1.1 Unless otherwise specified, the test specimens shall be conditioned as given in IS 6359 before testing.

B-2 STRANDS IN BRAID

B-2.1 Take one test specimen. From one of its ends, remove the interlacing and count the number of strands forming the braid. Take one strand and count the number of threads in it. Determine similarly the number of component threads in the remaining strands of the test specimen.

ANNEX C

[*Table* 1, *Sl No* (iv)]

DETERMINATION OF PLAITS IN CORD

C-l TEST SPECIMENS

C-l.1 For the purpose of this test, a length of cord measuring approximately 300 cm cut from each ball or hank in the test sample shall constitute the test specimens.

C-2 CONDITIONING OF TEST SPECIMENS

C-2.1 Prior to test, the test specimens shall be conditioned in a standard atmosphere at 65 ± 2 percent RH and 27 ± 2 °C temperature (*see* IS 196) for at least 24 hours.

C-3 PROCEDURE

C-3.1 Take a test specimen and apply a tension equal to 1 percent of minimum breaking load of the cord (*see* Note). After 60 ± 5 s, mark in the length in tension of five separate 30 cm specimens.

NOTE — The tension may be applied in a breaking load testing machine. Alternatively, it may also be applied by fixing one end of the cord to a peg and passing the cord around a pulley and hanging the desired load at the other end.

C-3.2 Release the load and count the number of plaits in each 30 cm specimen and calculate the average plaits per 30 cm.

C-3.3 Repeat the test with the remaining test specimens.

ANNEX 4(b)

(*Item 6.1*)

Wide Circulation draft of IS 3255 Scoured or Dyed Cotton Tapes For Aerospace Purposes — Specification

For comments only Doc: TXD/13 (21155) WC

भारतीय मानक ब्यूरो

भारतीय मानक मसौदा

वस्त्रादि – वायु आकाशिय प्रयोजनों के लिए अभिमार्जित या रंजित सूती टेप – विशिष्टि

BUREAU OF INDIAN STANDARDS

Draft *Indian Standard*

SCOURED OR DYED COTTON TAPES FOR AEROSPACE PURPOSES — SPECIFICATION

(*Second Revision* of IS 3255)

ICS : 59.060.10:49.025.60

Not to be reproduced without permission of BIS or used as Standard	Last date for receipt of comments is **06 January 2023**

FOREWORD
(Formal clause will be added later)

Cotton tapes are mostly used in supply dropping parachutes, looping, pipping and pack covers etc. These cotton tapes can be woven on shuttle loom or needle loom. Needle looms are capable of inserting the double number of wefts compared to the shuttle looms, hence the tapes woven on needle loom has higher cover factor.

This standard was first published in 1965 and subsequently revised in 1975. The second revision has been made in the light of experience gained since its last revision and to incorporate the following major changes:

a) The requirements for cotton tapes woven on needle loom have been incorporated.
b) The references to Indian standards have been updated.
c) Packing and marking clauses have been modified.

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 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

1.1 This standard covers scoured or dyed cotton tapes of width 12.7, 19.0, 25.0, 28.5, 31.7, 38.0, 44.4, 50.0, 57.0, 63.5, 75.0, 89 and 102 mm used mainly in supply dropping parachutes.

1.2 This standard specifies the requirements for cotton tapes woven on both shuttle loom and needle loom.

2 REFERENCES

The standards listed 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 the standards indicated in Annex A.

3 MATERIAL

3.1 Unsized 3 - ply cotton yarn free from spinning defects given in IS 171 may be found suitable.

3.2 The cotton tape shall be supplied in loomstate or scoured or scoured dyed.

4 TYPES

4.1 Based on the type of loom, the cotton tapes are classified as follows:

a) *Type I* —Cotton tapes woven on shuttle loom;
b) *Type II* — Cotton tapes woven on needle loom.

5 REQUIREMENTS

5.1 The tape shall meet the physical requirements given in Table 1.

Table 1 Physical Requirements
(*Clause* 5.1)

Length per roll	**Width**, mm	**Mass**, *Max*		**Ends in full width**	**Picks per cm,** for Type I	**Picks per cm,** for Type II	**Warpway breaking Load** (20 cm × full width), *Min* (*see* Note)	
		g/m	kg/100 m roll				kN	kgf
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
100 m unless otherwise specified	12.7	8	0.8	38	12 ± 1	24 ± 2	0.54	55
	19.0	12	1.2	56			0.84	86
	25.0	16	1.6	74			1.22	125
	28.5	18	1.8	84			1.24	127
	31.7	20	2.0	94			1.38	141
	38.0	24	2.4	112			1.81	185
	44.4	28	2.8	130			1.96	200
	50.0	31	3.1	148			2.45	250
	57.0	36	3.6	168			2.50	255
	63.5	40	4.0	186			2.78	284
	75.0	47	4.7	222			3.68	375
	89	55	5.5	258			3.90	398
	102	63	6.3	294			4.46	455
	± 1.5 (12.7–75.0); ± 2 (89–102)			+ 4 - 0 (38–186); +6 - 0 (222–294)				
Method of test	IS 1954	IS 1964		IS 1963		IS 1963	IS 1969	

NOTES
1 The test specimens shall be conditioned for 48 hours at 27 ± 2°C and 65 ± 2 percent RH before testing for breaking strength.
2 The tolerance of ±10 percent shall be allowed in linear density of yarn
3 Linear density of weft yarn shall be half and picks/dm shall be double in case of tapes woven on needle loom.
4 Incase of cotton tapes woven on needle loom two weft yarns per single pick shall also be allowed.

5.2 The tape shall also meet the chemical requirements given as under:

Table 2 Chemical Requirement
(*Clause* 5.2)

Sl No.	Characteristic	Requirement	Method of Test
(1)	(2)	(3)	(4)
i)	*p*H value	6.5 to 8.5	IS 1390
ii)	Scouring loss, percent, *Max*	3	IS 1383 (Severe Method)
iii)	Colour fastness: i) Light ii) Washing	 5 or better 5 or better	 IS/ISO 105-B01 or IS/ISO 105-B02 IS/ISO 105-C10 [Test Number A (1)]
iv)	Water solubles, percent, *Max*	1	IS 3456
NOTE — Sulphur dyes shall not be used in production of dyed tapes.			

5.3 The tapes shall be uniformly woven with firm selvedges in 2 × 2 twill weave and be free from weaving defects and also from sizing and finishing materials.

5.4 In respect of the requirements not covered in this standard the tapes shall not be inferior to the sealed sample agreed to in the contract or order.

6 PACKING

6.1 Each roll shall be wrapped in kraft paper; further packing of rolls in the case or carton shall be as detailed in the contract or order.

7 MARKING

7.1 Each roll shall carry the following information:

a) Name and variety of material;
b) Length/roll (m) and mass of roll (g);
c) Width of tape (mm);
d) Type;
e) Month and year of manufacture in suitable code;
f) Name of the manufacturer/trade-mark; and
g) Any other information as required by the buyer or the law in force.

7.2 BIS Certification Marking

The scoured or dyed cotton tape rolls conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the scoured or dyed cotton tape rolls may be marked with the Standard Mark.

7.3 Each case/carton shall be marked with the details of the consignment as provided in the contract or order in addition to marking given in **7.1.**

8 SAMPLING

8.1 Lot — The quantity of nylon tape of the same type and width in a consignment shall constitute a lot.

8.2 Unless otherwise specified in the contract or order, the sampling plan given in Table 3 shall be followed.

8.2.1 Rolls shall be selected at random (*see* IS 4905).

8.2.2 Sub-sample rolls specified in col 4 of Table 3 shall be drawn from the sample rolls selected according to col 3 of the Table 3.

Table 3 Scale of Sampling

(*Clause* 8.2)

Sl No.	No. of Rolls in the Lot	Sample Size	Sub-Sample Size
(1)	(2)	(3)	(4)
i)	Up to 25	3	3
ii)	26 to 100	5	4
iii)	101 to 150	8	5
iv)	151 to 300	13	7
v)	301 to 500	20	8
vi)	501 to 1000	50	9
vii)	Above 1000	80	10

9 NUMBER OF TEST SPECIMENS AND CRITERIA FOR CONFORMITY

9.1 Number of test specimens and criteria for conformity shall be as given in Table 4.

Table 4 Number of Test Specimens and Criteria for Conformity

(*Clause* 9.1)

Sl No.	Characteristics	Number of Samples	Criteria for Conformity
(1)	(2)	(3)	(2)
i)	**Length, linear density width, mass, ends, picks and plies**	According to column 3 of Table 2	All the test specimens shall pass the tests
ii)	**Breaking load, *p*H value and colour fastness**	According to column 4 of Table 2	All the test specimens shall pass the tests for sample size below 300. One defect is allowed for the sample size between 301-1000. Two defects are allowed for sample size above 1000.

ANNEX A
(*Clause* 2)
LIST OF REFERED INDIAN STANDARDS

IS No./Other Publication	*Title*
171 : 1993	Textiles — Ring spun grey cotton yarn for weaving — Specification (*fourth revision*)
1383 : 1977	Methods for determination of scouring loss in grey and finished cotton textile materials (*first revision*)
1390 : 2022	Textiles Determination of *p*H of aqueous extract (*third revision*)
1954 : 1990	Determination of length and width of woven fabrics – Methods (*second revision*)
1963 : 1981	Methods for determination of threads per unit length in woven fabrics (*second revision*)
1964 : 2001	Textiles — Methods for determination of mass per unit length and mass per unit area of fabrics (*second revision*)
1969(Part 1) : 2018	Textiles — Tensile properties of fabrics — Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
2500 (Part 1) : 2000	Sampling procedures for inspection by attributes Part 1 Sampling schemes indexed by acceptance quality limit (AQL) for lot — by — lot inspection (*third Revision*)

3456 : 2022	Method for determination of water — Soluble matter of textile materials *(first Revision)*
IS/ISO 105-B01 : 2014	Textiles — Tests for colour fastness — Part B01 Colour fastness to light: Daylight
IS/ISO 105-B02 : 2014	Textiles — Tests for colour fastness — Part B02 Colour fastness to artificial light: Xenon arc fading lamp test
IS/ISO 105-C10 : 2006	Textiles — Tests for colour fastness Part C10 Colour fastness to washing with soap or soap and soda

ANNEX 5(a)
(*Item 7.1*)
Comments from M/s MLDC, Kanpur on IS Textiles — Cotton Webbing for Parachutes — Specification

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDRADS

Draft for comments only Doc No.: TXD 13 (22617)
June 2023

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भारतीय मानक मसौदा
वस्त्रादि — पैराशूट के लिए कपास के वेबिंग — विशिष्टि

(IS 3449 का *तीसरा पुनरीक्षण*)

Draft *Indian Standard*
TEXTILES — COTTON WEBBING FOR PARACHUTES — SPECIFICATION
(*Third Revision* of IS 3449)

ICS : 49.025.60

Textile Materials for Aeronautical Applications Sectional Committee, TXD 13	Last date for receipt of comments is 08 Aug 2023

FOREWORD

(Formal clauses will be added later)

This standard was first published in 1966 and was subsequently revised in 1979 and 1984. The third revision has been made in the light of experience gained since its publication and to incorporate the following major changes:

a) Requirement for colour fastness to dyed cotton webbing has been modified;
b) Sampling and marking clauses have been updated; and
c) References to the Indian standards have been updated.

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 : 2022 ‘Rules for rounding off numerical values (*second revision*).’ The

number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This standard specifies the requirements for two types of cotton webbing mainly used in the fabrication of man-dropping parachutes.

2 REFERENCES

The standards listed 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 the standards listed in Annex A.

3 TYPES

The cotton webbings shall be of following two types depending upon their widths:

a) *Type I* — Cotton webbing having width of 38 mm.
b) Type II — Cotton webbing having width of 75 mm.

4 MANUFACTURE

4.1 The webbing shall be manufactured from unsized cotton yarns of nominal counts as follows:

a) Warp — 3 ply yarn of resultant count 150 tex; and
b) Weft — 3 ply yarn of resultant count 90 tex.

4.2 The weave of the cotton webbing shall be 2/2 V twill.

5 FINISH

5.1 Condition of Material

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

a) Loomstate;
b) Scoured and rot-proofed; and
c) Scoured, dyed and rot-proofed.

5.2 Dyeing

If dyeing is required, the colour shall be as stated in the contract or order and either the webbing or the yarns from which it is to be manufactured shall be dyed. Sulphur dyes shall not be used. The rotproofing treatment by LPCP or PCPL as stated in **5.3** may be given subsequently.

5.3 Rot-Proofing

If rot-proofing is required, the webbing or the yarns from which it is to be manufactured shall be evenly and thoroughly impregnated with a solvent solution or aqueous emulsion of lauryl pentachlorophenol (LPCP) or of pentachlorophenyl laurate (PCPL). This shall be followed by removal of the excess and subsequent drying or thorough solvent removal. The treated textile shall be dry in handling and non-tacky. The LPCP or PCPL content of the treated textile when tested according to the methods prescribed in IS 3522 (Part 2) or Annex A shall not be less than 1.7 percent and not more than 2.5 percent on the oven dry mass of the textile material. The free pentachloro phenol content of the treated textile shall not exceed 10 percent of the LPCP or PCPL content (*see* Note under **B-3**).

5.4 Freedom from Defects

In case of webbing to be used for personnel parachutes, each roll shall be visually examined metre by metre for the defects as given in Annex C. The roll shall be acceptable only if it is free from these defects.

6 REQUIREMENTS

6.1 The cotton webbings shall meet the physical and chemical requirements as given in Tables 1 and Table 2.

Table 1 Physical Requirements of Cotton Webbing for Parachutes
(*Clause* 6.1)

Type	**Length of Roll, m, *Min***	**Width, mm**	**Ends In Full Width**	**Picks Per cm**	**Mass, g/m, *Max***	**Breaking Load, Warpway (20 cm ×Full Width), N, *Min***
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I	100 or as ordered	38	112	12	27	1 815
II	100 or as ordered	75	222	12	50	3 675
Tolerance	—	± 1.5 mm	+4 mm −0 mm	± 1	—	—
Method of Test, Ref to	Annex D	Annex E	IS 1963		Annex F	IS 1969 (Part 1)

Table 2 Chemical Requirements of Cotton Webbing for Parachutes
(*Clause* 6.2)

Sl.No	Characteristic	Requirements for Types I and II	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Colour fastness to: a) Light b) Washing, Test C (3)	 5 or better 4 or better	 IS/ISO 105-B01 or IS/ISO 105-B02 IS/ISO 105-C10
ii)	Scouring loss, percent, *Max*	3	IS 1383
iii)	Water soluble matter, percent, *Max*	1	IS 3456

7 MARKING

7.1 Each roll shall carry the following information:

a) Name of the manufacturer/trade-mark;
b) Length and width (mm) of material;
c) Type;
d) Length/roll (m); and
e) Month and year of manufacture.

7.2 BIS Certification Marking

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed there under, and the products may be marked with the Standard Mark.

8 PACKING

8.1 Unless otherwise agreed to between the buyer and the seller, the webbings shall be packed as given in **8.2**.

8.2 Webbing rolls, individually wrapped in polyethylene (*see* IS 2508) or water proof paper (*see* IS 1398), shall be tightly packed in heavy cee jute cloth (*see* IS 3751) to form a bale not exceeding 50 kg in gross mass.

8.3 Each bale shall be marked with the details of the consignment as provided in the contract or order in addition to the marking given in **7.1.**

9 SAMPLING

9.1 Lot

All the rolls of webbing purporting to be of one definite type and quality delivered to one buyer against one despatch note shall constitute a lot.

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

9.3 Unless otherwise agreed to between the buyer and the seller, the number of rolls to be selected at random from a lot shall be in accordance with col 2 of Table 3.

Table 3 Sample Size and Criteria for Conformity
(*Clause* 9.3)

Sl No.	Lot Size (Number Of Rolls)	Sample Size (Number of Rolls To Be Selected)	Permissible Number Of Non-Conforming Rolls	Sub-Sample Size (Number of Rolls to be Selected)
(1)	(2)	(3)	(4)	(5)
i)	Up to 100	10	1	5
ii)	101 to 300	15	1	6
iii)	301 to 500	25	2	7
iv)	501 to 800	35	3	8
v)	801 to 1 300	50	4	9
vi)	1 301 and above	75	6	10

9.4 For evaluating (a) ends in full width and picks per cm, (b) width, and (c) length, the rolls selected as in col 3 of Table 3 shall constitute the test sample.

9.5 For evaluating (a) mass, (b) breaking load, (c) water soluble matter, (d) scouring loss, and (e) colour fastness, the number of rolls specified in col 5 of Table 3 shall constitute the test sample. These rolls shall be selected at random from those selected in col 3 of Table 3. The required number of test specimens shall be drawn from each roll and subjected to corresponding tests.

NOTE — In the case of breaking load tests, at least 10 representative test specimens shall be drawn from each roll for the purpose of tests.

9.6 Criteria for Conformity — The lot shall be considered to be inconformity with the requirements of this standard if the following conditions are satisfied;

a) The number of rolls found non-conforming with respect to (i) ends in full width and picks per cm, and (ii) width does not exceed the corresponding number given in col 4 of Table 3.

b) In the case of length, the value obtained for each roll shall be compared with its declared or marked length. The mean percentage of deficiency in length, if any, shall be determined and made applicable to the lot.

c) From the observed values of mass, the average $\bar{X}$ and the range R shall be calculated and the value of the expression $\bar{X} + 0.6\ R$ shall be less than or equal to the specified value.

d) From the observed values of breaking load tests in respect of each roll in the test sample, the average breaking load value shall be calculated. From all such average breaking load values the grand average $\bar{X}$ and the range R shall be calculated and the value of the expression $\bar{X} - 0.6\ R$ shall be greater than or equal to the specified value.

NOTES

1 The average breaking load value for a roll is the value obtained by dividing the sum of the observed values in respect of the test specimens taken from the roll by the number of test specimens. Grand average is the value obtained by dividing the sum of the average breaking load values in respect of the rolls in the test sample by the number of rolls tested.

2 Range R is the difference between the maximum and the minimum in a set of average breaking load values for the rolls tested.

e) From the observed values of water soluble matter, the average $\bar{X}$ and the range R shall be calculated and the value of the expression $\bar{X} + 0.6\ R$ shall be less than or equal to the specified value.

f) From the observed values of scouring loss, the average X and the range R shall be calculated and the value of the expression $\bar{X} + 0.6\ R$ shall be less than or equal to the specified value.

NOTES
1 Average is the value obtained by dividing the sum of the observed values by the number of tests.
2 Range R is the difference between the maximum and the minimum in a set of observed values.

g) The colour fastness ratings obtained on tests satisfy the corresponding requirements.

h) In case of webbing used for personnel parachutes, each roll shall be visually examined metre by metre for the defects given in Annex C and it shall be acceptable only if it is free from these defects.

ANNEX A

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
IS 196 : 1966	Atmospheric conditions for testing (*revised*)
IS 667 : 1981	Methods for identification of textile fibres (*first revision*)
IS 1383 : 1977	Methods for determination of scouring loss in grey and finished cotton textile materials (*first revision*)
IS 3456 : 2022	Method for determination of water-soluble matter of textile materials (*first revision*)
IS 1398 : 1982	Specification for packing paper water proof, bitumen — laminated (*second revision*)
IS 1963 : 1981	Methods for determination of threads per length in woven fabrics (*second revision*)
IS 1969 (Part 1) : 2018	Textiles — Tensile properties of fabrics Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
IS 2508 : 2016	Polyethylene films and sheets — Specification (*third revision*)
IS 3522 (Part 1) : 1989	Methods for estimation of common preservatives on textiles — Part 1 (*first revision*)
IS 3522 (Part 2) : 1989	Textiles — Estimation of common preservatives — Part 2
IS 3751 : 1993	Textiles — Heavy cee jute cloth — Specification (*first revision*)
IS/ISO 105-B01 : 2014	Textiles — Tests for colour fastness part B01 Colour fastness to light : Daylight
IS/ISO 105-B02 : 2014	Textiles — Tests for colour fastness Part B02 Colour fastness to artificial light : Xenon arc fading lamp test
IS/ISO 105-C10 : 2006	Textiles — Tests for colour fastness Part C10 Colour fastness to washing with soap or soap and soda

ANNEX B

(*Clause* 5.3)

DETERMINATION OF PENTACHLOROPENYL LAURATE (PCPL) CONTENT

B-1 GENERAL

The method is applicable to the determination of PCPL in the absence of added pentachlorophenol. The proofing is hydrolyzed, acidified and steam distilled and the pentachlorophenol in the distillate extracted with 1, 1, 1-trichloroethane and complexed with copper sulphate-pyridine reagent. The optical density of the complex in1, 1, 1-trichloroethane is measured on a suitable sepctrophotometer at 450 nm.

B-2 REAGENTS

B-2.1 Ethanediol (ethylene glycol);

B-2.2 1, 1, 1-trichloroethane;

B-2.3 Pridine (AR, GPR grade);

B-2.4 Sodium hydroxide, pellet;

B-2.5 Copper sulphate reagent solution 50 g/1;

B-2.6 Pentachlorophenol (standard reagent), melting point 180 °C minimum; and

B-2.7 Hydrochloric acid, concentrated 36 percent (*m/v*) (11 M).

B-2.8 Copper Sulphate — pyridine reagent prepared by mixing 4 ml pyridine with 6 ml copper sulphate solution immediately before use.

B-3 PROCEDURE

Weigh 2.5 g ± 0.05 g of the material, cut into small pieces of not more than 5 mm square and place in a dry 250 ml round flask (B 24/29 socket). Add 30 ml of ethanediol, 4 g of sodium hydroxide (pellet form), 2 ml to 4 ml of water in, that order and a few anti bumping granules. Connect the flask with a double surface condenser, bring the contents to boiling point on a sand bath and boil them vigorously for 30 min under reflux. After this allow the contents of the flask to cool, remove the reflux condenser and add through a funnel 60 ml water followed by 20 ml hydrochloric acid. Steam distill the contents of the flask ensuring that a constant volume is maintained by applying gentle heat as necessary. Collect 300 ml of distillate in a suitable receiver, applying care to prevent loss of pentachlorophenol in the distillate by adequate cooling. Discontinue the external heating of the flask a few minutes before disconnecting the steam supply. Disconnect the condenser and fit it vertically over the distillate receiver. Wash down the condenser with 25 ml to 30 ml of trichloroethane and collect the washing in the distillate. Transfer the distillate and trichloroethane washings to a 500 ml separating funnel and shake thoroughly. Allow the layers of water and trichloroethane to separate completely before running off the trichloroethane layer into a 100 ml separating funnel. Wash the condenser and distillate receiver with a further 25 ml to 30 ml trichloroethane and add this to the aqueous solution into the 500 ml separating funnel. Repeat the extraction as given above and add the trichloroethane layer to the first trichloroethane extract in the 100 ml separating funnel. Add to the bulked trichloroethane extract 10 ml of copper sulphate-pyridene reagent and shake well. After complete separation of the aqueous and trichloroethane layers, run the lower trichloroethane layer into a 100 ml volumetric flask via a small funnel containing anhydrous sodium sulphate supported by means of a quartz wool plug. Add a small quantity of trichloroethane to the copper sulphate-pyridine solution remaining in the separating funnel, shake and allow the layers to separate. Filter the trichloroethane layer through quartz wool plug and collect in the volumetric flask. Wash the filter with further small quantities of trichloroethane and finally make up to 100 ml trichloroethane.

Determine the optical density of the solution using a suitable spectrophotometer at 450 nm using trichloroethane as a blank. Estimate the PCPL content by reference to a calibration graph prepared from known standards of pentachlorophenol (1.0 percent pentachlorophenol = 1.71 percent PCPL).

NOTE — If the proofing is expected to contain both pentachlorophenol and PCPL then the free pentachlorophenol content should be determined as given in IS 3522 (Part 1) and the amount found deducted from the apparent PCPL content.

B-4 CALIBRATION

B-4.1 Direct — Prepare a calibration graph using 5 ml, 10 ml, 15 ml aliquots of a standard solution of pentachlorophenol reagent (1 g/200 ml) in trichloroethane to cover a range of 1, 2 and 3 percent respectively. Dilute each aliquot to 50 to 60 ml with trichloroethane, add 10 ml of copper sulphate-pyridine reagent, shake well and then follow the described procedure. Plot optical density against concentration of PCPL.

B-4.2 Indirect — Prepare a calibration graph using 5 ml, 10 ml, 15 ml aliquots of a standard solution of pentachlorophenol reagent (1 g/200 ml) in dilute sodium hydroxide solution (sufficient for complete solution of pentachlorophenol). Place each aliquot in a round bottomed flask, add 60 ml water and 20 ml hydrochloric acid. Fit the flask for steam distillation and then follow the described procedure. If the distillation technique is satisfactory then the graphs obtained as in **B-4.1** and **B-4.2** should be the same.

ANNEX C

[*Clauses* 5.4 and 8.6 (h)]

CLASSIFICATION OF MAJOR DEFECTS

C-1 Width Deviation — Any part outside the limits specified in this standard.
C-2 Warp Bow — Any part in which the warp bow when measured on a 1 m length exceeds 10 mm.
C-3 Slack or Unevenly Woven Selvedges — Any part that does not lie flat and even or shows a distinct 'saw tooth' effect.
C-4 Cut, Broken or Missing Threads — Two or more in warp orweft regardless of length.
C-5 Knots in Warp Ends or Weft Picks — One or more.
C-6 Floats — Any float affecting more than two ends and extending more than 6.5 mm.
C-7 Pick Variation — Variation outside the tolerances specified in this standard other than slight local variation.
C-8 Mechanical Damage, Abrasion Marks — Any damage affecting the breaking load.
C-9 Inclusions — Any hard or soft foreign bodies which cause appreciable added thickness.
C-10 Cut, Hole or Tear — Three or more warp or weft threads ruptured at adjoining points.
C-11 Loop, Kinks, Snarls (Except Selvedges) — All over 3 mm in length.
C-12 Selvedge, Cut, Broken, Torn, Scalloped — Any cut, broken, torn or scalloped selvedge.
C-13 Spot, Stain or Streaks — (a) Single ends or picks 40 cm or more in length, and (b) Double ends or picks 20 cm or more in length.

ANNEX D
(*Table* 1)

METHOD FOR DETERMINATION OF LENGTH OF ROLL

D-1 TEST SPECIMENS

D-1.1 For the purpose of this test, all the rolls in the test sample (*see* **9.4**) shall constitute the test specimens.

D-2 EQUIPMENT

D-2.1 A flat table, little over 5 m long, having a smooth horizontal surface with markings in metres and centimetres on one side, shall be used.

D-3 PROCEDURE

D-3.1 Unroll one test specimen, draw one of its ends across the full length of the table and smoothen the portion of the webbing on the table with no greater tension than is necessary to make it lie straight and flat.

D-3.2 Mark on the webbing the first 5 m length as measured against the mark on the table. Measure the entire length, correct to a centimetre against the markings on the table.

D-3.3 Compare the value obtained in **D-3.2** with the declared or marked length of the roll and note the deficiency in length, if any.

D-3.4 Repeat the test with the remaining test specimens and calculate the mean percentage deficiency in length, if any.

ANNEX E
(*Table* 1)

METHOD FOR DETERMINATION OF WIDTH OF THE WEBBING

E-1 TEST SPECIMENS

E-1.1 For the purpose of this test, all the rolls in the test sample (*see* **9.4**) shall constitute the test specimens.

E-2 PROCEDURE

E-2.1 Unroll one test specimen and lay a portion of it on a horizontal surface and smoothen it out with no greater tension than is necessary to make it lie straight and flat.

E-2.2 Measure to an accuracy of 1 mm the width of the webbing by means of a graduated steel scale placed at right angles to the selvedges.

E-2.3 Determine similarly the width of the webbing at 5 different places uniformly distributed along the length of the roll. Calculate the mean of the 5 test values.

E-2.4 Repeat the test with the remaining test specimens.

E-3 REPORT

E-3.1 Report the lot to be in conformity with the relevant requirements of Table 1 if the number of rolls whose width varies by more than the tolerance prescribed in the Table 1 is not more than the corresponding number given in col 4 of Table 3.

ANNEX F
(*Table* 1)

METHOD FOR DETERMINATION OF MASS

F-1 TEST SPECIMENS

F-1.1 Cut a piece of webbing approximately 4 m in length from each of the rolls constituting sample under test (*see* **9.5**).

F-2 CONDITIONING OF TEST SPECIMENS

F-2.1 Prior to test, the test specimens shall be conditioned in a standard atmosphere at (65 ± 2) percent relative humidity and (27 ± 2) °C temperature (*see* IS 196) for 48 hours.

F-3 PROCEDURE

F-3.1 Take a test specimen and apply a tension equal to one percent of the minimum specified breaking load of the webbing (*see* Note). After (60 ± 5) s , place two marks on the webbing 3 m apart.

NOTE — The tension may be applied in a breaking load testing machine. It may also be applied by fixing one end of the webbing to a peg, passing the webbing around a pulley and hanging the desired load at the other end.

F-3.2 Release the load and cut the test specimen at the marks and then determine its mass to the nearest 0.1 g.

F-3.3 Calculate the mass of the webbing by the following formula:

$$W = \frac{W_1}{3}$$

where

W = mass, the webbing (g/m); and
W_1 = mass (g) of 3 m length of the webbing (*see* **F-3.2**).

F-3.4 Repeat the test with the remaining test specimens (*see* **F-1.1**).

F-4 REPORT

F-4.1 Report the lot to be in conformity with the relevant requirements of Table 1 if the condition prescribed in **9.6** (c) is satisfied.

ANNEX 5(b)

(*Item 7.1*)

Comments from M/s MLDC, Kanpur on Textiles —Rot-Proofed Cotton Tapes for Aerospace Purposes— Specification

BUREAU OF INDIAN STANDRADS

Draft for comments only Doc No.: TXD 13()
April 2023

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भारतीयमानक मसौदा

वस्त्रादि—वायु आकाशीय प्रयोजनों के लिए रोट-प्रूफकॉटनटेप—विशिष्टि

(IS 3846 का *दूसरा पुनरीक्षण*)

Draft *Indian Standard*

TEXTILES —ROT-PROOFED COTTON TAPES FOR AEROSPACE PURPOSES— SPECIFICATION

(*Second Revision* of IS 3846)

Textile Materials for Aeronautical Applications Sectional Committee, TXD 1323 June 2023	Last date for receipt of comments is

FOREWORD

(*Formal clauses will be added later*)

This standard was first published in 1966 and has now been revised in the light of experience gained during its use. The majority of widths of tape for which details of construction and properties have been specified are multiples of 5 mm and it is hoped that only those tapes, or others in the same category, will be used in new designs. Details of three widths which are not multiplies of 5 mm are also given, as an interim measure only; these are non-preferred widths and it is intended to omit these after the manufacturers and users have changed over.

In the preparation of this standard, considerable assistance has been derived from BS : 5F. 47-1972 'Specification for cotton tape', Aerospace series, issued by the British Standards Institution.

Tapes conforming to this standard are intended for use on metallic surfaces of the aircraft, such as ribs, leading edge, trailing edge and any other part to be subsequently covered with fabric.

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 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1 SCOPE

This Indian standard specifies the requirements for 10 varieties of cotton tapes, scoured, undyed or dyed and rot-proofed for aerospace purposes.

2 REFERENCES

The standards listed below 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 the standards listed below:

IS No.	*Title*
IS 196:1966	Atmospheric conditions for testing (revised)
IS 1383:1977	Methods for determination of scottring loss in grey and finished cotton textile materials (*first revision*)
IS 1963:1981	Methods for determination of threads per unit length i'n woven fabrics (*second revision*)
IS 1969 (Part 1) : 2018	Textiles – Tensile properties of fabrics – Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
IS 3456:2022	Method for Determination of Water-Soluble Matter of Textile Materials (First Revision)
IS 3522 (Part 1) : 1989	Methods for estimation of common preservatives on textiles - Part 1 (*first revision*)
IS 3522 (Part 2) : 1989	Textiles — Estimation of common preservatives – Part 2 (*first revision*)
IS 9755:2021	Textiles — High Density Polyethylene (HDPE) / Polypropylene (PP) Woven Sacks for Packaging Fertilizers — Specification (s*ixth revision*)
IS/ISO 105 B01 : 2014	Textiles — Tests for colour fastness B01 Colour fastness to light : Daylight
IS/ISO 105 B02 : 2014	Textiles — Tests for colour fastness B02 Colour fastness to artificial light: Xenon arc fading lamp test
IS/ISO 105-E01 : 2013	Textiles – Tests for colour fastness Part E01 Colour fastness to water (first revision)

3 GENERAL REQUIREMENTS

3.1Yarn

The tape shall be manufactured from un-sized cotton yarns of nominal counts as follows:

a) Warp — 2 ply yarn of 10tex counti.e.resultant count 20 tex; and
b) Weft — singles of 17 tex count. [two ply yarn is more suitable in place of single ply yarn in weft to avoid breakage]

2.2 Tapes

The tapes shall be of plain weave and uniformly woven on needle loomwith firm selvedges and shall be reasonably free from defects as given in Appendix A. [Shuttleless construction shall not be permitted--not required].

3 SPECIFIC REQUIREMENTS

3.1Construction and Physical Properties

The tapes shall comply with the requirements of Table 1.

3.2 Dyeing

If required, either the tapes or the yarns from which it is to be manufactured shall be dyed with suitable dyes to shades as agreed to between the buyer and the seller. Sulphur dyes shall not be used. The colour shall be as stated in the contract or the order.

3.2.1 If dyed, the tapes shall conform to the colour fastness requirements as laid down in Table 2.

3.3 Chemical Requirements

The tapes shall also conform to the chemical requirements as laid down in Table 2.

3.4 Rot-Proofing

3.4.1 The tapes shall be rot-proofed with pentachlorophenyl laurate (PCPL) from aqueous emulsions in accordance with IS 11662 Specification for preservative treatment of textiles. The PCPL content shall not be less than 3.5 percent on oven dry mass of the tape when tested by the method prescribed in Appendix E. However, if agreed to between the buyer and the seller any other rot-proofing agent may also be used.'

3.4.1.1 The free pentachlorophenol content of the treated textile shallnot exceed 10 percent of the LPCP or PCPL content (*see* Note under **E-3**).

Table 1 Constructional and Physical Properties

(*Clause* 3.1)

Variety No.	**Width**	**Length**	**Ends In Full Width +/_ or min.**	**Picks Per cm,** *Min*	**Mass,** *Max*	**Individual Breaking Load on (Full Width × 20 cm Strips),** *Min*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
i)	10 ± 1.0	65 or as agreed to between the buyer and the seller	36	17	1.2	80
ii)	13 ± 1.0		48		1.6	105
iii)	15 ± 1.0		57		1.9	125
iv)	20 ± 1.0		72		2.4	160
v)	25 ± 1.5		96		3.2	215
vi)	30 ± 1.5		116		3.9	260
Vii)	32 ± 1.5		120		4.0	265
viii)	38 ± 1.5		144		4.8	320
ix)	40 ± 2.0		150		5.1	330
x)	50 ± 2.0		192		6.3	430
Method of Test	Appendix B	Appendix D	IS 1963*	IS 1963*	Appendix C	IS 1969†

*Methods for determination of threads per unit length in woven fabrics (*first revision*).
†Methods for determination of breaking load and elongation at break of woven textile fabrics (*first revision*).

4 PACKING

4.1 The tapes shall be made into rolls of 65 m lengths or any other lengthas agreed to between the buyer and the seller.

4.2 The rolls shall be individually wrapped in kraft paper or in polyethylene film having thickness not less than 40 microns and a number of such rolls shall be packed in wooden packing cases previously lined with a layer of water-proof packing material such as polyethylene film or in high density polyethylene woven sacks (*see* IS 9755). The number of rolls to be packed in a case shall be as agreed to between the buyer and the seller.

5 MARKING

5.1 Each roll of tapes shall be legibly marked with the following information by stitching a cloth label to the inner end and attaching a tag to the outer end:

d) Name of the manufacturer, initials or trade-mark, if any; and
a) Name of the material;
b) Width of the tape (mm);
c) Length of the roll (m);
e) Month and year of manufacture.

Table 2 Chemical Requirements
(*Clauses* 3.2.1 and 3.3)

Sl No.	Characteristic	Requirement	Method of Test
(1)	(2)	(3)	(4)
i)	Scouring loss percent, *Max*	2	IS 1383* (Severe method)
ii)	Water soluble matter, percent *Max*	1	IS 3456†
iii)	‡Colour fastness to a) Light b) Water, change in colour	 5 or better 5[4 or better]	IS 686§ IS 2454‖ IS 767¶
*Methods for determination of scouring loss in grey and finished cotton textile materials (*firstrevision*). †Method for determination of water soluble matter of textile materials. ‡Applicable to dyed tapes only. §Method for determination of colour fastness of textile materials to daylight. ‖Method for determination of colour fastness of textile materials to artificial lights (xenon lamp). ¶Method for determination of colour fastness of textile materials to water.			

5.1.1 Each roll of tape may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions, under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

6 SAMPLING

6.1 Lot — The quantity of a definite variety and quality of tape delivered to one buyer against one despatch note shall constitute a lot.

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

6.3 Unless otherwise agreed to between the buyer and the seller, the number of rolls to be selected at random from a lot shall be in accordance with col 2 of Table 3.

6.4 For evaluating (a) ends in full width and picks per decimetre, (b) width, and (c) length, the rolls selected as in col 2 of Table 3 shall constitute the test sample.

6.5 For evaluating (a) mass, (b) breaking load, (c) water soluble matter, (d) scouring loss, and (e) colour fastness, the number of rolls specified in col 4 of Table 3 shall constitute the test sample. These rolls shall be selected at random from those selected in col 2 of Table 3. The required number of test specimens shall be drawn from each roll and subjected to corresponding tests.

NOTE — In the case of breaking load tests, at least 10 representative test specimens shall be drawn from each roll for the purpose of tests.

Table 3 Sample Size and Criteria for Conformity

[*Clauses* 6 3, 6.4, 6.5 and 6.6(a)]

Sl No.	Lot Size (Rolls)	Sample Size (Number of Rolls To Be Selected)	Permissible Number of Nonconforming Rolls	Sub-Sample Size (Number of Rolls To Be Selected)
(1)	(2)	(3)	(4)	(5)
i)	Upto 100	10	1	5
ii)	101 to 300	15	1	6
iii)	301 to 500	25	2	7
iv)	501 to 800	35	3	8
v)	801 to 1 300	50	4	9
vi)	1301 and above	75	6	10

6.6 Criteria for Conformity — The lot shall be considered to be in conformity with the requirements of this standard if the following conditions are satisfied:

a) The number of rolls found non-conforming with respect to (i) ends in full width and picks per decimetre, and (ii) width, does not exceed the corresponding number given in col 3 of Table 3.

b) In the case of length, the value obtained for each roll shall be compared with its declared or marked length. The mean percentage of deficiency in length, if any, shall be determined and made applicable to the lot.

c) From the observed values of mass, water soluble matter and scouring loss, the average and the range *R* shall calculated and the values of the expression + 0.6 *R* shall be less than or equal to the specified values.

d) The breaking load value of individual test specimen in a lot shall not be less than the value specified in this standard.

e) The colour fastness ratings obtained in tests satisfy the corresponding requirements.

NOTES

1 Average is the value obtained by dividing the sum of the observed values by the number of tests.
2 Range *R* is the difference between the maximum and the minimum in a set of observed values.

ANNEX A

(*Clause* 2.2)

CLASSIFICATION OF MAJOR DEFECTS

A-1Width Deviation — Any part outside the limits specified in this standard.

A-2 Warp Bow — Any part in which the warp bow when measured on a 1 m length exceeds 10 mm.

A-3Slack or Unevenly Woven Selvedges — Any part that does not lie flat and even or shows a distinct 'saw tooth' effect.

A-4Cut, Broken or Missing Threads — Two or more in warp or weft regardless of length.

A-5. Knots in Warp Ends or Weft Picks — One or more.

A-6 Floats — Any float affecting more than two ends and extending more than 6.5 mm.

A-7 Pick Variation — Variation outside the tolerances specified in this standard other than the slight local variation.

A-8 Mechanical Damage, Abrasion Marks — Any damage affecting the breaking load.

A-9 Inclusions — Any hard or soft foreign bodies which cause appreciable added thickness.

A-10 Cut, Hole or Tear — Three or more warp or weft threads ruptured at adjoining points.

A-11 Loops, Kinks, Snarls (Except Selvedge) — All over 3 mm in length.

A-12 Selvedge Cut, Broken, Torn, Scalloped— Any cut, broken, torn or scalloped selvedge.

A-13 Spot, Stain or Streaks — a) Single ends or picks 40 cm or more in length, and b) Double ends or picks 20 cm or more in length.

ANNEX B

(*Table* 1)

METHOD FOR DETERMINATION OF WIDTH OF THE TAPE

B-1 TEST SPECIMENS

B-1.1 For the purpose of this test, all the rolls in the test sample (*see***6.4**) shall constitute the test specimens.

B-2 PROCEDURE

B-2.1 Unroll one test specimen and lay a portion of it on a horizontal surface and smoothen it out with no greater tension than is necessary to make it lie straight and flat.

B-2.2 Measure to an accuracy of 1 mm the width of the tape by means of a graduated steel scale placed at right angles to the selvedges.

B-2.3 Determine similarly the width of the tape at 5 different places uniformity distributed along the length of the roll. Calculate the mean of the 5 test values.

B-2.4 Repeat the test with the remaining test specimens.

B-3 REPORT

B-3.1 Report the lot to be in conformity with the relevant requirements of Table 1 if the number of rolls whose width varies from the relevant value specified in Table 1 by more than the tolerance prescribed in the table is not more than the corresponding number given in col 3 of Table 3.

APPENDIX C
(*Table*1)

METHOD FOR DETERMINATION OF MASS

C-1 TEST SPECIMENS

C-1.1 Cut a piece of tape approximately 4 m in length from each of the rolls constituting the sample under test (*see* **6.5**).

C-2 CONDITIONING OF TEST SPECIMENS

C-2.1 Prior to test, the test specimens shall be conditioned in a standard atmosphere at (65 ± 2) percent relative humidity at (270 ± 2) °C temperature (*see* IS 196) for 48 h.

C-3 PROCEDURE

C-3.1 Take a test specimen and apply a tension equal to one percent of the minimum specified breaking load of the tape (*see*Note). After (60± 5) s, place two marks on the tape 3 m apart.

NOTE — The tension may be applied in a breaking load testing machine. It may also be applied by fixing one end of the tape to a peg, passing the tape around a pulley and hanging the desired load at the other end.

C-3.2 Release the load and cut the test specimen at the marks; then determine its mass to the nearest 0.1 g.

C-3.3 Calculate the mass of the tape per metre by the following formula:

$$W = \frac{W_1}{3}$$

where

W = mass of the tape (g/m); and
W_1 = mass of 3 m length of the tape (g) (*see* **C-3.2**).

C-3.4 Repeat the test with the remaining test specimens (*see***C-1.1**).

C-4 REPORT

C-4.1 Report the lot to be in conformity with the relevant requirements of Table 1 if the condition prescribed in **6.6** (c) is satisfied.

APPENDIX D

(*Table* 1)

METHOD FOR DETERMINATION OF LENGTH OF ROLL

D-1 TEST SPECIMENS

D-1.1 For the purpose of this test, all the rolls in the test sample (*see* **6.4**) shall constitute the test specimens.

D-2 EQUIPMENT

D-2.1 A flat table, little over 5 m long, having a smooth horizontal surface with markings in metres and centimetres on one side, shall be used.

D-3 PROCEDURE

D-3.1 Unroll one test specimen, draw one of its ends across the full length of the table and smoothen the portion of the tape on the table with no greater tension than is necessary to make it lie straight and flat.

D-3.2 Mark on the tape the first 5 m length as measured against the mark on the table. Measure the entire length, correct to a centimetre against the markings on the table.

D-3.3 Compare the value obtained in **D-3.2** with the declared or marked length of the roll and note the deficiency in length, if any.

D-3.4 Repeat the test with the remaining test specimens and calculate the mean percentage deficiency in length, if any.

APPENDIX E

(*Clause*3.4.1)

DETERMINATION OF PENTACHLOROPENYL LAURATE (PCPL) CONTENT

E-1 General — The method is applicable to the determination of PCPL inthe absence of added pentachlorophenol. The proofing is hydrolyzed,acidified and steam distilled and the pentachlorophenol in the distillateextracted with 1, 1, 1-trichloroethane and complexed with copper sulphatepyridinereagent. The optical density of the complex in 1, 1, 1-trichloroethaneis measured on a suitable spectrophotometer at 430 nm.

E-2 Reagents

E-2.1 Ehanediol(ethylene glycol).

E-2.2 1, 1, 1-trichloroethane.

E-2.3 Pyridine (AR, GPR grade).

E-2.4 Sodium hydroxide, pellet.

E-2.5 Copper sulphate solution 50 g/1.

E-2.6 Pentachlorophenol (standard reagent), melting point 188°C minimum.

E-2.7 Hydrochloric acid, concentrated, 36 percent (*m/v*) (11 M).

E-2.8 Copper Sulphate— Pyridine reagent prepared by mixing 4 ml pyridine with 6 ml copper sulphate solution immediately before use.

E-3 Procedure — Weigh 2.5 g± 0.05 g of the material, cut into small piecesof no more than 5 mm square and place in a dry 250 ml round flask(B24/29 socket). Add 30 ml of ethanediol, 4 g of sodium hydroxide(pelletform), 2ml to 4 ml of water, in that order and a few anti bumpinggranules. Connect the flask with a double surface condenser, bring thecontents to boiling point on a sand bath and boil them vigorously for30 minutes under reflux. After this allow the contents of the flask to cool,remove the reflux condenser and add through a funnel 60 ml waterfollowed by 20 ml hydrochloric acid. Steam distill the contents of theflask ensuring that a constant volume is maintained by applying gentle heatas necessary. Collect 300 ml of distillate in a suitable receiver,

applyingcare to prevent loss of pentachlorophenol in the distillate by adequatecooling. Discontinue the external heating of the flask a few minutes beforedisconnecting the steam supply. Disconnect the condenser and fit itvertically over the distillate receiver. Wash down the condenser with 25 to30 ml of trichloroethane and collect the washing in the distillate. Transfer the distillate and trichloroethane washings to a 500 ml separating funnel and shake thoroughly. Allow the layers of water and trichloroethane toseparate completely before running off the trichloroethane layer into a100 ml separating funnel. Wash the condenser and distillate receiver witha further 25 ml to 30 ml trichloroethane and add this to the aqueous solutioninto the 500 ml separating funnel. Repeat the extraction as given aboveand add the trichloroethane layer to the first trichloroethane extract in the100 ml separating funnel. Add to the bulked trichloroethane extract 10 mlof copper sulphate-pyridine reagent, and shake well. After completeseparation of the aqueous and trichloroethane layers, run the lowertrichloroethane layer into a 100 ml volumetric flask through a small funnelcontaining anhydrous sodium sulphate supported by means of a quartzwool plug. Add a small quantity of trichloroethane to the copper sulphatepyridinesolution remaining in the separating funnel, shake and allow thelayers to separate. Filter the trichloroethane layer through quartz woolplug and collect in the volumetric flask. Wash the filter with further smallquantities of trichloroethane and finally make up to 100 ml trichloroethane.

Determine the optical density of the solution using a suitable spectrophotometer at 450 nm using trichloroethane as a blank. Estimatethe PCPL content by reference to a calibration graph prepared fromknown standards of pentachlorophenol (1.0 percent pentachlorophenol= 1.71 percent PCPL).

NOTE — If the proofing is expected to contain both pentachlorophenol and PCPLthen the free pentachlorophenol content should be determined as given in IS3522(Part 1)*; and the amount found deducted from the apparent PCPL content.

E-4 CALIBRATION

E-4.1 Direct — Prepare a calibration graph using 5ml, 10ml, 15 ml aliquots of a standard solution of pentachlorophenol reagent (1 g/200 ml) intrichloroethane to cover a range of 1, 2 and 3 percent respectively. Diluteeach aliquot to 50ml to 60 ml with trichloroethane, add 10 ml of coppersulphate-pyridine reagent, shake well and then follow the described procedure. Plot optical density again concentration of PCPL.

E-4.2 Indirect — Prepare a calibration graph using 5, 10 and 15 mlaliquots of a standard solution of pentachlorophenol reagent (1 g/200 ml)in dilute sodium hydroxide solution (sufficient for complete solution ofpentachlorophenol). Place each aliquot in a round bottomed flask, add60 ml water and 20 ml hydrochloric acid. Fit the flask for a steamdistillation and then follow the described procedure.If the distillation technique is satisfactory then the graphs obtainedas in **E-4.1** and **E-4.2** should be the same.

ANNEX 5(c)
(*Item 7.1*)
Comments from IS 6349 Tape Nylon Tubular for Aerospace Applications

ADRDE's observation of IS:6349, Tape Nylon Tubular for Aerospace Applications

1. Clause no. 2 (Materials), yarn denier and ply combination is not clear for both the variety. Denier and ply shall be clear to manufacturer.
2. Tolerance shall be provided in yarn linear density of yarn.
3. Tolerance in width of the tapes shall be provided
4. Thickness measurement is specified under pressure of 2N, it shall be 200 g/cm² as per other similar specifications.
5. Picks per dm shall be minimum as per other similar specifications.
6. Elongation shall be 18% minimum as per other similar specifications.
7. Colour fastness for dyed tapes shall be specified
8. pH shall be shall specified.

ANNEX 5 (d)

(*Item 7.1*)

Comments from M/s ADRDE, Agra on IS 4726 Specification of Light Weight Nylon Fabric for Parachutes

SPECIFICATION FOR LIGHT WEIGHT NYLON FABRICS
FOR PARACHUTES

0. FOREWORD

1. SCOPE

1.1 This standard covers the requirements of light weight nylon fabrics for parachutes. These fabrics are used in the fabrication of parachutes intended for personnel, brake parachute and other aerial delivery purposes. The nylon cloths shall be of the following type as specified (see TABLE for characteristics).

Variety 1	–	32 gsm, Rip Stop Plain Weave
Variety 2	–	32 gsm, Plain Weave
Variety 3	–	35 gsm, Rip Stop Plain Weave
Variety 4	–	37 gsm, Rip Stop Plain Weave
Variety 5	–	48 gsm, 2/1 Twill Weave
Variety 6	–	52 gsm, Rip Stop Plain Weave, Low Porosity
Variety 7	–	52 gsm, Rip Stop Plain Weave
Variety 8	–	54 gsm, Rip Stop PlainWeave
Variety 9	–	75 gsm, 6×6 Huckaback Weave
Variety 10	–	82 gsm, 6×6 Huckaback Weave
Variety 11	–	93 gsm, Plain Weave
Variety 12	–	105 gsm, 6×6 Mock leno Weave
Variety 13	–	109 gsm, 2/1 Twill Weave
Variety 14	–	110 gsm, 8×8 Mock leno Weave
Variety 15	–	120 gsm, 6×6 Huckaback Weave

2. MANUFACTURE

2.1 Yarn — The yarn used in the manufacture of the fabric shall be of high tenacity, multi-filament, bright, nylon type 66 for all varieties. The melting point of yarn used in the manufacture of the fabric shall not be less than 244°C

NOTE – The tenacity of yarn may be as stated in the contract or the order if so as desired by the purchaser.

2.1.1 Twist – Any yarn twist (warp and weft) is acceptable, provided all requirements for this specification are met

2.2 Weave –

2.2.1 Variety 1 weave. The weave pattern for variety 1 fabric shall be Rip Stop Plain weave as specified in figure 1

2.2.2 Variety 2 weave. The weave pattern for variety 2 fabric shall be Plain weave as specified infigure 2

2.2.3 Variety 3 weave. The weave pattern for variety 3 fabric shall be Rip Stop Plain weave as specified in figure 3

2.2.4 Variety 4 weave. The weave pattern for variety 4 fabric shall be Rip Stop Plain weave as specified in figure 4(a) or figure 4(b).

2.2.5Variety 5 weave. The weave pattern for variety 5 fabric shall be 2/1 twill weave as specified in figure 5.
2.2.6Variety 6 weave.The weave pattern for variety 6 fabric shall be Rip Stop Plain weave as specified in figure 6(a) or figure 6(b).
2.2.7Variety 7 weave.The weave pattern for variety 7 fabric shall be Rip Stop Plain weave as specified in figure 7.
2.2.8Variety 8 weave.The weave pattern for variety 8 fabric shall be Rip Stop Plain weave as specified in figure4(a) or figure 4(b).
2.2.9Variety 9 weave.The weave pattern for variety 9 fabric shall be 6×6 Huckaback weave as specified in figure 8.
2.2.10Variety 10 weave.The weave pattern for variety 10 fabric shall be 6×6 Huckaback weave as specified in figure 9.
2.2.11Variety 11 weave.The weave pattern for variety 11 fabric shall be Plain weave as specified in figure 2.
2.2.12Variety 12 weave.The weave pattern for variety 12 fabric shall be 6×6 Mock leno weave as specified in figure 10
2.2.13Variety 13 weave.The weave pattern for variety 13 fabric shall be 2/1 twill weave as specified in figure 5.
2.2.14Variety 14 weave.The weave pattern for variety 14 fabric shall be 8×8 Mock leno weave as specified in figure 11
2.2.15Variety 115 weave.The weave pattern for variety 1 fabric shall be 6×6 Huckaback weave as specified in figure 9

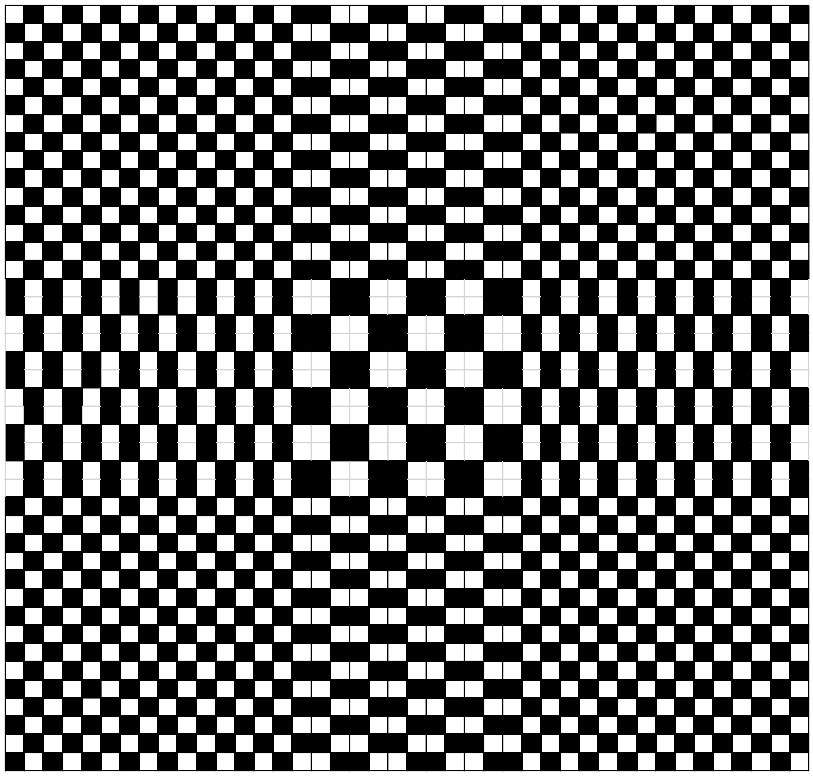


FIGURE 1

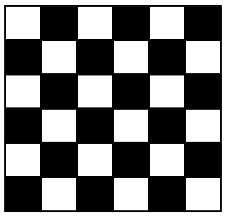


FIGURE 2

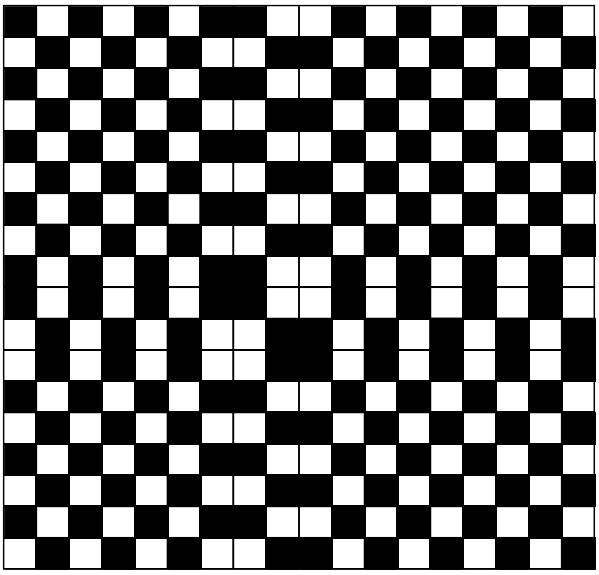


FIGURE 4(a)

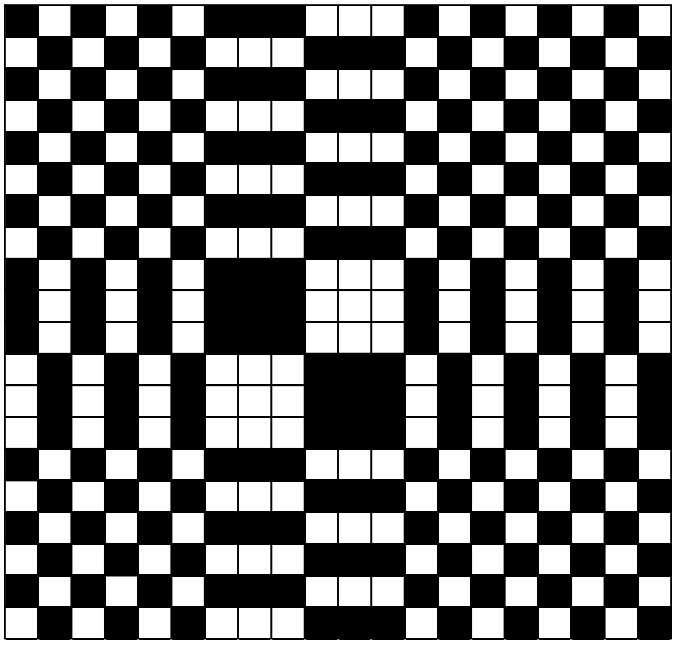


FIGURE 4(b)

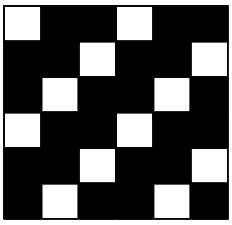


FIGURE 5

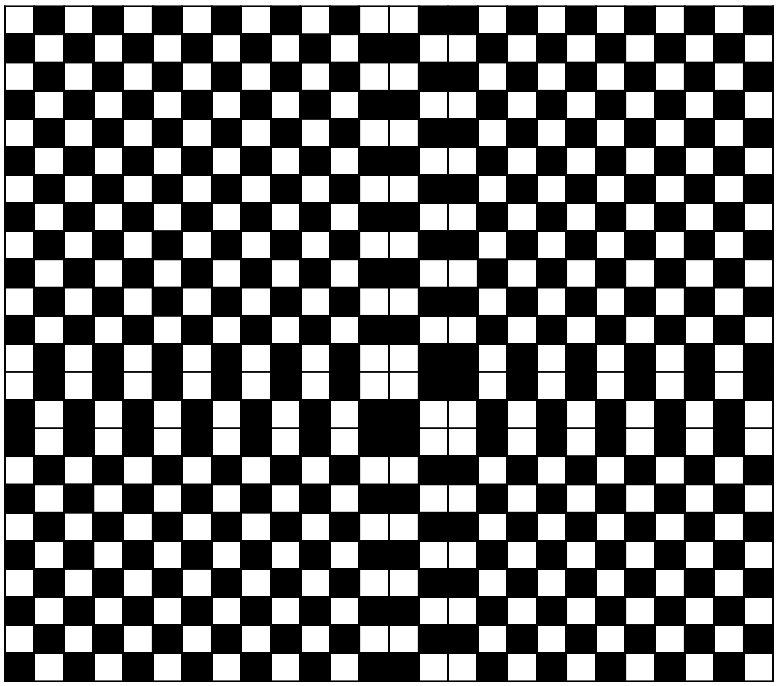


FIGURE 6(a)

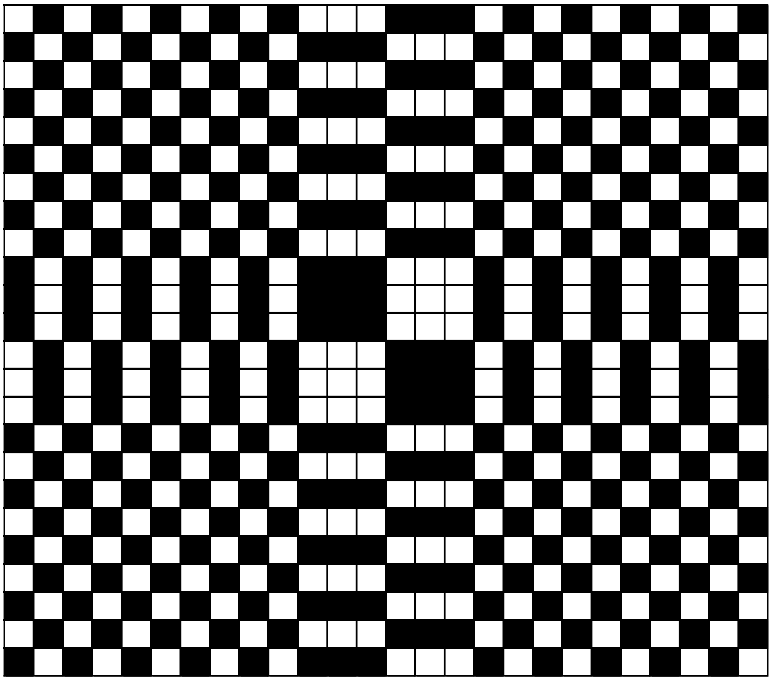
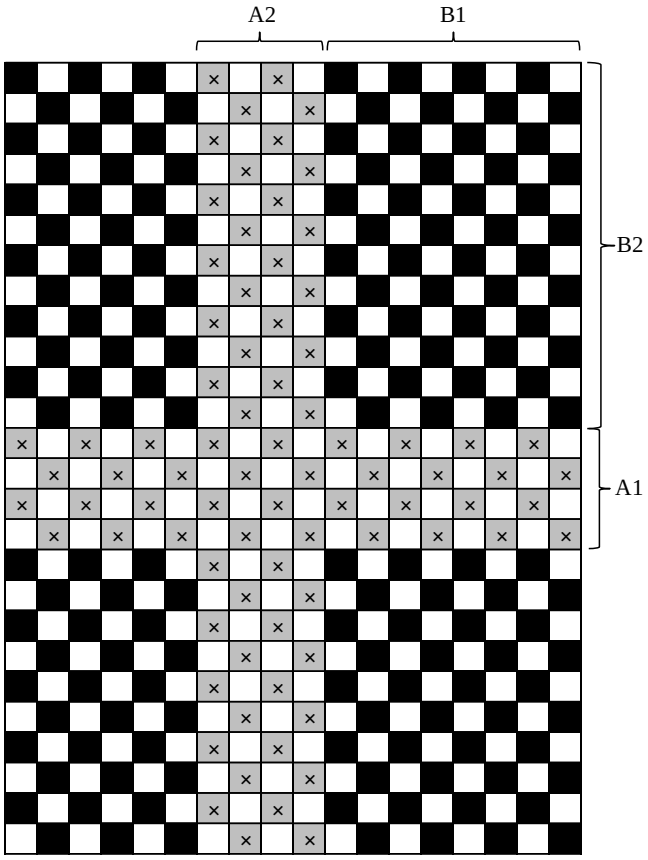


FIGURE 6(b)



A_1, A_2 – Ends and picks of course yarn of 17 Tex

B_1, B_2 – Ends and picks of fine yarn of 5 Tex

FIGURE 7

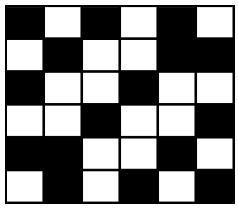


FIGURE 8

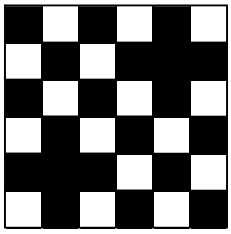


FIGURE 9

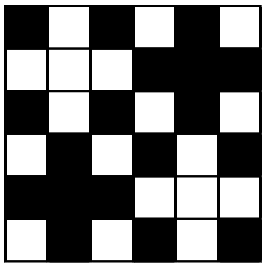


FIGURE 10

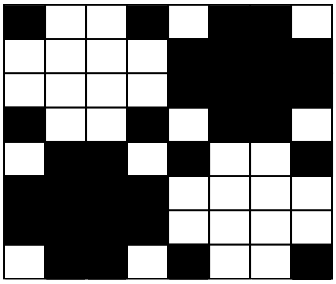


FIGURE 11

2.3*Finish* — The fabric shall be given a preliminary scour, sufficient to remove sizing and other adhering material at a temperature which will not result in permanent setting of the fabric. The fabric shall then be heat-set under appropriate conditions of temperature and time followed by dyeing, as and when required, to the agreed shade with acid or disperse or pre-metalised dyes. The sequence of processes is at the manufacturers' discretion and shall be so accomplished as to achieve the specified properties. The fabric shall not be bleached.

2.4 The selvedges should be straight, even and well-made and should have the same tension as the remainder of the fabric. The use of shuttle or shuttleless loom is acceptable. The acceptable fabric width shall be inclusive of the selvedges produced on shuttle loom but exclusive of fringed ends produced on shuttleless looms. The fabric should be free from manufacturing and finishing defects. The finished fabric shall be thoroughly clean and shall not have any objectionable odour.

2.5 The fabric may be calendared at the discretion of the manufacturer provided the finished fabric complies with the requirements laid down in **3.1** to **3.7**.

2.6 The finished fabric should contain silicone polymer finish so applied that it is evenly and uniformly distributed throughout the fabric. The amount of silicone polymer applied shall be from 0.3 to 0.5 percent based on the dry mass of the fabric. The fabric after padding with silicone emulsion shall be dried and cured to obtain proper silicone polymer finish. The manufacturer shall submit a certificate for each roll indicating that the required quantity of silicone polymer finish has been applied.

2.7 The residual size, finishing, or other non-fibrous material shall not exceed 2 percent of the dry mass of the fabric when evaluated by a method as agreed to between the buyer and the seller.

2.8 The fabric shall be delivered within one year of its date of manufacture.

3. REQUIREMENTS

3.1 Construction and Physical Properties — The fabric shall comply with the requirements of Table 1.

3.2 Air Porosity -The air porosity of the fabric shall comply as specified in Table 1.

3.2.1 The air porosity of the fabric shall be determined by the method prescribed in Appendix A.

3.3 Permanence of Finish — The permanence of finish of the fabric shall be such that when the fabric is subjected to the test specified in Appendix B, the conditions stipulated in **3.3.1** to **3.3.3** are fulfilled.
3.3.1 The mean of the air porosity values determined after testing shall be within 15% of the mean of the readings determined before testing.
3.3.2 The fabric thickness after testing shall not exceed the specified thickness as per Table 1 for all fabrics.
3.3.3 The fabric shrinkage measured after testing shall not be more than 3% for all fabrics, either in the warp or in the weft direction.
3.4 Melting Point — The melting point of nylon yarn used in the manufacture of the fabric shall not be less than 244°C.

3.4.1 The melting point of the nylon yarn shall be determined according to Appendix B of IS: 1843-1963*.

3.5 *p*H Value — The *p*H value of the finished fabric shall not be less than 5.5 nor more than 8.5.

3.5.1 The *p*H value of the finished fabric shall be determined by the cold method prescribed in IS: 1390-1984†.

3.6 Colour Fastness — The dyed fabric shall be fast to light and water. The minimum colour fastness rating of change in colour of the fabric to artificial light and to washing Test 1 shall be: 5 or better when tested by the method given in IS/ISO 105-B01 or IS/ISO 105-B02‡; and 4 or better when tested by the method given in IS/ISO 105-C10 [Test Number A(1)]§.

3.7 Sealed Sample — If, in order to illustrate or specify the unmeasurable characteristics like general appearance, feel, etc, of the fabric, sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects.

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

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*Specification for nylon-monofilaments.
†Methods for determination of *p*H value of aqueous extracts of textiles (*first revision*).
‡Method for determination of colour fastness of textile materials to artificial light (xenon lamp).
§Method for determination of colour fastness of textile materials to washing:

Variety No.	TABLE 1 PARTICULARS OF NYLON FABRICS FOR PARACHUTES CANOPY									
	Nominal Linear Density of yarn, Tex×Ply (Tolerance -5% to +10%)		Ends/ dm, min	Picks/ dm, min	Mass	Thickness, Max (see NOTE 1)	Breaking Load per 5 cm, both ways, *Min*	Elongation at break, both ways, %, *Min*	Tearing Strength, both ways, *Min*	Air Permeability at 10" Water Head Pressure
	Warp	Weft								
	(1)	(2)	(3)	(4)	(7)	(8)	(9)	(11)	(12)	(13)
					g/m^2	mm	kgf		kgf	$cm^3/cm^2/s$
1	3.3×1	3.3×1	430	430	32±10%	0.07	38	20	3.00	430-510
2	3.3×1	3.3×1	430	430	32±10%	0.07	38	20	1.70	488-671
3	3.3×1	3.3×1	480	480	35±10%	0.07	38	20	2.30	60-183
4	3.3×1	3.3×1	490	490	37±10%	0.08	38	20	2.30	320-450
5	5.0×1	5.0×1	440	440	48±5%	0.10	60	20	2.30	397-579
6	3.3×1	3.3×1	640	640	52±5%	0.10	45	20	2.24	0-122
7	17×1 & 5.0×1	17×1 & 5.0×1	228 of 5.0×1 & 76 of 17×1	228 of 5.0×1 & 76 of 17×1	52±5%	0.16	50	20		600-780
8	5.0×1	5.0×1	480	480	54±5%	0.25	71	20	2.3	397-579
9	11.1×1	11.1×1	270	270	75±5%	0.16	82	20		360-480
10	11.1×1	11.1×1	300	300	82±5%	0.30	92	20	2.3	360-480
11	16.7×1	16.7×1	260	260	90±5%	0.17	130	20		152-274
12	16.7×1	16.7×1	280	280	105±5%	0.27	125	20		367-487
13	16.7×1	16.7×1	290	290	109±5%	0.20	120	20		153-213
14	15.6×1	15.6×1	300	300	110±5%		109	20		472-595
15	23.3×1	23.3×1	230	230	120±5%	0.50	163	20	10	480-630
Test Method						IS:7702	IS: 6919		Appendix D	Appendix A
NOTE 1 -										

4. PACKAGING

4.1 The nylon fabric shall be packed in continuous length on cardboard rolls which have been previously covered by a layer of kraft paper (*see* IS: 1397-1967*).

5. MARKING

5.1 Each roll of nylon fabric shall be marked on both ends with the following information:

a) Name of the material;
b) Manufacturers' name, initials or trade-mark;
c) Identification No. of the fabric;
d) Width and length of the fabric;
e) Date, month and year of manufacture;
f) Mean air porosity; and
g) Colour fastness ratings in the case of dyed fabric.

5.1.1 The fabric may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of theIndian Standards Institution (Certification Marks) Act, and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer.ISI marked products are also continuously checked by ISI for conformity to thatstandard as a further safeguard. Details of conditions under which a licence for theuse of the ISI Certification Mark may be granted to manufacturers or processors,may be obtained from the Indian Standards Institution.

6. PACKING

6.1 The rolls shall be wrapped with polyethylene film (*see* IS: 2508 - 1977†). A suitable number of such rolls shall be arranged in bundles and secured by 3-ply jute twine or cotton twine to form a pack. A suitable number of such packs shall then be wrapped with kraft paper and placed in wooden packing case, which is previously lined with one layer of waterproof packing paper. The gross mass of the case shall not exceed 40 kg. The empty spaces, if any, in the case shall be stuffed with cushioning material to avoid damage to the contents in transit. The case shall be nailed taking care to see that the rolls do not pierce the fabric inside the case.

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*Specification for kraft paper (*first revision*).

†Specification for low density polyethylene film (*first revision*).

7. SAMPLING

7.0 The samples shall be drawn lot-wise for carrying out tests specified in this standard. Unless otherwise specified, the lot shall be as defined under respective sampling plans as detailed in **7.1** to **7.3**.

7.1 Sampling Plan 'A' for Air Porosity

7.1.1 *Lot* — The total length of the nylon fabric manufactured from the same type of yarn and of same weave and finish delivered to a buyer against one despatch note shall constitute a lot.

7.1.2 Each roll of the lot shall be tested for air porosity (non-destructive) at intervals of 5 m.

7.2 Sampling Plan 'B'

7.2.1 *Lot* — All the rolls of nylon fabric manufactured from same type of yarn and of same weave and finish delivered to a buyer against one despatch note shall constitute a lot.

7.2.2 One sample of one metre in length and of full width shall be drawn from each roll for carrying out the following tests:

a) Mass,
b) Thickness,
c) Breaking load,
d) Elongation at break,
e) Tearing strength, and
f) Yarns per decimetre.

7.3 Sampling Plan 'C'

7.3.1 *Lot* — The quantity of nylon fabric manufactured from the same type of yarn and of same weave and finish delivered to a buyer against one despatch note shall constitute a lot.

7.3.2 One sample of two metres in length and of full width shall be selected from each lot for carrying out the following tests:

a) Permanence of finish,
b) *p*H value of aqueous extract,
c) Colour fastness to light and washing,
e) Weave,
f) Melting point of yarn,
g) Tenacity of yarn and
h) Turns per metre.

8. VISUAL INSPECTION AND CRITERIA FOR CONFORMITY

8.1 Each lot as defined in **7.3.1** shall be visually examined for the following:

a) Width — The width of the roll of fabric shall not be less than the value as given in Table 1. The rolls having less width shall be segregated and rejected.

b) Total Length of Each Roll — The lot shall be unacceptable if thetotal of the actual length of the rolls examined is less than thetotal of the length marked on the rolls.

c) Each roll shall be examined for the markings as detailed in **5.1**,on both ends.

d) Freedom from Defects — Each roll shall be visually examined forthe defects as specified in Appendix E. No roll shall contain morethan 7 major defects/100 m. For this purpose, all the rolls shall bevisually examined metre by metre and the defects classified in accordance with Appendix E. The unit of the product forexamination shall be one linear metre. For each unit of product,the defects shall be counted as follows:

e) Each major defect shall be flagged by a red string sewn in theselvedge. Three minor defects occurring per linear metre shall beflagged by a red string sewn in the selvedge. 50 cm allowance shall be made for each major defect flagged except for continuousdefect which shall be given a one metre allowance for each metrein which defect occurs.

f) Unless otherwise specified the fabric shall be in continuouslengths of not less than 80 m without joints. Shorter cuts are

(i) One major defect and one minor defect shall be counted as onemajor defect.
(ii) Three or more minor defects shall be counted as one majordefect.
(iii) One or more major defects shall be counted as one majordefect.
(iv) A continuous major defect shall be counted as one majordefect for each unit of product or fraction thereof in which itoccurs.

e) Each major defect shall be flagged by a red string sewn in theselvedge. Three minor defects occurring per linear metre shall beflagged by a red string sewn in the selvedge. 50 cm allowance shall be made for each major defect flagged except for continuousdefect which shall be given a one metre allowance for each metrein which defect occurs.

f) Unless otherwise specified the fabric shall be in continuouslengths of not less than 80 m without joints. Shorter cuts are allowed in accordance with the following:

Minimum Length of Cuts	Permissible Short Cuts in Total Supply
m	percent
80	75
40	15
10	10

g) Overall Examination — Each roll shall be visually examined foroverall defects as follows:
(i) Spottiness, poor penetration of dye or off shade;
(ii)Uneven weaving throughout; and
(iii)Unevenness and streakiness of dyeing in excess of that shown by sealed sample (see **3.8**) for appearance.

h) From the observed values for breaking load and tearing strength,the average X shall be within the limit specified. No individualreading shall be less than 95 percent of the minimum valuespecified.

j) All the test specimens tested for the remaining characteristicsshall also satisfy the relevant requirements.

APPENDIX A
(*Clause* 3.2.1)

METHOD FOR DETERMINATION OF AIR POROSITY

A-1. TEST SPECIMENS

A-1.1 For the purpose of this test, all the pieces of nylon fabric selected as in **7.1.2** constitute the **test specimens**.

A-2. CONDITIONING OF TEST SPECIMENS

A-2.1 Prior to test, the test specimens shall be conditioned in a standard atmosphere at 65 ± 2 percent relative humidity and 27 ± 2°C temperature for 24 hours (*see also* IS: 6359-1971*).

A-3. PRINCIPLE

A-3.1 The method is based on the measurement of the rate of flow of air through a given area of the fabric by a given pressure drop across the fabric.

A-4. APPARATUS

A-4.1 The apparatus shall consist of:

a) a suction or a blower fan for drawing air through a known area of fabric;
b) circular orifice;
c) clamp to hold the test specimen (*see* Note);
d) means for adjusting the pressure drop across the fabric to a known amount, and
e) means for measuring the velocity of air flowing through the fabric.

NOTE — The clamp should be such as to effectively eliminate peripheral leakage of air.

A-4.2 The apparatus shall be capable of testing large pieces without cutting.

A-5. PROCEDURE

A-5.1 Take one of the test specimens conditioned as in **A-2** above.Mount a portion of the test specimen between the clamp and thecircular orifice with sufficient tension to eliminate wrinkles, if any,taking care to see that the fabric is not distorted in its own plane.

A-5.2 Start the suction or the blower fan and adjust the rate of flow of air till a pressure drop of 25 cm water head across the fabric is indicated.

A-5.3 Note the rate of flow of air in cubic centimeter per second.

A-5.4 Repeat the test at intervals of 5 meters over the entire length of the piece.

A-5.5 Calculate the mean of all the test values.

*Methods for conditioning of textiles.

A-5.6 Calculate the rate of flow of air per square centimeter of fabric per second by the following formula:

$$F = \frac{f}{A}$$

where

F = rate of flow of air per square centimeter of fabric in cubic centimeter per second,

f = mean rate of flow of air in cubic centimeter per second through the fabric as obtained in **A-5.5**, and

A = area of the fabric under test in square centimeters.

A-5.7 Repeat the test with the remaining test specimens.

APPENDIX B
(*Clause* 3.3)

METHOD FOR DETERMINATION OF PERMANANCE OF FINISH

B-1. TEST SPECIMENS

B-1.1 Cut out two test specimens measuring approximately 50 × 50 cm from each piece of nylon fabric.

B-2. PROCEDURE

B-2.1 Determine the air porosity and thickness of the two test specimens taken from the same piece in accordance with the method prescribed in Appendix A and Table 1.

B-2.2 Using a template and indelible ink, mark out a square measuring 45 × 45 cm on each test specimen. Make the test specimen in the form of loops by stapling the two opposite sides in such a way that one of the test specimens has the warp yarns and the other has the weft yarn in the vertical direction in the loop. Place both the test specimens in the loop form in a container of adequate capacity filled with boiling water to within 7.5 cm of the top. Insert a glass rod of 6.5 mm diameter and 55 cm long on the top of the loop of each test specimen. Place a glass tube or rod of similar dimensions as the glass rod and weighing approximately 45 g at the bottom of the loop of each test specimen. Suspend both the loops in such a way (by binding each glass rod with twine or wire to another glass rod of similar dimensions to rest on the top of the container) that they are completely immersed in the boiling water.

B-2.3 Subject the specimens to the action of boiling water for a period of 15 minutes. Remove the test specimens from the bath and allow the water to drain off for a few minutes. Remove the staples from the test specimens and place them flat on a horizontal screen and dry them in air.

B-2.4 When the test specimens are thoroughly dried, condition the test specimens in a standard atmosphere of 65 ± 2 percent RH and 27° ± 2°C for at least 4 hours.

B-2.5 Measure the 45 cm square marked on the specimens to the nearest millimetre at 6 different places, 3 in the warp direction and 3 in the weft direction and compute the mean of each.

B-2.6 Measure the air porosity of the test specimens by the method given in Appendix A and compute the mean air porosity.

B-2.7 Measure the thickness of the specimens in accordance with the method prescribed in Table 1 and compute the mean thickness.

B-2.8 Calculate the percentage shrinkage in the warp and the weft direction of the test specimens by the following formula:

$$S = \frac{45 - d}{45} \times 100$$

where

S = percentage shrinkage in the warp or the weft direction, and

d = mean distance between the marks in cm after boiling (*see* **B-2.5**).

B-2.9 Repeat the test with the remaining test specimens.

APPENDIX C

(*Clause* 3.1 and *Table* 1)

METHOD FOR DETERMINATION OF TEARING STRENGTH OF WOVEN FABRICS

D-1. TEST SPECIMEN

D-1.1 Prepare ten rectangular test specimens of size 75 × 200 mm, five from each warp and weft direction. Cut the specimens to be used for the measurement of the tearing strength of warp yarns with the longer dimensions parallel to the weft yarns and the specimens to be used to measure the tearing strength of weft yarns with the longer dimensions parallel to the warp yarns. Cut a 75 mm slit lengthwise in each specimen starting in the centre of one of the short edges. Test the specimens in each warp and weft direction.

D-2. CONDITIONING OF THE TEST SPECIMENS

D-2.1 Prior to test, the test specimen shall be conditioned in a standard atmosphere at 65 ± 2 percent RH and 27 ± 2°C temperature (*see* IS: 6359-1971*) for at least 24 hours.

D-3. APPARATUS

D-3.1 Tensile Testing Machine of Constant Rate of Traverse
Type — The maximum load required to tear the specimens shall be within the rated operating capacity of the tester which may be considered as the range of 15 to 85 percent of the rated capacity.

D-3.2 Clamps, having gripping surfaces parallel, flat and capable of preventing slipping of the specimen during a test, and measuring at least 25×75 mm, with the longer dimensions perpendicular to the direction of application of the load.

D-4. PROCEDURE

D-4.1 Test the conditioned specimens in the standard atmosphere of 65 ± 2 percent relative humidity and 27 ± 2°C temperature.

*Method for conditioning of textiles.

D-4.2 Set the nominal gauge length at 75 mm and select the capacity of the tester suitable for the specimen to be tested. Operate the pulling jaw at 300 ± 10 mm/min.

D-4.3 Disengage the pawls on the pendulum from the ratchet so that they become inoperative.

D-4.4 Place the specimen in the clamps so that the slit is centered in the jaws and one of the tongues is held in each clamp in such a manner that originally adjacent cut edges of the tongues form a straight line joining the centres of the clamps and the two tongues present opposite
faces of the fabric to the operator.

D-4.5 If the force to tear a single specimen is less than the minimum working range of the tester at the time of use, superimpose the minimum number of specimens required to bring the tearing force within working range of the tester to form a multiply specimen and in that case appropriate number of test specimens are to be prepared according to **D-1.1**. If a multiply specimen is required, grip the plies together in the machine and tear them simultaneously.

D-4.6 Start the testing machine and the autographic recorder. Continue the tear until the moving jaw has travelled for a minimum of 75 mm after the tear was initiated as registered on the chart (approximately 38 mm length of tear).

D-5. CALCULATION

D-5.1 Calculate the tearing strength of each specimen by averaging the five highest peak load registered during 75 mm of travel of the moving clamp ignoring the initial peak load (*see* Note) and dividing by the number of plies if more than single (*see* **D-4.5**).
NOTE — Frequently the initial peak force required to continue the tear is substantially greater than subsequent peak and should be ignored in the calculation.

D-5.2 Calculate the tearing strength of the sample as the average of the tearing strength obtained for the tested specimens (*see* **D-5.1**) to the nearest 50 g in both warp and weft direction. Divide the average obtained by the number of plies in the specimen.

D-6. REPORT

D-6.1 Report the lot to be in conformity with the requirements of **3.3**, if the average tearing strength of the test specimens in both warp and weft directions as calculated above are not less than the minimum specified in Table 1, col 2.

APPENDIX D
[*Clauses* 2.2.3 *and* 8.1(e)]

CLASSIFICATION OF DEFECTS

Defect	*Description*	*Major*	*Minor*
Abrasion	Any abrasion mark showing fuzziness	×	
Biased filling	Biased filling more than 5 cm from horizontal at greatest point of bias	×	
Bowed filling	Filling bow more than 5 cm in height (as measured from a straight line cord to the highest point of arc)	×	
Broken or missing end	Two or more contiguous, regardless of length	×	
	Single, more than 90 cm long	×	
	Single 90 cm long or less.		×
Broken or missing pick	Two or more contiguous, regardless of length	×	
	One pick, full width		×
Cut, hole, or tear (other than pin holes, etc)	Three or more warp or filling threads ruptured at adjoining points	×	
Floats or skips	Any multiple float 5 mm or more	×	
	Single floats of 1 cm or more in length	×	
	Contiguous float or pin floats*, the sequence of which measures 2 cm or more in length	×	
	Any multiple float up to 5 mm square	—	×
	Single float up to 1 cm in length	—	×
	Contiguous float or pin floats*, the sequence of which measures less than 2 cm in length	×	—

*A pin float is defined as a float measuring 3 mm or less. Single pin float shall not be considered as defect.

Defect	*Description*	*Major*	*Minor*
Heavy filling bar or heavy place	Over 0.5 cm in width and varying 10 percent or more from normal pick count	×	
	Over 1 cm in width and varying less than 10 percent from normal pick count	×	
	0.5 cm or less in width and varying 10 percent or more from normal pick count	—	×
	1 cm or less in width and varying less than 10 percent from normal pick count	×	
Jerked-in filling	Any jerked-in filling occurring more than 4 times within 25 cm	×	
	Any jerked-in filling occurring 4 times or less within 25 cm	— ×	
Loops, kinks or snarls (except selvedge)	All over 3 mm in length	×	
	Three or more (in any linear metre) up to 3 mm in length	×	
	Up to two (in any linear metre) up to 3 mm in length		×
Mispick or double pick	Three or more additional picks in the shed	×	
	Two picks		×
Pin holes or yarn deformations	Over 6 pinholes or yarn deformations occurring within an area equal to a 15 cm diameter circle	×	
	Three to six pin holes or yarn deformations occurring within an area equal to a 15 cm diameter circle		×
Selvedge cut, broken, torn scalloped	Any cut, broken, torn, or scalloped selvedge	×	
Selvedge slack or wavy	Clearly noticeable waviness along selvedge edge when no tension is on selvedge	×	

Defect	*Description*	*Major*	*Minor*
Selvedge stringy or loopy 1.5 mm (1/16 in) loops shall be acceptable	More than 8 cm of continuous stringyor loopy selvedge projecting 3 mm ormore	×	
	Continuous stringy or loopy selvedgeprojecting up to 3 mm	—	×
Selvedge tight	Any clearly noticeable roll of edge oredges when tension is released	×	
Reinforced selvedge fraying	Design proper weave eliminate warpfraying	—	×
Smash	Any smash	×	
Spot, stain or streak (not applicable to dye streaks)	Single ends or picks 40 cm or more inlength	×	
	Double ends or picks 20 cm or more in length	×	
	Over 2 ends or picks 12 cm or more in length or a clearly noticeable area more than 6 mm2 in area whichever is greater	×	
	Single ends or picks 6 cm up to 40 cm in length	—	×
	Over two ends or picks less than 12 cm in length or a clearly noticeable area 6 mm2 or less in area, whichever is greater.		×
Slubs or stripback*	More than 5 over 1 cm in length	×	
	Two up to and including 5 over 2 cm in length	×	
	One over 2 cm in length	×	
	Five or less over 1 cm but not exceeding 1 cm in length	—	×
	One over 1 cm but not exceeding 2 cm in length	—	×
Weak place	Any weak place	×	
Weave	Pattern not conforming to weave diagram specified	×	
Width	Less than specified	×	
Wrong draw	Resulting in clearly noticeable warpwise streak more than 45 cm in length	×	
Manufacturer's Missing (weavers) Identification yarn		×	

*A strip back is defined as a broken filament(s) wrapped around the remaining yarn forming an enlarged area resembling a slub.