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Specification for Polyethylene Film and Sheeting



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Foreword

Uganda National Bureau of Standards (UNBS) is a parastatal under the Ministry of Trade, Industry and Cooperatives established under Cap 327, of the Laws of Uganda, as amended. UNBS is mandated to co-ordinate the elaboration of standards and is

- (a) a member of International Organisation for Standardisation (ISO) and
- (b) a contact point for the WHO/FAO Codex Alimentarius Commission on Food Standards, and
- (c) the National Enquiry Point on TBT Agreement of the World Trade Organisation (WTO).

The work of preparing Uganda Standards is carried out through Technical Committees. A Technical Committee is established to deliberate on standards in a given field or area and consists of key stakeholders including government, academia, consumer groups, private sector and other interested parties.

Draft Uganda Standards adopted by the Technical Committee are widely circulated to stakeholders and the general public for comments. The committee reviews the comments before recommending the draft standards for approval and declaration as Uganda Standards by the National Standards Council.

The committee responsible for this document is Technical Committee UNBS/TC 19, Packaging and Packaging products.

Specification for Polyethylene Film and Sheeting

1 Scope

1.1 This specification covers the classification of polyethylene film and sheeting from 0.03 mm - 0.3 mm in thickness, inclusive. The film or sheeting may contain additives for the improvement of the surface properties, pigments, or stabilizers, or combinations thereof.

1.2 This specification allows for the use of recycled polyethylene film or resin as feedstock, in whole or in part, as long as all the requirements as governed by the producer and end user are also met.

1.3 This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 Normative references

The following referenced documents referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 291, Plastics — Standard atmospheres for conditioning and testing

ISO 527-3, Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets

ISO 1183-1, Plastics — Methods for determining the density of non-cellular plastics — Part 1: Immersion method, liquid pycnometer method and titration method

ISO 1183-2, Plastics — Methods for determining the density of non-cellular plastics — Part 2: Density gradient column method

ISO 472, Plastics — Vocabulary

ISO 13468-1, Plastics — Determination of the total luminous transmittance of transparent materials — Part 1: Single-beam instrument

ISO 7229, Rubber- or plastics-coated fabrics — Measurement of gas permeability

ISO 7765-1, Plastics film and sheeting — Determination of impact resistance by the free-falling dart method — Part 1: Staircase methods

ISO 7765-2, Plastics film and sheeting — Determination of impact resistance by the free-falling dart method — Part 2: Instrumented puncture test

ISO 8295, Plastics — Film and sheeting — Determination of the coefficients of friction

ISO 6383-1, Plastics — Film and sheeting — Determination of tear resistance — Part 1: Trouser tear method

ISO 6383-2, Plastics — Film and sheeting — Determination of tear resistance — Part 2: Elmendorf method

DUS 1892, Test method for specular gloss of plastic films and solid plastics

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

ISO 293, Plastics — Compression moulding of test specimens of thermoplastic materials

ISO 4593, Plastics — Film and sheeting — Determination of thickness by mechanical scanning

ISO 2528, Sheet materials — Determination of water vapour transmission rate (WVTR) — Gravimetric (dish) method

ISO 15106-2, Plastics — Film and sheeting — Determination of water vapour transmission rate — Part 2: Infrared detection sensor method

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 472 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1 treated
surface characteristics of the sheet or film have been modified by flame, corona discharge, or other means to promote the adhesion of inks, etc

3.2 yield
the area provided by a given weight of film or sheeting of specified thickness.

4 Classification

The film and sheeting covered in this specification shall be designated by a type number, composed by listing the desired cell limit for each of the five properties, in the order shown in Table 1.

Table 1 — Type numbers

Property Order Number	Property	1	2	3	4	Units
1	Density ^A	0.926–<0.941	0.941–0.965	<0.910	...	g/cm ³
2	Impact strength	40–70	71–150	151–300	>300	grams
3	Coefficient of friction ^G	0.20–0.40	0.41–0.70	>0.70
4	Haze	5.0–9.0	>9.0
5	Nominal thickness	0.0300-0.0508	0.0508–0.1016	0.1016-0.1778	0.1778-0.3048	mm

^A Annealed density of molded plaques or Melt Index extrudates

^G Coefficient of friction listed in this table is based on the kinetic coefficient of friction

5 General requirements

5.1 Appearance

The material shall have appearance qualities conforming with those produced by good commercial practice. It shall be as free as commercially possible of gels, streaks, pinholes, particles of foreign matter, and undispersed raw material. Gels need to be kept as minimal as possible when recycled materials are used in the films. There shall be no other visible defects such as holes, tears, or blisters. The edges shall be free of nicks and cuts visible to the unaided eye. There shall be no visible evidence of damage from shipping.

5.2 Thickness tolerances

The point-to-point thickness tolerances of the film or sheeting covered in this specification shall be nominal $\pm 5\%$.

5.3 Yield tolerances

The actual yield of film or sheeting covered in this specification shall be within the tolerance limits of the nominal yield as prescribed in Table 2. In cases where each roll, blanket, or unit of production is packaged and marked by the producer as the ultimate consumer sales unit with stated dimensions, the single-roll tolerances for yield shall apply.

Table 2 — Yield tolerances

Number of Rolls	Tolerance, %
Single rolls and lots up to and including 25 rolls	± 10
Lots over 25 rolls and up to and including 100 rolls	± 5
Lots over 100 rolls	± 3

5.4 Width tolerances

The tolerance for width shall be ± 3.3 mm of nominal width except that the tolerance shall be not less than ± 3.3 mm.

5.5 Length

For unit consumption the length of film or sheeting per roll shall be within $+4, -0\%$ of the length as marked, or as agreed upon between the purchaser and the seller. Each roll shall be in one piece, except that it is permissible for no more than 10% of the rolls in any one shipment to contain a maximum of three pieces. Such rolls shall be clearly labelled.

6 Detail requirements

6.1 The film or sheeting shall conform to the requirements of Table 1 as indicated by the type designation.

6.2 The film and sheeting shall not be blocked excessively as agreed upon between the purchaser and the seller

7 Sampling

Samples of film or sheeting sufficient to determine conformance to this specification shall be taken at random.

8 Test methods

8.1 Conditioning

Condition the test specimens at $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ relative humidity for not less than 40 h prior to test in accordance with ISO 291 unless otherwise specified by agreement or the relevant material specification. In cases of disagreement, the tolerances shall be $\pm 1^\circ\text{C}$ and $\pm 5\%$ relative humidity.

8.2 Test conditions

Conduct the tests at $23 \pm 2^\circ\text{C}$ and $50 \pm 10\%$ relative humidity unless otherwise specified by agreement or the relevant material specification. In cases of disagreement, the tolerances shall be $\pm 1^\circ\text{C}$ and $\pm 5\%$ relative humidity.

8.3 Density

Determine the annealed density of the moulded plaques or melt index extrudate as specified in Specification **D4976**. Plaques shall be compression moulded in accordance with ISO 293.

8.4 Impact strength

Test the film or sheeting for impact strength in accordance with test methods ISO 7765-1 or ISO 7765-2.

Note The impact resistance of polyethylene film, while partly dependent on thickness, has no simple correlation with sample thickness. Hence, impact values expressed in grams cannot be normalized over a range of thicknesses without producing misleading data as to the actual impact resistance of the material. Data from these methods are comparable only for comparing specimens that vary in thickness by no more than $\pm 25\%$ from the nominal or average thickness of the specimens tested.

8.5 Coefficient of friction, kinetic

Determine the kinetic coefficient of friction in accordance with test method ISO 8295.

8.6 Haze

Determine the haze of the film or sheeting in accordance with Test Method ISO 13468-1.

8.7 Treatment

Designate the film or sheeting simply as untreated or treated in accordance with 3.2.1.

8.8 Thickness

The thickness of the film and sheeting shall be determined in accordance with ISO 4593.

8.8.1 Test specimens

Five specimens, at least 5 by 5 cm in area, taken randomly across the width of the roll shall be tested. At least one set of specimens shall be measured from each roll being tested.

8.9 Yield

8.9.1 Calculate the actual yield using procedure in ISO 4591.

8.9.2 Calculate the nominal yield using ISO 4591 and the unannealed film density. Determine the unannealed film density in accordance with test method ISO 1183-2, using three specimens after conditioning in accordance with ISO 291.

8.9.3 Calculate the deviation of the actual yield from the nominal yield as follows:

$$D = \frac{[(Y_a - Y_n)]}{Y_n} \times 100$$

Where,

D deviation from the nominal yield, %,

Y_a measured yield, m²/kg, and

Y_n nominal yield, m²/kg

9 Packaging and package marking

9.1 The material shall be packaged in a manner that protects the integrity of the film or sheeting.

9.2 Shipping containers shall be marked with the name, type in accordance with this specification, thickness, width, and weight of the film or sheeting contained therein, as defined by the contract or order under which the shipment is made, the name of the manufacturer, and the contract order number.

Annex A **(informative)**

Other properties

A.1 Tensile strength and elongation

When tensile strength and elongation are to be measured, test in accordance with Test Method ISO 527-3. It is important that these properties be measured in both the transverse and longitudinal directions.

A.2 Tear strength

When required, determine the tear strength in accordance with test methods ISO 6383-1 or ISO 6383-2, as agreed upon between the purchaser and the seller.

A.3 Water vapor transmission

Determine the water vapor transmission of polyethylene film and sheeting, when necessary, in accordance with Test Methods ISO 2528 or ISO 15106-2, as agreed upon between the purchaser and the seller.

A.4 Gas transmission

Determine the gas transmission through polyethylene film and sheeting, when necessary, in accordance with Test Method ISO 7229 or specific methods for the gases of interest, as agreed upon between the purchaser and seller.

A.5 Odor

When required, rate the film and sheeting odor as satisfactory or unsatisfactory when compared to an odor standard. The odor standard and test method shall be agreed upon between the purchaser and the seller.

A.6 Gloss

Determine the gloss of polyethylene film and sheeting, when necessary, in accordance with test method **DUS 1892**. Sample preparation and test method shall be agreed upon between the purchaser and the seller.

A.7 Transparency

Determine the transparency, when required. The specular transmittance data obtained should correlate with "see-through" clarity.

A.8 Flatness

When required, rate the film or sheeting for degree of flatness. The test method and the degree of flatness shall be agreed upon between the purchaser and the seller.

Annex B (informative)

Alternative techniques for determination of average thickness

B.1 Thickness

This method for thickness determination is to be used as a referee method for average thickness and is especially suitable for use in determining the average thickness for embossed film and sheeting. For routine testing or specification, standard dead weight methods shall be used.

B.1.1 Apparatus

The apparatus shall consist of the following:

- a) Analytical balance, equipped with pan straddle or other stationary support, sensitive to 0.0005 g,
- b) Class S Weights,
- c) Beaker, 250-mL,
- d) Fine Thread or Wire, non-absorbent,
- e) Thermometer, 0 to 100°C, graduated in 1°C divisions,
- f) Die or Template, for cutting test specimens, 10 by 10 cm, with dimensional tolerance of ± 0.01 cm/side, and
- g) Sharp knife or razor.

B.1.2 Test specimens

Test five 10 by 10 cm specimens taken uniformly across the width of the sheet.

B.1.3 Procedure

By means of the die or template and the sharp knife or razor, cut five specimens from the sample of material. Weigh each specimen to the nearest 0.5 mg on the analytical balance. Record the weight as W . Determine the density of each specimen in accordance with method A of test Methods ISO 1183-1 or test method ISO 1183-2, and record as D . Use of a wetting agent is recommended.

B.1.4 Calculation

Calculate the average thickness of each test specimen, using the following formula, and average the five values:

$$T = \frac{394W}{100D} = \frac{3.94W}{D}$$

where:

T average thickness of test specimen, mils,

W weight of test specimen, g,

D density of test specimen, g/cm³,

394 conversion factor, cm to mils, and

100 area of specimen, cm².

B.2 Average thickness based on yield per roll

Calculate the average thickness based on yield per roll as follows:

$$\text{average thickness, mils} = \frac{2307 \times \text{net weight}}{\text{density} \times \text{length} \times \text{width}}$$

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Bibliography

ASTM D2103-15, Specification for Polyethylene Film and Sheeting

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