भारतीय मानक
Indian Standard

IS 4228 : 2023

वस्त्रादि — वायु आकाशीय प्रयोजनों के लिए नॉइलान टेप — विशिष्टि

(दूसरा पनरीक्षण)

Textiles — Nylon Tapes for Aerospace Purposes — Specification

(Second Revision)

ICS 49.025.60

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July 2023 **Price Group 6**

Textile Materials for Aeronautical and Related Products Sectional Committee, TXD 13

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Textiles Materials for Aeronautical and Related Products Sectional Committee had been approved by the Textiles Division Council.

Nylon has special properties like low density and high strength, so it is mostly used textile fibre in aerospace applications. Nylon tapes woven on either shuttle loom or needle loom is used in reinforcement/fabrication of parachutes and other aerial delivery equipment. Needle looms are capable of inserting the double number of wefts compared with the shuttle looms, hence the tapes woven on needle loom has higher cover factor.

This standard was first published in 1967 and subsequently revised in 1979. This 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 nylon tapes woven on needle loom has been incorporated;
b) Packing and sampling clauses have been modified; and
c) The references to Indian Standards have been updated.

The composition of the committee responsible for the formulation of this standard is listed in Annex B.

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.

Indian Standard

TEXTILES — NYLON TAPES FOR AEROSPACE PURPOSES — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard covers nylon tapes of 14 mm, 19 mm, 25 mm, 25.4 mm, 32 mm, 38 mm, and 44 mm widths, generally used in the fabrication of parachutes and other aerial delivery equipment.

1.2 This standard specifies the requirements for nylon tapes woven on 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 listed in Annex A.

3 MATERIAL

3.1 The material of the yarn, that is Nylon 6/ Nylon 6 6, shall be identified by microscopic and dissolution test as given IS 667.

3.2 Multifilament, bright and high tenacity nylon yarn as specified in Table 1 and Table 2 shall be used in manufacture of nylon tapes. The twist in the resultant yarn shall not be less than 100 per metre both for warp and weft.

4 TYPES

4.1 Based on the type of loom, on which the nylon tapes are woven shall be classified as under:

a) *Type* I — Nylon tapes woven on shuttle loom; and

b) *Type* II — Nylon tapes woven on needle loom.

5 REQUIREMENTS

5.1 The nylon tapes woven on shuttle loom shall meet the physical requirements as given in Table 1 and the nylon tapes woven on needle loom shall meet the physical requirements as given in Table 2.

5.1.1 In case of needle loom (*Type* II), the selvedge shall be made firm with interlocking thread.

5.1.2 The tapes shall be uniformly woven with firm and regular selvedges in 2/2 herring bone twill weave with one reversal. The nylon tapes shall be free from weaving defects and stains.

5.1.3 In order to illustrate or specify the indeterminable characteristics, such as general appearance, lustre, feel and shade, a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects.

5.2 The tapes shall further meet the chemical requirements as specified in Table 3.

5.2.1 The tapes shall be free from tendering substances.

5.2.2 *Dyed Tapes*

Acid/disperse dyes may be used; however, metallized/chrome dyes shall not be used [*see* IS 4472 (Part 3)].

Table 1 Physical Requirements of Nylon Tapes Woven on Shuttle Loom (Type I)
(*Clauses* 3.2 and 5.1)

Sl No.	Width, mm	Length /Roll	Warp, Tex (*see* Note 3)	Weft, Tex (*see* Note 3)	Thickness, mm	Ends in Full Width (*see* Note 3)	Picks/ dm (*see* Note 3)	No. of Plies (*see* Note 3) Warp	No. of Plies (*see* Note 3) Weft	Mass, *Max* g/66 m Roll (Net)	Breaking Load on Full Width × 20 cm, kgf ,*Min* (*see* Note 2)	Elongation at break, Percent, *Min* (*see* Note 2)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	14 ± 1	66 m, unless otherwise specified in contract or order.	23	23	0.6	87	127	2	4	575	230	18
ii)	19 ± 1		23	23	0.5	142	141	1	2	410	193	18
iii)	25 ± 1		23	23	0.5	71	127	4	2	740	400	18
iv)	25.4 ± 1.6 (*see* Note 1)		23	23	0.25	99	218	1	1	295	137	14
v)	32 ± 1		23	23	0.5	89	127	4	2	940	506	18
vi)	38.0 ± 1.5		23	23	0.5	106	127	4	2	1 110	605	18
vii)	44.0 ± 1.5		23	23	0.5	125	127	4	2	1 295	705	18
Tolerance	—	—	$+10$ *percent* -5 *percent*	$+10$ *percent* -5 *percent*	—	—	—	—	—	—	—	—
Method of Test, Ref to	IS 1954	—	IS 7703 (Part 1)		IS 7702 under a pressure of 200 gf/cm^2	IS 1963		—		IS 1964	IS 1969 (Part 1)	

Table 2 Physical Requirements of Nylon Tapes Woven on Needle Loom (Type II)

(*Clause* 3.2 and 5.1)

Sl No.	Width, mm	Length /Roll	Warp, Tex, (*see* Note 3)	Weft, Tex (*see* Note 3)	Thickness, mm	Ends in Full Width, *Min* (*see* Note 3)	Picks/ Dm, *Min* (*see* Note 3)	No. of Plies (*see* Note 3)		Mass, *Max*, g/66 m Roll (Net)	Breaking Load on Full Width × 20 cm, kgf, *Min* (*see* Note 2)	Elongation at break, Percent, *Min* (*see* Note 2)
								Warp	Weft			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	14 ± 1	66 m, unless otherwise specified in contract or order.	23	23	0.6	87	254	2	2	575	230	18
ii)	19 ± 1		23	23	0.5	142	282	1	1	410	193	18
iii)	25 ± 1		23	23	0.5	71	254	4	1	740	400	18
iv)	25.4 ± 1.6 (*see* Note 1)		23	11	0.25	99	436	1	1	295	137	14
v)	32 ± 1		23	23	0.5	89	250	4	1	940	506	18
vi)	38.0 ± 1.5		23	23	0.5	106	250	4	1	1 110	605	18
vii)	44.0 ± 1.5		23	23	0.5	125	250	4	1	1 295	705	18
Tolerance	—	—	$+10\ percent$ $-5\ percent$	$+10\ percent$ $-5\ percent$	—	—	—	—	—	—	—	—
Method of Test, Ref to	IS 1954	—	IS 7703 (Part 1)		IS 7702 under a pressure of 200 gf/cm^2	IS 1963		—		IS 1954	IS 1969 (Part 1)	

NOTES

1 This is special light variety for high cover factor.

2 In case of dyed threads, 5 percent relaxation shall be allowed to the values given in length per unit mass and extension at break.

3 If yarn of 46 or 92 tex is used, number of ends and picks per dm shall be suitably modified to meet all other specified requirements.

Table 3 Chemical Requirements of Nylon Tapes
(*Clause* 5.2)

Sl No.	Characteristics	Requirements	Methods of Test, Ref to
(1)	(2)	(3)	(4)
i)	*p*H value of aqueous extract	6.0 - 8.5	IS 1390
ii)	Colour fastness to (in case of coloured cords):		
	a) Light	5 or better	IS/ISO 105-B02
	b) Washing, Test C (3)	4 or better	IS/ISO 105-C10

6 MARKING

6.1 Each roll shall bear a securely attached label with the following information:

a) Name of the material and its net mass (g);
b) Length (m), Width (mm), Thickness (mm);
c) Type; and
d) Name/trade-mark of the manufacturer and the year of manufacture.

6.2 BIS Certification Marking

The nylon 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 nylon tape rolls may be marked with the Standard Mark.

7 PACKING

7.1 Unless otherwise agreed to between the buyer and the seller, the nylon tapes shall be packed as given in **7.2**.

7.2 An appropriate number of rolls shall be arranged in a cylindrical bundle and secured by jute twine to form a pack. A suitable number of such packs shall be arranged and wrapped with polyethylene film of at least 100 microns thickness (*see* IS 2508) and placed in a wooden packing case of adequate strength, previously lined with one layer of waterproof packing paper conforming to Type 2 of IS 1398. The empty spaces, if any, in the packing case shall be stuffed with cushioning materials to avoid damage in transit. The case shall be bound by iron hoops or wires. The gross mass of the case shall not exceed 40 kg.

7.3 Each case shall be marked with the consignment details as provided in the contract or order in addition to the markings given in **6.1**.

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 4 shall be followed.

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

8.2.2 Sub-sample rolls specified in col (5) of Table 4 shall be drawn from the sample rolls selected according to col (3) of the Table 4.

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 5.

9.2.3 For breaking load and elongation test, an additional 2 m test sample from each of the sample rolls remaining after drawing the subsample (*see* **8.2.2**) shall be taken if so, specified in the contract.

Table 4 Scale of Sampling
(*Clause* 8.2)

Sl No.	No. of Rolls in the Lot	Sample Size	Permissible no. of defective rolls in respect of tests on sample rolls	Sub-Sample Size	Permissible no. of defective rolls in respect of tests on sub-sample rolls
(1)	(2)	(3)	(4)	(5)	(6)
i)	Up to 25	3	0	3	None
ii)	26 - 100	5	0	4	
iii)	101 - 150	8	0	5	
iv)	151 - 300	13	0	7	
v)	301 - 500	20	1	8	
vi)	501 - 1 000	50	1	9	
vii)	Above 1 000	80	2	10	

Table 5 Number of Test Specimens and Criteria for Conformity
(*Clause* 9.1)

Sl No.	Characteristics	Number of Samples	Criteria for Conformity
(1)	(2)	(3)	(4)
i)	Length, linear density width, mass, thickness, ends, picks and plies	According to col (3) of Table 4.	Non-conforming rolls not to exceed corresponding number given in col (4) of Table 4.
ii)	Breaking load, elongation, *p*H value, colour fastness	According to col (5) of Table 4.	All the rolls to satisfy the relevant requirements.

ANNEX A
(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 667 : 1981	Methods for identification of textile fibres (*first revision*)
IS 1390 : 2022	Textiles — Determination of *p*H of aqueous extract (*third revision*)
IS 1398 : 1982	Specification for packing paper water proof, Bitumen-laminated (*second revision*)
IS 1954 : 1990	Determination of length and width of woven fabrics – Methods (*second revision*)
IS 1963 : 1981	Method for determination of threads per unit length in woven fabrics (*second revision*)
IS 1964 : 2001	Textiles — Methods for determination of mass per unit length and mass per unit area of 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 4472 (Part 3) : 2021	Textile dyestuffs — Identification of the application classes of dyes on textile materials (*first revision*)
IS 7702 : 2012	Textiles — determination of thickness of textiles and textile products (*first revision*)
IS 7703 (Part 1) : 1990	Methods of test for man-made fibres continuous filament flat yarn: Part 1 Linear density (*first revision*)
IS/ISO 105-B02 : 2014	Textiles — Tests for colour fastness Part B04 Colour fastness to artificial weathering: 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
(*Foreword*)

COMMITTEE COMPOSITION

Textile Materials for Aeronautical and Related Products Sectional Committee, TXD 13

Organization	*Representative(s)*
Aerial Delivery Research and Development Establishment, Agra	DR MANOJ KUMAR **(*Chairperson*)**
Aerial Delivery Research and Development Establishment, Agra	SHRI GAURAV SINGH SHRI PRASANTA KUMAR MALLIK (*Alternate*)
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Vikram Sarabhai Space Centre, Thiruananthapuram	DR SANTHOSH B. SHRI ANIL PENULY (*Alternate*)
Viraj Syntex Pvt Limited, Kanpur	SHRI AMIT SINGH
BIS Directorate General	SHRI J. K. GUPTA SCIENTIST 'E'/DIRECTOR AND HEAD (TEXTILES) [REPRESENTING DIRECTOR GENERAL (*Ex-officio*)]

Member Secretary
SHRI BANOTHU RANGA
SCIENTIST 'B'/ASSISTANT DIRECTOR
(TEXTILES), BIS

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