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IS : 4727 - 1968
(Reaffirmed 1996)

Indian Standard

**SPECIFICATION FOR NYLON WEBBING
FOR AERONAUTICAL PURPOSES**

(Third Reprint SEPTEMBER 1999)

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October 1968

AMENDMENT NO. 1 JULY 1994
TO
IS 4727 : 1968 SPECIFICATION FOR NYLON WEBBING FOR
AERONAUTICAL PURPOSES

This amendment has been issued to modify the pressure under which the thickness of webbing shall be determined and also to incorporate latest versions of cross referred standards.

(Page 4, Table 1) — Substitute the following for the existing table:

Table 1 Particulars of Nylon Webbing, Undyed or Dyed for Aeronautical Purposes
 (Clause 3.1)

TYPE	ENDS IN FULL WIDTH <i>Min</i>			PICKS/DM	WEIGHT <i>Max</i>	WIDTH	THICK- NESS	NO OF FOLDS OF YARN			BREAKING LOAD ON FULL WIDTH X 20 cm STRIP <i>Min</i>	
	Face + Back		Binding					Warp				Weft
	(2)	(3)						(4)	Face	Back		
(1)	(2)	(3)	(4)	(5)	(6) g/m	(7) mm	(8) mm	(9)	(10)	(11)	(12)	(13) kgf
1	281		34	90	90	44 ± 1.5	2.0 <i>Min</i> 3.0 <i>Max</i>	2	2	1	2	2 950
2	Total end = 198			70	60	44 ± 1.5	1.1 <i>Min</i> 2.0 <i>Max</i>	← 2 →			2	1 815
Methods of Test	IS 1963 : 1981*	IS 1963 : 1981*	Appen- dix A	Appen- dix B	IS 7702 : 1975†	—	—	—	—	—	IS 1969 : 1985‡	

NOTE — The thickness of webbing shall be determined at a pressure of 200 g/cm².

*Methods for determination of threads per unit length in woven fabrics (*second revision*).

†Methods for determination of thickness of woven and knitted fabrics.

‡Methods for determination of breaking load and elongation of woven textile fabrics (*second revision*).

(Page 5, Table 2) — Substitute the following for the existing table:

Table 2 Other Requirements of Webbing
 (Clause 3.2)

Sl. No.	CHARACTERISTIC	REQUIREMENT	METHOD OF TEST
1	pH value of aqueous extract	Between 5.5 to 8	IS 1390 : 1983* (Cold method)
2	Colour fastness to light	5 or better	IS 686 : 1985† or IS 2454 : 1985‡
3	Length	100 m per roll or any other length as agreed to between the buyer and the seller	Appendix C
	*Methods for determination of pH value of aqueous extract of textile materials (<i>first revision</i>).		
	†Methods for determination of colour fastness of textile materials to day light (<i>first revision</i>).		
	‡Methods for determination of colour fastness of textile materials to artificial light (Xenon lamp) (<i>first revision</i>).		

(Page 6, clause 6.1) — Substitute 'IS 2508 : 1984*' for 'IS 2508 : 1963*' and 'IS 1398 : 1982†' for 'IS 1398 : 1960†'.

(Page 6, foot-notes) — Substitute the following for the existing:

*Specification for low density polyethylene films (*second revision*).

†Specification for paper, packing, water proof, bitumen laminated (*second revision*).*

AMENDMENT NO. 2 NOVEMBER 1998
TO
IS 4727 : 1968 SPECIFICATION FOR NYLON
WEBBING FOR AERONAUTICAL PURPOSES

(Page 3, clause 2.2.1.1) — Insert the following at the end of the clause:

‘Webbing shall be soft and pliable.’

(Page 3, clause 2.2.2) — Insert the following after first sentence:

‘In case webbings are produced on needloom its ends shall be made firm with interlocking thread.’

(Page 3, clause 2.3) — Substitute the following for the existing:

‘2.3 Dyeing — Webbing shall either be yarn dyed or piece dyed. The dyeing shall be done preferably with acid/disperse dyes. Metallized/Chrome/Sulphur dyes shall not be used in production of dyed tapes.’

[Page 5, Table 2 (see also Amendment No.1)] — Insert the following at the end of the table:

Sl.No	CHARACTERISTIC	REQUIREMENT	METHODS OF TEST
4.	Colour fastness to washing : Test 5	4 or better	IS 3417 : 1979

[Page 10, clause D-2.1(c), last sentence] — Substitute the following for the existing:

‘c) The rack shall rotate about the arc at a uniform speed of about 1 to 2 rev/min.’

(TX 13)

Indian Standard

SPECIFICATION FOR NYLON WEBBING FOR AERONAUTICAL PURPOSES

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Committee, TDC 27

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Indian Standard
**SPECIFICATION FOR NYLON WEBBING
FOR AERONAUTICAL PURPOSES**

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 August 1968, after the draft finalized by the Textile Materials for Aeronautical Purposes Sectional Committee had been approved by the Textile Division Council.

0.2 This standard is based on provisional specification No. IND/ADE/0058 'Webbing nylon for parachute harness—undyed/olive green and blue' and IND/ADE/0066 'Webbing nylon 44 mm—undyed/olive green and blue', issued by the Chief Inspectorate of Aerial Delivery Equipment, Agra.

0.3 This standard contains clauses 3.3, 3.10.1 and 4.1 which call for agreement between the buyer and the seller for permitting the buyer to use his option for selection to suit his requirements.

0.4 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 shall be rounded off in accordance with IS:2-1960*. 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 prescribes the constructional details and other particulars of 2 types of nylon webbing, undyed or dyed, used in personnel parachutes and other aeronautical purposes.

1.2 This standard does not specify the general appearance, feel, etc, of the webbing (*see also 3.10*).

2. MANUFACTURE

2.1 Yarn—Nylon yarn used in the manufacture of webbing shall be of 840 d. It should be bright and of high tenacity. It should be either of Nylon 6 or Nylon 66. The final ply of the warp and weft yarns should have a minimum of 100 tpm. The single yarns forming the final plied yarn should be twisted together in a single operation.

*Rules for rounding off numerical values (*revised*).

2.2 Webbing

2.2.1 Weave—Type 1 nylon webbing shall be woven in double-plain weave with single weft. The binder warp ends should weave 2 up, 2 down with one end working as one. The face and back warp yarns shall be woven with 2 ends working as one except the warp yarns forming the selvedge, which shall be woven with one end working as one. The number of warp yarns used for forming the selvedge shall not exceed 8 for one end and 9 for the other end respectively.

2.2.1.1 Type 2 shall be woven in 2 up, 2 down herringbone twill with one reversal of twill at the centre.

2.2.2 The finished webbing should be clean, even and well-woven with firm and regular selvedges. The webbing should be free from weaving defects and stains. The dyed webbing should be of uniform shade.

2.3 Dyeing—Webbing should either be yarn-dyed or piece-dyed. The dyeing shall be done with acetate or acid type dyes. Metallized or chrome dyes shall not be used.

3. REQUIREMENTS

3.1 Construction—The webbing shall comply with the requirements of Table 1.

3.2 Other requirements of the webbing along with the methods of test are given in Table 2.

3.3 Treatment of Webbing—The webbing when required by the buyer shall be supplied impregnated with resin. Resin shall be polyvinyl butyral plasticized with butyl ricinoleate suitably applied from a water dispersion, dried and cured so as to form a firmly-adherent and evenly-distributed deposit or coating on the yarns of the webbing. The curing of the resin impregnated webbing shall be done in the temperature range of 115° to 186°C.

3.4 Resistance to Accelerated Ageing—The impregnated webbing shall have not less than 90 percent of the untreated breaking load, when tested according to the method given in Appendix D.

3.5 Colour—When undyed webbing is impregnated, the colour may deviate from the natural state to that degree imposed by the colour of the treating agent used. However, in the case of dyed webbing being impregnated, the colour of the webbing shall match with the colour of the sealed sample (see 3.10).

TABLE 1 PARTICULARS OF NYLON WEBBING UNDYED OR DYED FOR AERONAUTICAL PURPOSES

(Class 3.1)

TYPE	ENDS IN FULL WIDTH Min		PICKS/dm	WEIGHT WIDTH THICKNESS Max	NO. OF FOLDS OF YARN			BREAKING LOAD ON FULL WIDTH STRIP Min kg				
	Face + Back	Binding			Face	Back	Binding		Warp	Weft		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1	281		34	90	90	44 ±1.5	44 2.0 Min 3.0 Max	2	2	1	2	2 950
2	Total ends = 198			70	60	44 ±1.5	1.1 Min 2.0 Max		2		2	1 815
Methods of Test	8.1 of IS: 1963-1961*		8.2 of IS: 1963-1961* dix A		Appen- dix A		8.2 to 8.5 of IS: 1954-1961†		—		9.1 to 9.4 of IS: 1969-1961‡	

NOTE — The thickness of webbing shall be determined at a pressure of 210 g/m².

*Method for determination of ends and picks per unit length in woven fabrics.

†Methods for determination of dimensions of fabrics.

‡Method for determination of breaking load and elongation at break of woven fabric (by constant-rate-of-traverse machine).

TABLE 2 OTHER REQUIREMENTS OF WEBBING

(Clause 3.2)			
Sl. No.	CHARACTERISTIC	REQUIREMENT	METHODS OF TEST
(1)	(2)	(3)	(4)
1.	pH value	Between 6 and 9	IS : 1990-1961* Cold method
2.	Colour fastness to light	5 or better	IS : 686-1957† or IS : 2454-1967‡
3.	Length	100 m per roll or any other length as agreed to between the buyer and the seller	Appendix C

*Methods for determination of pH value of aqueous extract of textile materials.

†Method for determination of colour fastness of textile materials to day light.

‡Method for determination of colour fastness of textile materials to artificial light.

3.6 Weight — An addition of 10 percent over the maximum weight specified in respect of untreated webbing shall be allowed for the impregnated webbing.

3.7 Thickness — The thickness of the impregnated webbing shall be not less than 12 percent of the maximum thickness specified for untreated webbing.

3.8 Weight of Resin Deposition — The treated webbing shall contain a maximum of 8.5 percent by weight of matter extractable in methyl ethyl ketone when tested by the method prescribed in Appendix E.

3.9 Resistance to Abrasion — The impregnated webbing shall have not less than 85 percent of the untreated breaking load when tested by the method prescribed in Appendix F.

3.10 Sealed Sample — If, in order to illustrate or specify the indeterminate characteristics like the type of finish, feel, etc, of the webbing, a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects.

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

4. PACKAGING

4.1 The webbing shall preferably be made into rolls of 100 m or any other length as required by the buyer.

5. MARKING

5.1 Each roll shall be legibly marked with the following information:

- a) Name of the material:

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- b) Length of webbing contained in a roll;
- c) Year of manufacture;
- d) Colour fastness rating; and
- e) Manufacturer's name, initials or trade-mark, if any.

5.1.1 The product may also be marked with Standard mark.

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

6. PACKING

6.1 A suitable number of rolls shall be arranged in the form of cylindrical bundles and secured by jute twine to form a pack. A suitable number of such packs shall be arranged and wrapped with polyethylene film (*see IS:2508-1963**). The wrapped bundles shall be placed in a wooden packing case which is previously lined with one layer of waterproof packing paper (*see IS:1398-1960†*). The voids in the case, if any, shall be stuffed with cushioning material to avoid damage in transit. The case shall be bound by iron hoops or wires. The gross weight of the case when packed shall not exceed 40 kg.

7. SAMPLING

7.1 The quantity of nylon webbing of the same type and class delivered to a buyer against a despatch note shall constitute the lot.

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

7.3 Unless otherwise agreed to between the buyer and the seller, the number of rolls to be selected from a lot shall be in accordance with col 1 and 2 of Table 3.

7.4 The rolls selected according to 7.3 shall constitute the test sample for testing ends in full width, picks per decimetre, width, thickness and length.

*Specification for low density polyethylene films.

†Specification for paper packing waterproof bitumen laminated.

TABLE 3 SAMPLE SIZE AND CRITERIA FOR CONFORMITY

(Clause 7.3)

LOT SIZE	SAMPLE SIZE	PERMISSIBLE NO. OF DEFECTIVES	SUB-SAMPLE SIZE
(1)	(2)	(3)	(4)
Up to 51	8	0	3
51 to 150	13	0	4
151 ,, 300	20	1	5
301 ,, 500	32	1	7
501 and above	50	2	10

7.5 The number of rolls to be selected for testing breaking load, weight in grammes per metre and pH value shall be according to col 4 of Table 3. These may be selected from those already tested in 7.4. For lot size less than 500, three rolls and otherwise 5 rolls shall be selected for testing colour fastness.

7.6 In case the lot consists of treated webbing, the number of rolls to be selected for subjecting to the relevant tests shall be according to col 4 of Table 3.

7.7 Criteria for Conformity—The lot shall be declared conforming to the requirements of this standard if the following conditions are satisfied:

- a) The number of rolls found defective for any one or more of the characteristics (except length) tested in 7.4 does not exceed the corresponding number given in col 3 of Table 3.

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

- b) From the test results for weight in grammes per metre, the average \bar{x} and the range R shall be calculated and the value of the expression $\bar{x} + 0.6 R$ does not exceed the corresponding limit.
- c) From the test results for breaking load, the average \bar{x} and the range R shall be determined and the value of the expression $\bar{x} - 0.6 R$ is greater than or equal to the corresponding limit specified.
- d) All the test results for pH value and colour fastness satisfy the relevant requirements.
- e) In case of treated webbings, all the test results satisfy the relevant requirements.

APPENDIX A

(Table 1)

METHOD FOR DETERMINATION OF WEIGHT PER METRE

A-1. TEST SPECIMENS

A-1.1 Cut a piece of webbing approximately 4 m in length from each of the rolls constituting the sample under test (*see 7.4*).

A-2. CONDITIONING OF TEST SPECIMENS

A-2.1 Prior to test, the test specimen shall be conditioned in a standard atmosphere at 65 ± 2 percent RH and $27^\circ \pm 2^\circ\text{C}$ temp (*see IS: 196-1966**) for 24 hours.

A-3. PROCEDURE

A-3.1 Take a test specimen and apply a tension equal to 1 percent of the minimum breaking load of the webbing. After 60 ± 5 seconds, mark in the length in tension two separate 1 m specimens at the marks and determine the weight of each specimen to the nearest gram.

A-3.2 Repeat the test with the remaining test specimens.

APPENDIX B

(Table 1)

METHOD FOR DETERMINATION OF WIDTH OF THE WEBBING

B-1. TEST SPECIMENS

B-1.1 For the purpose of this test, all the rolls in the test sample (*see 7.4*) 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 smooth 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 webbing by means of a graduated steel scale placed at right angles to the selvages.

B-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.

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

*Atmospheric conditions for testing (*revised*).

APPENDIX C

(Table 2)

METHOD FOR DETERMINATION OF LENGTH OF ROLL

C-1. TEST SPECIMENS

C-1.1 For the purpose of this test, all the rolls in the test sample (*see 7.4*) shall constitute the test specimens.

C-2. EQUIPMENT

C-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.

C-3. PROCEDURE

C-3.1 Unroll one test specimen and 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.

C-3.2 Mark on the webbing the first 5 m length as measured against the mark on the table. Measure the entire length in 5 m lengths till a length less than 5 m remains. Measure this length correct to a centimetre in metres and centimetres against the markings on the table.

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

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

APPENDIX D

(Clause 3.4)

METHOD FOR ACCELERATED AGEING OF IMPREGNATED WEBBING

D-1. TEST SPECIMEN

D-1.1 For the purpose of this test, all the impregnated webbing rolls in the sample shall constitute the test specimen (*see 7.6*).

D-2. EQUIPMENT

D-2.1 An accelerated weathering unit consisting essentially of the following features:

- a) Vertical carbon arc mounted at the centre of a vertical cylinder. The arc shall be designed to accommodate either 2 or 3 pairs of carbon but shall burn only 1 pair at a time automatically transferring from one pair to another as the carbons are consumed. The

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arc shall be operated on 60 A and 50 V across the arc for ac and on 50 A and 60 V across the arc for dc.

- b) The arc shall be surrounded by removable panels (or filters) having good absorbing or transmitting properties.
- c) A rotating rack with holders in which the specimens shall be placed side by side and exposed to radiation from the arc with the centre of the face of the specimen at a radial distance of approximately 45 cm from the arc. The rack shall rotate about the arc at a uniform speed of about 1 rev/2 h.
- d) Water spray nozzles mounted horizontally in the test chamber inside the specimen rack and so placed that water shall strike the specimens evenly over the entire length in the form of a fine spray in sufficient volume to cover the specimens immediately on impact. The apparatus shall be operated so that the specimens are exposed to successive cycles of 102 minutes of light without spray followed by 18 minutes of light with spray.
- e) Means for maintaining the required temperature of water in the spray, namely, $26.7^{\circ} \pm 5.6^{\circ}\text{C}$.
- f) Means for maintaining the required pressure of water entering the spray, namely, 0.844 to 1.265 kg/cm².
- g) Means for delivering the required quantity of water per spray nozzle to the specimen, namely, 0.5 to 1 l/h per spray nozzle.
- h) Means for maintaining the air temperature within the machine, namely, at $68^{\circ} \pm 5.7^{\circ}\text{C}$ with the filters in place at the exposure plane of the specimen rack, and at $80^{\circ} \pm 5.7^{\circ}\text{C}$ when filters are removed; means for measuring the temperature.

D-3. PROCEDURE

D-3.1 Take 5 test specimens of impregnated webbing and 5 specimens of untreated webbing. Place them side by side in the rack arranging in such a way that one impregnated webbing alternates with that of one untreated webbing. The specimens shall be placed 2.5 cm apart. Expose the specimens to carbon arc light source for a total of 100 hours. Remove the test specimen at the end of the exposure period and condition them to standard atmospheric conditions for 24 hours. When the test specimens have been conditioned, test them for breaking load by the method given in Table 1.

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APPENDIX E*(Clause 3.8)***METHOD FOR DETERMINATION OF WEIGHT OF RESIN DEPOSITION****E-1. TEST SPECIMEN**

E-1.1 For the purpose of this test, all the impregnated webbing rolls in the test sample shall constitute the test specimen (*see 7.6*).

E-2. APPARATUS**E-2.1 Soxhlet Apparatus****E-2.2 Methyl Ethyl Ketone****E-3. PROCEDURE**

E-3.1 Take a test specimen of impregnated webbing and remove from it warp and weft yarn so that the yarns weigh about 5 g. Dry the sample to constant weight in a weighing bottle at a temperature of $104^{\circ} \pm 4.5^{\circ}\text{C}$. Extract the test specimen with methyl ethyl ketone in a soxhlet apparatus for 6 hours. Determine the final weight of the extracted specimen after constant weight has been obtained under the same drying conditions as mentioned above.

E-3.2 Calculate the percentage weight of resin deposit by the following formula:

$$\text{Percentage weight of resin deposit} = \frac{\text{loss in weight on extraction}}{\text{dry weight of sample}} \times 100$$

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

APPENDIX F*(Clause 3.9)***METHOD FOR DETERMINATION OF RESISTANCE TO ABRASION****F-1. TEST SPECIMENS**

F-1.1 For the purpose of this test, all the impregnated webbing rolls in the test sample shall constitute the test specimen (*see 7.6*).

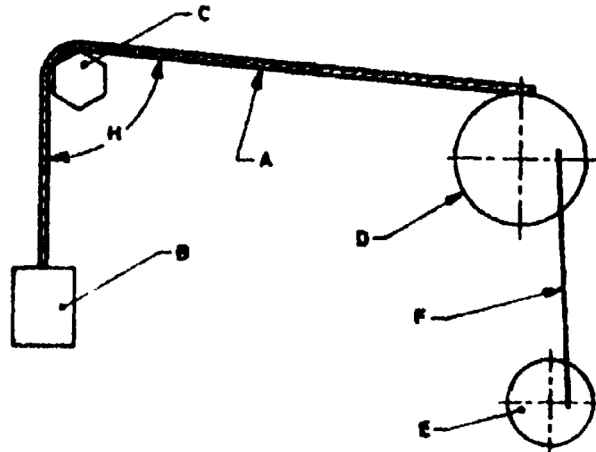
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F-2. EQUIPMENT

F-2.1 A device as illustrated schematically in Fig. 1.



- A — Webbing
- B — Weight, 2.4 ± 0.06 kg
- C — Hexagonal rod, 6.35 A/F, cold rolled, 97 to 101 RHB
- D — Drum 400 mm dia
- E — Crank
- F — Connecting rod
- H — Angle formed by webbing $85^\circ \pm 2^\circ$

FIG. 1 SCHEMATIC DIAGRAM OF ABRASION RESISTANCE TESTING DEVICE

F-3. PROCEDURE

F-3.1 Take one test specimen of impregnated webbing *A* and attach weight *B* to one end. Pass the webbing over the hexagonal bar *C* and attach the other end of the webbing to the oscillating drum *D*. Oscillate the drum so that the webbing is given a 30 ± 2.5 cm traverse over the hexagonal bar at the rate of 60 ± 2 strokes/min. In this way, impart 5 000 strokes to the webbing. Remove the webbing on expiry of the last stroke and determine its breaking load by the method specified in Table 1.

F-4. Repeat the test with the remaining test specimens but changing the edges of the hexagonal bar for each test specimen tested.

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