DRAFT TANZANIA STANDARD

GDC 4 (2) DTZS Stretch Cling Film-Specification

TANZANIA BUREAU OF STANDARDS

1st Edition

1 Scope

This draft Tanzania standard specifies requirements, methods of sampling and test for stretch cling film used for wrapping food to keep it fresh, boxes, luggage and palletized products, such as tea, chemicals, machinery and other similar applications for storage and safe transportation.

This standard covers flexible unsupported films made from natural or synthetic compounds of linear low-density polyethylene or any other polymeric materials or blends.

2 Normative references

The following documents are 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 527-3 :2018 Plastics — Determination of tensile properties — Part 3: Test conditions for films and sheets.

ISO 7765-1:1988 Plastics film and sheeting — Determination of impact resistance by the free-falling dart method — Part 1: Staircase methods.

ISO 14782:1999 Plastics — Determination of haze for transparent materials.

3.Terms and definitions

For the purpose of this document, the following terms and definitions shall apply;

3.1 cling

property of material's ability to adhere to itself or another surface

3.2 flex resistance

resistance of a material to crack or otherwise fail at flexing creases

3.3 stretch cling film

material that elongates when applied under tension and which, through elastic recovery, conforms to the item(s) packaged

3.4 stress retention

residual load expressed as a percentage of the original load on the material after the test specimen has been maintained at a constant elongation for a specified time

3.5 power stretch cling

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

3.6 elastic recovery

extent that a material returns to its original length after being subjected to an extension, and is expressed as a percentage

3.7 linear low density polyethylene (LLDPE)

copolymer or terpolymer of ethylene produced by catalytic polymerization of ethylene with other 1-alkenes

3.8 manual stretch cling film

mode of stretch cling film wrapping manually

3.9 tear propagation resistance

It is a force required to extend a tear of stretch cling film

4. Types

Stretch film shall be classified into the following grades,

a) Grade 1 — Manual stretch cling film.
b) Grade 2 — Power stretch cling film.

5. Requirements

5.1 General requirements

5.1.1 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 unaided 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.

5.1.2 The material used for manufacturing natural stretch cling film shall be linear low density polyethylene, having density between 910 to 940 kg/m^3 at 27°C or any polymeric material or blend that needs 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.

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

5.1.4 The film shall be free from any objectionable odour.

5.1.5 The film shall have no splices or air bubbles.

5.1.6 For food applications, only transparent stretch cling films made from food grade non-recycled resins shall be used.

5.2 Specific requirements

5.2.1 Dimensional requirements

5.2.1.1 Nominal thickness

When tested in accordance with Annex A, 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 shall be as given in Table 1.

Table 1 Tolerance on thickness

Nominal Thickness	Tolerance, Percentage
Up to and including 25 µm	± 20
Above 25 µm	± 15

5.2.1.2 Tolerance on width

The tolerance on width shall be as given in Table 2 unless otherwise agreed to between the supplier and the purchaser.

Table 2 Tolerance on width

Nominal width	Tolerance ,Percentage
Up to 500mm	± 5
Above 500 mm and up to 1250 mm	± 8
Above 1250 mm	± 20

5.2.2 Impact strength (Falling dart)

When tested by the method determined in ISO 7765-1:1988, 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.

Table 3 Impact Strength (Falling Dart)

Average thickness of the film (µm)	Impact Failure Load Min(gf),	
	Grade 1	Grade 2
10	50	70
15	60	80
25	80	100
35	100	120
45	120	140
50	130	150

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

5.2.3 Clarity and haze for transparent film

Haze of the stretch cling film, when tested in accordance with ISO 14782:1999, shall conform to the requirements given in Table 4.

Table 4 Clarity and Haze

Clarity	45°Gloss	Haze, Percentage
Normal clarity	30 to 35	10 to 15
High clarity	>55	<10

5.2.4 Ultimate tensile strength

The minimum tensile strength at break when tested in accordance with ISO 527-3 for various thicknesses of stretch cling film, at different levels of impact strength shall be as given in Table 5.

Table 5 Ultimate Tensile Strength

Direction	Tensile Strength at break, Min (kg/cm^2)	
	Grade 1	Grade 2
Machine direction (MD)	200	300
Transverse direction (TD)	175	250

5.2.5 Elongation at break

The elongation at break when tested in accordance with ISO 527-3 for various thicknesses of stretch cling film, at different levels of impact strength shall not be less than the values given in Table 6.

Table 6 Elongation at Break

Thickness of the Film (µm)	Elongation at Break, Min (%)			
	Grade 1		Grade 2	
	MD	TD	MD	TD
10 up to 20	300	400	400	500
Above 20 up to 40	400	500	500	600
Above 40	500	600	700	800

5.2.6 Elastic recovery and stress retention

When tested by the method given in Annex B, the elastic recovery and the stress retention in machine direction obtained at 150 percent elongation shall not exceed 60 and 70 percent respectively.

5.2.7 Tear propagation

When tested by the method given in Annex C, the tear propagation of stretch cling film shall not be less than the values given in Table 7 for appropriate average thicknesses of the film.

Table 7 Tear Propagation

Thickness of the film (µm)	Tear Propagation, Min (g/cm)			
	Grade 1		Grade 2	
	MD	TD	MD	TD
10 up to 30	70	80	80	100
Above 30	80	90	100	120

5.2.8 Flex resistance

When the film tested in accordance with ASTM F392/F392M-11 (2015), it shall not show any sign of cut growth and/or initiation of cracks and tears.

5.2.9 Force of elongation

The force taken by the specimen of 25 mm width at 150 mm/min when tested in accordance with ISO 527-3, to an extension of 100, 150, 200 percent for various thicknesses of stretch cling film at different levels of impact strength, shall not be less than the values given in Table 8.

Table 8 **Force of elongation in machine direction**

Thickness of film (µm)	Elongation, Percent	Force ,Min(kg/cm^2)
10 to 30	100	50
	150	70
	200	100
Above 30	100	80
	150	100
	200	125

5.2.10 Self cling (Shear and peel strength)

The shear and peel strength for cling stretch film shall be not less than 0.5 N/cm^2 when tested with accordance with Annex D.

5.2.11 Deviation of gas transmission rate, %

The determination of Oxygen and Carbon dioxide transmission rate for cling stretch film used in food application shall be conducted in accordance with ISO 2556. The deviation of the gas transmission rate shall be 20% when determined by formula shown in Annex E.

5.2.12 Deviation of water vapour permeance, %

The determination of water transmission rate for cling stretch film used in food application shall be conducted in accordance with ISO 2528. The deviation of the gas transmission rate shall be 20% when determined by formula shown in Annex E.

6. Packing and marking

6.1 Packing

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

6.2 Marking

Each roll shall be marked legibly with the following information:

a) Manufacturer's name and/or recognized trade mark.

b) Type of material.

c) Batch number. and date of manufacture.

d) Product name.

e) dimensions (width, length and thickness)

f) Application (food application or non-food application)

7 Sampling

7.1 Lot

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

7.1.1 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 column 2 of Table 9.

7.1.2 The rolls of stretch cling films shall be selected at random from the lot. In order to ensure randomness of selection, 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 cm, 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.

7.2 Number of tests and criteria for Conformity

7.2.1 From each of the roll of the film selected according to 7.1.2 approximately 10 m^2 of the film of full width shall be cut; care being taken to exclude not less than 2 metre 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.

7.2.2 Each of the pieces as obtained in 7.2.1 from a lot shall be examined for general requirements (see 5.1), and dimensional requirements (see 5.2.1). Any piece which does not meet the requirement of any of the above characteristics shall be considered as defective.

7.2.3 If the number of defective found (see 7.2.2) is less than or equal to the corresponding permissible number of defective given in column 3 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 column 3 of Table 8, one more lot of samples may be examined.

7.2.4 The lot having been found satisfactory according to 7.2.3 shall be tested for specific requirements (see 5.2). For this purpose, the rolls already tested according to 7.2.2 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 7.2.1),

7.2.4.1 The lot shall be deemed to have satisfied these requirements if all the test results for different characteristics given in 7.2.4 are found meeting the relevant requirements of the specification.

7.2.5 The lot shall be declared as conforming to the requirements of the specification, if the requirements for various characteristics as given in 7.2.3 and 7.2.4 are satisfied.

Table 9 Scale of Sampling and Permissible Number of Defective

(Clauses 7.1.1 *and* 7.2.3)

Lot Size	Number of rolls	Permissible number of Defectives
1	1	0
2 to 15	2	0
16 to 40	3	0
41 to 65	5	0
66 to 110	7	0
111 to 180	10	0
181 to 300	15	0
301 to 500	25	1
501 to 800	35	2
801 to 1300	50	3
13001 and above	75	4

Annex A

(**clause 4.2.1.1)**

DETERMINATION OF THICKNESS

A-1 APPARATUS

A-1.1 A dead weight dial micrometer with a flat anvil of 6 mm diameter or larger in area and 4.8 mm diameter flat surface on the head of the spindle or a spring dial micrometer (dial thickness gauge) which has been calibrated against a dead weight dial micrometer shall be used. In case of dispute, only dead weight dial micrometer shall be used and the reading shall be taken between 15 s and 2 min after the load is applied.

A-2 SPECIMENS

Test five specimens, at least 5 × 5 cm^2 in area, taken uniformly across the width of the test piece.

A-3 PROCEDURE

Dry and clean the surface of the anvil and spindle head, and of the specimen. Place the specimen on the anvil and lower the spindle head on to it slowly. The total load applied by the spindle shall be 110g.Make one measurement on each specimen approximately at the centre of the specimen. Take mean of the measurements of all the specimens of a sample to obtain the average thickness of the sample.

A-4 ASSESSMENT OF RESULTS

The thickness of the film shall be determined on the basis of the mass per square meter of the film. Specimen size 10 x 10 cm piece of the film. Balance capable of measuring to the nearest 0.1 mg mass 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);

D= Density in g/cm^3.

A-5 ACCURACY

This method is capable of producing measurements with a maximum error of + 0.000 25 cm.

Annex B

(Clause **5.2.6)**

DETERMINATION OF ELASTIC RECOVERY AND STRESS RETENTION IN MACHINE DIRECTION

B-1 General

This test method covers the measurement of recovery for extension and retention of stretch cling film. It is related to the tightness of a package.

B-2 Apparatus

B-2.1 Tensile Testing Machine, with a reversible chart.

B-2.2 Specimen Cutter, capable of producing nick free 25 mm ± 0.03 mm testing strips.

B-2.3 Micrometer, capable of measuring the thickness of the specimens.

B-3 Test specimen

B-3.1 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-3.2 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-4 Procedure

B-4.1 Clamp the first specimen in the grips so that it is free to slack but is not under tension.

B-4.2 Start the testing machine and chart and elongate the specimen at 150 mm/min to an extension of 100,150, and 200 percent and stop the testing m/c and chart.

B-4.3 Wait 60 s or 24 h, during which time specimen will relax.

B-4.4 When testing materials of unknown response, investigate a series of times of recovery.

B-4.5 Return the crosshead to the original grip separation simultaneously reversing the chart.

B-4.6 Wait 180 seconds, re-elongate the specimen to the same extension.

B-4.7 Repeat the procedure for other four specimens also.

B-5 Assessment of results

B-5. 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-5.2 Determine the length BE and GE in chart units and calculate the stress retention percent using the following equation:

Stress retention percent = (GE/BE) x 100

B-5.3 Read and record the force at point G in kg of different percentage of elongations. Stress retention at 150 % elongation: the average stress retention at 150 % elongation is 70%. Elastic recovery at 150 % elongation is 60%.

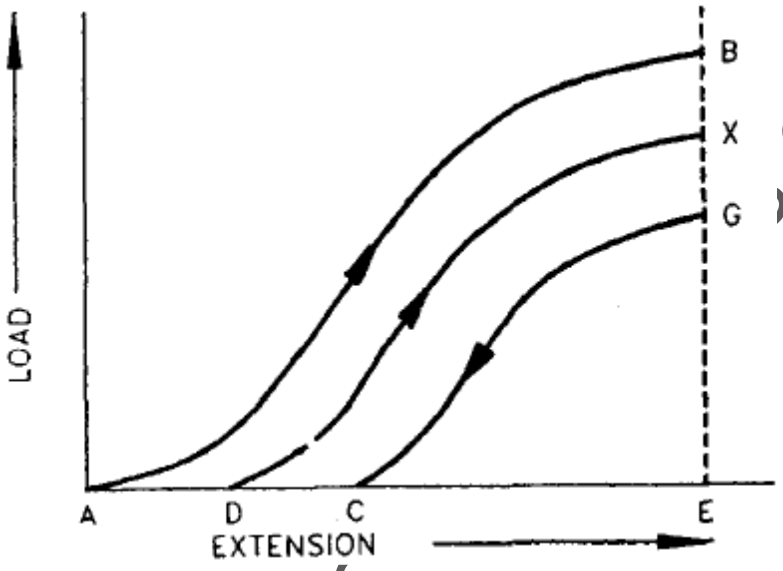

Figure 1: Load Versus Extension Curves

ANNEX C

(Clause 5.2.7)

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 Apparatus

C-2.1 Tensile Testing Machine, with a reversible chart.

C-2.2 Specimen Cutter,

C-2.3 Micrometer,

C-3 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-4 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.

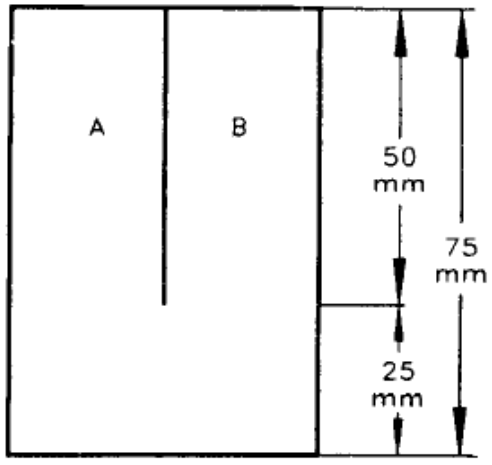

Figure 2: Grips

ANNEX D

(Clause 5.2.10)

DETERMINATION OF SELF CLING (SHEAR AND PEEL STRENGTH)

D.1 Sample preparation

Cut 10 sheets of sample 50 mm long and 25 mm wide, with every two sheets forming a set. Place the adhesive sides of each set of samples face to face in a lap joint, the length of a lap joint being 15mm and the width of the lap joint being 25mm. Lay the samples on a smooth surface, use a rubber roller (diameter of 40mm, length of 100mm, mass of 300g) and carry out reciprocation rolling and press on the lap joint three times, until there is no air left between the lap jointed layers of cling wrap film. Leave the prepared samples in an environment under test conditions for 20 minutes and then conduct the test.

D.2 Procedure

Stretch out each set of the samples on a tension machine and determine the force needed to separate the two sheets of sample. The arithmetic mean value of the five sets shall be regarded as the result. The stretching velocity, using an appropriate test instrument, shall be 250± 50 mm/min. The self-cling (shear and peel strength) shall be determined by the formula;

$$T = \frac{P}{a \times b}$$

Where

T – The self-cling (shear and peel strength), in Newton/centimetre^2 (N/cm^2)

P - The force needed to separate the sample, in Newton N

b -The width of the lap joint in cm

a - The length of the lap joint in cm

ANNEX E

(Clause 5.2.11 and 5.2.12)

Determination of deviation of Gas Transmission rate and Water Transmission rate

E.1 Deviation of Oxygen Transmission rate (OTR), %

The deviation of the Oxygen transmission rate shall be determined by formula;

$$\Delta Y = \frac{Y - Y_0}{Y_0}$$

in which,

Y – The actual measured oxygen transmission rate, in $cm^3/m^2/day$

Y_0 – The nominal oxygen transmission rate, in $cm^3/m^2/day$

ΔY – The deviation of the oxygen transmission rate, percentage (%)

E.2 Deviation of carbon dioxide Transmission rate (OTR), %

The deviation of the carbon dioxide transmission rate shall be determined by formula;

$$\Delta R = \frac{R - R_0}{R_0}$$

in which,

R – The actual measured oxygen transmission rate, in $cm^3/m^2/day$

R_0 – The nominal oxygen transmission rate, in $cm^3/m^2/day$

ΔR – The deviation of the oxygen transmission rate, percentage (%)

E.3 Deviation of Water Transmission rate (WTR), %

The deviation of the Water transmission rate shall be determined by formula;

$$\Delta W = \frac{W - W_0}{W_0}$$

in which,

W – The actual measured oxygen transmission rate, in $cm^3/m^2/day$

W_0 – The nominal oxygen transmission rate, in $cm^3/m^2/day$

ΔW – The deviation of the oxygen transmission rate, percentage (%)

Bibliography

1. ASTM F392/F392M-11(2015)— Standard Practice for Conditioning Flexible Barrier Materials for Flex Durability.

2. KS 2437:2013 Stretch Cling Film-Specification.

3. IS 14995:2001 Stretch Cling Film-Specification.