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**Testing methods of plastic films for
electrical purposes**

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Japan Electrical Insulating and Advanced Performance Materials Industrial Association (JEIA)/Japanese Standards Association (JSA) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently JIS C 2151:1990 is replaced with this Standard.

This Standard has been made based on IEC 60674-2:1988 *Specification for plastic films for electrical purposes—Part 2 : Methods of test* for the purpose of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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Contents

	Page
Introduction	1
1 Scope	1
2 Normative references	1
3 General notes on tests	3
4 Thickness	3
4.1 Determination of thickness by micrometer	3
4.2 Determination of gravimetric thickness of a sample	4
4.3 Determination of average gravimetric thickness of a roll	4
5 Density	4
6 Width	4
7 Windability (bias/camber and sag)	4
7.1 Principle	4
7.2 Introduction	4
7.3 Method A	5
7.4 Method B	7
8 Coefficient of friction	9
9 Wetting tension (polyolefine films)	9
9.1 Test principle and introductory remarks	9
9.2 Apparatus	10
9.3 Reagents	10
9.4 Test specimens	11
9.5 Conditioning	11
9.6 Procedure	11
9.7 Evaluation	12
9.8 Report	12
10 Tensile properties	12
10.1 Test specimens	12
10.2 Speed of testing	12
10.3 Result	12
11 Edge tearing resistance	12
11.1 Method A	12
11.2 Method B	13
12 Tear resistance	14
13 Stiffness of film	14

14	Surface resistivity	14
15	Volume resistivity	14
15.1	Method A : Electrode method	14
15.2	Method B : Method for wound capacitor dielectric films or films too thin for Method A	15
16	Dissipation factor and permittivity	16
16.1	Method A	16
16.2	Method B	20
17	Electric strength	21
17.1	A.C. test	21
17.2	D.C. test	21
18	Electrical weak spots	22
18.1	Method A (Testing narrow strips of film in long lengths)	22
18.2	Method B (Testing wide strips of film)	24
18.3	Method C (Testing of film in rolls)	25
18.4	Method D (roller-electrode gap method)	26
19	Resistance to breakdown by surface discharges	27
20	Electrolytic corrosion	27
21	Dimensional change	27
21.1	Test specimens	27
21.2	Procedure	28
21.3	Results	28
22	Dimensional stability under tension with rising temperature	28
22.1	Test specimens	28
22.2	Procedure	28
22.3	Results	29
23	Dimensional stability under pressure with rising temperature	29
23.1	Test equipment and instrument	29
23.2	Test specimens	29
23.3	Procedure	29
23.4	Results	29
24	Resistance to penetration at elevated temperature	30
25	Volatile content (loss of mass on heating)	30
25.1	Test specimens	30
25.2	Procedure	30
25.3	Result	30
26	Thermal endurance	30
27	Burning characteristics	30
27.1	Apparatus	30
27.2	Test specimens	31

27.3	Conditioning	31
27.4	Procedure	31
27.5	Interpretation of results	32
28	Water absorption in a damp atmosphere	33
28.1	Apparatus	33
28.2	Test specimens	33
28.3	Procedure	33
28.4	Results	34
29	Absorption of liquid	34
29.1	Principle	34
29.2	Apparatus	34
29.3	Test specimens	34
29.4	Procedure	34
29.5	Calculations	35
29.6	Result	35
30	Ionic impurities	35
31	Effect of insulating varnishes	35
31.1	Procedure	35
31.2	Results	36
32	Effect of polymerisable resinous compounds in a liquid state	36
32.1	Procedure	36
32.2	Results	36
Annex 1 (informative)	Test method of coefficient of friction	37
Annex 2 (informative)	Test method of surface resistivity and volume resistivity	41
Annex 3 (informative)	Comparison table between JIS and corresponding International Standard	49

Testing methods of plastic films for electrical purposes

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **IEC 60674-2** *Specification for plastic films for electrical purposes—Part 2 : Methods of test* published in 1988, and Amendment 1 (2001) with some modifications of the technical contents. The Amendment to the said International Standard has been edited and integrated into this Standard.

The portions with continuous sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with explanations is given in Annex 3 (informative).

1 Scope This Standard specifies testing methods of plastic films to be used for electrical equipment, electronic equipment, wires, general electrical insulation, capacitors, etc.(hereafter referred to as “films”).

NOTE : The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between **JIS** and the relevant International Standard are IDT (identical), MOD (modified) and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

IEC 60674-2 : 1988 Specification for plastic films for electrical purposes—Part 2 : Methods of test and Amendment 1 (2001) (MOD)

2 Normative references The following standards contain provisions which, through reference in this text, constitute the provisions of this Standard. If the indication of the year of publication is given to these referred standards, only the edition of the indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply. The normative references without the indication of the year of coming into effect or the year of publication apply only to the most recent edition (including amendments).

JIS C 2107 Methods of test for pressure-sensitive adhesive tapes for electrical purposes

NOTE : *IEC 60454-2 : 1994 Specification for pressure-sensitive adhesive tapes for electrical purposes—Part 2 : Methods of test* is equivalent to the said standard.

JIS C 2110 Testing methods for electric strength of solid insulating materials

NOTE : *IEC 60243 : 1967 Recommended methods of test for electric strength of solid insulating materials at power frequencies* is equivalent to the said

standard.

JIS C 2120 *Testing method of varnished cloths and tapes for electrical insulation*

NOTE : IEC 60394-2 : 1972 *Varnished fabrics for electrical purposes—Part 2 : Methods of test* is equivalent to the said standard.

JIS K 7112 *Plastics—Methods of determining the density and relative density of non-cellular plastics*

NOTE : ISO 1183 : 1987 *Plastics—Methods of determining the density and relative density of non-cellular plastics* is equivalent to the said standard.

JIS K 7127 *Plastics—Determination of tensile properties—Part 3 : Test conditions for films and sheets*

NOTE : ISO 527-3 : 1995 *Plastics—Determination of tensile properties—Part 3 : Test conditions for films and sheets* is identical to the said standard.

JIS K 7128-1 *Plastics—Film and sheeting—Determination of tear resistance—Part 1 : Trouser tear method*

NOTE : ISO 6383-1:1983 *Plastics—Film and sheeting—Determination of tear resistance—Part 1 : Trouser tear method* is identical to the said standard.

JIS K 7128-2 *Plastics—Film and sheeting—Determination of tear resistance—Part 2 : Elmendorf tear method*

NOTE : ISO 6383-2 : 1983 *Plastics—Film and sheeting—Determination of tear resistance—Part 2 : Elmendorf method* is identical to the said standard.

JIS K 7130 *Plastics—Film and sheeting—Determination of thickness*

NOTE : Clauses 3 (Determination of thickness by mechanical scanning, method A), 4 (Determination of thickness of a sample by gravimetric techniques, method B1) and 5 (Determination of average thickness and yield of a roll, by gravimetric techniques, method B2) of JIS K 7130 are equivalent to the respective relevant clauses of the following International Standards :

ISO 4591 : 1992 *Plastics—Film and sheeting—Determination of average thickness of sample and average thickness and yield of a roll, by gravimetric techniques (gravimetric thickness)*

ISO 4593 : 1993 *Plastics—Film and sheeting—Determination of thickness by mechanical scanning*

IEC 60093 : 1980 *Methods of test for volume resistivity and surface resistivity of solid electrical insulating materials*

IEC 60212 : 1971 *Standard conditions for use prior to and during the testing of solid electrical insulating materials*

- IEC 60216-1 : 2001 *Electrical insulating materials—Properties of thermal endurance—Part 1 : Ageing procedures and evaluation of test results*
- IEC 60216-2 : 1990 *Guide for the determination of thermal endurance properties of electrical insulating materials—Part 2 : Choice of criteria*
- IEC 60250 : 1969 *Recommended methods for the determination of the permittivity and dielectric dissipation factor of electrical insulating materials at power, audio and radio frequencies including metre wave-lengths*
- IEC 60343 : 1991 *Recommended test methods for determining the relative resistance of insulating materials to breakdown by surface discharges*
- IEC 60426 : 1973 *Test methods for determining electrolytic corrosion with insulating materials*
- IEC 60589 : 1977 *Methods of test for the determination of ionic impurities in electrical insulating materials by extraction with liquids*
- IEC 60648 : 1979 *Method of test for coefficients of friction of plastic film and sheeting for use as electrical insulation*
- IEC 60674-3 *Plastic films for electrical purposes—Part 3 : Specifications for individual materials*
- ISO 4592 : 1992 *Plastics—Film and sheeting—Determination of length and width*

3 General notes on tests

3.1 Discard at least the first three layers of film from the roll to be tested before removing test specimens.

3.2 Sample rolls shall be exposed for at least 24 h to the standard atmosphere $23\text{ }^{\circ}\text{C} \pm 2\text{ K}$ and $(50 \pm 5)\%$ r.h. before test specimens are removed for test. Unless otherwise specified, all individual test specimens shall be conditioned for 1 h and tested in the same standard atmosphere.

4 Thickness Thickness shall be measured by any one or more of the methods given below as required by the each sheet in **IEC 60674-3** or individual material standards.

4.1 Determination of thickness by micrometer Determination of thickness by mechanical scanning shall be as follows.

4.1.1 Principle The method is based on method A of **JIS K 7130** using a precision micrometer to measure the thickness of a single sheet test specimen.

4.1.2 Test specimens and measuring points Cut three strips about 100 mm wide across the width of the sample. The test strips shall not contain creases or other defects.

Determine the thickness of the test strips in accordance with the requirements of method A of **JIS K 7130** using a micrometer having plane or radiused measuring surfaces.

Measurements shall be made at nine points at approximately equally spaced intervals along the length of the test strips. In the case of samples not more than 300 mm wide make the measurements every 50 mm along the length of the test strips. In the case of untrimmed rolls, readings shall not be taken within 50 mm of the edges.

4.1.3 Result The thickness is the central value of all the measurements, the highest and lowest values on each strip being reported.

4.2 Determination of gravimetric thickness of a sample Principle : calculation of the thickness of a sample from measurements of mass, area and density in accordance with method B1 of **JIS K 7130**.

4.3 Determination of average gravimetric thickness of a roll Principle : calculation of the average thickness from measurements of the length, average width and net mass of the roll and the density of the film in accordance with method B2 of **JIS K 7130**.

5 Density To be determined in accordance with **JIS K 7112**. The particular method will be specified by each sheet in **IEC 60674-3** or individual material standards.

6 Width To be determined in accordance with **ISO 4592**, except that a 5 m sample length is used. Determine the width five times along the length at equal intervals after the film has relaxed for one hour.

Record each width measured and report the central value as the width of the roll.

7 Windability (bias/camber and sag)

7.1 Principle An assessment is made of the distortion of the film as supplied in the roll.

Two forms of distortion may be apparent in the film which can impair its subsequent winding characteristics. These distortions are :

- a) the film may exhibit bias or camber and therefore its edges may not be straight (see figure 1) ;
- b) the film may sag below its general level in areas where it has been stretched (see figures 2 and 3).

Information : For terms related to bias camber and sag, see also **JIS C 2150**.

7.2 Introduction Two methods are given. Method A is appropriate for narrow (i.e. not more than 150 mm) films where distortion is apparent mainly as bias/camber and

also for the measurement of sag for very thick films where the tension required for extension by Method B is excessive.

Method B is appropriate for wider (i.e. greater than 150 mm) films where distortion is apparent, mainly as sag.

7.3 Method A

7.3.1 Principle To assess bias/camber, a length of film is unwound and laid on a flat surface and the deviation of each of its edges from a straight line is measured (see figure 1).

To assess sag, a length of film is unwound and laid orthogonally over two parallel bars under defined conditions and the deviation from a uniform catenary is measured (see figure 2). It may sometimes be convenient to make this measurement using the rollers of a winding machine, but in cases of dispute of the results, the apparatus in 7.3.3.1 shall be used.

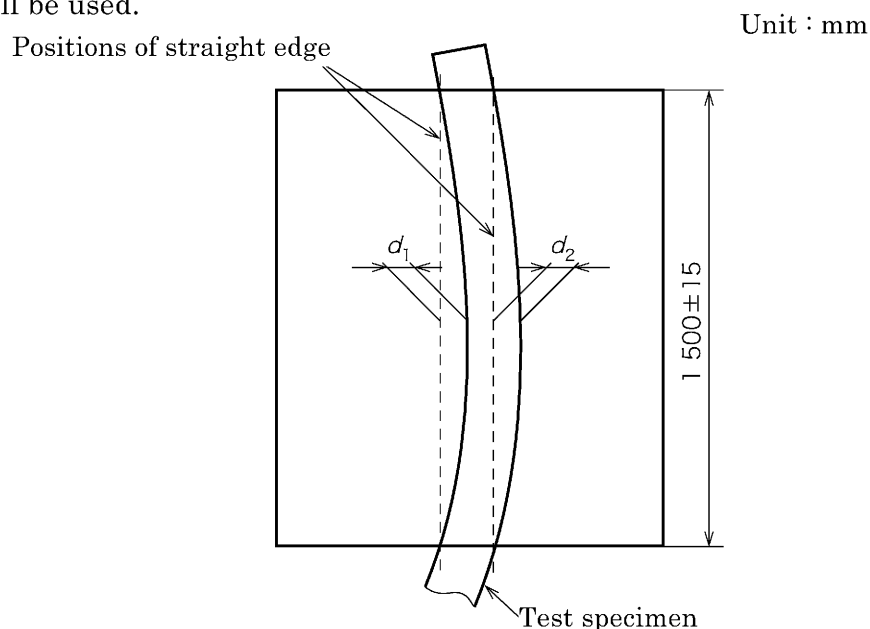


Figure 1 Measurement of bias/camber

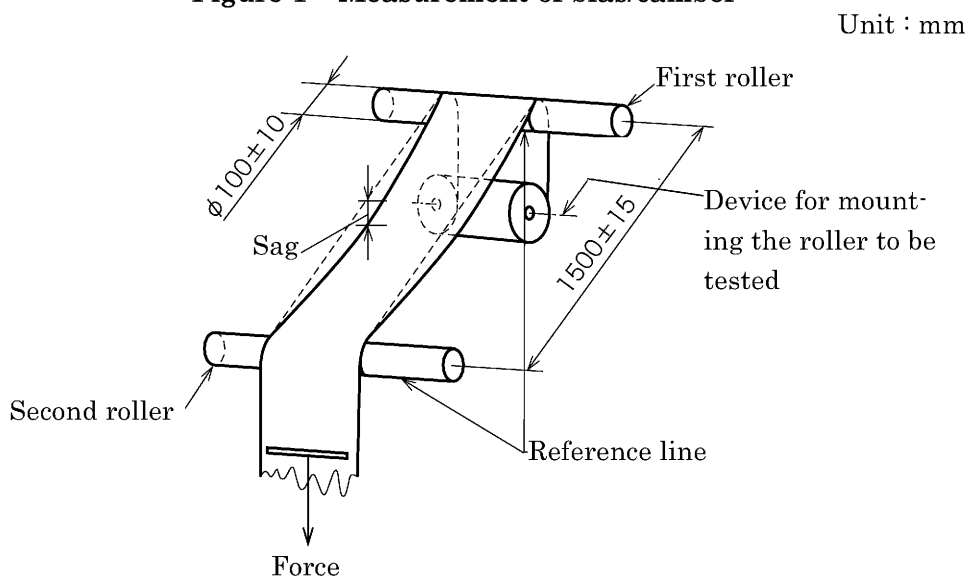


Figure 2 Measurement of sag

7.3.2 Measurement of bias/camber

7.3.2.1 Apparatus The apparatus shall be as follows.

- a) **Table** A flat, horizontal table of any suitable material having a satin finish (not polished) of sufficient width to accommodate the maximum width of film to be tested and of length $1\,500\text{ mm} \pm 15\text{ mm}$ with ends parallel to within 0.1° (or 1.8 mm per 1 metre of table width).

Alternatively, the table may be longer than the above length but must then have two reference lines clearly marked on its surface $1\,500\text{ mm} \pm 15\text{ mm}$ apart and parallel to the same accuracy. The parallelism between reference lines shall be within 0.1° (within 1.8 mm per 1 metre of reference line).

- b) **Brush** A soft brush suitable for smoothing the film specimen on the table surface.
- c) **Straight-edge** A long (in excess of $1\,525\text{ mm}$) steel straight-edge.
- d) **Rule** A 150 mm steel rule with 1 mm graduations.

7.3.2.2 Test specimens The first three layers of film from the roll are discarded. For each specimen a fresh length of approximately 2 m is taken, being drawn from the roll with the lightest tension necessary to unwind it slowly.

7.3.2.3 Procedure The specimen length of film is placed lengthwise over the table as shown in figure 1. Starting from one end, the soft brush is used to lightly press the film into intimate contact with the table surface, expelling any trapped air as far as possible.

The steel straight-edge is then placed along one edge of the film so that any deviation of the film edge from a straight line can be readily observed. The straight-edge is adjusted to coincide with the film edge at the two table ends (or at the reference marks if these are used). The distance d_1 between the straight edge and the film edge is measured to the nearest 1 mm at approximately mid-span by means of the steel rule.

The deviation of the second film edge d_2 is then measured using the same procedure.

The sum of the distances in millimetres of the two edges of the film from the steel straight-edge at the mid-span ($d_1 + d_2$) is the bias/camber value for that test specimen. The above procedure is repeated for two further test specimens.

7.3.2.4 Results The bias/camber is the central value of the three determinations, the other two values being reported.

7.3.3 Measurement of sag

7.3.3.1 Apparatus The apparatus shall be as follows.

- a) **Framework with rollers attached** A rigid framework supporting two parallel, freely rotatable metal rollers, each roller $100\text{ mm} \pm 10\text{ mm}$ in diameter and of sufficient length to accommodate the maximum width of film to be tested. The axes of the rollers shall be in the same horizontal plane and set mutually parallel to within 0.1° (i.e. within 1.8 mm per 1 m length of roller) with a separation of $1\,500\text{ mm} \pm 15\text{ mm}$ (see figure 2).

Information : It is convenient to mark the reference line for positioning the one side end of the film on two metal rollers.

The roller surfaces shall be accurately cylindrical to within 0.1 mm with any suitable satin finish (not polished). The framework shall be fitted with a device for mounting the roll of film being tested immediately below one of the rollers. The mounting shall be such that :

- 1) the axis of the film roll is parallel to the superior roller to within 1° ;
 - 2) the side edges of the film are freely adjustable ;
 - 3) the film may be drawn off the roll against an adjustable unwind tension.
- b) **Device for applying tension to the film** At the opposite end of the framework a weighted or sprung clamp is fixed to the film web hanging freely from the second roller. The weight or spring loading and its position on the film may be adjusted so as to give a substantially uniform tension across the web as specified in **IEC 60674-3** or individual material standards.
- c) **Dimension measuring device** A device for measuring along a line midway between the rollers the distance of the film below the plane of those rollers (see figure 2). The device may comprise simply a long (not less than 1 525 mm) steel straight-edge and a 150 mm steel rule with 1 mm graduations, or more complex devices may be employed whereby the film position is noted automatically or semi-automatically.

7.3.3.2 Test specimens Immediately before the test, the first three layers of film from the roll are discarded. For each specimen a fresh length of approximately 2 m is drawn from the roll with the lightest tension necessary to unwind it slowly.

7.3.3.3 Procedure The specimen length of film is placed over the apparatus rollers. The free end of the film is clamped in the tensioning device, the tension adjusted to the value given for the film in **IEC 60674-3** or individual material standards and the lateral position of the film as it passes over the second roller adjusted so that the film web lies approximately horizontal at mid-span.

Using the steel straight-edge and graduated steel ruler or other suitable device the film is checked across the film width at mid-span and any edge sag or sag lanes noted. The maximum depth of any sag lane below the general film surface surrounding it is measured to the nearest 1 mm (see figure 2) and reported as the sag value for that test.

The above procedure from **7.3.3.2** is repeated for two further test specimens.

7.3.3.4 Result The sag value is the central value of the three determinations, the other two values being reported.

7.4 Method B

7.4.1 Principle The total amount of sag and bias/camber is assessed by one measurement. A length of film is unwound and laid orthogonally over two parallel bars under defined conditions. The film is strained until free of visible sag and bias/camber

and the extension necessary to achieve this is measured. It may sometimes be convenient to make this measurement using the rollers of a winding machine but in cases of dispute, the dimensions and distances shall be as given in 7.4.2 below.

7.4.2 Apparatus The apparatus shall be as follows.

- a) **Framework with rollers attached** The framework with rollers attached shall be as specified in 7.3.3.1 a).
- b) **Device for applying tension to the film** At the opposite end of the framework a weighted or sprung clamp is fixed to the film web hanging freely from the second roller. The weight or spring loading of the clamp and its position on the film may be varied to give an adjustable tension substantially uniform across the web.
- c) **Dimension measuring device** A steel straight-edge (not less than 1 525 mm) and a flexible steel rule 2 m or more in length with 1 mm graduations.
- d) **Suitable self-adhesive labels**

7.4.3 Test specimens The first three layers of film from the roll are discarded and a fresh length of approximately 2 m is drawn from the roll with the lightest tension necessary to unwind it slowly.

7.4.4 Procedure The specimen length of film is placed over the apparatus rollers. With light hand tension applied to the web, the free end of the film is moved so that the film web between the rollers is as flat as possible and the free end is then clamped in the tensioning device. The tension is adjusted to $1.0 \text{ MN/m}^2 \pm 0.2 \text{ MN/m}^2$ (based on the nominal thickness and width of the film).

Two reference marks (between 1.0 m and 1.1 m apart) are applied to the film on a line exhibiting minimal sag and which is approximately parallel to the edges of the film (see figure 3). These marks may conveniently be specific edges of two self-adhesive labels applied to the film surface.

The distance between the marks is measured to within $\pm 0.5 \text{ mm}$ using the flexible steel tape.

The tension applied to the film is increased until :

- a) the film is visually smooth ;
- b) each film edge is straight to within 0.5 mm at mid-span when compared with the straight-edge, and
- c) the sag at any point does not exceed 7.5 mm when compared with the straight-edge.

The distance between the reference marks at this tension is measured using the steel tape and the extension of the film is expressed as a percentage of the original mark separation.

The above procedure from 7.4.3 is repeated for two further test specimens.

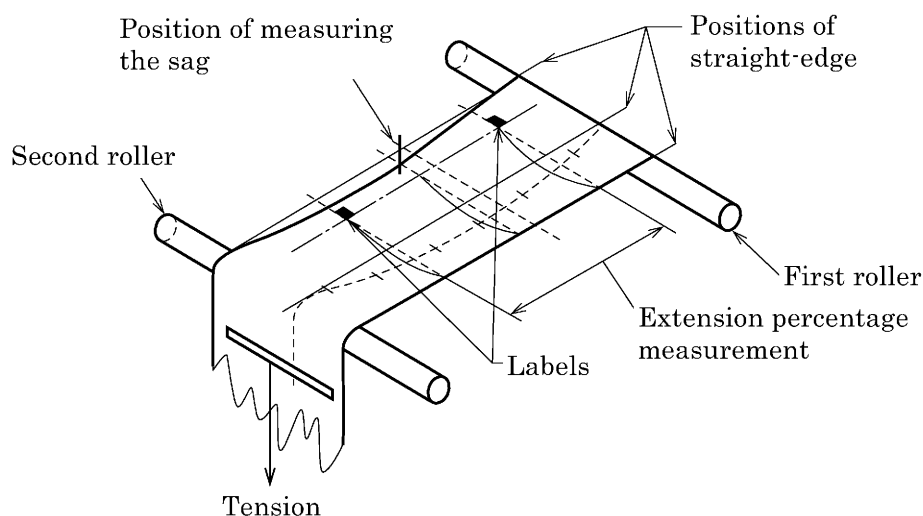


Figure 3 Measurement of extension percentage

7.4.5 Result The total sag and bias/camber is the central value of the three determinations, the other two values being reported.

8 Coefficient of friction To be determined in accordance with IEC 60648.

This method covers determination of starting and sliding friction of plastic film and sheeting when sliding over itself or other substances under specified conditions. The procedure permits the use of a stationary sled with a moving plane or a moving sled with a stationary plane. Both procedures yield the surface coefficient of friction for a given test specimen.

Information : See Annex 1 (informative) for the summary of the test method of the coefficient of friction as given in IEC 60648.

9 Wetting tension (polyolefine films)

9.1 Test principle and introductory remarks The determination of the wetting tension is based on the phenomenon that drops of a series of an organic liquid mixture with gradually increasing surface tension, when they have reached a specific concentration, have the ability to wet the film surface. Since the wetting tension of a film in contact with a drop of the respective liquid mixture in the presence of air is a function of the surface energies of both the air-film and the film-liquid interfaces, any trace of surface-active impurities in the liquid reagents or on the film may affect the results. It is, therefore, important that the film surface to be tested should not be touched or rubbed, that all equipment be clean and that reagent purity be carefully controlled.

Information : It is possible that films other than polyolefine films can not be measured by this method.

9.2 Apparatus

- a) Cotton-tipped wooden applicators approximately 150 mm long.
- b) Two burettes, 50 ml.
- c) Bottles, 100 ml with caps and labels (cleaned with chrome sulphuric acid and rinsed with distilled water).

9.3 Reagents Prepare mixtures of reagent-grade formamide (HCONH_2) and reagent-grade ethylene-glycol-monoethyl-ether ($\text{CH}_3 \text{ CH}_2\text{—O—CH}_2 \text{ CH}_2\text{—OH}$) in the proportions shown in the following table 1 for the integral values of wetting tension in the range over which measurements are to be made.

If desired, add to each of the mixtures mentioned in table 1 a very small amount of dye of high tinctorial value. The dye used should be of such colour as to make drops clearly visible on the surface of the polyolefin film. Furthermore, the dye must be of such chemical composition that it will not measurably affect the wetting tension of the liquid mixtures.

- NOTES
- 1 It is recommended that the surface tension of the liquid mixtures be checked weekly. Any wetting tension method usually applied in the laboratory is suitable.
 - 2 Although the shown liquid mixtures are relatively stable, exposure to temperatures above 30 °C and humidity above 70 % r.h. should be avoided.
 - 3 Both ethylene-glycol-monoethyl-ether and formamide are toxic and should be handled with due precaution. National safety regulations should be observed. Since formamide is particularly dangerous when in direct contact with the eyes, safety goggles should be worn when making up the liquid mixtures.

Table 1 Concentrations of ethylene-glycol-monoethyl-ether, formamide mixtures used in measuring wetting tension of polyethylene and polypropylene films

Formamide volume fraction %	Ethylene-glycol-monoethyl-ether volume fraction %	Wetting tension mN/m
0	100.0	30
2.5	97.5	31
10.5	89.5	32
19.0	81.0	33
26.5	73.5	34
35.0	65.0	35
42.5	57.5	36
48.5	51.5	37
54.0	46.0	38
59.0	41.0	39
63.5	36.5	40
67.5	32.5	41
71.5	28.5	42
74.7	25.3	43
78.0	22.0	44
80.3	19.7	45
83.0	17.0	46
87.0	13.0	48
90.7	9.3	50
93.7	6.3	52
96.3	3.7	54
99.0	1.0	56

9.4 Test specimens One sample across the entire width of a roll should be tested in such a way that one determination at each location 1/4, 1/2, 3/4 of the way across the width of the film is made.

If the range of these three determinations exceeds 2.0 mN/m, indicating that the polyolefin film has been unevenly treated, measurements, as described above, shall be made at three points spaced along the length of the roll (a total of nine measurements).

Extreme care must be taken to prevent the surface of the film sample from being touched or handled in the areas upon which the test is to be made.

9.5 Conditioning Standard atmosphere B according to IEC 60212 during testing (23 °C/50 % r.h.).

9.6 Procedure Wet the extreme tip of a cotton applicator with one of the mixtures. Use only a minimum amount of liquid as an excess of reagent may affect the result.

Spread the liquid lightly over an area of approximately 6.5 cm² of the test specimen at the selected location. Do not try to cover a larger area lest there be insufficient liquid to give complete coverage. Note the time required for the continuous liquid coverage formed on the film to break up into droplets. If the continuous liquid coverage

holds for more than 2 s proceed to the next highest wetting tension mixture, but if the continuous liquid coverage breaks into droplets in less than 2 s proceed to the next lowest wetting tension mixture. A clean, new cotton applicator must be used each time to avoid contamination of the solution.

Proceed in the direction indicated above continuously repeating the prescribed steps until it is possible to select the right mixture according to 9.7.

Experience with the test has shown that occasionally erroneous results can be obtained by working progressively to lower surface tension mixtures. Therefore, it is recommended that the tester should check the wetting tension of the film by working progressively to higher surface tension mixtures.

9.7 Evaluation The mixture is considered as wetting the test specimen when it remains intact as a continuous coverage of the liquid for 2 s as close as possible. Shrinkage of the periphery of the continuous liquid coverage does not indicate lack of wetting ; only breaking into droplets within 2 s indicates lack of wetting. Severe peripheral shrinking may be caused by too much liquid being placed upon the film surface. The surface tension of the applied mixture in millinewtons per metre which remains intact for 2 s is called the wetting tension of the polyolefin film test specimen.

9.8 Report If one specimen has been tested and the range of results is not more than 2.0 mN/m, report the central value of the three wetting tension test results.

In case of an unevenly treated polyolefin film, for which nine determinations have been made, report the central value and the individual values.

10 Tensile properties The tensile properties shall be as specified in JIS K 7127.

Tensile properties generally to be specified are tensile stress and percentage elongation at break but sometimes 1 % secant modulus may be specified.

10.1 Test specimens Test specimens shall be in accordance with clause 6 of JIS K 7127, i.e. strips 10 mm to 25 mm wide, not less than 150 mm long, with gauge marks at least 50 mm apart.

Five specimens shall be tested in each of the directions specified in each sheet of IEC 60674-3 or in individual material standards.

10.2 Speed of testing The speed of testing is the rate of separation of the grips of the testing machine during a test and shall be the speed specified in each sheet of IEC 60674-3 or in individual material standards.

10.3 Result For each property and for each direction of test, the result is the central value of the five determinations, the highest and lowest values being reported.

11 Edge tearing resistance The edge tearing resistance shall be measured by either of the following methods.

11.1 Method A Method A shall be as specified in JIS C 2120.

11.2 Method B

11.2.1 **Apparatus** The apparatus shall be as follows.

- Testing machine** The testing machine shall be a constant-rate-of-traverse type tensile testing machine (the measured value is within 15 % to 85 % of the capacity) or a testing machine equivalent to this.
- Testing fixture** The testing fixture shall be testing fixture B shown in figure 4. The thickness of the V-shaped cutting plate shall be $1.00 \text{ mm} \pm 0.05 \text{ mm}$ and the cross section of the V part shall be a semicircle of 0.5 mm in radius.

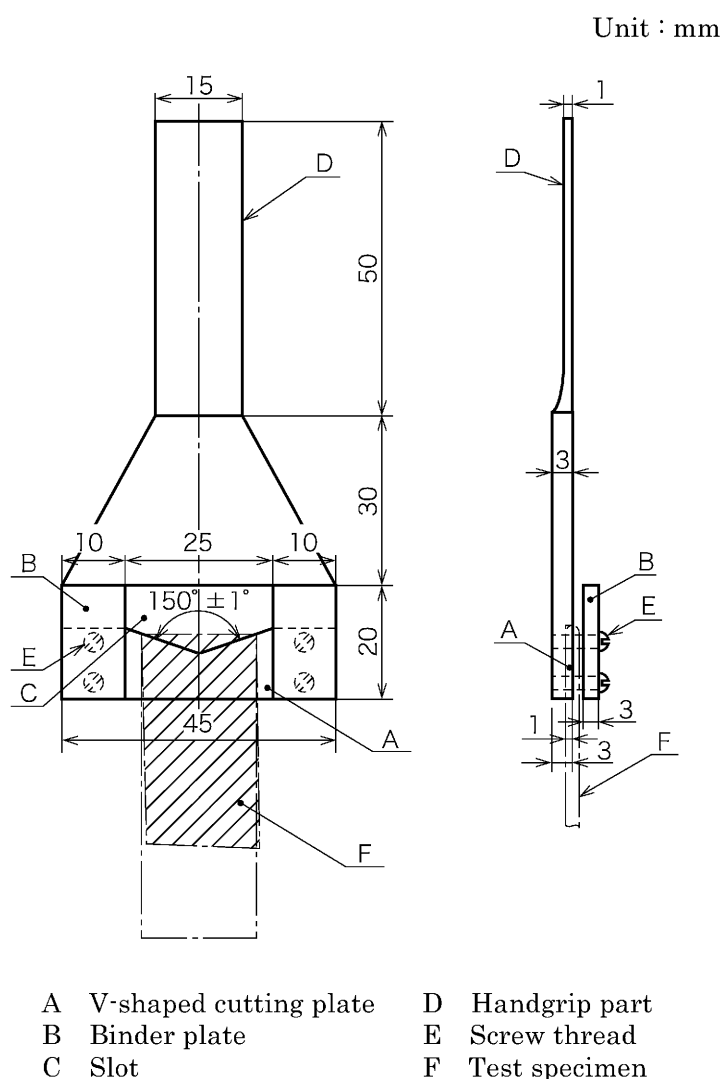


Figure 4 Testing fixture B and test specimen for measurement of edge tearing resistance

11.2.2 **Test specimen** Five test specimens having a width 20 mm and a length about 200 mm shall be taken in each of the longitudinal direction and the traverse direction

of a film covering its whole width.

11.2.3 Procedure

- a) Attach the handgrip to the upper part of the tensile testing machine so that the centre line of the cut plate of the testing fixture is made to agree with the centre of the upper and lower clamp and the gap between the top of cutting and the lower clamp becomes about 50 mm.
- b) Fold the test specimen in two so that the film surface touches through the slot of the testing fixture and fix the test specimen to the lower clamp of the testing machine by inserting it into the clamp.
- c) Pull the test specimen at a speed of about 200 mm per minute and read the force when the test specimen is torn in units of N.

11.2.4 Result Report the average value and the minimum value of five measured values in each of the longitudinal direction and the traverse direction of the film.

12 Tear resistance The tear resistance shall be determined in accordance with either **JIS K 7128-1** or **JIS K 7128-2**. The method to be used will be specified in each sheet of **IEC 60674-3** or in individual material standards.

13 Stiffness of film This test method describes a means for determining the flexibility of a material by means of a fixed angle flexometer in which the test specimen bends under its own weight. A rectangular strip of material is supported on a horizontal platform in a direction perpendicular to one edge of the platform. The strip is placed on the platform with a specified length overhanging the platform and the time taken for this overhang to fall to an angle of $41^{\circ} 30'$ below the horizontal is recorded.

14 Surface resistivity To be determined according to **IEC 60093**.

Information : The method given in the previous edition of **JIS** is described in **Annex 2 (informative)** for information.

15 Volume resistivity

15.1 Method A : Electrode method To be determined according to **IEC 60093**, using a guarded electrode of 25 mm diameter and an unguarded one of at least 40 mm diameter.

Determinations to be made under the conditions specified in each sheet of **IEC 60674-3** or in individual material standards from the following :

- a) standard dry conditions of **IEC 60212** (18°C to 28°C / $< 1.5\%$ r.h.) ;