

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS

Draft for comments only

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भारतीय मानक मसौदा

वस्त्रादि — विमान अवरोधक बैरियर के लिए नायलॉन टेप — विशिष्टि

Draft Indian Standard

**TEXTILES — NYLON TAPE FOR AIRCRAFT ARRESTER BARRIER
— SPECIFICATION**

ICS: 49.025.60

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

last date for receipt of comments is
22 November 2024

FOREWORD

(Formal clauses will be added later)

An aircraft arrester barrier is a safety system used at airports and military airbases to safely decelerate and stop aircraft during emergency landings or aborted takeoffs. These barriers are crucial for situations where an aircraft is unable to stop within the available runway length due to mechanical issues, high-speed landings, or runway overruns.

Nylon tapes is one of the critical components used in aircraft arrester barriers. These tapes function as energy absorbers in the arresting mechanism, allowing them to halt the aircraft's motion effectively and minimize damage. These tapes play a crucial role in protecting both aircraft and personnel during emergency landings on runways equipped with arresting barriers.

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 and performance requirements for nylon tape 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 REFERENCES

2.1 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 The yarn used for the nylon tape shall be of bright, high tenacity (minimum 9.5 gpd) *see* IS 1670, light and heat stabilized, multifilament nylon 6,6 yarn, and twisted as per the requirements given in Table 1. The melting point of nylon 6,6 yarn shall not be less than 247°C when determined according to method stipulated in IS 5762.

4 TYPES

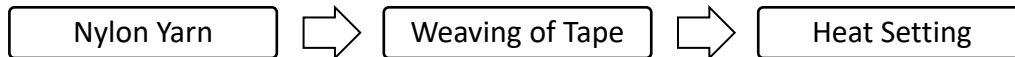
Based on the width and type of treatment nylon tapes are classified as follows.

- a) *Type I*—Nylon tape 26 mm Untreated
- b) *Type II*—Nylon tape 26 mm UVR (Ultra Violet Resistant) Treated, Black
- c) *Type III*—Nylon tape 26 mm WR (Water Repellent) - UVR Treated, Black
- d) *Type IV*—Nylon tape 30 mm Untreated
- e) *Type V*—Nylon tape 30 mm UVR (Ultra Violet Resistant) Treated, Black
- f) *Type VI*—Nylon tape 30 mm WR (Water Repellent) - UVR Treated, Black

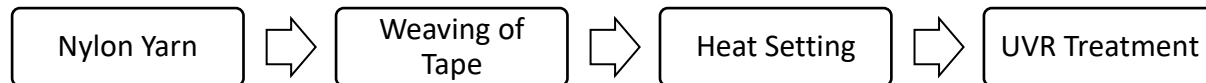
5 MANUFACTURE

5.1 The Tape shall be evenly woven under suitable tension. The selvages of Tape shall be firm and regular. Sequence of manufacture for the respective varieties of tape is given below:

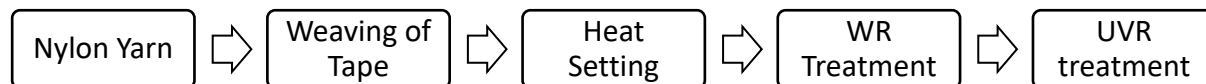
5.1.1 *Sequence of manufacture for Type I and IV*



5.1.2 Sequence of manufacture for Type II and V



5.1.3 Sequence of manufacture for Type III and VI



5.2 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. Procedure of UVR treatment with chemical composition is given in the Annex F.

NOTE — Any change either in the prescribed formulation or the process of application to provide specified U.V. resistance shall be as agreed to between buyer and seller.

5.2.2 Extractable material

The tape after the resin treatment and curing when extracted by the method prescribed in Annex L shall have 4-5 % extractable material on the dry weight of tape.

5.3 WR-UVR Treated Tape

The nylon tapes shall be WR-UVR treated as per the suggested procedure given in Annex G. The WR – UVR treated nylon tape when extracted by the method given in Annex J shall have maximum 6.5 percent extractable material to the dry weight of tape.

NOTE — Any change either in the prescribed formulation or the process of application to provide specified U.V. resistance shall be as agreed to between buyer and seller.

6 FINISH

6.1 The tape shall be suitably heat set (if required). The process of sequence which is supposed to enable the manufacturer to achieve the specified properties shall be as agreed between the buyer and the seller.

6.2 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, Annex B may be considered.

7 REQUIREMENTS

7.1 The Nylon tape shall conform to the requirements as specified in Table 1.

Table 1 Requirements of Tape Nylon
(Clauses 3.1 and 7.1)

SI No.	Characteristic	Requirement						Method of Test, Ref to
		Type I	Type II	Type III	Type IV	Type V	Type VI	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
i)	Width, mm	26 ± 1	26 ± 1	26 ± 1	30 ± 1	30 ± 1	30 ± 1	IS 1954
ii)	Thickness under a pressure of 200 g/cm ² , mm, <i>Max</i>	3.0	3.0	3.0	4.0	4.0	4.0	IS 7702
iii)	Weight, g/m, <i>Max</i>	45	50	51	68	75	76	Annex K
iv)	Breaking strength on full width × 20 cm between grips, kgf, <i>Min</i>	2 150	2 040	2 040	3 300	3 135	3 135	1969 (Part 1)
v)	Weave	Double Plain, 2 ends working as 1, 2 picks/shed						Visual
vi)	Ends in full width, <i>Min</i> Ground (face + back) Binder	170 20			260 34			IS 1963
vii)	Picks per dm, <i>Min</i>	160			134			
viii)	Denier of Yarn × Ply (see NOTE 1) a) Warp b) Binder c) Weft	1680×1 840×1 840×1						4910 (Part 2)
ix)	Yarn twist/m (see NOTE 2) a) Warp, <i>Min</i> b) Binder c) Weft	100 Nil/Intermingled Nil/Intermingled						IS 832 (Part 1)
x)	Drop Angle, degree, <i>Max</i>	—	35	35	—	35	35	Annex H
xi)	Water Absorbency WR-UVR tapes, percent, <i>Max</i>	—	—	15	—	—	18	Annex E
xi)	pH	5.5 to 8.5						IS 1390

NOTES

- (-)5 percent to (+)10 percent tolerance shall be provided in linear density of yarn. In case of UVR and WR – UVR treated webbings additional 5 percent relaxation shall be provided.
- 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.

7.2 RESISTANCE TO ACCELERATED AGEING

- a) The UVR treated tape & WR-UVR treated tape after carbon arc exposure, as per Annex C, Test method 1, shall retain minimum 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 Annex D, Test method 2 shall retain minimum 93% of the original breaking strength of treated counterpart.

7.3 Sealed Sample

If, in order to illustrate or specify the, unmeasurable 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. The custody of the sealed sample shall be a matter of prior agreement between the buyer and the seller.

8 MARKING

8.1 The Nylon tape shall be suitably marked or labelled with the following information:

- a) Name and type of the material;
- b) Manufacturer's name, initials or trade-mark;
- c) Length of the roll;
- d) Indication of the source of manufacture; and
- e) Other declarations required as per law in force.

8.2 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 thereunder, and the product may be marked with the Standard Mark.

9 PACKAGING

9.1 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.

10 SAMPLING

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

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

10.3 Sampling Plan A

10.3.1 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.

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

10.3.3 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.

10.4 Sampling Plan B

10.4.1 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.

10.4.2 Five samples or 10 percent 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; and
- c) Mass.

10.5 Sampling Plan C

10.5.1 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.

10.5.2 Two samples or 2 percent 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;
- i) Water repellency test; and
- j) Stiffness (drop angle).

10.6 Sampling Plan D

10.6.1 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.

10.6.2 In case of UVR and WR-UVR treated tapes, three samples or 3 percent 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.

10.7 Criteria for Conformity

10.7.1 All the sample units drawn as per clause 10 sampling plan, shall be tested/examined to the relevant requirement / specification. The lot shall be considered to be in conformity if the requirements given in Table 1 are satisfied.

ANNEX A
(Clause 2)

LIST OF REFERRED STANDARDS

<i>IS No.</i>	<i>Title</i>
IS 832 (Part 1) : 2021	Textiles — Determination of Twist in Yarns Part 1 Direct Counting Method (<i>third revision</i>)
IS 1390 : 2022	Textiles — Determination of <i>pH</i> of Aqueous Extract (<i>third revision</i>)
IS 1670 : 1991	Textiles – Yarn – Determination of breaking load and elongation at break of single strand (<i>second revision</i>)
IS 1954 : 2024	Textiles — Fabrics — Determination of Width and Length (<i>third revision</i>)
IS 1963 : 1981	Methods for determination of threads per unit length in woven fabrics (<i>second revision</i>)
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 (<i>fourth revision</i>)
IS 4910 (Part 2) : 2023	Tyre Yarns, Cords and Tyre Cord Fabrics Made from Man-Made Fibres — Methods of Test Part 2 Linear Density (<i>second revision</i>)
IS 5762 : 1970	Methods for determination of melting point and melting range
IS 7151 : 1991	Corrugated fibreboard boxes for para - Dropping of supplies — specification
IS 7702 : 2012	Textiles — Determination of thickness of textiles and textile products (<i>first revision</i>)
IS 9738 : 2003	Polyethylene bags for general purposes — Specification (<i>second revision</i>)

ANNEX B
(Clause 6.2)

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 percent 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
Mis-pick 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 selvages	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 is 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

B-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 Annex 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.

B-2.2 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.

ANNEX C
(Clause 7.2)

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 sampling plan D shall constitute the test specimen.

C-2 EQUIPMENT

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 arc consumed. The arc shall be operated on 60 A and 50 V across the arc for a.c. 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 to 2 rev/min.
- 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 min of light without spray followed by 18 min of light with spray.
- e) Means for maintaining the required temperature of water in the spray, namely, 26.7 ± 5.6 °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 11/h per spray nozzle.
- h) Means for maintaining the air temperature within the machine, namely, at 68 ± 5.7 °C with the filters in place at the exposure plane of the specimen rack, and at 80 ± 5.7 °C when filters are removed; means for measuring the temperature.

C-3 PROCEDURE

Take 3 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 h. Remove the test specimen at the end of the exposure period and condition them to standard atmospheric conditions for 24 h. When the test specimens have been conditioned, test them for breaking load by the method given in Table 1.

ANNEX D
(Clause 7.2)

METHOD FOR ACCELERATED AGEING OF TREATED TAPE

TEST METHOD-2: UV-B light exposure

D-1 TEST SPECIMENS

The test specimens for breaking strength shall be cut from the sample as specified in IS 1969 (Part 1).

D-2 TEST CONDITIONS

D-2.1 The test shall be carried out with fluorescent UV-B lamp (313 nanometer or its equivalent).

D-2.2 The duration of the test shall be 100 h.

D-2.3 The test cycle shall be 8 h at 60 ± 3 °C with UV radiation alternating after 4 h at 50 ± 3 °C with condensation.

D-2.4 Irradiation level throughout the test shall be maintained at 0.63W/m².

D-3 TEST PROCEDURE

D-3.1 Determine the original average breaking strength of hail protection nets specimens separately as per the test specified in IS 1969 (Part 1).

D-3.2 Expose the specimens alternately to ultraviolet light alone and to condensation in one respective cycle.

D-3.2.1 The type of fluorescent UV lamp, the timing of the UV exposure and the temperature of condensation shall be as specified in **D-2**.

D-3.3 Determine the average breaking strength of the specimens separately after UV exposure as mentioned above.

D-3.4 Determine the percent retention of original strength as follows:

Percent retention of original breaking strength = $b/a \times 100$

where a = average breaking strength before UV exposure as obtained in **D-3.1**; and b = average breaking strength after UV exposure as obtained in **D-3.3**.

NOTES

1. The UV source is an array of fluorescent lamps (with lamp emission concentrated in the UV range).
2. Condensation is produced by exposing the test surface to a heated, saturated mixture of air and water vapour, while the reverse side of the specimen is exposed to the cooling influence of ambient room air.

ANNEX E

[Table 1 Sl No. (xi)]

METHOD FOR WATER REPELLENCY TEST – IMMERSION ABSORPTION TEST

E-1 TEST SPECIMEN LENGTH: 20 cm × full width of WR-UVR nylon tape

E-2 APPARATUS

- 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.

E-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 $27 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$ and 65 percent ± 2 percent 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 $27 \text{ }^\circ\text{C} \pm 2 \text{ }^\circ\text{C}$. 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.

E-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 **E-3 (d)**

O = Original conditioned weight of the specimen as described in **E-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 and O.

ANNEX F
(Clause 5.2)

**METHOD OF TREATMENT OF NYLON TAPES TO OBTAIN U.V. RESISTANT
FINISH COATING**

F-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 for 48 hours. After this take out the solution in a suitable container and add 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.

F-2 EQUIPMENT/MACHINE REQUIRED

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 percent.
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.

F-3 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 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 percent 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.

F-4 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.

F-5 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.

ANNEX G (*Clause 5.3*)

METHOD OF WR - UVR TREATMENT

G-1 PREPARATION OF SOLUTION FOR WR TREATMENT

Aquateq - SPL, a Perfluoroalkyl based Fluorocarbon Compound should be used as WR (Water Repellent) on tape nylon. 30 g -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.

G-2 PROCEDURE

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 °C for 45 minutes.

G-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 °C -150 °C for 5 minutes. After WR treatment, UVR treatment should be done according to the clause no. **5.2**.

ANNEX H

(Table 1)

METHOD FOR DETERMINATION OF STIFFNESS (DROP ANGLE) OF TAPES

H-1 TEST SPECIMEN

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

H-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 percent \pm 2 percent RH and 27 °C \pm 2 °C temperature.

H-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: -

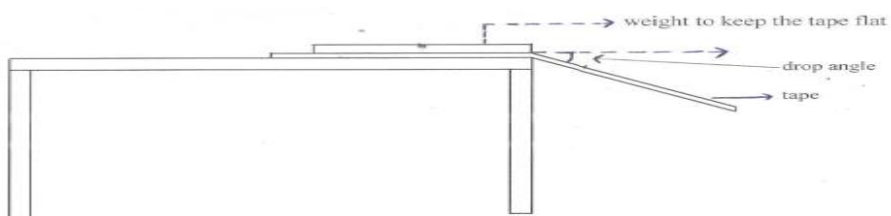


FIG 1 SCHEMATIC DIAGRAM FOR MEASUREMENT OF DROP ANGLE

ANNEX J
(Clauses 5.2 and 5.3)

**METHOD FOR DETERMINATION OF EXTRACTABLE MATERIAL AFTER WR
AND UVR TREATMENT**

J-1 PROCEDURE

In case of WR-UVR treated tapes; firstly, the UVR treatment is to be extracted as per the method stipulated in Annex L.

J-2 After the complete extraction of UVR treatment, WR treatment should be extracted as per the method stipulated in Annex L with a deviation that is using ethyl alcohol in the place of methyl ethyl ketone.

J-3 CALCULATION

The total WR-UVR extractable material, percent = (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 J-1

W = wt. of tape in g after extraction as per method given in J-2

ANNEX K

[Table 1 Sl No. (iii)]

METHOD FOR DETERMINATION OF MASS

K-1 TEST SPECIMENS

K-1.1 Cut a piece of webbing approximately 4 m in length from each of the rolls constituting sample under test.

K-2 CONDITIONING OF TEST SPECIMENS

K-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.

K-3 PROCEDURE

K-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.

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

K-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.

K-3.4 Repeat the test with the remaining test specimens.

K-4 REPORT

K-4.1 Report the lot to be in conformity with the relevant requirements of Table 1 if the condition are satisfied.

ANNEX L

(*Clause 5.2.2*)

METHOD FOR DETERMINATION OF WEIGHT OF RESIN DEPOSITION

L-1 TEST SPECIMEN

For the purpose of this test, the impregnated webbing rolls shall constitute the test specimen.

L-2 APPARATUS

L-2.1 Soxhlet Apparatus

L-2.2 Precision Balance

L-3 PROCEDURE

L-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 ± 4.5 °C. Extract the test specimen with methyl ethyl ketone in a soxhlet apparatus for 6 h. Determine the final weight of the extracted specimen after constant weight has been obtained under the same drying conditions as mentioned above.

L-4 CALCULATION

L-4.1 Calculate the percentage weight of resin deposit by the following formula:

$$\text{Percentage weight of resin deposit} = \left(\frac{\text{Loss in weight on extraction}}{\text{Dry weight of sample}} * 100 \right)$$

L-4.2 Repeat the test with the remaining test specimens.

L-5 REPORT

L-5.1 Report the lot to be in conformity with the relevant requirements if the condition are satisfied.