DEAS 1115-4:2023

ICS: 97.140

DRAFT EAST AFRICAN STANDARD

Mattresses — Specification – Part 4: Polyethylene foam

EAST AFRICAN COMMUNITY

First Edition 2023

Copyright notice

Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 069, *Organic and Inorganic chemicals.*

Attention is drawn to the possibility that some of the elements of this document may be subject of patent rights. EAC shall not be held responsible for identifying any or all such patent rights.

DEAS 1115 consists of the following parts, under the general title *mattresses — Specification —*:
– *Part 1: Flexible polyurethane foams*
– *Part 2: Spring mattresses*
– *Part 3: Reconstituted flexible polyurethane foam mattresses*
– *Part 4: Polyethylene foam*

Mattresses — Specification – Part 4: Polyethylene foam

1 Scope

This Draft East African Standard specifies requirements, sampling and test methods for polyethylene foam. This standard does not cover orthopaedic mattresses.

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.

DEAS 1115-1, *Mattresses — Specification – Part 1: Flexible polyurethane foams*

ISO 845, *Cellular plastics and rubbers — Determination of apparent density*

ISO 1856, *Flexible cellular polymeric materials — Determination of compression set*

ISO 1798, *Flexible cellular polymeric materials — Determination of tensile strength and elongation at break*

ISO 8067, *Flexible cellular polymeric materials — Determination of tear strength*

ISO 2439, *Flexible cellular polymeric materials — Determination of hardness (indentation technique)*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in DEAS 1115-1 shall 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

— IEC Online browsing platform: available at https://iec.ch

4 Requirements

4.1 General requirements

4.1.1 Polyethylene 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.

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

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

4.1.4 If the mattress contains flame retardants, they shall be proven to be safe.

4.1.5 Polyethylene foam shall be supplied in the form of blocks, trimmed blocks, slabs, cushions, or sheets cut from trimmed blocks, or other shapes cut from any of these forms

4.2 Specific requirements

4.2.1 Polyethylene foam mattress shall comply with requirement specified in Table 1 when tested in accordance with method prescribed therein.

Table 1: Specific requirements for polyethylene foam mattress

SL. No	Characteristic		Requirement	Test method
i)	Density, kg/m^{3,} min	light duty	20	Annex A
		medium duty	30	
		heavy duty	40	
		superior heavy duty	50	
ii)	Compression set, %, max		10	Annex B
iii)	Tensile strength, kPa, min, • Transverse direction • Machine direction		 176 245	Annex C
iv)	Elongation at break, kPa, min. • Transverse direction • Machine direction		 42 80	
v)	Tear resistance, N/mm of width, min PS to consult and decide whether inclusion or deletion		0.147	ISO 8067
vi)	Flammability		a) no specimen shall burn for 3 minutes or more, and b) specimen shall burn beyond the guage line	Annex D

4.2.2 When tested in accordance with Annex E, the mattress shall conform to the dimensions declared on the label subject to the following tolerance limits;

± 10 mm for dimensions <750 mm
± 25 mm for dimensions (750-1350) mm
± 40 mm for dimensions >1350 mm

4.2.3 The cover of reconstituted flexible polyurethane foam mattress 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 of Polyethylene foam

SL. No	Characteristic		Requirement			Test method
i)	Breaking strength (woven ticking) N, min.		**Light**	**medium**	**Heavy and super heavy**	ISO 13934-1
		Warp	350	450	450	
		Weft	95	200	200	
ii)	Bursting strength (knitted ticking), KPa, min.		150			ISO 13934-2
iii)	Mass in g/m^2 (min.)		Light	medium	Heavy and super heavy	Annex F
			68	68	120	
iv)	Colour fastness to washing	Change in colour, rating, min.	4			ISO105-C10
		Staining of transfer cloths, rating, min				
v)	Colour fastness to dry-cleaning	Change in colour, rating, min.	4			ISO 105-D01
		Staining of transfer cloths, rating, min				

5 Packaging

Polyethylene foam mattress shall be individually wrapped in suitable materials that prevent any damage, gross and distortion to contents during storage and transportation.

6 Labelling

Each Polyethylene foam mattress shall be legibly and indelibly labelled, in English and/or any other official language (French, Kiswahili, etc) used in the importing East African Partner State with the following information:

6.1 on the outer upper waist of the mattress or a label attached on it:

a) grade of foam mattress;
b) nominal length, width and thickness;
c) registered trade name of the product if any;
d) name of the manufacturer;
e) batch number/lot number;
f) date of manufacture;
g) country of origin; and
h) disposal instructions and precautionary statements.

6.2 on the foam:

a) grade of foam mattress;
b) nominal length, width and thickness;
c) name of the manufacturer;
d) batch number/lot number; and
e) country of origin.

6.3 For mattresses without permanent fabric cover all information in 6.2 shall appear while for mattresses with permanent fabric cover c), d) and e) in 6.2 shall appear on the foam

7 Sampling

Representative samples shall be taken according to the sampling plan given in Table 2.

Each sample shall consist of the following:

a) for inspection, a complete piece; and

b) for testing, pieces of total volume of at least 0.01 m^3.

Table 2 — Sampling plan

Number of mattresses in the lot	Number of samples to be selected
2 - 8	2
9 - 15	3
16 - 25	5
26 - 50	8
51 – 90	13
91 - 150	20

Annex A

(normative)

Determination of density

A.1 Apparatus

A.1.1 Soft material thickness gauge for measurement of linear dimensions up to 100 mm with an accuracy of one percent.

A.1.2 *Balance*

Capable of weighing the test specimen to an accuracy of one per cent of the total mass.

A.2 Test specimen

Obtain test specimens, of regular shape not less than 100 mm x 100 mm x 100 mm, one each from top, middle and bottom portions of the foam slab with respect to direction of rise of foam, cured for 48 hours at room temperature. Condition the specimens for 6 hours at 27 °C ± 2°C and at 65 % ± 5 % relative humidity before testing.

A.3 Number of specimens

Unless otherwise specified three specimens shall be tested.

A.4 Linear dimension

A.4.1 *Measurement below 100 mm linear dimension*

Set the dial at zero. Place the specimen centrally below the foot. Lower the foot with the application of the specified load. Note the reading taking into account the metallic spacers used, if any. Repeat this thrice in each direction for every specimen.

A.4.2 *Measurement above 100 mm linear dimension*

Place the specimen on a plane table and measure the dimension with vernier caliper or steel tape accurately. Repeat this thrice for every specimen.

A.4 Procedure

Determine the linear dimensions as described in A.4.1 and A.4.2 Weigh the specimens on a balance with an accuracy of one per cent of the total mass.

A.5 Calculation

Density (P) kg/m = $\frac{m}{v} \times 1\,000$

where

m is a mass *of* specimen in g, and

V is a volume of the specimen in cm

A.6 Report

Report the mean density of the three specimens tested.

Annex B

(normative)

Compression Set Test

The test consists of maintaining the foam specimen under specified conditions of temperature and observing the degree of recovery within a specified time after release.

B.1 Apparatus

The apparatus consists of two flat plates of 200 mm x 200 mm, with appropriate spacers and clamps to keep the plates parallel to each other when clamped with specimen between the plates.

B.2 Test specimen

Cut the test specimen from a foam slab which has been cured for 48 hours at room temperature in such a way that the load is applied in the direction of the rise of the foam to get specimen of **100** mm x **100** mm x **50** mm. Test specimens shall be free from any contamination and skin on the vertical sides. When thin materials are to be tested, sufficient specimens of **100** mm x **100** mm shall be taken so that the sum of their thickness before compression is at least 25 mm. The specimens shall be plied together and interleaved with photographic glass mounting slides where the number of plies is greater than two, and the complete assembly shall be treated during the test as single thick specimen.

Condition the test specimens at 27°C ± 2°C and 65 ± 5 per cent relative humidity for 6 hours before testing. A minimum of 3 specimens shall be tested for 50%.

B.3 Procedure

A soft material dial thickness gauge is used for measuring the thickness of the specimen. In case of thin material calculate the thickness of the foam by deducting the aggregate thickness of the glass slides from the measured total thickness of the assembly. The specimen shall then be put between the plates and with the help of spacers subjected to 50 per cent deflection. The whole assembly is then stored under standard atmospheric conditions for 70 hours or at 70°C ± 2C for 22 hours. After this duration, the plates are removed and the specimen is allowed to recover for at least 30 minutes under standard testing conditions.

The thickness is measured again with the soft material dial thickness gauge.

B.4 Calculation and reporting

Compression set at the rate of 50 percent deflection

$(h0 - h50)/ h\mathbf{0} \times 100$

where

h_0 is an original height of the specimen in mm,

h_{50} is a final height of the specimen in mm after 50 percent deflection test

Average of the values obtained from the three samples tested shall be reported.

Annex C

(normative)

Tensile strength Test

C.1 Apparatus

The apparatus consists of a power-driven machine (medium load tensile tester) with the following provisions:

a) sensitive dial indicator which remains at the point of maximum load after rupture of the specimen and measures the tension at the point,

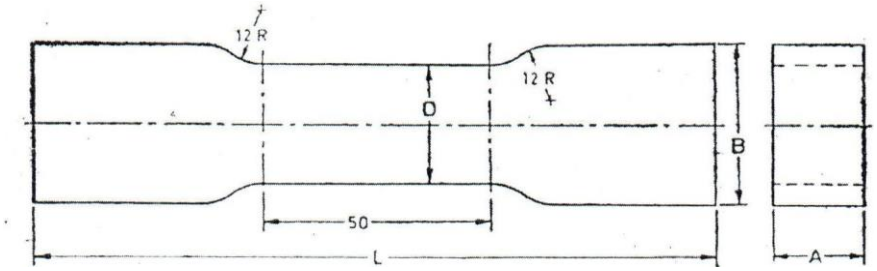
b) suitable grips for holding the specimen,

c) rate of travel of power actuated grip shall be 500mm ± 50 mm per minute and uniform at all times and

d) the total capacity of the tester be such that the ultimate load is at least one-fifth of the total capacity of the machine.

C.2 Test specimen

Punch the specimen in the shape of a dumb-bell shown in the figure D.1 below by means of a sharp die out of a foam sheet of 10mm or 20 mm thickness. The foam sheet shall be cut vertically in the direction of the rise of the foam with the help of a splitting machine, from the foam slab cured at room temperature for 48 hours. Condition the test specimen at 27°C ± 2C and 65 ± 5 percent relative humidity for 6 hours before testing. Three specimens shall be tested.



	A	B	D	L
Small	10	25	13	152
Large	2	3	2	152
	0	8	6	

All dimensions in millimeters.

Figure C.1 dumb-bell test piece

C.3 Procedure

C.3.1 Determine the thickness and width of the specimen accurately by means of a vernier caliper or soft material thickness gauge as described in clause 3. Make two-gauge marks 50 mm apart as shown in the figure.

C.3.2 Clamp the specimen in the grips. The minimum separation between the grips shall be 65 mm. Adjust the specimen symmetrically between the grips for uniform distribution of the tension applied over the cross-section.

C.3.3 Start the machine and note continuously the distance between the two-gauge marks and record the distance at rupture. Note the lead indicated on the dial.

C.5 Calculation and reporting

C.5.1 Tensile strength *(β),* N/mm^2 = $\frac{F_{max}}{A}$

where

F max is a force at failure of the specimen in N, and

A is an original cross-sectional area in mm^2

C.5.2 Tensile stress (δ_t), N/mm^2 = $\frac{F_t}{A}$

where

F is a force at specified elongation in N, and

A is an original cross-sectional area in mm^2

C.5.3 Ultimate elongation (Elongation at Break)

Ultimate elongation (ε_b) per cent = $\frac{L_b - Lo}{L_O} \times 100$

where

L_b is a length between the gauge marks in mm at the time of failure, and

L_O is an original length between the gauge marks in mm.

C.5.4 Report

Report the averages of the three-specimen tested

Annex D

(normative)

Test for flammability of foam mattresses

D.1 Apparatus

An apparatus as shown schematically in Figure A.1 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 % or better.

D.2 Test specimens

From the appropriate slab cut five specimens each of size 12.5 $\pm$ 0.5 mm x 12.5 $\pm$ 0.5 mm 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.

D.3 Procedure

Clamp a test specimen in the holder of the apparatus so that it is held vertically in the centre 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 % 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.

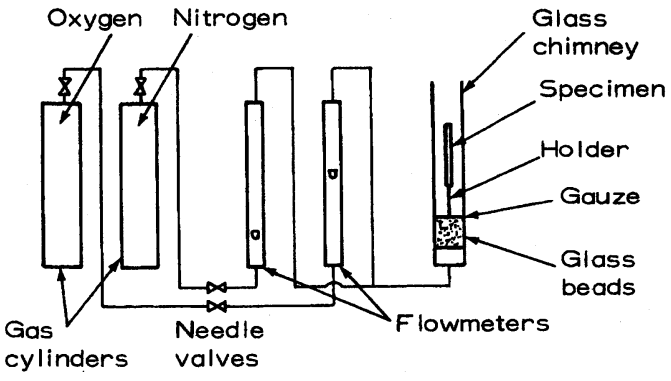


Figure D.1 — General arrangement of flammability test apparatus

Annex E

(normative)

Dimensions

E.1 Apparatus

E.1.1 Metre rule, a steel rule graduated in millimeters and accurate to 1 mm (or better).

E.1.2 Micrometer, a micrometer accurate to 0.01 mm (or better) with a presser foot of area at least 6.5 cm and capable of exerting a pressure of 100 ± 10 Pa.

E.2 Procedure

Measure the dimensions of each sample (using the steel rule for dimensions greater than 30 mm and the micrometer for dimensions not exceeding 30 mm).

Annex F

(Normative)

Test method for mass per unit area

F.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.

F.2 Apparatus

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

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

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

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

F.3 General

Condition the sample
Before testing, maintain all specimens for at least 16 h in an atmosphere having a relative humidity of wise 65 % ± 2 % and a temperature of 23 °C ± 2 °C.

F.4 Procedure 1 - Full width specimen

F.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.

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

F.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 agreed 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.

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

F.5 Procedure 2 - For representative for large cuttings

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

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

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

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

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

NOTE: 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.

F.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.

F.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.

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

F.7 Calculation

F.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 millimeters; and
w is the width of the specimen, in millimeters

F.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.

Bibliography

[1] US 202:2021, *Textiles — Foam mattress — Specification*

