भारतीय मानक

Indian Standard

IS 14611 : 2024

बहुस्तरीय क्रॉस लेमिनेटेड चद्दर/तिरपाल/ कवर/कृषि फिल्म्स — विशिष्टि

(दूसरा पुनरीक्षण)

Multilayered Cross Laminated Sheets/Tarpaulins/Covers/ Agricultural Films — Specification

(Second Revision)

ICS 83.140.20

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FOREWORD

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

This standard was first published in 1998 and was subsequently revised in 2016.

The original standard was covering only three types of material namely, light duty, medium duty and heavy duty. However due to technological advancement enabling to make thinner and thicker films, two new types of multilayered cross laminated films based on their mass per unit area, namely, extra light duty (XLN) and extra heavy duty (XHN) films were incorporated in the first revision. XLN films, based on their thickness have been used for mulching, low tunnels, packing, water proofing, dunnage, etc. XHN films have generally been used for heavy pond lining, waste pit lining, etc. Requirements of 'average tensile strength and elongation at break after exposing to UV radiation and weathering' were also introduced in the first revision.

This standard allows variation of ± 10 percent in mass per unit area of the films/sheets as the extruded films/sheets would have some variations in thickness and weight due to the manufacturing process.

Canvas tarpaulins made from common proofed canvas/duck and paulins are covered in IS 2089 : 1977 'Specification for common proofed canvas/duck and paulins (tarpaulins) (*second revision*)' and for HDPE woven tarpaulins are covered in IS 7903 : 2017 'Textiles — Tarpaulins made from high density polyethylene (HDPE) woven fabrics — Specification (*fifth revision*)'.

In HDPE woven sheets/tarpaulins/covers/agricultural films, the woven basic fabric which is not waterproof is laminated with LDPE Film is laminated to make it waterproof. The functional life of both the canvas and HDPE films has been directly dependent on the life of the secondary agent. However, the multilayered cross laminated sheets/tarpaulins/covers/agricultural films and fabricated products do have the desired mechanical properties like tear, tensile, impact strength and the waterproofing properties in the basic material itself that is, without the use of a secondary agent.

Multilayered cross laminated sheets, tarpaulins, covers and fabricated products have been used for packing, ground covers (mulching), water conservation systems (canal lining, pond lining, reservoirs, community water tanks, fresh water ponds, fish ponds, diggi, *Azola* farming, check dam lining, landscaping terrace gardening, effluent treatment plants, pulp and paper land fill and sewage ponds, desalination plants, fly ash land fill, fish hatchery basement waterproof, civil engineering waterproof applications, oil drilling reservoir pits, golf course water reservoir lining in contour lakes, rain water harvesting, etc), cover and plinth (CAP) and fumigation covers, poultry curtains and sheet between cages, agricultural operations (vermibeds, storing and drying of spices grapes and food products, etc), waterproof covers for huts, shelters and during grain harvesting, horticulture operations, low tunnels and allied purposes.

When used in open as CAP covers, wagon covers or truck covers, proper lashing is required to be done to avoid de-lamination of the film due to excessive flexing. The suggested method of lashing for trucks has been detailed in Annex B.

General construction and method of installation of vermibed has been detailed in Annex C.

In this revision, the major modifications incorporated are as follows:

a) Clause **5** Construction of sheets/tarpaulins/covers/agricultural films has been updated;
b) Amendments have been incorporated;
c) Cross-referred standard has been updated; and
d) Editorial changes have been done.

The composition of the Committee responsible for formulation of this standard is given in Annex K.

(*Continued on third cover*)

Indian Standard

MULTILAYERED CROSS LAMINATED SHEETS/TARPAULINS/ COVERS/AGRICULTURAL FILMS — SPECIFICATION

(Second Revision)

1 SCOPE

1.1 This standard prescribes the requirements, constructional details, method of sampling and tests for multilayered cross laminated sheets, tarpaulins, covers and agricultural films intended for packing, ground covers (mulching), water conservation systems and fumigation covers, agricultural operations, horticulture, etc.

1.2 Plastic films for greenhouses are not cover under this standard. For plastic films for greenhouses a separate standard, IS 15827 has been published.

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 subjected to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards.

3 TERMINOLOGY

For the purpose of this standard the definitions given in IS 2244 and the following shall apply.

3.1 Cross Lamination — A laminate comprising of at least two biaxially oriented films bonded to one another, each film comprising of polyolefins group material having a fibrillar grain structure that imparts a predominant direction of split-ability to that film. The film follows a zigzag course through it. Laminates of the film are bonded to one another with the said directions transverse to each other and the bonding between the films is sufficiently weak to allow local de-lamination of the films to occur upon tearing of the laminate.

4 TYPES

The material shall be of the following five types based on mass per unit area of the film:

a)	Type XLN	:	Extra light duty
b)	Type LN	:	Light duty
c)	Type MN	:	Medium duty
d)	Type HN	:	Heavy duty
e)	Type XHN	:	Extra heavy duty

5 CONSTRUCTION OF SHEETS/TARPAULINS/ COVERS/AGRICUL TURAL FILMS

5.1 Primary raw material used for manufacturing multi-layered cross laminated sheets/tarpaulins/ covers/agricultural films shall consist of Low density polyethylene (LDPE) and linear low density polyethylene (LLDPE) conforming to IS 7328. However high density polyethylene HDPE may or may not be used depending upon the functional requirement of multi-layered cross laminated sheets/ tarpaulins/covers/agricultural films as per IS 7328. To achieve desired properties, combination of various types of polyethylene, such as high-density polyethylene (HDPE), linear low-density polyethylene (LLDPE), low-density polyethylene (LDPE) and polyethylene-based plastomers may also be used.

5.2 The panels shall be flat (lap) joined and heat sealed to each other with two sealing bands at a distance of 10 mm ± 1 mm between them (*see* Fig. 1).

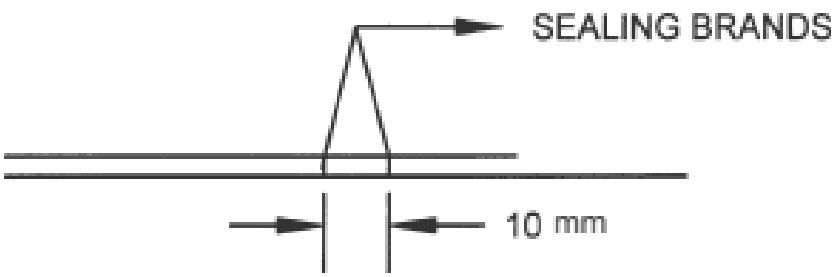


FIG. 1 FLAT (LAP) JOINED SEAL

5.3 The ends and the sides of the film shall be folded $50_{+}{}^{-0}{}_{20}$ mm or as specified by the purchaser and be hammed by heat sealing with two sealing bands with distance of 10 mm ± 1 mm between them (*see* Fig. 2). There shall be no hemming in the sheets.

5.4 Cross seals may be used at the rate of one on alternate panels excluding the two side panels and no piece of less than 900 mm in length shall be used for making the panel. The cross seal shall be made by flat (lap) joint and heat sealed with two sealing bands separated at a distance of 10 mm ± 1 mm. Narrow width panels of 250 mm to 900 mm in width after fabrication may be used at the rate of two per film to obtain the required width of the film.

6 REQUIREMENTS

6.1 Workmanship

The sheets/tarpaulins/covers/agricultural films shall be uniform in colour, texture and finish and shall be substantially free from pin-holes and particles of foreign matter. There shall be no other visible defects such as holes, tears or blisters. The edges shall be free from nicks and cuts visible to unaided eye.

6.2 Substance

Mass per unit area of the sample, in gram per square meter (gsm) shall be as given in Table 1 when determined as per IS 7016 (Part 1). The permissible variation in the mass per unit area of the film shall be ± 10 percent on the value declared by the manufacturer.

6.3 Accelerated Ageing Test

The sample shall show no apparent deterioration like softening, stiffening, tackiness, brittleness, discoloration and degradation of physical properties when tested for accelerated ageing as per IS 7016 (Part 8). The tensile strength and tear strength of the aged material when tested as indicated in col (8) of Table 1 shall be within the limits specified in Table 1.

6.4 Water Proofness Test

A 20 cm diameter piece of the sample when subjected to a 90 cm head of water for 1 h as per method prescribed in IS 7016 (Part 7) shall not allow water to percolate through and not become wet on its outer surface.

6.5 Strength of Joints/Seams

The joint for Type LN, Type MN, Type HN and Type XHN shall be capable of withstanding a load of 2.5 kg on 2.5 cm strip for 1 h when tested as per the method given in Annex D.

NOTE — Strength of joints test is not applicable to Type XLN.

6.6 Flex Test

The sample shall pass the flex test for minimum 50 000 cycles when tested as per IS 7016 (Part 4) in normal conditions as well as after ageing under specified conditions as per IS 7016 (Part 8).

6.7 Ease of In-Situ Repair

It shall be the responsibility of the manufacturer to provide a kit and instructions for repairing of defects/damages that may occur during usage of sheets/tarpaulins/covers/agricultural films. This may be either adhesive tapes or solvent based cement as recommended by the manufacturer. A trial of repairing a cut may be demonstrated by the manufacturer. In case adhesive tapes are provided for repair, the minimum adhesion of the tape to the material of the film shall be 1.5 N per 10 mm width when tested as per Annex E.

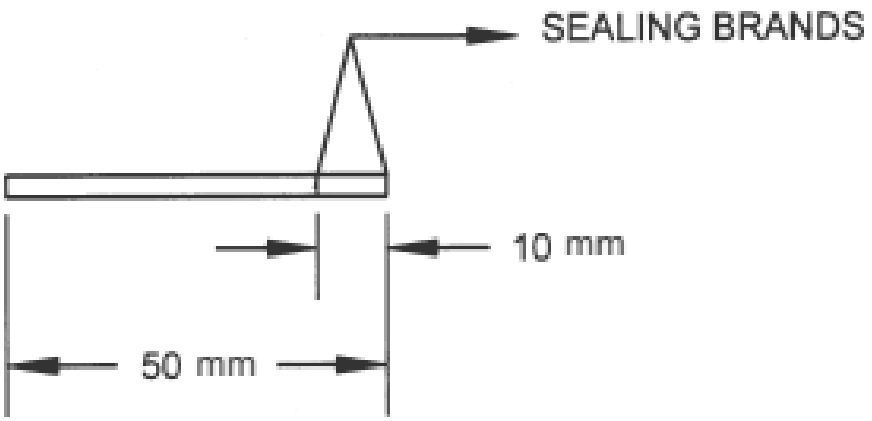


FIG. 2 HEMMING FOLDED ~ 50 mm

6.8 The finished material shall also comply with the requirements given in Table 1.

7 FIXING OF EYELETS (FOR TARPAULINS ONLY)

7.1 Eyelets and Rope Lashing

Eyelets and rope lashing shall be used as agreed to between the purchaser and the supplier.

7.2 Unless otherwise agreed to between the purchaser and the supplier, the eyelets shall be fixed at an approximate interval of 3 feet (91.44 cm) on the length side and at every joint or at approximately 26 inch (66.04 cm) interval on the width side. All the four corners shall be reinforced by special triangular pieces of the film support and then eyeletted. There shall be no eyelets and corner reinforcement in the sheetings.

7.3 The tarpaulins/covers shall be measured by laying it on a plain surface fully spread out and held tightly as given in IS 7016 (Part 1). The tolerance as agreed to between the buyer and the seller may be permitted.

8 SAMPLING AND CRITERIA FOR CONFORMITY

The scale of sampling and criteria for conformity of the material shall be as prescribed in Annex J.

9 PACKING AND MARKING

9.1 Packing

The sheets/tarpaulins/covers/agricultural films shall be packed as agreed to between the purchaser and the supplier.

9.2 Marking

9.2.1 Each sheet/tarpaulin/cover/agricultural film shall be legibly marked at one corner on one side with the following:

a) Type and size of sheet/tarpaulin/cover/ agricultural film;

b) Manufacturer's name and/or his recognized trade-mark, if any;

c) Batch or lot number in code or otherwise;

d) Month and year of manufacture; and

e) Any other statutory requirements.

9.2.2 *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 products may be marked with the Standard Mark.

10 QUALITY OF REAGENTS

Unless specified otherwise, pure chemicals and distilled water (*see* IS 1070) shall be employed in tests.

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

Table 1 Requirements for Multilayered Cross Laminated Sheets/Tarpaulins/Covers/Agricultural Films

(*Clauses* 6.2, 6.3 *and* 6.8)

Sl No.	Characteristic	Requirement					Method of Test, Ref to IS No./Annex
		XLN Extra Light	LN Light	MN Medium	HN Heavy	XHN Extra Heavy	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mass per unit area, g/m²	35 to 60	70 to 100	120 to 150	200 to 250	300	IS 7016 (Part 1)
ii)	Tensile strength[1)], *Min*, kg/cm²						
	a) Longitudinal direction	250	250	250	250	250	IS 13360 (Part 5/Sec 1) and IS 13360 (Part 5/Sec 3) Test conditions – Specimen Type 2 and test speed 500 mm/min
	b) Transverse direction	200	200	200	200	200	-do-
iii)	After ageing at 70 °C ± 1 °C for 168 h, *Max*, kg/cm²						
	a) Longitudinal direction	30 percent decrease from the original					-do-
	b) Transverse direction	-do-					-do-
iv)	Elongation at break, *Min*, percent						
	a) Longitudinal direction	300	400	400	400	400	-do-
	b) Transverse direction	250	300	300	300	300	-do-
v)	Tear strength, *Min*, g:						
	a) Longitudinal direction	650	1 200	2 080	3 200	4 000	Annex G
	b) Transverse direction	450	900	1 600	2 800	3 500	-do-
	After ageing at 70 °C ± 1 °C for 168 h, *Max, g*						
	a) Longitudinal direction	30 percent decrease from the original					-do-
	b) Transverse direction	-do-					-do-
vi)	Dart impact strength, *Min*, g	100	250	400	700	800	Method B of IS 13360 (Part 5/Sec 6)
vii)	Average tensile strength and elongation at break after exposing to UV radiation and weathering, *Min*, (kgf)	50 percent of the original strength					Annex H

[1)] *See* Annex F for calculation of average thickness and tensile strength.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

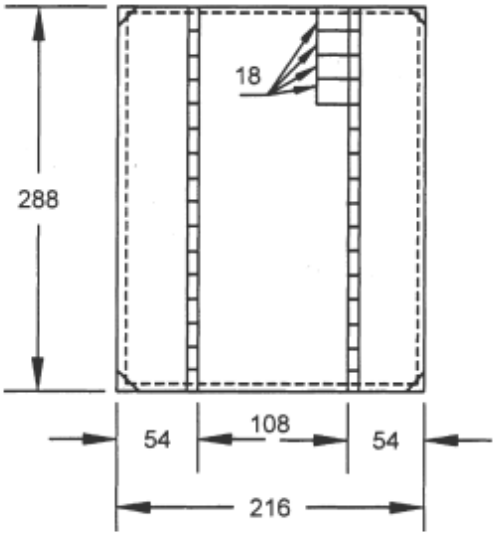
IS No.	*Title*
IS 1070 : 2023	Reagent grade water — Specification (*fourth revision*)
IS 1969 (Part 1) : 2018/ ISO 13934-1 : 2013	Textiles — Tensile properties of fabrics: Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*)
IS 2244 : 1972	Glossary of terms relating to treated fabrics (*first revision*)
IS 2508 : 2016	Polyethylene films and sheets — Specification (*third revision*)
IS 4905 : 2015/ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
IS 7016	Methods of test for rubber or plastics coated fabrics:
(Part 1)	Determination of roll characteristics,
(Sec 1) : 2022/ ISO 2286-1 : 2016	Methods for determination of length, width and net mass (*third revision*)
(Sec 2) : 2019/ ISO 2286-2 : 2016	Methods for determination of total mass per unit area, mass per unit area of coating and mass per unit area of substrate (*second revision*)
(Sec 3) : 2019/ ISO 2286-3 : 2016	Method for determination of thickness (*second revision*)
(Part 4) : 2003/ ISO 7854 : 1995	Rubber- or plastic-coated fabrics — Determination of resistance to damage by flexing (*second revision*)
(Part 7) : 2023/ ISO 1420 : 2016	Determination of resistance to penetration by water (*third revision*)
(Part 8) : 2023/ ISO 1419 : 2019	Accelerated ageing (*first revision*)
IS 13360	Plastics — Methods of testing:
(Part 5)	Mechanical properties,
(Sec 1) : 2021/ISO 527-1 : 2019	Determination of tensile properties — General principles (*second revision*)
(Sec 3) : 2022/ISO 527-3 : 2018	Determination of tensile properties — Test condition for film and sheeting (*second revision*)
(Sec 6) : 1999/ ISO 7765-1 : 1988	Determination of impact resistance by the free-falling dart method — Staircase methods
IS 15827 : 2019	Cladding films for greenhouse/polyhouse — Specification (*first revision*)

ANNEX B

(*Foreword*)

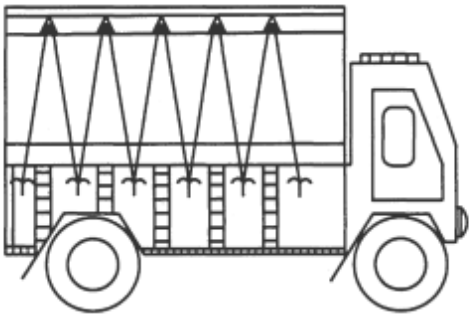
METHODS OF FIXING CROSS LAMINATED TARPAULINS ON TRUCKS

B-1 Two eyelets bands as shown in Fig. 3A and 3B would be provided at approximately 4.5 feet (137.16 cm) distance from the centre of the width of a truck tarpaulins on each side with eyelets placed at every 2 feet (60.96 cm) interval. The rope passes through the top of the tarpaulin. The rope would be passed through these eyelets and hooked on the hooks of the body of the truck and again through the eyelets so on from front to the back of the truck so that the rope is tied only on each side and no rope passes through the top of the tarpaulin.



All dimensins in millimetres.

3A Constructional Detail of Truck-Tarpaulin



3B Fixing of Cross Laminated Tarpaulin on Trucks

FIG. 3 METHODS OF FIXING CROSS LAMINATED TARPAULIN ON TRUCKS

ANNEX C

(*Foreword*)

GENERAL CONSTRUCTION AND METHOD OF INSTALLATION OF VERMIBED

C-1 In the case of vermibed of multilayered cross laminated film, all joints will be double heat sealed. Along the length (longer side), two pockets will be made of 100 mm flat size. One pocket will be at the top of the bed and the second at 300 mm from the bottom. During erection of the vermibed, either a ¾ inch galvanized iron (GI) pipe frame will be made at the top to give the cover a rectangular shape or alternatively, bamboos up to 60 mm diameter can be inserted along the length in the pocket to reduce cost. Plastic/Metal eyelets are provided at equal intervals to fix vertical supports along the length. Spacers of GI pipe or bamboo will be used along the width to give proper shape. Detailed instructions will be provided by the manufacturer.

C-2 The preferred size of the vermibed is 3 600 mm × 1 200 mm × 600 mm (12 feet × 4 feet × 2 feet) of 250 gsm (g/m^2). However, it may be fabricated to any desired size and thickness of film as agreed to between purchaser and supplier. In the dimensions, the tolerance will be (-) 0 inch and (+) up to 6 inch. The product will be packed as agreed to between the purchaser and supplier. A typical design and structure of vermibed is given in Fig. 4(a) and 4(b).

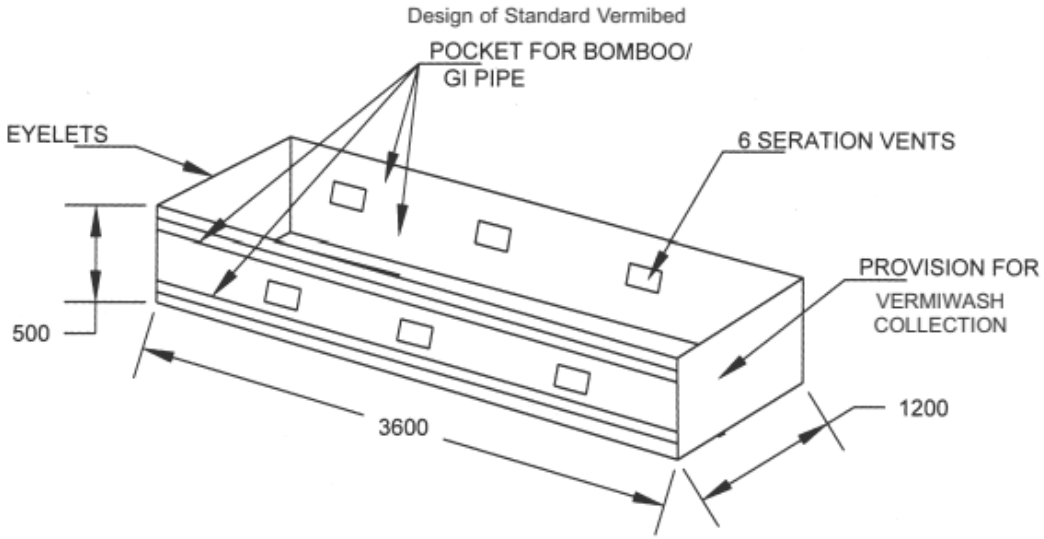


FIG. 4 (A) TYPICAL VERMIBED CONSTRUCTION

E

FIG. 4 (B) INSTALLED STANDARD VERMIBED WITH BAMBOOS

ANNEX D

(*Clause* 6.5)

DETERMINATION OF STRENGTH OF SEAMS

D-1 OUTLINE OF THE METHOD

This test is carried out by applying the load to the test piece for a specified time after fixing the same in a grip.

D-2 APPARATUS

The apparatus consists of two grips capable of accommodating test piece 25 mm in width for welded seams, a suitable stand, a weight support and a series of weights capable of being fitted to the weight support (*see* Fig. 5).

Laboratory screw clips of 40 mm width constitute suitable grips for this test. Means shall be provided for attaching them to the stand and the weight support in such a manner that the tension is uniformly applied to the test specimen.

D-3 PREPARATION OF TEST SPECIMENS

D-3.1 For Welded Seams

A test piece 25 mm wide and approximately 100 mm in length shall be cut at right angles to the direction of the weld in such a manner that the seam is equidistant from each end of the test piece. At least three test pieces shall be cut from each weld.

D-4 PROCEDURE

Mount the test piece in the grips so that the grips are 50 mm apart with the seam equidistant and parallel to each grip. Suspend one grip from the stand and attach to the other grip of the weight carrier. Add the weights to the weight carrier so that the total load applied plus the weight of the carrier is that specified in **6.5** but taking precautions that no tension is applied to the test piece until all the weights have been attached to it. Then release slowly the weight carrier over a period of approximately 2 min and leave suspended for a total period of 60 min from the time of first applying the load.

D-5 REPORT

The material shall be taken to have passed the test, if welding/sealing at the joints remains unchanged after withstanding the specified load for the specified time.

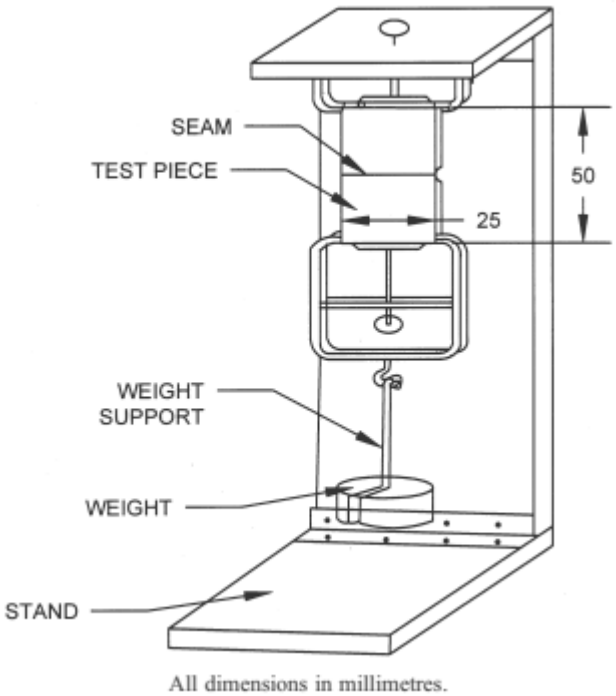


FIG. 5 APPARATUS FOR SEAM STRENGTH TEST

ANNEX E

(*Clause* 6.7)

DETERMINATION OF EASE OF REPAIR OF SHEETS/TARPAULINS/COVERS/AGRICULTURAL FILMS BY ADHESIVE TAPE

E-l OUTLINE OF THE METHOD

Ease of repair of film covered by adhesive tape shall be determined by finding the force required to peel a strip of tape from the surface on which it is applied at a specified angle and speed.

E-2 PROCEDURE

E-2.1 Cut a specimen of 10 cm × 25 cm size from the film cover extended material provided for testing. Clean the surface of specimen with a clean piece of untreated tissue paper, cotton wool or cotton cloth. Apply 30 cm of the adhesive tape of minimum 3 cm width on the specimen in the manner that tape lies centrally on the specimen extending beyond the specimen to be accommodated in the testing equipment.

E-2.2 Place the roller centrally across the test specimen, once in each direction at constant speed of approximately 30 cm/min ensuring that no air bubble is trapped between the tape and the specimen.

E-2.3 Fold the free end of the tape at an angle 180˚ and peel of 3 cm from the specimen leaving 22 cm in contact. Clamp the specimen in the lower jaw of tensile testing machine (a pendulum or spring balance type). Attach the free end of tape to the head of the tension measuring device and disengage the pawls, if any. Start the tensile testing machine taking reading at 2 cm intervals when the tape is pulled from specimen. Disregard the first 5 cm and last 3 cm. The load required to cause the separation of the tape from the specimen shall be reported, in N/cm. The mean of 5 readings shall give the result. If the tape breaks during the test, report the test on another set of test specimens.

ANNEX F

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

CALCULATION OF AVERAGE THICKNESS AND TENSILE STRENGTH

F-1 As the multilayered cross laminated films have corrugated surface, the direct measure of thickness will give misleading results as it will measure the distance between the two peaks only and no consideration will be given for the valleys. To overcome this, the average theoretical thickness of the film shall be calculated by following formula:

$$V \text{ (Volume of 1 m} \times \text{1 m film)} = 1 \text{ m} \times 1 \text{ m} \times \text{average thickness} \qquad \text{...(i)}$$

$$m \text{ (mass of film)} = V \times \text{density}$$

$$V = \frac{m}{Density} \qquad \text{....(ii)}$$

From equation (i) and (ii),

$$\frac{m}{\text{Density}} = 1 \text{ m}^2 \times \text{average thickness}$$

$$\text{Therefore, average thickness} = \frac{m}{\text{Density} \times 1 \text{ m}^2}$$

$$= \frac{\times \text{g}}{0.928 \frac{\text{g}}{\text{cm}^3} \times 10\,000 \text{ cm}^2}$$

NOTE — Density of cross laminated films = 0.928 g/cm^3.

$$\text{Therefore, average thickness} = \frac{X}{9\,280} \text{ cm}$$

Thus, cross-sectional area of 2.5 cm wide film will be: $\frac{2.5 \times X}{9280}$

$= X\ (0.000\ 269\ 4)\ \text{cm}^2$

$\frac{\text{Tensile strength}}{X\ (0.000\ 269\ 3)\ \text{cm}^2}$ = Breaking load, in kg

where X is the mass of the film, in grams per square metre (gsm).

ANNEX G

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

DETERMINATION OF TEARING STRENGTH

G-1 TESTING MACHINE

G-1.1 Pendulum type machine wherein the specimen is held between a pair of clamps, one movable and other stationary and torn by the fall of pendulum through the force of gravity.

G-1.2 Pendulum carrying a circumferential graduated scale so as to indicate the force used in tearing the specimen.

G-1.3 Knife attachment for initial slitting of the specimen. Testing machine is given in Fig. 6.

G-2 PREPARATION OF TEST PIECES

The sample is cut to size with sample cutter. The sample size is 50 mm × 62 mm, the actual tearing length being 43 mm (62 less than the initial incision of 19 mm).

G-3 PROCEDURE

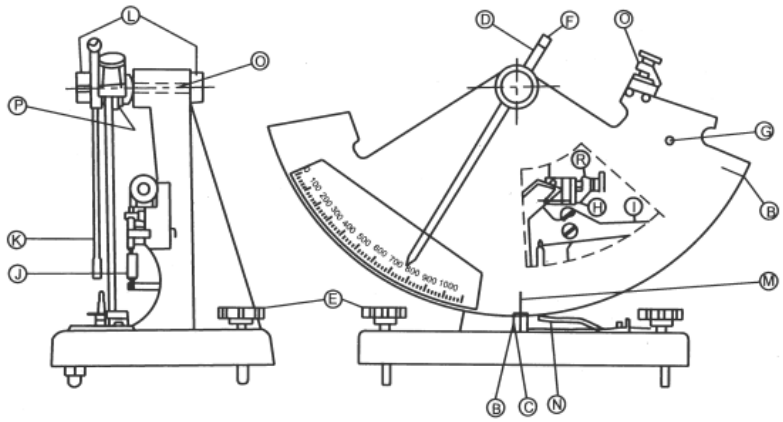
Place the specimen securely in the clamps, slit the specimen midway between the clamps. Place the pointer on the mark given in pendulum. Press the pendulum release, causing the pendulum to fall. Read from the scale, to the nearest division, the force required to tear the specimen. Make not less than five tests in each principle direction of the film that is machine and transverse.

G-4 CALCULATION

The tearing strength shall be calculated, in g.

G-4.1 Factor Calculation

$$= \frac{\text{Obtained reading in milli Newton (mN)} \times \text{Pendulum factor} \times 1\ 000 \times 0.101\ 972\ 62}{1\ 000}$$



Key

B Reference lines on pendulum
C Datum block
D Friction pointer housing and spring
E Levelling screws
F Knurled lock nut
G Calibration weight hole
H Knife blade
I Knife operating lever
J Knife return spring
K Friction pointer
L Plastic retaining knob
M Friction pointer stop
N Pendulum release lever
O Spindle shaft
P Pendulum positioning locking rings
Q Pendulum clamp
R Fixed clamp

FIG. 6 TEARING TESTER

ANNEX H

[*Table* 1, *Sl No.* (vii)]

UV RESISTANCE TEST

H-1 To determine the effect of UV radiation and weathering on the tensile strength, multilayered crosslaminated sheets/tarpaulins/covers/agricultural films shall be exposed as given in **H-2** and **H-3**.

H-2 TEST CONDITION

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

H-2.2 The duration of the test shall be 192 h (that is, eight days) in continuous mode.

H-2.3 The test cycle shall be: 8 h at 60 °C ± 3 °C with UV radiation alternating with 4 h at 50 3 °C ± 3 °C with condensation. Irradiance level throughout the test shall be maintained at $0.63 \pm^{0.04}_{0}$ W/m^2.

H-3 TEST PROCEDURE

H-3.1 Determine the original average tensile strength of fabric as per the test method specified in IS 1969 (Part 1).

H-3.2 Expose the specimens alternately to ultraviolet light and condensation in respective test cycle in continuous mode for total 192 h. The type of fluorescent UV lamp, the timing of the UV and condensation exposure and the temperature of the UV exposure and condensation shall be specified in **G-2**.

H-3.3 Determine the average tensile strength of the fabric separately after UV exposure as mentioned above.

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

Percent retention of original tensile strength

$$= \frac{b}{a} \times 100$$

where

a = average tensile strength before UV exposure as obtained in **H-3.1**; and

b = average tensile strength after UV exposure as obtained in **H-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 test specimen is exposed to the cooling influence of ambient room air.

ANNEX J

(*Clause* 8)

SCALE OF SAMPLING AND CRITERIA FOR CONFORMITY

J-1 LOT

J-1.1 In any consignment, all the rolls of sheets of the same type, colour and finish shall be grouped together and each such group shall constitute a lot.

J-1.2 The conformity of the lot to the requirements of the specification shall be ascertained for each lot separately. The number of rolls n to be selected from a lot shall depend on the size of the lot N and shall be in accordance with Table 2.

Table 2 Number of Rolls of Sheets to be Selected for Sampling

(*Clause* J-1.2)

Sl No.	Lot Size, *N*	Number of Rolls to be Selected, *n*
(1)	(2)	(3)
i)	Up to 50	2
ii)	51 to 100	3
iii)	101 to 200	4
iv)	201 to 300	5
v)	301 to above	7

The rolls of sheets shall be selected at random and to ensure the randomness of selection, random number tables shall be used (*see* IS 4905). In case such tables are not available, the following procedure may be adopted subject to agreement between the purchaser and the supplier:

Arrange all the rolls in the lot in a systematic manner and starting from any roll, count them as 1, 2, 3... etc, up to *r* and so on, where *r* being the integral part of *N/n* (*N* being the lot size and *n* the sample size). Every r^{th} roll thus counted shall be withdrawn till the requisite number of rolls is obtained.

J-1.3 Number of Tests

J-1.3.1 From each of the rolls selected according to **J-1.1**, one meter length of thermoplastic sheet shall be cut, care being taken to exclude not less than 0.25 m length of the material from either end. The test specimens necessary for the various tests specified in the standard shall be cut from the length of thermoplastic sheet thus obtained.

J-1.3.2 All the tests shall be conducted on each test specimens cut from these meter lengths as obtained in **J-1.3.1**.

J-1.3.3 The material in the lot shall be tested for tests given in **6.1** to **6.8**. For this purpose, test specimens of suitable length may be taken.

J-1.3.4 Strength of welded joints may be tested on a piece cut out from actual film covers.

J-1.4 Criteria for Conformity

The lot shall be declared as conforming to the requirements, if the entire test specimen passes all the tests given in **6.1** to **6.8**.

J-2 SAMPLING OF SHEETS/TARPAULINS/ COVERS/AGRICUL TURAL FILMS

J-2.1 Lot

All the sheets/tarpaulins/covers/agricultural films produced from essentially similar type materials by the same manufacturer shall be grouped together to constitute a lot.

J-2.2 Each lot shall be inspected separately for the requirements of this standard. For this purpose, from each lot a number of covers shall be selected at random in accordance with col (2) and (3) of Table 3.

The number of covers required in co1 (3) of Table 3 shall be taken equally from as many bales as possible. The covers to be taken from a bale shall be chosen at random.

J-3 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

J-3.1 Each one of the covers selected for inspection shall be examined for visual defects, if any and for construction requirements laid down by the buyer. A cover failing in one or more of these requirements shall be regarded as defective.

J-3.2 Mass of each cover selected for test shall fall within the range specified by the purchaser. However, the buyer, if he so desires may check each cover purchased for mass.

J-3.3 The tarpaulin covers selected for test shall be tested for all the requirements specified in **6**. The lot shall be declared to be in conformity with these requirements, if each of these cover satisfies all the requirements.

NOTE — If the buyer so desires the portion of the cover from where the sample has been cut out for the test, shall be mended by the manufacturer.

Table 3 Scale of Sampling of Sheets/Tarpaulins/Covers/Agricultural Films

(*Clause* J-2.2)

Sl No.	No. of Covers in the Lot	No of Covers to be Inspected	Permissible Number of Defectives	No of Covers to be Tested
(1)	(2)	(3)	(4)	(5)
i)	Up to 100	13	1	1
ii)	101 to 300	20	2	2
iii)	301 and over	32	3	3

ANNEX K

(*Foreword*)

COMMITTEE COMPOSITION

Plastics Sectional Committee, PCD 12

Organization	*Representative(s)*
Central Institute of Petrochemicals Engineering & Technology (CIPET), Chennai	DR SHISHIR SINHA **(*Chairperson*)**
All India Plastics Manufacturers Association (AIPMA), New Delhi	SHRI DEEPAK BALLANI
Central Institute of Petrochemicals Engineering & Technology (CIPET), Chennai	DR S. N. YADAV DR SMITA MOHANTY (*Alternate*)
Central Pollution Control Board, New Delhi	SHRIMATI DIVYA SINHA SHRI C. K. DIXIT (*Alternate*)
Chemical and Petrochemical Manufactures Association (CPMA), New Delhi	SHRI UDAY CHAND
Coca-cola India Pvt Ltd, Gurugram	SHRI VIRENDRA LANDGE SHRI RAJENDRA DOBRIYAL (*Alternate*)
CSIR - Central Food Technological Research Institute (CFTRI), Mysuru	SHRI R. S. MATCHE SHRI KESHAVA MURTHY P. (*Alternate*)
CSIR - Indian Institute of Toxicological Research (IITR), Lucknow	DR V. P. SHARMA DR A. B. PANT (*Alternate*)
CSIR - National Chemical Laboratory (NCL), Pune	DR P. R. SURESHA SHRIMATI SANGEETA HAMBIR (*Alternate* I) DR R. V. GUNDLOORI (*Alternate* II)
Department of Chemicals & Petrochemicals, Min. of Chemicals & Fertilizers, New Delhi	SHRI O. P. SHARMA SHRI VARUN SINGH POONIA (*Alternate*)
Food Corporation of India (FCI), Delhi	SHRI RAJAGOPAL A. SHRI A. K. U. B. SINGH (*Alternate*)
Food Safety and Standards Authority of India (FSSAI), Delhi	SHRI CHIRAG GADI
GAIL (India) Ltd, Noida	SHRI MANISH KHANDELWAL
Haldia Petrochemicals Limited, Kolkata	SHRI RAJ K. DATTA SHRI SUVOMOY GANGULY (*Alternate*)
HPCL Mittal Energy Limited (HMEL), Noida	SHRI VINEET KUMAR GUPTA SHRI ALAKESH GHOSH (*Alternate*)
Huhtamaki India Ltd, Mumbai	SHRI MUTHUSAMY CHOCKALINGAM SHRI AISHWARYA VANGE (*Alternate*)
Indian Pharmacopoeia Commission, Ghaziabad	DR JAI PRAKASH DR MANOJ KUMAR PANDEY (*Alternate*)
IIT, Delhi	SHRI ANUP K. GHOSH

Organization	*Representative(s)*
Indian Centre for Plastics in the Environment (ICPE), Mumbai	SHRI T. K. BANDOPADHYAY SHRI ARUNAVA GUHA (*Alternate*)
Indian Flexible Packaging & Folding Carton Manufacturers Association (IFCA), Mumbai	SHRI ATIN CHAUDHURI
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Ministry of Environment & Forests (MoEF), New Delhi	SHRI SATYENDRA KUMAR SHRI AMIT LOVE (*Alternate*)
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ONGC Petro Additions Ltd (OPAL), Dahej	SHRI VIVEK MEHTA
Organization of Plastics Processors of India, Mumbai	SHRI DEEPAK LAWALE
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Member Secretary
SHRI SHIVAM DWIVEDI
SCIENTIST 'B'/ASSISTANT DIRECTOR
(PETROLEUM, COAL AND RELATED PRODUCTS), BIS

(*Continued from second cover*)

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.

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