भारतीय मानक **IS 14995 : 2024**

Indian Standard

खिंचावदार क्लिंग फिल्में — विशिष्टि

(पहला पुनरीक्षण)

Stretch Cling Films — Specification

(First Revision)

ICS 83.140.20

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard (First 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.

Stretch wrapping is a cost effective and highly efficient means of unitization. It is applied by a hand dispenser or by machine to the load or pallet and is ideal for any type of regular or irregular sized product, inclusive of wrapping heavy machinery. Its chemical composition gives it high tensile strength and memory providing a rubber band effect. Consequently, stretch cling film holds securely in place, regardless of handling conditions and adjusts to loads that shift or settle after packing.

The use of stretch film for safe transportation of palletized products such as tea, chemicals and machinery, would be particularly gainful for exports. Stretch cling films have wider acceptance in home markets as well as exports. The application areas include:

a) *For lighter loads up to* 350 kg — for protection without crushing such as potato crisps where the packed load requires protection against dust, pilfer-proofness or humidity during storage;
b) *For assorted loads between* 350 kg *and* 750 kg — for users demanding high load security at lower unit cost;
c) *For loads from* 750 kg *up to* 1 tonne — as protection for general applications; and
d) *For loads exceeding* 1 tonne — for palletized goods and heavy irregular loads providing extra holding force and toughness.

This Indian Standard was first published in 2001.

The modifications in this revision are as follows:

a) Cross-referred standard has been updated; and
b) Editorial changes have been done.

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

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

STRETCH CLING FILMS — SPECIFICATION

(First Revision)

1 SCOPE

1.1 This standard prescribes the requirements, methods of sampling and test for stretch cling films.

1.2 This standard covers flexible unsupported tubular/cast films of 10 µm and above in thickness made from natural compound of linear low density polyethylene (LLDPE) having density between 910 kg/m^3 to 940 kg/m^3 at 27 °C or any other polymeric materials or blend that meets the requirement of this standard.

1.3 Coloured films shall be as agreed to between the purchaser and the supplier.

2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of the 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 edition of these standards.

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 2828 and the following shall apply.

3.1 Core Extension — The length to which the core extends beyond the edges of the wrap material.

3.2 Cling — The property of material's ability to adhere to itself or another surface.

3.3 Elastic Recovery — The extent that a material returns to its original length after being subjected to an extension.

3.4 Food Wrap Material — A material designed for use in direct food contact.

3.5 Linear Low Density Polyethylene (LLDPE) — It is a copolymer or terpolymer of ethylene produced by catalytic polymerization of ethylene with other 1-alkenes having density in the range of 910 kg/m^3 to 940 kg/m^3 at 27 °C.

3.6 Manual Stretch Cling Film — A mode of stretch cling film wrapping manually.

3.7 Stretch Cling Material — The material used for overwrapping, which when applied under tension, elongates and through elastic recovery conforms to the item packaged.

3.8 Stress Retention — The residual load expressed as a percentage of original load on the material after the test specimen has been maintained at a constant elongation for a specified time.

3.9 Overlap — The width of stretch cling material that covers a previous layer of stretch cling material.

3.10 Power Stretch Cling — A mode of stretch wrap machinery operation in which wrap material elongation is achieved through the use of power assist pre-stretch device and relative load motion.

3.11 Tapeless Measure — A device that measures linear distance using the number of rotations of a wheel in contact with the surface of the material to be measured.

3.12 Tear — Self-propagating tear resistance.

3.13 Yield (Coverage) — Area per unit weight.

4 MATERIAL

4.1 The material used for manufacturing natural stretch wrap/cling film shall be linear low density polyethylene, having density between 910 kg/m^3 to 940 kg/m^3 at 27 °C (*see* IS 7328) or any polymeric material or blend that meet the requirement of this standard. Any additive, to impart cling properties of the film may be added to the resin in quantity as agreed to between the supplier and purchaser.

4.2 When the film is meant for food contact applications the inputs shall comply with the requirement of IS 10146.

5 MATERIAL CLASSIFICATION

Stretch cling film shall be of the following grades:

a) *Grade* 1 — Manual stretch cling film; and
b) *Grade* 2 — Power stretch cling film

6 REQUIREMENTS

6.1 General

6.1.1 *Appearance*

The material shall be uniform in colour, texture and finish. The material shall be free from streaks and

foreign particles. There shall be no other visible defects, such as holes, tears or blisters. The edges shall be free from nicks and cuts visible to naked eye. The natural films shall be free from pin holes and free from defects that may affect the serviceability such as wrinkles, fold-over creases and gels.

6.1.2 *Film Form*

The film shall be furnished in the form of roll or in any other form as agreed to between the purchaser and the supplier.

6.1.3 *Odour*

The film shall be free from any objectionable odour.

6.1.4 No splices are allowed.

6.2 Dimensional Requirements

The material dimensions and their permissible variations shall conform to the following, unless otherwise specified by the user.

6.2.1 *Nominal Thickness and Nominal Width*

Nominal thickness and width are as desired for a particular application.

6.2.2 *Tolerance on Thickness*

Tolerance on nominal thickness at any one point for the average of five consecutive points across the width measured in a minimum of 25 mm increments for various thickness when tested in accordance with Annex C of IS 2508 shall be as given in Table 1.

The thickness of the film shall be determined on the basis of the mass per square meter of the film. Specimen size 10 cm × 10 cm piece of the film and balance capable of measuring to the nearest 0.1 mg mass of the film shall be used.

Calculate the thickness of the film by the following equation:

$$T = \frac{W}{A \times D}$$

where

T = thickness in microns;

W = mass of the specimen in g;

A = area of specimen (m^2); and

D = density in gm/cm^3.

6.2.3 *Tolerance on Width*

Unless otherwise agreed to between the purchaser and the supplier, the tolerance on width shall be as given in Table 2. Roll width shall be measured by a steel tape having an accuracy of 1 mm.

Table 1 Tolerance on Thickness

(*Clause* 6.2.2)

Sl No.	Nominal Thickness	Tolerance, Percent
(1)	(2)	(3)
i)	Up to and including 25 µm	± 20
ii)	Above 25 µm	± I5

Table 2 Tolerance on Width

(*Clause* 6.2.3)

Sl No.	Nominal Width	Tolerances, mm
(1)	(2)	(3)
i)	Up to 500 mm	± 5
ii)	Above 500 mm and up to 1250 mm	± 8
iii)	Above 1250 mm	± 20

6.2.4 *Tolerance on Diameter*

The roll diameter tolerance shall be ± 5 percent of nominal outside diameter.

6.2.5 *Tolerance in Length*

The length per roll of stretch cling film material shall be within ± 7.5 percent of length as marked or otherwise agreed to between the purchaser and supplier when measured by tapeless measure.

6.3 Yield Tolerance

The actual yield shall be within the tolerance limits of the nominal yields when determined in accordance with the method given in Annex E.

	Yield tolerance, percent
Any one roll	± 7
Lots over 25 rolls	± 5

6.4 Mechanical and Physical Properties

6.4.1 *Impact Strength* (*Falling Dart*)

The impact failure load obtained from the dart of 66 cm (± 1 cm) shall not be less than the values given in Table 3 for appropriate average thickness of the film when tested in accordance with IS 13360 (Part 5/Sec 6).

6.4.2 *Clarity and Haze*

Haze of the stretch cling film shall conform to the requirements given in Table 4 when tested in accordance with IS 13360 (Part 9/Sec 5).

6.4.3 *Ultimate Tensile Strength*

The minimum tensile strength at break for various thicknesses of stretch cling film, at different levels of impact strength shall be as given in Table 5 when tested in accordance with IS 13360 (Part 5/ Sec 3).

Table 3 Impact Strength (Falling Dart)

(*Clause* 6.4.1)

Sl No.	**Average Thickness of the Film** (µm)	**Impact Failure Load (gf),** *Min*	
		Grade 1 (Manual Stretch)	Grade 2 (Power Stretch)
(1)	(2)	(3)	(4)
i)	15	60	80
ii)	25	80	100
iii)	35	100	120
iv)	45	120	140
v)	50	130	150

NOTE — The value of impact failure load for intermediate thickness may be obtained by interpolation.

Table 4 Clarity and Haze

(*Clause* 6.4.2)

Sl No.	**Grade**	**45° Gloss**	**Haze, Percent**
(1)	(2)	(3)	(4)
i)	Normal clarity film	30 to 35	10 to 15
ii)	High clarity film	> 55	< 10

Table 5 Ultimate Tensile Strength

(*Clause* 6.4.3)

Sl No.	**Tensile Strength at Break** (kg/cm^2)	**Grade 1 (Manual Stretch)**	**Grade 2 (Power Stretch)**
(1)	(2)	(3)	(4)
i)	Machine direction (MD)	200	300
ii)	Transverse direction (TD)	175	250

6.4.4 *Elongation at Break*

The elongation at break for various thicknesses of stretch cling film, at different levels of impact strength shall not be less than the values given in Table 6 when tested in accordance with IS 13360 (Part 5/See 3).

6.4.5 *Force of Elongation at* 100 *percent,* 150 *percent and* 200 *percent in Machine Direction*

The force taken by the specimen of 25 mm width at 150 mm/min to an extension of 100 percent, 150 percent and 200 percent for various thicknesses of stretch cling film at different level of impact strength, shall not be less than the values given in Table 7 when tested in accordance with IS 13360 (Part 5/Sec 3).

6.4.6 *Elastic Recovery/Stress Retention in Machine Direction*

The elastic recovery and the stress retention in machine direction obtained at 150 percent elongation shall not exceed 60 percent and 70 percent respectively when tested in accordance with the method given in Annex B.

6.4.7 *Tear Propagation*

The tear propagation of stretch cling film shall not be less than the values given in Table 8 for appropriate average thicknesses of the film when tested in accordance with the method given in Annex C.

Table 6 Elongation at Break

(*Clause* 6.4.4)

Sl No.	**Thickness of Film,** µm	**Elongation Percent at Break,** *Min*			
		Grade 1 (Manual Stretch)		Grade 2 (Power Stretch)	
		MD	TD	MD	TD
(1)	(2)	(3)	(4)	(5)	(6)
i)	10 to 20	300	400	400	500
ii)	above 20 up to 40	400	500	500	600
iii)	above 40	500	600	700	800

Table 7 Force of Elongation at 100 Percent, 150 Percent and 200 Percent in Machine Direction

(*Clause* 6.4.5)

Sl No.	**Thickness of Film,** µm	**Elongation,** Percent	**Force,** kg/cm^2
(1)	(2)	(3)	(4)
i)		100	50
ii)	10 to 30	150	70
iii)		200	100
iv)		100	80
v)	Above 30	150	100
vi)		200	125

Table 8 Tear Propagation

(*Clause* 6.4.7)

Sl No.	**Thickness** µm	**Tear Propagation,** kg/cm			
		Grade 1 (Manual Stretch)		Grade 2 (Power Stretch)	
		MD	TD	MD	TD
(1)	(2)	(3)	(4)	(5)	(6)
i)	10 to 30	70	80	80	100
ii)	Above 30	80	90	100	120

6.4.8 *Peel Cling of Stretch Cling Film*

The peel cling of the stretch cling film shall be as agreed to between the supplier and the purchaser and shall be determined in accordance with the method given in Annex D.

7 ORDERING INFORMATION

The inquiry and order for materials shall indicate the following where applicable:

a) Grade colour required;
b) Thickness;
c) Material length per roll;
d) Outside roll diameter;
e) Material width; and
f) Core dimension (inside diameter) and extension.

NOTE — Where necessary, ordering information may be expanded or modified for special uses.

8 PACKING AND MARKING

8.1 Packing

The roll of stretch cling film shall be packed as agreed between the purchaser and the supplier.

8.2 Marking

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

a) Manufacturer's name and recognized trade-mark, if any;
b) Batch No. and date of manufacture;
c) Product name (grade);
d) Material length per roll in metres;
e) Material weight per roll in kg;
f) Width and thickness of the roll; and
g) Any other statutory requirements.

8.2.2 *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.

9 SAMPLING

9.1 Lot

9.1.1 In any consignment, all rolls of stretch cling film of the same grade shall be grouped together to constitute a lot.

9.1.2 Test for determining the conformity of the lot to the requirements of the specification shall be done on each lot separately. The number of rolls of the film to be selected for this purpose shall be in accordance with col (3) of Table 9.

9.1.3 The rolls of stretch cling films shall be selected at random from the lot. In order to ensure randomness of selection, procedures given in IS 4905 maybe followed. Alternately, the following procedure may be adopted:

Starting from any roll of the film in the lot, count them in one order as 1, 2 .....etc, up to *r* and so on, where *r* is the integral part of *N/n*. Every r^{th} roll of the film thus counted shall be withdrawn till the required number of rolls of the films are taken from the lot.

9.2 Number of Tests and Criteria for Conformity

9.2.1 From each of the roll of the film selected according to **9.1.3**, approximately 10 m^2 of the film of full width shall be cut, care being taken to exclude not less than 2 m lengths of film (or three full turns of the roll) from either end. The test specimens for the various tests shall be cut from different parts of each of the 10 m^2 pieces.

9.2.2 Each of the pieces as obtained in **9.2.1** from a lot shall be examined for general requirements (*see* **6.1**), dimensional requirements (*see* **6.2**) and yield tolerance (*see* **6.3**). Any piece which does not meet the requirement of any of the above characteristics shall be considered as defective.

9.2.3 If the number of defective piece found (*see* **9.2.2**) is less than or equal to the corresponding permissible number of defective given in co1(4) of Table 9, the lot shall be tested for the remaining requirements of the specification. If the number of defective found is more than the corresponding permissible number given in col (3) of Table 9, one more lot of samples may be examined.

9.2.4 The lot having been found satisfactory according to **9.2.3** shall be tested for mechanical and physical properties (*see* **6.4**). For this purpose, the rolls already tested according to **9.2.2** and found satisfactory shall be used for testing any of these characteristics. Specimen(s) for these tests shall be cut from 10 m^2 piece already taken from each roll/ folded film selected (*see* **9.2.1**).

The lot shall be deemed to have satisfied these requirements if all the test results for different characteristics given above are found meeting the relevant requirements of the specification.

9.2.5 The lot shall be declared as conforming to the requirements of the specification, if the requirements for various characteristics as given in **9.2.3** and **9.2.4** are satisfied.

Table 9 Scale of Sampling and Permissible Number of Defective

(*Clauses* 9.1.2 *and* 9.2.3)

Sl No.	Lot Size (*N*)	Number of Rolls/ Folded Films to be Selected (*n*)	Permissible Number of Defective
(1)	(2)	(3)	(4)
i)	1	1	0
ii)	2 to 15	2	0
iii)	16 to 40	3	0
iv)	41 to 65	5	0
v)	66 to 110	7	0
vi)	111 to 180	10	0
vii)	181 to 300	15	1
viii)	301 to 500	25	1
ix)	501 to 800	35	2
x)	801 to 1 300	50	3
xi)	1 301 and above	75	4

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No.	*Title*
IS 2508 : 2016	Polyethylene films and sheets — Specification (*third revision*)
IS 2828 : 2019/ISO 472 : 2013	Plastics — Vocabulary (*second revision*)
IS 4905 : 2015/ISO 24153 : 2009	Random sampling and randomization procedures (*first revision*)
IS 10146 : 1982	Specification for polyethylene for its safe use in contact with foodstuffs, pharmaceuticals and drinking water
IS 13360	Plastics — Methods of testing:
(Part 5)	Part 5 Mechanical properties,
(Sec 3) : 2022/ISO 527-3 : 2018	Section 3 Determination of tensile properties — Test conditions for film and sheets (*second revision*)
(Sec 6) : 1999/ ISO 7765-1 : 1988	Determination of impact resistance by the freefalling dart method — Staircase methods
IS 14500 : 1998	Linear low density polyethylene (LLDPE) films — Specification

ANNEX B

(*Clause* 6.4.6)

DETERMINATION OF ELASTIC RECOVERY AND STRESS RETENTION OF STRETCH CLING FILM IN MACHINE DIRECTION

B-1 GENERAL

This test method covers the measurement of recovery for extension and retention of stretch cling film.

B-2 TERMINOLOGY

B-2.1 Elastic Recovery — The percentage of the given deformation that behaves elastically after 180 s, when subjected to the extension prescribed in this test method. It is related to the ability of a package to resume its original shape after being distended during its use cycle.

B-2.2 Stress Retention — The percentage of stress retained after 60 s or 24 h or both after application. It is related to the tightness of a package.

B-3 APPARATUS

B-3.1 Tensile Testing Machine — with a reversible chart.

B-3.2 Specimen Cutter — capable of producing nick free 25 mm ± 0.03 mm testing strips.

B-3.3 Micrometer — capable of measuring the thickness of the specimens.

B-4 TEST SPECIMEN

B-4.1 Test specimen are taken from several rolls of the film and when possible, from several production runs of a product. Strong conclusion about a specific property of a film cannot be based on a single roll of product.

B-4.2 Cut five specimens parallel to the machine direction that are 25 mm wide and long enough to provide for an initial grip separation of 127 mm. Measure the thickness of each specimen. Condition the test specimens at standard atmospheric condition for not less than 24 h prior to testing.

B-5 PROCEDURE

B-5.1 Clamp the first specimen in the grips so that it is free to slack but is not under tension.

B-5.2 Start the testing machine and chart and elongate the specimen at 150 mm/min to an extension of 100 percent, 150 percent, and 200 percent and stop the testing m/c and chart. Note down the force at 100 percent, 150 percent and 200 percent elongation (*see* Fig. 1 at extension *AE*, curve *AB* is generated).

B-5.3 Wait 60 s or 24 h, during which time specimen will relax [extension *BG* is generated (*see* Fig. 1)].

B-5.4 When testing materials of unknown response, investigate a series of times of recovery.

B-5.5 Return the crosshead to the original grip separation simultaneously reversing the chart [curve *GCA* is generated, (*see* Fig. 1)].

B-5.6 Wait 180 s, re-elongate the specimen to the same extension as used originally in point 2 [curve *ADX* is generated, (*see* Fig. 1)].

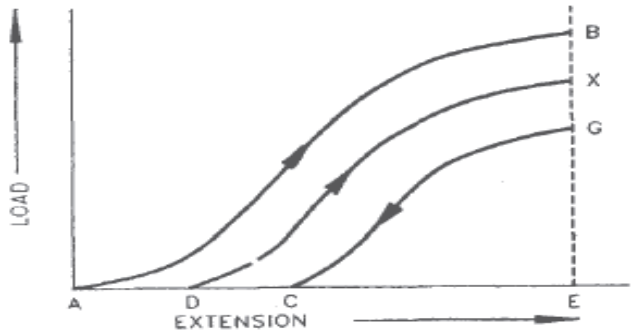

FIG. 1 LOAD VERSUS EXTENSION CURVES

B-5.7 Repeat the procedure for other four specimens also.

B-6 ASSESSMENT OF RESULTS

B-6.1 Determine the length of *DE* and *AE* in chart units and calculate the elastic recovery percent using following equation:

$$\text{Elastic recovery percent} = (DE/AE) \times 100$$

B-6.2 Determine the length *BE* and *GE* in chart units and calculate the stress retention percent using the following equation:

$$\text{Stress retention percent} = (GE/BE) \times 100$$

B-6.3 Read and record the force at point *G* in kg of different percentage of elongations. Stress retention at 150 percent elongation: the average stress retention at 150 percent elongation is 70 percent.

Elastic recovery at 150 percent elongation is 60 percent.

ANNEX C

(*Clause* 6.4.7)

DETERMINATION OF TEAR PROPAGATION

C-1 GENERAL

This method covers the determination of the force measuring to propagate a tear in stretch cling film.

C-2 TERMINOLOGY

C-2.1 Tear Propagation Resistance — It is a force required to propagate a tear of stretch cling film. The transverse direction tear strength is most important tear measurement because if the tear propagates in vertical direction of a load then the pack completely loses its stability.

C-3 APPARATUS

C-3.1 Tensile Testing Machine

C-3.2 Specimen Cutter

C-3.3 Micrometer

C-4 TEST SPECIMEN

The specimen shall be of the single tear type and shall consists of strip 75 mm long by 25 mm wide and shall have a clean longitudinal slit of 50 mm long cut with a sharp cutter. Thickness to be measured below the slit. Minimum five strips to be tested each in the machine direction and transverse direction of the material being used.

C-5 PROCEDURE

Secure tongue '*A'* in one grip and tongue '*B*' (*see* Fig. 2) in the other grip of the tensile testing machine using an initial grip separation of 50 mm. Align the specimen so that its major axis coincides with an imaginary line joining centre of the grips. Using a grip separation speed of 150 mm/min, start the machine and record the load necessary to the tear through the entire unslit 25 mm portion of the specimen. Take the average results of five specimens in each of the principle film in each direction and report.

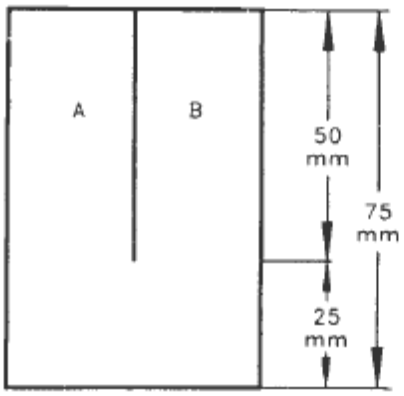

FIG. 2 GRIPS

ANNEX D

(*Clause* 6.4.8)

DETERMINATION OF PEEL CLING OF STRETCH CLING FILMS

D-1 GENERAL

This test method measures cling between two layers of film in both stretched and unstretched conditions. This test method is a peel cling procedure. A 25 mm wide film strip is adhered to a flat film attached to an inclined surface. The force required to remove the film strip from the flat film is measured.

D-2 TERMINOLOGY

D-2.1 Peel Cling of Stretch Cling Film — This a force required for peeling the cling to cling surface of the film.

D-3 APPARATUS

D-3.1 A Universal Testing Machine — with load cell 1 000 g load capacity.

D-3.2 Cling Attachment — with pulley at one corner.

D-3.3 Cling Clamp

D-3.4 String — non-elastic

C-3.5 Separation Bond Paper

D-3.6 Steel Rod — 6 mm thick × 250 mm long.

D-4 PROCEDURE

D-4.1 Install the cling film base attachment with universal testing machine and level the base. Set the testing machine crosshead speed for 150 mm/min. Feed the end of the string not fastened to the clamp through the pulley on the cling attachment and place in the centre of the upper jaw. The sampling and number of specimens depends on the purpose of testing. The test specimen should be taken from several rolls of the film and when possible from several production runs of a product. Strong conclusions about a specific property of a film cannot be based on a single roll of product.

D-4.2 The roll to be tested must have three outer wrap removed just prior to sample selection. Perform testing outside surface to inside surface, and conduct testing within 30 min of sample preparation. In case of single side cling film, it may be necessary to test outside-to-outside surface or inside-to-inside surface. Place the film being sampled on the glass cutting surface without touching the film test surface, without creating any wrinkles in machine direction with the outer surface up. Align the paper sheets under and over the film to make paper/film/paper sandwiches. Cut the specimen from the sandwich 25 mm (TD) × 175 mm (MD). Place a 125 mm × 500 mm sample squarely on the incline face with its outside surface up. Direction of the film parallel to the length of the block pulling lightly to eliminate the wrinkles with stretching the film. Roll the free end of the film on the steel rod to within 25 mm. Take the corresponding 25 mm wide paper/film/paper sandwich sample and slide the paper to exposed about 12.5 mm of film. With the outside surface up, place this exposed film section on the inclined film sample and at the top of the incline. Align it so that the remainder of the sample, with paper still in place will lie between the parallel guide lines that run full face length of the incline. Grasp the opposite end of the paper and gently pull the paper away from the film creating a smooth contact surface with the sample. Roll the lower end of the 25 mm sample and insert it in the film clip. Start the machine, at the moment when the 25 mm film sample is separating from the incline at the horizontal cling line, the force is to be observed. This value is the cling force.

D-5 ASSESSMENT OF THE RESULTS

Cling values are reported in N/mm^2.

ANNEX E

(*Clause* 6.3)

DETERMINATION OF YIELD TOLERANCE

E-1 Calculation of Actual Yield

Yield is the amount of area provided by a given mass of a film of specified thickness. The actual yield Y_a shall be calculated as follows:

$$Y_a, \text{ cm}^2/\text{kg} = A/M$$

where

A = area in cm^2 calculated from the length and the width of the roll/folded film; and

M = mass, in kg, of the film on the roll/folded film.

E-2 Calculation of Nominal Yield

The nominal yield Y_n shall be calculated as follows:

$$Y_n, \text{ cm}^2/\text{kg} = \frac{1\,000}{d \times t}$$

where

d = density, in g/ml, as determined in accordance with IS 13360 (Part 3/ Sec 10), IS 13360 (Part 3/Sec 11) and IS 13360 (Part 3/Sec 12); and

t = nominal thickness in cm as determined in Annex C of IS 2508.

E-3 Calculation of Deviation of Actual Yield from the Nominal Yield

The deviation of actual yield from the nominal yield shall be calculated as follows:

$$D = \frac{Yn - Ya}{Yn} \times 100$$

where

D = deviation from the nominal yield in percent; and

Y_n, Y_a = nominal yield and actual yield as determined in **E-2** and **E-1** respectively.

ANNEX F

(*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)
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