DRAFT TANZANIA STANDARD

Flexible polyurethane foam mattresses - Specification

TANZANIA BUREAU OF STANDARDS

First Edition 2021

0 Foreword

This Draft Tanzania Standard is being developed by Plastic and Plastic Products Technical Committee under supervision of the Chemical Division Standards Committee and it is in accordance with the procedures of the Bureau

This Draft Tanzania Standard is the third edition of flexible polyurethane foam mattresses – specification.

This Draft Tanzania Standard has been prepared with assistance drawn from the following documents:

KS 376: Part 0:2013 Specification for flexible polyurethane foams, published by Kenya Bureau of Standards

KS 376: Part 1:2013 Specification for flexible polyurethane (polyether) foams, published by Kenya Bureau of Standards

IS 1051: 2018 Specification for flexible polyurethane foam for domestic mattresses, published by India Bureau of Standards

SABS 1291: Part 1 Mattresses having unsupported polymeric covers, published by South African Bureau of Standards

SABS 1291: Part 2: 1993 Foam mattresses for domestic and hotel use, published by South African Bureau of Standards

BS 1877: Part 10: 2011, Specification for mattresses and bumpers for children's cots, perambulators and similar domestic articles, published by British Standards Institution Various specifications of local spring mattresses manufacturing companies

The assistance obtained from the above source is hereby acknowledged with thanks.

For the purpose of deciding whether a particular requirement of this Tanzania 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 TZS 4.

Flexible polyurethane foam mattresses – specification

1 Scope

This Draft Tanzania Standard specifies requirements, sampling and test methods of flexible polyurethane foam mattresses.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies."

TZS 4, *Rounding off numerical values*

TZS 20/ISO 13934-2*, Textiles - Tensile properties of fabrics — Part 2: Determination of maximum force using the grab method*

TZS 22/ ISO 13934-1, Textile - Tensile properties of fabrics - Part 1: Determination of maximum force and elongation at maximum force using the strip method

TZS 43/ ISO 105-C10, Methods for the determination of colour fastness of textile Materials to washing

TZS 138/ ISO 105-D01, Method for determination of colour fastness of textile materials to dry cleaning

TZS 359, *Methods of test and sampling for Flexible polyurethane foam*

3 Terms and definitions

For the purpose of this Draft Tanzania Standard, the following definitions shall apply:

3.1 block
mass of polyurethane foam formed by a free-rising foam process, in its original form prior to conversion.

3.2 bursting strength
the force required to rupture a fabric by distending it with pressure applied at right angles to the plane of the fabric

3.3 breaking strength
the maximum load (or force) supported by a specimen in a tensile test carried to rupture

3.4 defective
foam that fails in one or more respects to comply with the relevant requirements of the specification

3.5 polyurethane foam
the foam in which the polyol component is either polyether or polyester and produced by the reaction of polyol with an organic polyisocyanate in the presence of water, and that may include catalysts, surface-active agents, auxiliary blowing agents, fillers plasticizers, colourants, and any other additives that do not adversely affect the properties of the foam.

3.6 lot
not less than 1 m^3 and not more than 100 m^3 of foam of the same grade, and nominal dimensions, from one manufacturer, submitted at any one time for inspection and testing.

3.7 tick
a suitable outer cover that provides a comforting top layer of the mattress

3.8 warp
yarns / threads lying lengthways in a fabric as woven

3.9 weft
yarns / threads lying width ways in a fabric as woven (at right angles to the warp)

3.10 yarn
a generic term for a continuous strand of textile fibres or filaments without twisting, suitable for plying, knitting, braiding, weaving or otherwise intertwining to form a textile end product

4 Requirements

4.1 General requirement

4.1.1 The grades of flexible polyurethane foam mattress shall be in four grades:
(i) Light duty grade
(ii) Medium duty grade
(iii) Heavy duty grade
(iv) Superior heavy duty grade

4.1.2 Flexible polyurethane foam shall not contain impurities or harmful residues such as amines which are volatile and driven off by heat generated in the formation of foam.

4.1.3 Adhesive used shall be either nitrile or neoprene based. If neoprene based adhesives are used, it shall not have acidity of more than pH 3.5. The adhesives shall be able to withstand heat and moisture treatments as effectively as the foam itself.

4.1.4 The foam core shall be clean in appearance and free from any objectionable odour and any residual amines likely to be harmful to human tissues.

4.1.5 The mattress core shall be flexible polyurethane foam of polyester or polyether type which is defined as expanded cellular product produced by interaction of polyhydroxy compound, water and isocyanate.

4.1.6 The foam shall consist of cells of uniform characteristics which are essentially open and inter-connecting.

4.2 Specific requirement

4.2.1 Flexible polyurethane foam mattresses shall conform to the specific requirements given in Table 1.

Table 1 — specific requirements

SL. No	Characteristic		Requirement	Test method
i	Colour		report	TZS 359
ii	Compression set ,%, max	Light duty grade	12	
		Medium duty grade	10	
		Heavy duty grade	8	
		Superior heavy duty grade	5	
iii	Density, kg/m^3 , min	Light duty grade	16	
		Medium duty grade	23	
		Heavy duty grade	27	
		Superior heavy duty grade	32	
iv	Durability,%, max		40	
v	Elongation at break i) Original, %, min. ii) After heat aging, retention of original, %, min.		 200 80	TZS 359

	iii) After humid aging, retention of original, %, min.		80	TZS 359
vi	Flammability		(a) no specimen shall burn for 3 min or more; and (b) no specimen shall burn beyond the gauge line	Annex A
vii	Hardness factor,	Light duty grade	3.6 - 14.4	Annex B
		Medium duty grade	3.6 -14.4	
		Heavy duty grade	3.6 -14.4	
		Superior heavy duty grade	3.6 -14.4	
viii	Heat ageing, retention of original ,%, min		80	TZS 359
ix	Porosity		report	Annex C
x	Tensile strength, N/mm^2,min	Light duty grade	0.069	TZS 359
		Medium duty grade	0.083	
		Heavy duty grade	0.098	
		Superior heavy duty grade	0.118	

4.2.2 The cover of flexible polyurethane foam mattresses shall be of a woven ticking, or a knitted ticking and shall conform to the specific requirements given in Table 2 when tested in accordance with the methods prescribed therein.

Table 2 - specific requirements for ticking

SL. No	Characteristic			Requirement			Test method
i)	Breaking strength (woven ticking) N, min.			Light	mediu m	heavy	TZS 22/ ISO 13934-1
		Polyester	Warp	350	450	600	
			Weft	280	300	350	
		Nylon	Warp	350	450	700	
			Weft	280	300	350	
		Cellulosic	Warp	250	300	450	
			Weft	160	200	280	
		Polyester/ Nylon/Cell ulosic Blends	Warp	300	350	500	
			Weft	180	200	250	

	Bursting strength (knitted ticking), KPa, min.	Polyester	200			TZS 20/ ISO 13934-2
		Nylon	200			
		Cellulosic	150			
		Polyester/ Nylon/Cellulosic	160			
ii)	Mass in g/m2 (min.)		Light	medium	heavy	Annex D
		Polyester	40	60	120	
		Nylon	40	60	120	
		Cellulosic	85	110	200	
		Polyester/ Nylon/Cellulosic Blends	60	80	150	
iii)	Colour fastness to washing	Change in colour, rating, min.	4			TZS 43/ ISO105-C10
		Staining of transfer cloths, rating, min				
iv)	Colour fastness to dry-cleaning	Change in colour, rating, min.	4			TZS 138/ ISO 105-D01
		Staining of transfer cloths, rating, min				
v)	Flammability		To comply with flammability requirements given in vi of table 1			Annex A

4.2.3 The dimensional requirements of the foam mattress supplied in the form of blocks, trimmed blocks, slabs or sheets cut from trimmed blocks, or other shapes cut from any of these forms shall be as shown in Table 3 when tested in accordance with the method specified therein.

Table 3 - Requirements for dimensions

S/No.	Characteristic	Requirement, mm	Tolerance, Mm	Test method
I	Length	1800-2000	- 0 +40	TZS 359 (see clause 2)
Ii	Width	750 - 900	-0 +10	
		901 - 1350	-0 +25	
		1351- 2000	-0 +40	
Iii	Thickness	75 -150	-0 +5	

5 Sampling

5.1 Representative samples shall be taken randomly from the factory, market or elsewhere and tested for compliance with the standard as prescribed in clause 9 of TZS 359.

6 Packing and marking

6.1 Packing

6.1.1 Each mattress shall be packed in a suitable transparent material and in case; plastics coverings are used as packaging for a mattress, the plastic cover shall be conspicuously marked with a warning to the effect that the covering should be kept away from children.

NOTE 1 - An example of suitable wording is as follows: To avoid danger of suffocation, remove these plastics cover before using mattress. The cover should then be destroyed or kept away from children.

6.1.2 Plastics used for packaging shall be not less than 30 microns thick

6.2 Marking

6.2.1 Flexible polyurethane foam mattresses shall be indelibly and legibly marked in the outer upper waist of the mattress or a label attached on it, with the following descriptions:

a) Grade of foam mattress,
b) The nominal length, width and thickness,
c) Registered trade name of the product if any,
d) Name of the manufacturer,
e) Batch number/lot number and date of manufacture,
f) Country of origin.

NOTE 2 - The TBS Certification Mark may be used by manufacturers only under license from TBS. Particulars of conditions under which the licenses are granted may be obtained from TBS offices.

Annex A

(Normative)

DETERMINATION OF FLAMMABILITY

A.1 APPARATUS

An apparatus as shown schematically in Figure 1 A and consisting of a heat-resistant glass tube (chimney) in which a test specimen can be mounted, the base of the tube being connected to metered supplies of oxygen and nitrogen. The glass tube shall have a diameter of at least 75 mm and a height of at least 450 mm, and shall have at its base a bed of glass beads (or other inert particles) that will mix and distribute the incoming gases. The tube shall also contain a clamp that is capable of holding a test specimen (vertically) that the top of the specimen is at least 100 mm below the top of the tube.

The oxygen and nitrogen used shall be of commercial grade (or better) and shall be supplied to the base of the glass tube through individual metering devices that enable the volumetric flow of each gas to be measured with an accuracy of 1 per cent or better.

A.2 TEST SPECIMENS

From the appropriate slab, pieces of total volume at least 0.01 m^3 cut five specimens each of size 12.5 $\pm$ 0.5 mm x 12.5 $\pm$ 0.5mm x 130 mm and draw a gauge line across each specimen 75 mm from the end that is to be positioned uppermost in the apparatus.

A.3 PROCEDURE

Clamp a test specimen in the holder of the apparatus so that it is held vertically in the center of the glass chimney. Open the valves of the gas cylinders and adjust the flow so that the oxygen content of the gas mixture is 20 $\pm$ 0.2 per cent and that the flow rate up the glass chimney (as calculated from the volumetric flow rate divided by the cross-sectional area of the chimney) is 40 $\pm$ 10 % mm/s. Allow the gas to flow for at least 30 s and then, using a small gas flame at the end of a tube, ignite the test specimen so that the whole of the upper surface is burning. Note whether the specimen burns for 3 min or longer and if not, whether or not the specimen has burned to below the 75 mm gauge line. Repeat the test with the remaining four specimens.

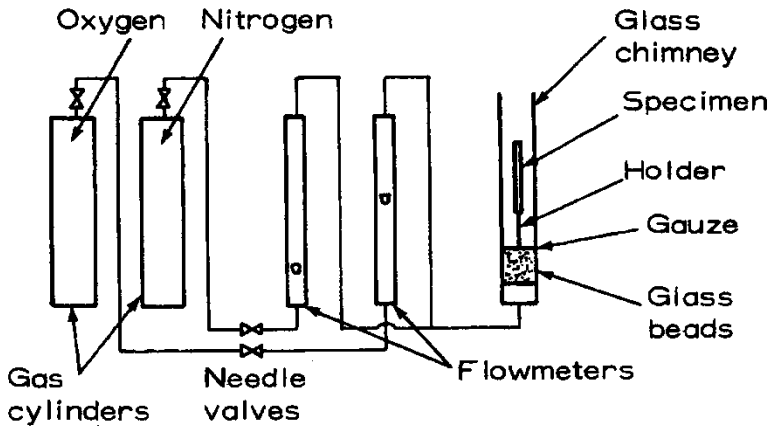

FIG. 1 A - GENERAL ARRANGEMENT OF FLAMMABILITY TEST APPARATUS

Annex B

(Normative)

DETERMINATION OF HARDNESS FACTOR

B.1 APPARATUS

A machine consisting of a flat circular indentor foot of thickness 10 mm, having the bottom edge rounded to a radius of 1 mm and a contact area of 322.5 cm, and that can be raised or lowered at a speed of 100" 20 m/m min and a base-plate that has 6.0 mm diameter perforations at 20 mm centres. The indentor foot is connected through a swivel joint to two gauges, one of which is capable of recording the force exerted by the foot upon the specimen and the other the distance travelled, relative to the base-plate.

B.2. TEST SPECIMEN

From the appropriate slab, pieces of total volume at least 0.01 m^3 cut one rectangular specimen of size 380 mm x 380 mm x 50 mm. For a sample of thickness less than 50 mm, specimens of thickness at least 15 mm may be plied together (without the use of an adhesive) to give a total thickness of 50 mm.

B.3 PROCEDURE

Place the specimen centrally under the indicator foot and lower the foot into contact with the specimen and record the distance between the foot and the base-plate. Flex the specimen twice by lowering the foot 35 mm then allow the specimen to recover for 10 min under no load.

Lower the foot until a force of 5 N *is* recorded on the gauge, record the distance travelled, and calculate, as follows, the thickness of the specimen under this load:

Thickness of specimen, mm = A — B

where,

A = the distance of the foot from the base-plate before flexing, in mm;

B = the distance travelled by foot, in mm.

Then lower the foot until the specimen is compressed to 60 per cent of its calculated thickness and note the force recorded on the gauge after 60 s.

B. 4 CALCULATION

Calculate, as follows, the hardness factor of the specimen, and record this value as the hardness factor of the sample:

Hardness factor = 0.102 x force, in newton’s required to produce 40 per cent compression.

Annex C

(Normative)

DETERMINATION OF POROSITY

C.1 APPARATUS

The apparatus consists, essentially, of a specimen holder connected through a flow meter to a supply of clean dry air. The apparatus shall include means for precise control of air flow rate and a manometer connected between the specimen holder and the flow meter. The specimen holder shall consist of a circular container, of internal diameter 38 mm and depth 25 mm, that has an air inlet of diameter 25 mm in the center of its base, and a cover with a central aperture of diameter 25 mm. The cover shall form an airtight seal with the top of the container, and the entire apparatus shall be free from leaks.

C.2 TEST SPECIMENS

From the appropriate slab (*see* **C.4.1**) cut four cylindrical specimens each of diameter 38 mm and height 25 mm.

C. 3. PROCEDURE

Level the manometer and set it at zero. Insert the test specimen holder and replace the cover. Turn on the air supply and adjust it to obtain a pressure in the apparatus (as recorded by the manometer) of 125 Pa. When the pressure reading is steady, note the rate of air flow recorded by the flow meter. Repeat the test with the remaining three specimens. Calculate the porosity of each specimen as follows:

Porosity, $m^3/s.m^2 = 2040\ F$

where,

F = the flow rate, in m^3/s.

Record the mean of the four results as the porosity of the sample.

C.4 Preparation of Test Samples and Test Specimen

C.4.1 From each sample obtain, as follows, a test sample for each test given in the Appendices.

Using a fine-toothed saw or rotary slicer (but not a heated wire), cut across the direction of rise of the foam (as determined by microscopical examination) a slab of suitable size and of the same thickness as that of the test specimens required for the relevant test, and that is free from skin.

NOTE: Slabs of the following thickness are required: 12.5 mm, 25 mm, 50mm.

C.4.2 When cutting the test specimens, use a die, a saw, or a knife, as appropriate, and ensure that the top and bottom surfaces of each specimen are flat and parallel to each other, that the sides are vertical, and that the test specimens are free from skin.

Annex D
(Normative)
Test method for mass per unit area

D.1 Principle

This method specifies the procedures for determining the mass per unit area of woven fabrics (including those of the stretch type), knitted fabrics, nonwoven fabrics, composite fabrics and narrow fabrics.

D.2 Apparatus

D.2.1 Table that has a smooth flat surface and is of a size that exceeds that of the fabric to be measured

D.2.2 Cutter, that is capable of cutting a square or circular specimen of area,0.01m^2 to accuracy of 1 % or better.

D.2.3 Metal plate, that is 5 mm smaller than the cutter and that has a thickness of 10 mm

D.2.4 Balance, that is capable of determining the mass of the specimen to accuracy of 0.2 % or, in the case of 0.01m^2 specimens, to an accuracy of 0.001g.

D.3 General

Condition the sample in accordance to ISO 139.

D.4 Procedure 1 - Full width specimen

D.4.1 Ensure that the fabric, which should preferably be selected from the middle of a piece, is not less than 0.5 m and not more than 4 m long, and lay it flat, and without tension, on the table.

D.4.2 Cut at both ends across the full width of the sample along parallel lines at right angles to the selvedge.

D.4.3 If the mass per unit area of a selvedge on a full –width piece appears to deviate appreciably from the mass per area of the body of the fabric, or if so agree upon between the parties concerned, trim off the selvedge along the outermost threads of the body of the fabric and use only the body of the fabric for the determination of the mass per unit area.

D.4.4 Measure the width and length of the specimen.

D.5 Procure 2 - For representative for large cuttings

D.5.1 Ensure that available cutting is representative of the sample.

D.5.2 Trim the cutting into a square or rectangle specimen by cutting along parallel lines at right angles to the warp (length) direction and at right angles to the weft(width) direction.

D.5.3 Measure the width and length of the specimen.

D.5.4 Use the balance to determine the mass of the specimen

D.6 Procedure 3 - For several small (0.01m^2) specimens

NOTE 2: On fabrics with large in woven designs, which involve local areas of appreciably different mass per unit area, the use of procedure 1 or procedure 2 is preferable.

D.6.1 Cut at least three square pieces, of side length of approximately 150 mm, from areas of the fabric selected to represent the samples as fully as possible but not within 50 mm of the selvedge.

D.6.2 Lay each piece flat, and without tension, on a suitable cutting surface. place the metal plate and cutter on each piece in turn and cut out a 0.01 m^2 specimen from each piece, ensuring that no loss of threads occurs.

D.6.3 Use the balance to determine the mass of the 0.01 m^2 specimens, and calculate the mean mass.

D.7 Calculation

D.7.1 In the case of procedure 1 and procedure 2, calculate the mass per unit area *M* in grams per square metre, using the following formula:

$$M = \frac{m \times 1,000,000}{L \times w}$$

where

m is the mass of the specimen, in grams
L is the length of the specimen, in millimetres; and
w is the width of the specimen, in millimetres

D.7.2 In the case of procedure 3, calculate the mass per unit area (*M* in grams per square metre) by multiplying the mean mass (in grams) by 100.

Annex E

(Normative)

ADVICE TO USERS

The durability of foam in a particular application and the comfort provided depends on the use of the correct grade of foam. The recommended grades of foam for each type of duty are given in Table 4. Foams of grade numbers lower than the lowest of the applicable numbers shown in Column 3 are not suitable, but those of higher grade numbers may be used if desired.

TABLE 4- GRADE OF FOAM SUITABLE FOR VARIOUS TYPES OF DUTY

1	2	3
TYPE OF DUTY	APPLICATION EXAMPLES	GRADE OF FOAM RECOMMENDED
Light (L)	Padding; scatter cushions; pillows Light duty mattresses Light duty mattress toppers	Light duty grade
Average (A)	Backs and armrests for private and commercial vehicles Backs and armrests for domestic furniture Medium duty mattresses Medium duty mattress toppers	Medium duty grade
Severe (S)	Backs and armrests for cinema and theatre furniture Backs and armrests for contract furniture Backs and armrests for public transport Seats for private and commercial vehicles Seats for domestic furniture Heavy duty mattresses Heavy duty mattress toppers	Heavy duty grade
Very Severe (V)	Seats for public transport Seats for cinema and theatre furniture Seats for contract furniture	Superior heavy duty grade