DUS 1688

DRAFT UGANDA STANDARD

First Edition
2017-mm-dd

Footwear — Sports shoes: Specification

Reference number
DUS 1688: 2017

Compliance with this standard does not; of itself confer immunity from legal obligations

A Uganda Standard does not purport to include all necessary provisions of a contract. Users are responsible for its correct application

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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 7, *[Textile, Leather, Paper and related products]*, Subcommittee SC 2, *[Leather and related products]*.

Footwear — Sports shoes: Specification

1 Scope

This draft Uganda standard prescribes the performance, requirements, sampling and test methods of sports footwear.

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.

DUS 1787, Standard test method for tear strength of conventional vulcanized rubber and thermoplastic elastomers

DUS 1788, Standard test method for measuring rubber detoriation-Cut growth using Ross flexing apparatus

ISO 3379, Leather — Determination of distention and strength of surface (Ball burst method)

US 696, Abrasion resistance of footwear materials (Martindale)

US 721, Footwear materials — Determination of absorption and desorption of water

US ISO 105-B02, Textiles — Tests for colour fastness — Part B02: Colour fastness to artificial light: Xenon arc fading lamp test

US ISO 105-X12, Textiles — Tests for colour fastness — Part X12: Colour fastness to rubbing

US ISO 3376, Leather — Physical and mechanical tests — Determination of tensile strength and percentage elongation

US ISO 9407, Shoes sizes-Mondopoint system of sizing and marking

US ISO 17696, Footwear — Test methods for uppers, linings and insocks — Tear strength

US ISO 17707, Footwear — Test methods for outsoles — Flex resistance

US ISO 17708, Footwear — Test methods for whole shoe — Upper sole adhesion

US ISO 18454, Footwear — Standard atmospheres for conditioning and testing of footwear and components for footwear

US ISO 19952, Footwear — Vocabulary

US ISO 20875, Footwear — Test methods for outsoles — Determination of split tear strength and delamination resistance

3 Terms and definitions

No terms and definitions are listed in this document

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

4 Requirements

4.1 Sampling and conditioning

Wherever, possible test pieces shall be taken from the whole footwear unless otherwise stated. If it is not possible to obtain test pieces from footwear large enough to comply with test requirements, then samples may be taken from the material from which the component has been manufactured. However, this should be noted in the test report. All test pieces shall be conditioned at as per US ISO 18454

4.2 Design

4.2.1 Footwear incorporating features to suit and enhance the performance of sports person of various streams for which the footwear is designed and are categorized as low performance (casuals),medium performance and high performance

4.2.2 Mass of the footwear up to ankle back height shall not exceed 800g per pair and for ankle height shall not exceed 900g per pair maximum (for size 8 as per US ISO 9407)

4.2.3 Sports footwear shall be such that it would bend easily from heel to toe and shall retain its original shape immediately after release of force

4.2.4 It will be reinforced suitably at counter with reinforcement such that it will neither collapse nor lose shape retention property and shall be flexible

4.3 Whole footwear

4.3.1 Construction

Unless the footwear has a rigid sole, an insole shall be present in such a way that it cannot be removed without damaging the footwear.

4.3.2 Marking

4.3.2.1 Footwear

a) At the waist of the sole, the size and fitting number of footwear shall be legibly and indelibly marked.

b) On the sock the following shall be legibly and indelibly marked:

i) manufacturer's name and/or registered trade mark

ii) size and fitting number of footwear

iii) country of manufacture/origin; and

iv) type of material (Upper and bottom).

c) On the quarters or the tongue, the following shall be legibly and indelibly marked:

i) manufacturer's name and/or registered trade mark

ii) batch number

iii) size and fitting number of footwear; and

iv) type of material (Upper and bottom).

d) On either side of the waist of the sole, the sock or the quarter, the manufacturer's name or registered trade mark and type of material (upper and bottom) shall be legibly and indelibly marked.

Note: The type of material can be marked on one or on all of the four areas indicated above.

4.3.2.2 Carton

Each box shall bear the following information legibly and indelibly marked:

i) size of footwear; and

ii) manufacturer's name or registered trade mark.

4.3.2.3 Bale

Each bale shall bear the following information legibly and indelibly marked

i) name of product

ii) quantity

iii) name of manufacturer or local supplier's name and/or registered trade mark; and

iv) country of manufacture/origin.

4.3.3 Individual packing

Each pair of footwear shall be wrapped in a suitable polythene bag or any other suitable material and packed in a suitable box that will protect it from damage during normal transportation and storage

4.3.4 Upper to midsole bond performance

When footwear, other than with a rigid sole is tested in accordance with the method as prescribed in US ISO 17708, the bond strength between upper to midsole shall be as in Table 1

Table 1 Adhesion test on full shoe (upper-mid sole)

Material	Requirement			Method of test
	Casuals	Medium performance	High performance	
Leather upper, sole adhesion along the edge over 16 points, kg/cm, *Min*	3.2	3.5	3.5	US ISO 17708
Fabric upper, sole adhesion along the edge over 16	3.2	3.5	3.5	US ISO 17708

points, kg/cm, *Min*				
Synthetic upper, sole adhesion along the edge over 16 points, kg/cm, *Min*	3.0	3.2	3.2	US ISO 17708

4.3.5 Sole to Mid Sole Bond Performance

When footwear, other than with a rigid sole is tested in accordance with the method as prescribed in US ISO 17708, the bond strength between sole to mid sole shall be as given in Table 2.

Table 2 Adhesion Test on Full Shoe (Sole-Midsole)

Characteristic	Requirement			Method of test
	Casuals	Medium performance	High performance	
Sole adhesion along the edge over 16 points in, kg/cm, *Min*	2.8	3.0	3.0	US ISO 17708

4.4 Upper

The upper material used in the sports footwear shall conform to various requirements given in Tables 3, 4 and 5 depending on the type of material. Thickness of the upper shall be as agreed to between the purchaser and the supplier

Table 3 Upper Material — Leather

Characteristic	Conditions, if Any	Requirement			Method of test
		Casuals	Medium performance	High performance	
Flexing endurance, no damage to film or leather till prescribed cycles, Min	Dry Wet Hydrolysis [1)]	50,000 20,000 60,000	50,000 20,000 60,000	75,000 30,000 75,000	US ISO 17707
Adhesive strength, adhesion to sole/midsole, kg/cm, Min	-	3.2	3.5	3.5	US ISO 17708
Tensile strength, kg f/cm^2,Min	Split Leather Full grain	140 200	150 210	160 250	US ISO 3376
Elongation at break, percent, Min	-	40	40	40	US ISO 3376
Lastometer test, mm, Min[2)]	Crack [3)] Burst	7 10	7 10	7 10	ISO 3379
Tear strength, kgf, *Min*	-	7.0	7.0	7.0	US ISO 17696
Colour fastness, crocking, rating, *Min*	Dry Wet	Fair Good	Fair Good	Fair Good	US ISO 105-X12
Fastness to artificial light (Xenon lamp), grey scale rating, *Min*	-	Between 3 and 4	Between 3 and 4	Between 3 and 4	US ISO 105-B02

(Applicable for coloured leathers only)					

NOTE — Results to be given in kgf and not in kgf/cm thickness

1) Hydrolysis to be conducted as per Annex B.

2) Load to be specified.

3) Not applicable for split leathers and nubuck leathers. Only distension at burst to be determined for these leathers

Table 4 Upper Material — Synthetic

(Clause 4.4)

Characteristic	Conditions, if Any	Requirement			Method of test
		Casuals	Medium performance	High performance	
Flexing endurance, no damage to film or upper material till prescribed cycles, *Min*	Dry Hydrolysis [1)]	50,000 60,000	50,000 60,000	75,000 75,000	US ISO 17707
Adhesive strength, adhesion to sole/ midsole, kg/cm, *Min*	-	3.2	3.5	3.5	US ISO 17708
Breaking strength, kg/50 mm, Min	-	40	50	60	US ISO 3376
Elongation at break, percent, Min	-	15	15	15	US ISO 3376
Tear strength, kg, Min	-	3.0	3.5	4.0	US ISO 17696
Colour fastness, crocking, rating, Min	Dry Wet	Fair Fair	Good Good	Good Good	US ISO 105-X12
Fastness to artificial light (Xenon lamp), grey scale rating, *Min*	-	Between 3 and 4	Between 3 and 4	Between 3 and 4	US ISO 105-B02

1) Hydrolysis to be conducted as per Annex B.

Table 5 Upper Material — Textile Fabrics

(Clause 4.4)

Characteristic	Conditions, if Any	Requirement			Method of test
		Casuals	Medium performance	High performance	
Flexing endurance, no damage to coating/lamination/upper material till prescribed cycles, *Min*	Coated and laminated materials only	50,000	50,000	75,000	US ISO 17707
Adhesive strength, Adhesion to sole/	-	3.2	3.5	3.5	US ISO 17708

midsole, kg/cm, *Min*					
Breaking strength, kg/ 50 mm, *Min*	-	40	50	60	US ISO 3376
Elongation, percent, Min	Cotton canvas Others	10 15	10 15	10 15	US ISO 3376
Tear strength, tongue tear, kgf, *Min*	-	3.0	3.5	4.0	US ISO 17696
Colour fastness to rubbing, grey, Dry scale rating, *Min*	Dry Wet	3 3	3-4 3-4	3-4 3-4	US ISO 105-X12
Fastness to artificial light (Xenon lamp), grey scale rating, *Min*	-	3-4	3-4	3-4	US ISO 105-B02

4.5 Midsole

The midsole material used in the sports footwear shall conform to various requirements prescribed in Tables 6 and 7 depending on the type of material. Specific gravity and hardness shall be as agreed to between the purchaser and the supplier.

4.6 Outsole

The outsole material used in the sports footwear shall conform to various requirements prescribed in Tables 8 and 9 depending on the type of material. Specific gravity and hardness shall be as agreed to between the purchaser and supplier.

4.7 Insole

The insole material used in the sports footwear shall conform to various requirements prescribed in Tables 10 and 11 depending on the type of material.

4.8 Sock liner

The sock liner material used in the sports footwear shall conform to various requirements prescribed in Tables 12 and 13 depending on the type of material. Specific gravity and hardness shall be as agreed to between the purchaser and the supplier.

Table 6 Midsole Material — Ethyl Vinyl Acetate (EVA)

(Clause 4.5)

Characteristic	Requirement			Method of test
	Casuals	Medium performance	High performance	
Tensile strength, kg/cm, Min	14.0	16.0	18.0	US ISO 3376
Elongation at break, percent, Min	230	230	230	US ISO 3376
Split tear strength, kg/25 mm, Min	2.8	3.0	3.0	US ISO 20875

Tear strength, kg/cm, Min	7.0	8.0	9.0	US ISO 17696
Compression set, percent, Max	60	55	50	Annex A
Adhesion to sole, kg/cm, Min	2.0	3.0	3.0	US ISO 17708
Heat resistance, shrinkage linear, percent, Max	2.0	2.0	2.0	Annex C

Table 7 Midsole Materials — Polyurethane

(Clause 4.5)

Characteristic	Conditions, if Any	Requirement			Method of test
		Casuals	Medium performance	High performance	
Tensile strength kg/cm, *Min*	Dry	18.0	20.0	22.0	US ISO 3376
	Hydrolysis 1)	Shall retain 90 percent of the initial tensile strength			
Elongation at break, percent, *Min*		300	300	300	US ISO 3376
Split tear strength, kg/25 mm, *Min*	Dry	2.6	2.8	2.8	US ISO 20875
	Hydrolysis 1)	Shall retain 90 percent of the initial tensile strength			
Die-C tear strength, kg/cm, *Min*		13	14	15	DUS 1787
Compression set, percent, *Max*		6	5	4	Annex A
Adhesion to sole, kg/cm, *Min*		2.8	3.0	3.0	US ISO 17708
Heat resistance, shrinkage linear, percent, *Max*		2.0	2.0	2.0	Annex C
1) Hydrolysis to be conducted as per Annex B.					

Table 8 Outsole Materials — Rubber

(Clause 4.6)

Characteristic	Conditions, if Any	Requirement			Method of test
		Casuals	Medium performance	High performance	
Trouser tear strength, kg/cm, Min		12	12	15	Annex D
Die-C tear strength, kg/cm, Min		30.0	35.0	40.0	DUS 1787

Abrasion resistance, mm^3, Max		150	130	110	US 696
Adhesion to midsole, kg/cm, Min		2.8	3.0	3.0	US ISO 17708
Ross flexing, cycles, Min:	At 27 ± 2°C	50,000	50,000	75,000	DUS 1788
		Cut growth shall not exceed 300 percent			
	At – 5°C	50 000	50 000	75 000	
		Cut growth shall not exceed 300 percent			

Table 9 Outsole Material: Thermo Plastic Urethane (TPU)

(Clause 4.6)

Characteristic	Conditions, if Any	Requirement			Method of test
		Casuals	Medium performance	High performance	
Tensile strength	Dry	>20 MPa	>20 MPa	>20 MPa	US ISO 3376
	Hydrolysis [1)]	Shall retain 80 percent of the initial tensile strength			
Die-C tear strength, kg/cm, Min	Dry	-	75.0	90.0	DUS 1787
	Hydrolysis [1)]	Shall retain 80 percent of the initial split tear strength			
Abrasion resistance, mm^3, Max	-	-	95	70	US 696
Adhesion to midsole, kg/cm, Min	-	-	3.0	3.0	US ISO 17708
Ross flexing, cycles, Min	At 27 ± 2°C	-	50,000	75,000	DUS 1788
		Cut growth shall not exceed 300 percent			
	At – 5°C	-	50 000	75 000	
		Cut growth shall not exceed 300 percent			
	Hydrolysis [1)]	-	50,000	75,000	
		Cut growth shall not exceed 300 percent			
1) Hydrolysis to be conducted as per Annex B.					

Table 10 Insole Material: Cellulose Board

(Clause 4.7)

Characteristic	Condition/requirement	Requirement			Method of test
		Casuals	Medium performance	High performance	
Tensile strength, kg/cm^2, Min	Wet	90	55	40	US ISO 3376

Water absorption and loss, percent, *Min*	Water uptake	35	35	35	US 721
	Water loss	40	40	40	
Abrasion resistance, cycles, Min	-	400	400	300	US 696
Flexing index, Min	-	2.7	3.2	3.7	Annex L

Table 11 Insole Material: Stoble Non-woven

(Clause 4.7)

Characteristic	Condition/requirement	Requirement			Method of test
		Casuals	Medium performance	High performance	
Trouser tear strength[1], kg, *Min*	-	-	6.0	10.0	Annex D
Abrasion resistance, cycles, *Min*	Dry	25 600	25 600	25 600	US 696
	Wet	12 800	12 800	12 800	
Ross flexing, cycles, *Min*	-	50,000	50,000	75,000	DUS 1788
Heat resistance, shrinkage, percent, *Max*	At 70°C for 1 hr	2.0	2.0	2.0	Annex C
1) Using a rectangular piece 50 mm × 25 mm with a cut 20 mm long placed centrally and parallel with the longer sides to form a trouser tear test piece. Carry out the test at constant rate of traverse of 100 mm/min					

4.9 Laces

The lace material used in the sports footwear shall conform to various requirements prescribed in Table 14.

4.10 Counters

The counter material used in the sports footwear shall conform to various requirements prescribed in Table 15.

4.11 Metallic Trims and Components

The metallic trims and component material used in sports footwear shall conform to various requirements prescribed in Table 16.

Table 12 Sockliner Material: Ethyl Vinyl Acetate (EVA)

(Clause 4.8)

Characteristic	Requirement			Method of test
	Casuals	Medium performance	High performance	

Tensile strength kg/cm^2, Min	5.0	5.0	5.0	US ISO 3376
Elongation, percent, Min	75	75	75	US ISO 3376
Die-C tear strength kg/cm, Min	3.0	3.0	3.0	DUS 1787
Compression set, percent, Max	65	65	65	Annex A
Heat resistance, shrinkage linear, percent, Max	2.0	2.0	2.0	Annex C

Table 13 Sockliner Material: Polyurethane

(Clause 4.8)

Characteristic	Conditions, if Any	Requirement			Method of test
		Casuals	Medium performance	High performance	
Tensile strength, kg/cm^2, Min	Dry	8.0	8.0	8.0	US ISO 3376
	Hydrolysis [1)]	Shall retain 80 percent of the initial tensile strength			
Die-C tear strength, kg/cm, Min	Dry	3.5	3.5	3.5	DUS 1787
	Hydrolysis [1)]	Shall retain 80 percent of the initial split tear strength			
Elongation, percent, Min	-	250	250	250	US ISO 3376
Compression set, percent, Max	-	10	10	10	Annex A
Heat resistance shrinkage linear, percent, Max	-	1.0	1.0	1.0	Annex C
1) Hydrolysis to be conducted as per Annex B.					

Table 14 Lace Material

(Clause 4.9)

Characteristic	Requirement			Method of test
	Casuals	Medium performance	High performance	
Breaking strength, kg, Min	35.0	40.0	45.0	US ISO 3376
Colour migration/colour fastness, grey scale rating, *Min*	3-4	3-4	3-4	Annex F
Gripping strength of tags, kg, Min	10	12	14	Annex E
Abrasion resistance, lace-lace abrasion, cycles, Min	4 000	5 000	6 000	Annex K

Table 15 Counter Material: Thermoplastic, Solvent Activated and Heat Activated Sheets

(Clause 4.10)

Characteristic	Condition/requirement	Requirement			Method of test
		Casuals	Medium performance	High performance	
Crush load, kg, *Min*	-	200.0	250.0	300.0	Annex H
Collapsing load, kg, *Min*	Dry, initial	12.0	16.0	20.0	Annex J
	Dry, after 10th collapse	6.0	8.0	10.0	
	Wet, initial	10.0	14.0	17.0	
Shape retention, percent, *Min*	Dry, initial	80	80	80	Annex J
	Dry, after 10th collapse	60	60	60	
Ross flexing resistance cycles (without crack), *Min*		25 000	30 000	35 000	DUS 1788

Table 16 Metallic Trims and Components

(Clause 4.11)

Characteristic	Requirement			Method of test
	Casuals	Medium performance	High performance	
Corrosion resistance	No corrosion	No corrosion	No corrosion	Annex G

Annex A
(normative)

Compression set (static)

A.1 DESCRIPTION

This method is used to measure the ability of a foam material to return to its original thickness after being compressed or deflected between two parallel plates at a specified temperature and duration.

A.2 MATERIALS

Midsole or Sockliner Made of Foam Material

A.3 EQUIPMENT

a) Compression Apparatus;

b) Spacers, of thickness 4.0, 4.5, 5.0, 5.5 and 6.0 mm;

c) Thickness Gauge; and

d) Air-Circulating Oven, capable of maintaining 45.0 ± 1.0°C.

A.4 SAMPLE PREPARATION

Die cut four test samples having a diameter of 25.4 mm and a thickness of 10.0 ± 2.0 mm. The sample must be prepared with parallel top and bottom surfaces, and sides, which are perpendicular to the top and bottom surfaces. If a test sample is less than 8.0 mm, multiple layers of the test material must be stacked, without the use of adhesive, until a thickness of 10.0 ± 2.0 mm is obtained. Test four samples per material.

A.6 TEST PROCEDURE

Measure the thickness of the samples. Place the appropriate spacers on the compression platen, such that 50 per cent compression will be obtained, as follows:

Sample thickness (mm)	Spacer thickness (mm)
8.0-8.5	4.0
8.5-9.5	4.5
9.5-10.5	5.0
10.5-11.5	5.5
11.5-12.0	6.0

Place the test specimen onto the bottom platen and position the top platen onto the test specimen. Tighten the nuts on the test equipment until the top platen firmly contacts each of the spacers. Within 15 min after

compressing the samples, place the compression set equipment with test samples into their appropriate environment as described below:

a) EVA, Latex, Polyethylene = 45 ± 2°C for 6 h; and

b) Polyurethane = 23 ± 2°C for 22 h.

At completion of the exposure, immediately remove the test sample from the compression set equipment. Allow the materials to recover at 27 ± 2°C as described below:

a) EVA, Latex, Polyethylene = 30 ± 2 min; and

b) Polyurethane = 60 ± 2 min.

Immediately following the completion of the recovery period, measure the thickness of the samples in the same manner described above. If the sample has set unevenly, record the minimum thickness.

A.7 CALCULATION

$$\text{Compression set} = \frac{(\text{originalthickness}) - (\text{finalthickness})}{(\text{originalthickness}) - (\text{spacer thickness})} \text{x}100$$

A.8 REPORT

The average of the four test samples to the nearest 0.1 percent.

Annex B
(normative)

Hydrolysis

B.1 PREPARATION AND CONDITIONING OF TEST PIECES FOR HYDROLYSIS

Polyurethane elastomers are susceptible to hydrolytic attack by moisture, causing embitterment and cracking of the surface. By subjecting parts of the product to the treatment described in this annex and then completing tests as required in the standard, this can be evaluated.

B.1.1 PREPARATION OF TEST PIECES

Remove any lining from the test pieces. The thickness of the soling shall be reduced to 7 mm by buffing or other suitable means, avoiding temperature increase. The test pieces shall be strips of 25 mm width and approximately 150 mm length. Three test pieces shall be cut in the along direction. These test pieces shall normally be prepared not less than 7 days after moulding or more than 2 months after.

B.1.2 Procedure for Conditioning of Test Specimens

Place the test specimens in a desiccator, above water for 7 days at 70 ± 1°C so that during this period they will be in a saturated water vapour atmosphere. At the end of this treatment, condition the test specimens for 24 h at 27 ± 2 º C and 65 ± 5 percent relative humidity No metal shall be present inside the desiccator.

Annex C
(normative)

Heat resistance, Shrinkage linear

C.1 DESCRIPTION

This method measures the amount of shrinkage, which a midsole/insole/sockliner material undergoes as a result of exposure to heat for a specified time period.

C.2 EQUIPMENT

a) Air-circulating oven, capable of maintaining a temperature of 70.0 ± 1.0°C. Calibrate to ensure temperature being maintained at 70.0 ± 1.0°C; and

b) Steel scale, capable of measuring to 0.5 mm.

C.3 SAMPLE PREPARATION

Wherever possible, use a whole midsole, insole or sockliner unit. If unable to use a complete unit, die or hand cut samples which are at least 100 mm long, and having a width of 25.4 mm.

NOTE: Midsole test samples should be 10.0 ± 1.0 mm in thickness, unless compression-molded midsole foam is being evaluated. For compression-molded midsole foams, the entire thickness of the midsole should be used, preferably from an area of the midsole, which is nearest to 10 mm in thickness.

For whole midsole, insole or sockliner units, draw a line along the entire length of the sample. For die cut test samples, draw a line along each of the samples as shown in fig 4 Test two samples per material.

C.4 TEST PROCEDURE

C.4.1 For Foam Based Material Only

Using a vernier caliper, measure the length of line *L* to the nearest 0.1 mm (L_1) Place the test sample in an oven at 70.0 ± 1.0°C for 60 ± 3 min. Remove the test sample from the oven, and allow it to cool for 30 ± 2 min at 27.0 ± 2.0°C. Re-measure the length of line *L* to the nearest 0.1 mm (L_2).

C.4.2 For All Midsoles or Insoles

Use a steel scale which is stiff enough that it will not bend when taking a length measurement. Place the bottom edge of the steel scale on the midsole or insole such that the steel scale contacts the foam at both point *E* and point *F* of line *L* as shown in Fig. 5. The length (L_1) is measured from the inside edge of lines *AB* and *CD* as shown in Fig. 5. Measure to the nearest 0.5 mm. Place the test sample in an oven at 70.0 ± 1.0°C for 60 ± 1 min. Remove the test sample from the oven, and allow it to cool for at least 30 min at 27.0 ± 2.0°C. Using a steel scale, re-measure the length (L_2) to the nearest 0.5 mm.

NOTE: Length measurements must be taken using the bottom edge of the steel scale (to prevent it from bending).

C.4.3 For Sockliners

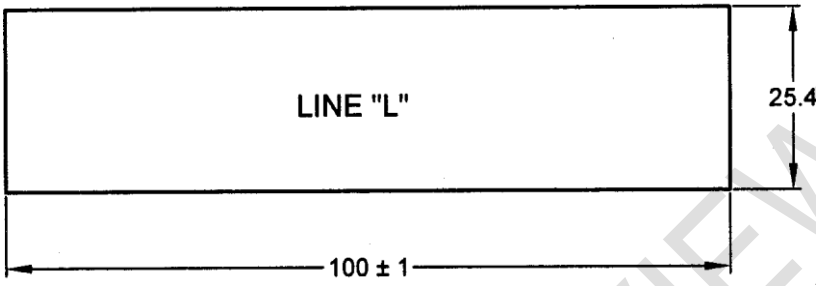
Using a vernier caliper, measure the length of line *L* to the nearest 0.1 mm (L_1) Place the test sample in an oven at 70.0 ± 1.0°C for 60 ± 1 min. Remove the test sample from the oven, and allow it to cool for at least 30 min at 27.0 ± 2.0°C. Using a vernier caliper, re-measure the length of line *L* to the nearest 0.1 mm (L_2)

C.5 CALCULATION

Shrinkage in length direction = $\frac{L1-L2}{L1} X100$

C.6 REPORT

The higher of the two measurements to the nearest 0.1 percent



All dimensions in millimeters

FIG. 4 SAMPLE FOR SHRINKAGE DUE TO HEAT

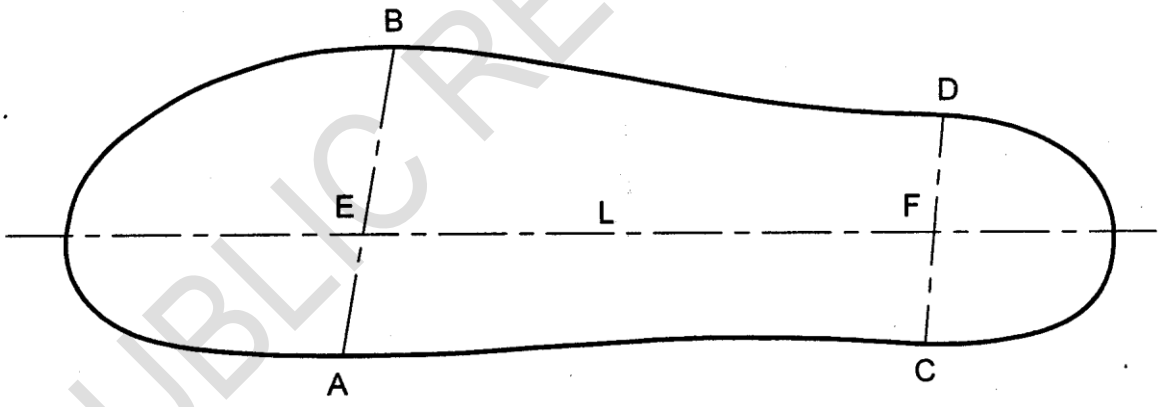


FIG. 5 L INEAR SHRINKAGE

Annex D
(normative)

Trouser tear strength

D.1 APPARATUS

D.1.1 Dies

The die used for cutting trouser test pieces shall have the outline dimensions as shown in Fig. 6.

D.1.2 Testing Machine

It shall be capable of registering the applied forces within 2 percent during the test while maintaining the specified constant rate of separation of the jaws of 100 ± 10 mm/min for the trouser test piece. A low inertia machine having autographic recording of force is essential when using the trouser test piece.

D.1.3 Thickness Gauge

D.1.4 Grips

The machine shall be provided with a type of grip which tightens automatically as the tension increases and exerts a uniform pressure across the widened end of the test piece. Each grip shall incorporate a means for positioning so that the test pieces are inserted symmetrically and in axial alignment with the direction of the pull. The depth of insertion shall be such that the test piece is adequately gripped, within the parallel portion, when testing angle and crescent test pieces. Trouser test pieces shall be inserted in the grips in accordance with Fig. 6.

D.2 TEST PIECE

Test pieces shall be cut from sheet of uniform thickness. Preferably the sheet shall have a thickness of 2.0 ± 0.2 mm; however, it is recognized that when sheets are prepared from certain products, this thickness may not be achievable. Sheets may be moulded, or prepared from products by cutting and/or buffing.

D.3 PROCEDURE

Measure the thickness of the test piece in the region in which tearing is expected to occur No reading in any one test piece shall deviate by more than 2 percent from the value to be used. If groups of test pieces are being compared, the median thickness of each group shall be within 1.5 percent of the grand median thickness of all groups. After conditioning the test piece at 27 ± 2°C for at least 24 h, immediately mount the test piece in the testing machine. Apply a steadily increasing traction force at a rate of separation of the grips of 100 ± 10 mm/min until the test piece breaks. Make an autographic recording of the force throughout the tearing process.

D.4 EXPRESSION OF RESULTS

The trouser tear strength expressed, in kg/cm of thickness, is given by the following formula:

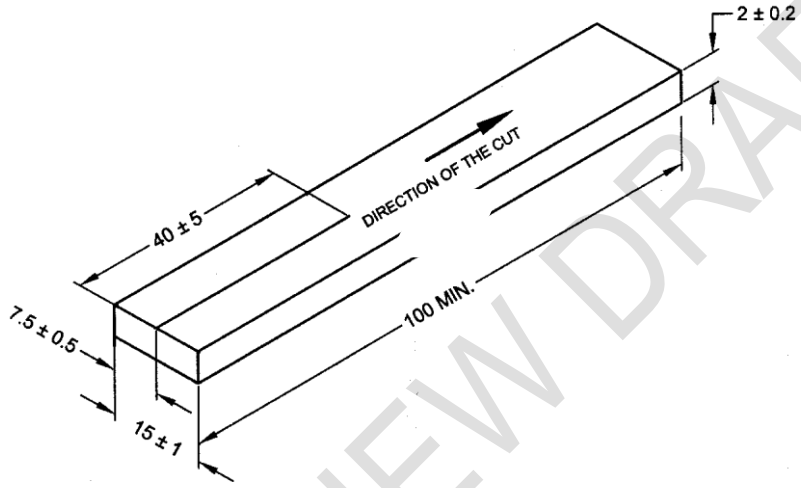
Trouser tear strength = $\frac{F}{d}$

Where

F = median force, in kg; and

d = thickness, of the test piece, in cm.

Determine the median and the standard deviation of the values for each direction. Express the results to the nearest kg/cm.



All dimensions in millimeters.

FIG. 6 TROUSER TEST PIECE

Annex E
(normative)

Gripping strength of tags

E.1 APPARATUS

E.1.1 Tensile strength testing machine, power-driven with a rate of traverse of 115 ± 12 mm/min

E.1.2 Slotted Plate

A rigid metal plate of suitable dimensions with a vertical edge tapered slot along the length of the plate In conjunction with the slopped plate, use the upper jaw of the testing machine to keep the slot at right angle to the direction of application of load during the test.

E.2 PROCEDURE

Move the conditioned test specimen with one of its tags uppermost horizontally along the slot until both sides of the base of the tag rest on the top of the slotted plate. Centre the plate so that longitudinal axis of the test specimen is along the axis of the application of the load. Apply by hand an initial tension sufficient to strengthen the lace. Clamp the free end of the straightened specimen in the pulling jaw so that the free distance between the upper grip and the pulling jaw is 100 mm at the start of the test. Operate the machine and record the highest load, in kg, registered before the tag is pulled from the lace. Discard the result and test another specimen if,

a) the tag comes through the slot without being removed from the fabric lace; and/or

b) the tag buckles at the base or the tag is scrapped without being removed from the lace before the specified minimum gripping strength is reached.

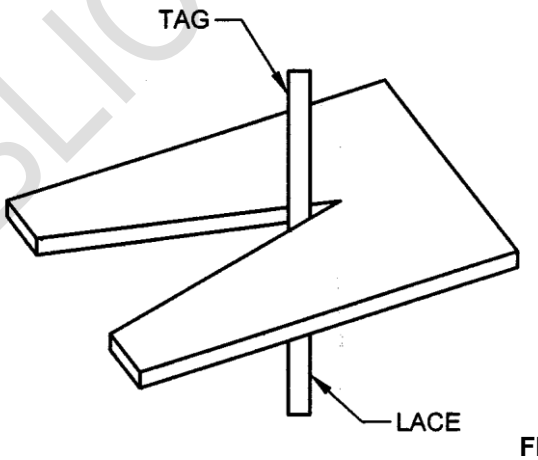


FIG. 7 SLOTTED PLATE

Annex F
(normative)

Colour migration/Colour fastness

F.1 TEST PIECE

Sample at least 2 pieces from the lot. The test piece shall be approximately 70 mm long and 10-15 mm wide.

F.2 PROCEDURE

a) two pieces of washed, white cotton strips (80 mm × 25 mm) are placed side by side, onto a glass or plexi-glass slide (100 mm × 60 mm);

b) the cotton is moistened with distilled water and the test pieces are laid on and centralized;

c) a second strip of cotton is then placed over the test pieces and moistened with distilled water;

d) the test pieces are covered with another glass slide, loaded with a weight of 500 g and left for 1 h;

e) the test pieces with the cotton strips are removed and stapled together on one end; and

f) they are allowed to dry at room temperature and then judged with the grey scale for colour loss

Annex G
(normative)

Corrosion

G.1 CHEMICAL

Sodium chloride test solution, one percent solution

G.2 TEST PIECE

Three test pieces from the lot.

G.3 APPARATUS

a) dessicator; and

b) air Circulating Oven.

G.4 PREPARATION OF SAMPLES

a) soak a large piece of washed, bleached cotton fabric in the sodium chloride test solution;

b) allow the fabric to dry;

c) cut the fabric up into small strips, approximately 6 cm × 3 cm; and

d) wrap the metallic trims/components in the fabric and bind them with a thread to ensure contact.

G.5 PROCEDURE

a) lay the dry test pieces in a dish;

b) place the dish in a desiccator with a little distilled water, and store for 3 days at 35°C.

G.6 EVALUATION

Visually examine the metallic trims/components for signs of corrosion and report.

Annex H
(normative)

Crush load

H.1 DESCRIPTION

This method measures the ability of a material to resist collapsing as a result of being compressed between two flat horizontal plates.

H.2 EQUIPMENT

H.2.1 Tensile Testing Machine

H.2.2 Compression plates, top plate has smooth surface; bottom plate has a circular groove cut centrally in it, as follows:

a) 1.0 ± 0.2 mm deep;

b) 1.5 ± 0.2 mm wide;

c) 49.0 ± 0.2 mm outside diameter of the circular groove; and

d) 44.0 ± 0.2 mm, inside diameter of the circular groove.

H.3 SAMPLE PREPARATION

Die cut the sample to a width of 25.4 ± 1 mm and a length of 150 ± 1 mm. Samples should always be cut such that the width direction corresponds to the height of the counter, and such that the sample is taken from near the base of the counter.

NOTE: To obtain a more uniformly shaped counter, place the test sample in an oven at 60°C for about 5 min, and reshape prior to die cutting.

Test three samples per material.

H.4 TEST PROCEDURE

a) measure the thickness at three points along the length of the sample (near the centre line) and record the average to the nearest 0.01 mm;

b) equip the tensile testing machine with the compression plates. Zero and calibrate the tensile testing machine. Set the crosshead speed to 25 mm/min;

c) position the test sample in the groove. If the test sample is too long, trim the length until the ends of the test sample butt when inserted in the groove;

NOTE: If the sample is over-trimmed, it must be discarded. It is not acceptable to have any gap between the ends of the test sample. Also, tape is not to 3400 (Part 1) be used to hold the two ends of the test sample together;

d) lower the top compression plate onto the test sample and continue to compress it until the sample collapses; and

e) record the maximum load to the nearest 0.1 kg.

H.5 REPORT

Report the average of the three samples to the nearest 0.1 kg.

NOTE: The thickness of the test sample is not factored into the crush strength measurement. However, it is important to measure the thickness of the test sample to verify the thickness for reference purposes.

Annex J
(normative)

Collapsing load and shape retention

J.1 DESCRIPTION

This method measures the load required to collapse counters, as well as their ability to maintain their formed shape. This method is not for use with injection molded counters.

J.2 EQUIPMENT AND APPARATUS

J.2.1.Dome Forming Tool — Dome forming tool comprises of a rigid heat and solvent resistant metal consisting of a dome capped piston of diameter 47.5 ± 0.5 mm dome of curvature radius 35.0 ± 0.5 mm. This will produce a dome height of 9.3 ± 0.2 mm.

a) a metal cylinder with an internal diameter less than 48 mm but large enough to allow the piston to move freely within it;

b) a length of at least 25 mm clamping ring flange on one end to take the clamping ring as specified;

c) a means of holding the piston to the cylinder in a position such that the edge of the domed cap is aligned with the outer surface of the clamping ring flange;

d) a clamping ring with an internal diameter of less than 48 mm but large enough to allow the piston to move freely within it;

e) an external diameter and design of any surface pattern that should ensure that the test specimen does not slip during the test, and should neither stretch nor compress the central area of the test specimen when it is clamped;

f) a method of tightening the clamping ring to the clamping flange on the end of the cylinder; and

g) a schematic diagram of the dome forming tool is given in Fig. 8;

J.2.2 A device, such as a press, for forcing the piston into the metal cylinder

J.2.3 Device for cutting, such as a press knife for cutting the following:

a) cutting circular test specimens of diameter 57 ± 1 mm to fit the dome forming tool;

b) cutting polyethylene rings of suitable diameter for the dome forming tool with external diameter 57 ± 1 mm and internal diameter 38 ± 1 mm; and

c) cutting circular test specimens of diameter to fit into the mould of the apparatus indicated at J.2.10 of diameter 63.5 ± 2 mm.

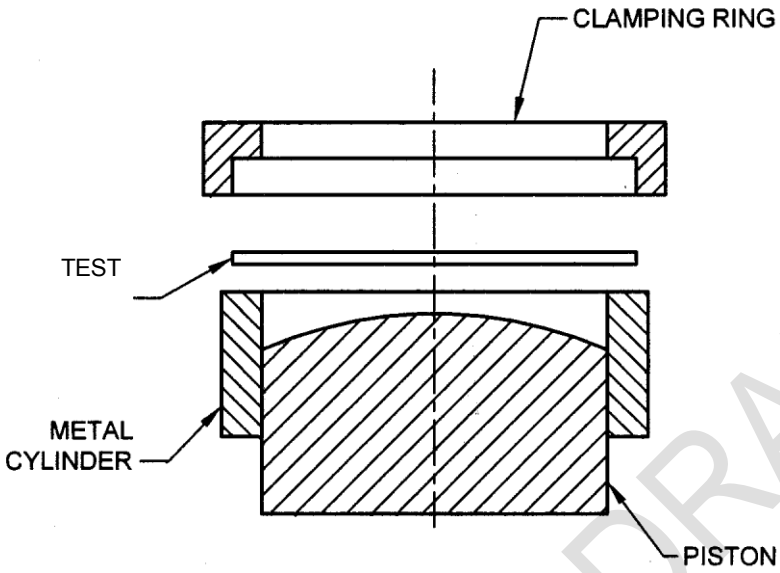


FIG.8 DOME FORMINGTOOL

J.2.4 Thin Polyethylene Sheet Material

J.2.5 An Electric Fan

J.2.6 Fan Assisted Oven, capable of maintaining a temperature of 95 ± 5°C.

J.2.7 Heat Resistant Gloves

J.2.8 Acetone or Other Solvent, recommended by the counter manufacturer

J.2.9 Silicone based release agent in the form of a spray.

J.2.10 A two part metal mould with a lower block having a spherical recess of diameter 47.5 ± 0.5 mm, depth 9.3 ± 0.2 mm and radius of curvature 35.0 ± 0.5 mm and an upper block having a downward facing spherical dome of the same dimensions as the spherical recess in the lower block, such that the dome will fit into the recess. A schematic mechanism for holding together the two halves of the mould is shown in Fig. 9.

J.2.11 A hydraulic press capable of applying a force of up to 120 ± 10 kN to the mould.

J.2.12 A source of steam, such as an electric kettle where water can be kept at boiling point

J.2.13 Tongs or similar apparatus for holding test specimens in a jet of steam.

J.2.14 A height gauge consisting of a flat plate with a clamping ring meeting the requirements and fitted on its lower surface.

J.2.15 Thickness gauge which,

a) has a spindle with a spherical lower surface of radius 1.5 ± 0.2 mm;

b) applies a force of 0.55 ± 0.10 N to the spindle;

c) is capable of measuring to the nearest 0.05 mm; and

d) is mounted so that the spindle passes vertically through the hole in the flat plate. A schematic diagram of the height gauge is given in Fig. 10.

J.2.16 A tensile testing machine with,

a) a jaw separation rate of 50 ± 5 mm/min; and

b) a force range appropriate to the test specimen material. This will usually be less than 500 N for stiffener materials.

J.2.17 A compression cage, for use with the tensile testing machine with,

a) a vertically mounted plunger, the end face of which is circular and has a diameter of 20.00 ± 0.25 mm;

b) a platform upon which the domed test specimen can be mounted centrally under the plunger; and

c) a minimum clearance of 20 mm between the plunger and the platform.

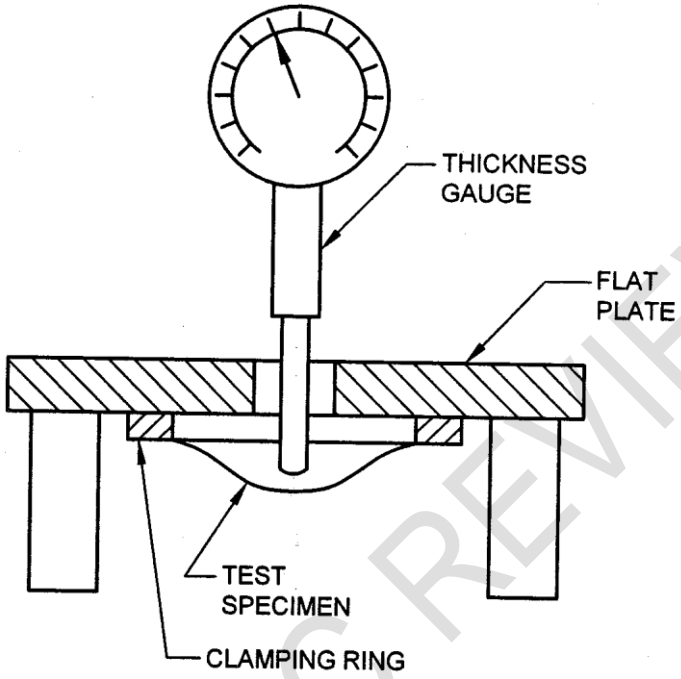


FIG. 10 HEIGHT GAUGE

J.2.18 A device for manually compressing the domed test specimens with,

a) a vertically mounted plunger, the end face of which is circular and has a diameter of 20.00 ± 0.25 mm;

b) a rigid base plate upon which the domed test specimen can be mounted centrally under the plunger; and

c) a minimum clearance of 20 mm between the base plate and the plunger.

J.3 SAMPLE PREPARATION

J.3.1 Die or hand cut samples 57.0 ± 1.0 mm in diameter.

NOTE: To minimize material differences between the dry and wet tests, cut two samples directly next to each other. Label the first D_1 (Dry sample 1), and the second W_1 (Wet sample 1). In a similar manner, cut samples D_2 and W_2 and D_3 and W_3 from different locations of the material.

J.3.2 To further minimize material differences, sample D_1 and W_1 should be formed in the same dome former, as should D_2 and W_2 and D_3 and W_3. Place the test sample on the base of the dome former with the

plunger retracted from the test sample to its lowest point (do not loosen the thumb screw so much that the plunger can be removed from the cylinder/base).

NOTE: If the sample is adhesive coated, a thin sheet of polyethylene (greater than 57 mm in diameter) should be placed on the adhesive-coated side(s).

J.3.3 With the thumb screw at the lowest point in the cylinder, tighten the thumb screw. Place the clamping ring on top of the dome former base, and close using the two toggle clips. Place the dome former in an air circulating oven at 95.0 ± 2.0°C for 8 min. Remove the dome former from the oven, and immediately place on the toggle press with its platen raised. Loosen thumb screw on the dome former, and lower the toggle press until clamp. Tighten the thumb screw to hold the plunger in the highest possible location in the cylinder.

NOTE: To ensure that the dome is properly formed, it is very important that the above step is undertaken very quickly to minimize cooling, and also such that the outer cylinder of the dome former contacts the toggle press base.

J.3.4 Remove the dome former from the toggle press, and allow to cool at 27.0 ± 2.0°C for 90 min. Remove the test sample from the dome former, and condition for an additional 24 h at 27.0 ± 2.0°C before performing any testing. Test three dry samples and three wet samples per material.

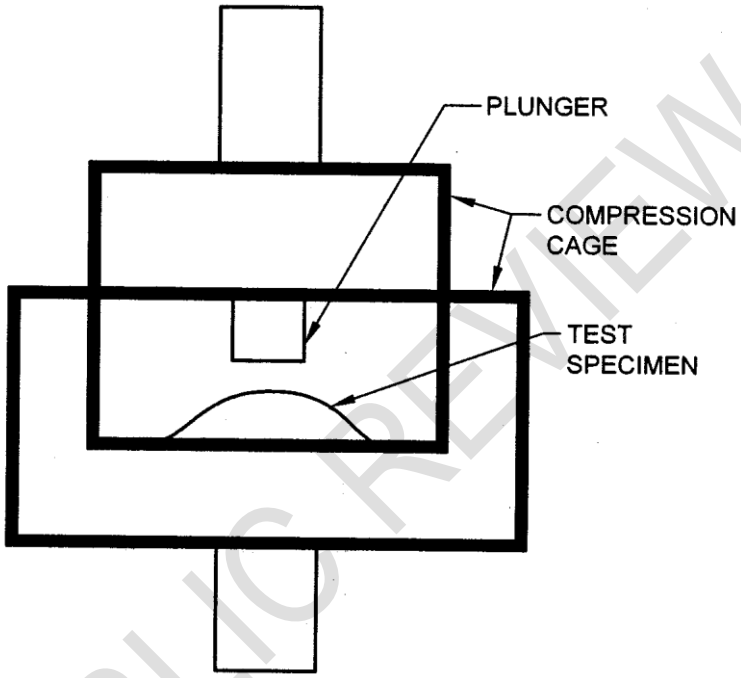


FIG. 11 COMPRESSION CAGE

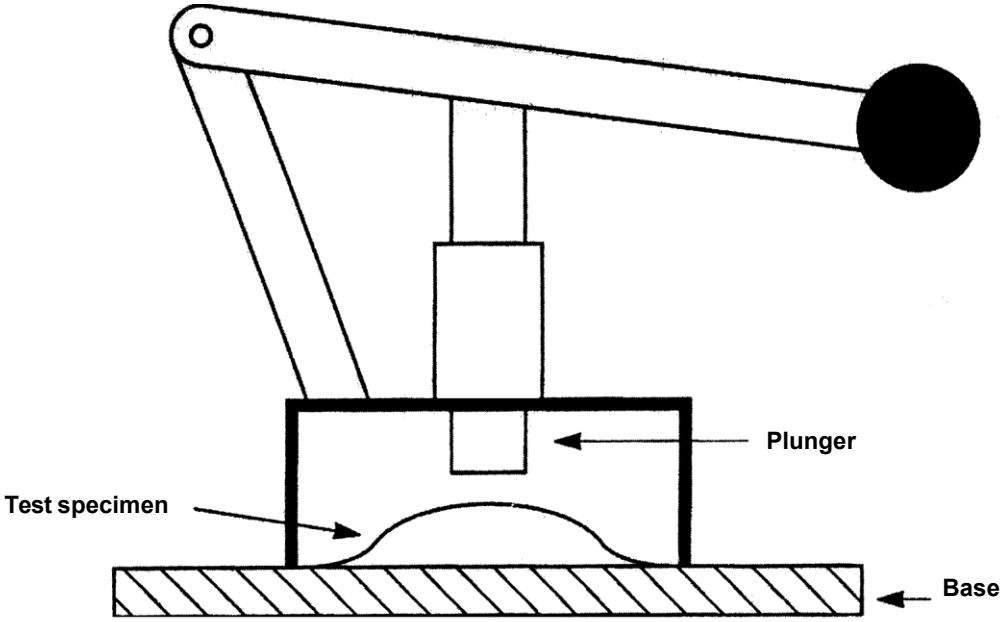


FIG. 12 MANUAL COMPRESSION DEVICE

J.4 TEST PROCEDURE

J.4.1 Dry Tests

a) using the height measuring device, measure the thickness of the base plate of the holding jig directly adjacent to the hole, and record to the nearest 0.01 mm (H_1);

b) place the dome centrally in the holding jig such that the base of the dome is in firm contact with the underside of the holding jig base plate;

c) place the holding jig under the plunger of the height measuring device;

d) zero the height measuring device on the top of the holding jig, directly adjacent to the hole in the base plate;

e) insert the plunger through the hole in the holding jig until it contacts the centre (lowest point) of the dome. Record the maximum height (H_2) to the nearest 0.01 mm;

f) position the compression cage in the tensile testing machine;

g) zero and calibrate the tensile testing machine. Set the crosshead speed to 50 mm/min;

h) insert the dome centrally under the compression plunger;

i) compress the dome until it collapses and a maximum load reading is obtained. (This will typically occur within 5 mm after the plunger first contacts the dome.) Record the maximum load to the nearest 0.1 kg. As the initial dry collapsing load (L_1);

j) reverse the crosshead direction of the tensile testing machine, and remove the dome once the plunger is no longer in contact with it. Push out any deformation of the dome;

k) place the dome centrally under the plunger of the repeated collapsing device. Manually collapse the dome 8 times such that the dome instantaneously contacts the base of the repeated collapsing device. In between each collapse, push out any deformation of the dome;

l) once again, insert the dome centrally under the compression plunger, and repeat Step g). Record the maximum load to the nearest 0.1 kg, as the tenth dry collapsing load (L_2). Reverse the crosshead direction of the tensile testing machine, and remove the dome once the plunger is not longer in contact with it. Push out any deformation of the dome; and

m) repeat steps (b) to (e) to obtain the height after 10th collapse (H_3).

J.4.2 Wet Tests

a) soak the test samples in distilled water at 23.0 ± 2.0°C for 1h; and

b) immediately after removal from the water, repeat steps (b) to (m) to obtain the same measurements, utilizing a wet test sample.

J.5 CALCULATIONS

Initial area shape retention, dry percent = $\frac{(H_2 - H_1)^2}{(9.33^*)^2} X100$

Shape retention after 10^{th} collapse, dry percent = $\frac{(H_3 - H_1)^2}{(9.33^*)^2} X100$

Initial area shape retention, wet percent = $\frac{(H^\dagger - H_1)^2}{(9.33^*)^2} X100$

* The height of each dome former plunger mold should be measured. If different from 9.33, the appropriate height should be substituted.

† H_2 in this case is for the wet sample.

J.6 REPORT

Report the average of the three samples. Shape retention, percent resilience, and percent moisture resistance are to be reported to the nearest 0.1 percent. Collapsing load is to be reported to the nearest 0.1 kg.

Annex K
(normative)

Lace-Lace abrasion resistance

K.1 APPARATUS

PFI/Bennewart Shoe Lace Tester

K.2 METHOD

a) cut long laces in half. One lace is clamped in the front moving clamp in such a manner that a loop is formed in the middle of the lace;

b) the second lace is clamped on one end in the opposing fixed clamp on the guide wheel side; and

c) the free end is then passed through the loop, over the guide wheel, and loaded with a 250 g weight.

K.3 REPORT

Report the average number of cycles, maximum, or till failure.

Annex L
(normative)

Flexing index

L.1 PRINCIPLE

A specimen is held in tension and repeatedly flexed through 180° until failure occurs. The base 10 logarithm of the number of flexing cycles to failure is calculated to give the flexing index of the material.

L.2 APPARATUS AND MATERIALS

a) a flexing machine with at least six pairs of jaws (*see* Fig. 13) that each have one jaw with a taper angle of 76 ± 4° and an internal tip radius of 0.8 ± 0.1 mm;

b) a means of rotating the jaw cyclically under simple harmonic motion, about an axis which is projected from the jaw tips (*see* Fig. 11), between two points 90 ± 2º each side of the vertical at a rate of 60 ± 10 cycles/min;

c) a second jaw with a means of maintaining a standard tensional force on the test specimen of 19.6 ± 0.1. A weight attached to the jaw so that a total mass of 2 000 ± 10 g is suspended from the test specimen is a convenient method of achieving this;

d) a method of counting the number of oscillations of the rotating jaw up to failure of the specimen; and

e) a means, such as a tongue wrench, of controlling the clamping force of the rotating jaw.

L.3 PREPARATION OF TEST SPECIMENS

a) place the uncut sheet material into a standard controlled environment of 27 ± 2°C and 65 ± 2 percent RH for at least 48 h; and

b) cut six rectangular test specimens, 70 ± 10 mm × 10.0 ± 0.1 mm three with their length parallel to the principal or along direction of the material and three at 90° to this in the across direction.

L.4 PROCEDURE

a) ensure that the atmosphere surrounding the test machine is at a temperature of 27 ± 2°C and a relative humidity of 65 ± 2 percent;

b) place each test specimen between a pair of jaws and on the flexing machine so that the longer edges of the specimen are perpendicular to the clamping edge of both jaws.

c) tighten each rotating jaw until it exerts a clamping force of 2.4 ± 0.4 kN on the test specimen;

d) for each non-rotating jaw, apply a tensioning force of 19.6 ± 0.1 N to the jaw;

e) tighten the jaw onto a test specimen until it exerts a clamping force, which is sufficient to prevent it slipping. The clamping force should not be unnecessarily high as this may damage the test specimen;

f) operate the flexing machine and record the total number of flexing cycles as each specimen fails. When all the test specimens have failed stop the flexing machine;

g) for each test specimen, calculate the base 10 logarithm of the total number of flexing cycles to failure; and

h) calculate the arithmetic mean of the logarithms for each of the principal directions of the material. These two values are termed the flexing indices.

L.5 TEST REPORT

a) the logarithm of the number of flexing cycles to failure for each test specimen, as calculated in **L.4.g)**;

b) the flexing index for each principal direction as calculated in **L.4.h)**; and

c) any deviations from this standard test method.

Annex M
(normative)

Tensile properties of Insole materials

M.1 PRINCIPLE

M.1.1 Method 1 — Tensile Strength (Semi-rigid Materials)

A dumb-bell shaped test specimen is gradually stretched, by a tensile testing machine, until it fails. The tensile strength of the specimen is determined. The test can be carried out with either dry or wet specimens.

M.1.2 Method 2 — Breaking Strength, Extension at Break, and Modulus (Flexible Materials)

A rectangular test specimen is gradually stretched, by a tensile testing machine, until it fails. The breaking strength, the extension at break and the modulus of elasticity at 5 percent extension of the specimen are all determined.

M.2 APPARATUS

M.2.1 A tensile testing machine with,

a) a jaw separation rate of 100 ± 10 mm/min;

b) a force range appropriate to the specimen under test. This will usually be less than:

1) 2 kN for footwear insole materials; and
2) 2 kN for flexible materials used for sewnin sock construction; and
c) the capability of measuring the force shall be of accuracy of at least 2 percent.

M.2.2 A press knife or other means of cutting dumbbell shaped test specimens, *see* Fig. 14.

M.2.3 A dial thickness gauge which applies a pressure of 49 ± 5 kPa over a circular area of diameter 10 ± 1 mm.

M.2.4 Distilled or De-ionized Water

M.2.5 A device such as a vernier caliper for measuring distance up to 25 mm to the nearest 0.1 mm

M.3 PREPARATION OF TEST SPECIMEN

a) store the uncut sheet material in a standard controlled environment of 27 ± 2°C and 65 ± 2 percent RH for at least 48 h before cutting out the test specimens and carry out the test in this environment;

b) cut six test specimens with the dimensions specified in Fig.12, three with their longer edges parallel to the perpendicular direction of the material and three at 90° to this with their longer edges parallel to the horizontal direction; and

c) examine the test specimens, reject any that show signs of damage and cuts.

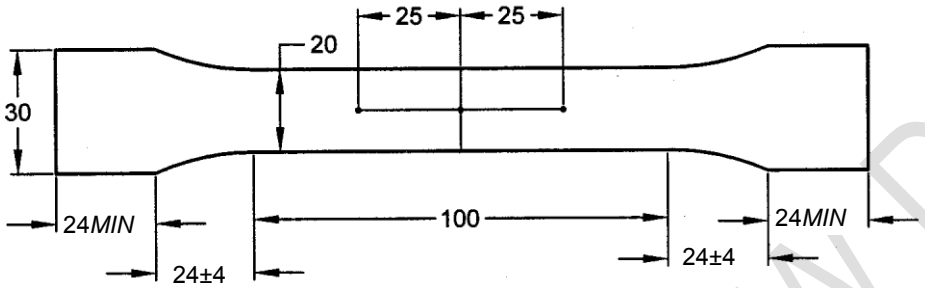
M.4 PROCEDURE

M.4.1 Method 1 — Tensile Strength (Semi-rigid Materials)

M.4.1.1 Use the thickness gauge to measure the thickness of each test specimen, to the nearest 0.01 mm, at the centre of the narrow portion and at two points on the longitudinal axis approximately 25 mm on either side of the centre, see Fig. 14.

M.4.1.2 Use the device to measure the width of each test specimen, to an accuracy of 0.1 mm, across the centre of the narrow portion and through points approximately 25 mm on either side of the centre, see Fig.14.

M.4.1.3 Adjust the tensile testing machine so that the jaws are approximately 150 mm apart.



All dimensions in millimetres.

FIG.14 DUMB BELL SPECIMEN FOR METHOD1

M.4.1.4 Insert one end of a test specimen in each of the jaws of the tensile testing machine (see M.3.1) and clamp it, so that a similar area of the test specimen is clamped in each jaw.

M.4.1.5 Mark a line on the test specimen along the clamping edge of each jaw.

M.4.1.6 Operate the tensile testing machine so that the jaws separate at a speed of 100 ± 10 mm/min.

M.4.1.7 Stop the machine when the test specimen fails and examine the type of failure and the alignment of the lines (see **M.4.1.1**) with the clamping edges of the jaws. Reject the results and repeat the test for specimens which,

a) slip asymmetrically in the jaws by more than 2mm; and

b) do not fail within the narrow portion of the test specimen.

M.4.1.8 Record from the graph of force versus extension the breaking force in newtons, as (*F*), to the nearest 5 *N*.

M.4.1.9 Repeat the procedure in **M.4.1.3** to **M.4.1.8** a further five times for the remaining test specimens.

M.4.1.10 For each test specimen calculate:

[*T*] The arithmetic mean of the three thickness measurements (see **M.4.1.1**).
[*W*] The arithmetic mean of the three width measurements (see **M.4.1.2**)
[*A*] The cross-sectional area in mm_2 using the formula: [*A*] + [*T*] × [*W*].
[*S*] The tensile strength in MPa using the formula: [S] = [F]/[A].

M.4.1.11 Calculate the arithmetic mean tensile strength of the three test specimens cut in each principal direction.

M.4.1.12 If the tensile strength of wet test specimens is required then,

a) repeat the procedure in **M.4.1.1** to **M.4.1.2** with six new test specimens;

b) store the six test specimens for 6.0 ± 0.2 h in the distilled or de-ionized water (see **M.2.2)**, so that they are fully immersed but not lying in contact with the vessel or other specimens;

c) for each test specimen remove it from the water and gently press a soft absorbent cloth or paper tissue over its surfaces to blot away any excess water. Repeat the procedure in **M.4.1.3** to **M.4.1.8**; and

d) repeat the procedure in **M.4.1.10** to **M.4.1.11**.

M.4.2 Method 2 — Breaking Strength, Extension at Break, and Modulus (Flexibles)

M.4.2.1 On each test specimen mark two lines which are:

a) a similar distance from the centre of the test specimen;

b) at 90° to the longer edges of the test specimen; and

c) 100 ± 1 mm apart.

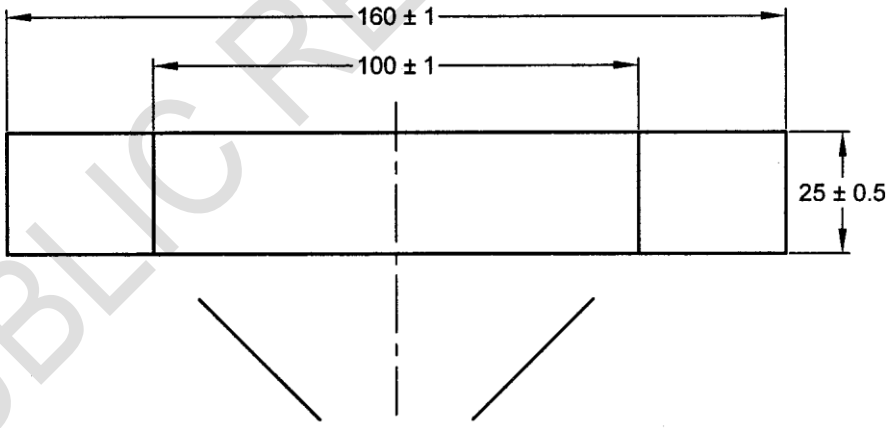
M.4.2.2 Adjust the tensile testing machine so that the jaws are 100 ± 1 mm apart.

M.4.2.3 Insert one end of a test specimen in each of the jaws of the tensile testing machine (see **M.4.1.4**) and clamp it, so that,

a) the lines are aligned with the clamping edges of the jaws;

b) the test specimen is neither taut nor slack; and

c) a similar are of the test specimen is clamped in each jaw.



LINES DRAWN AS (M.4.2.1)

All dimensions in millimetres.

FIG. 15 RECTANGULAR SPECIMEN FOR METHOD 2

M.4.2.4 Operate the tensile testing machine so that the jaws separate at a speed of 100 ± 10 mm/min.

M.4.2.5 Stop the machine when the test specimen fails and examine the type of failure and the alignment of the lines (see **M.4.1.1**) with the clamping edges of the jaws. Reject the results and repeat the test for specimens which:

a) slip asymmetrically in the jaws by more than 2 mm; and

b) fail within 5 mm of either jaw, but only if less than three of the six test specimens show this type of failure.

M.4.2.6 Record from the graph of force versus extension,

a) breaking force in newtons to the nearest 5 N;

b) extension at break in millimeters to the nearest 1 mm;

c) the force on the specimen when it has been extended by 5 percent equivalent to a jaw separation of 105 mm, as F, to the nearest 1 N.

M.4.2.7 Repeat the procedure in **M.4.2.2** to **M.4.2.6** a further two times for the other two specimens cut in the same principal direction.

M.4.2.8 For each test specimen divide the breaking force (see **M.4.2.6**) by the width of the test specimen in mm to give a breaking strength in N/mm to the nearest 0.1 N/mm.

M.4.2.9 For each test specimen calculate the modulus of elasticity at 5 percent extension, in terms of tensile stress in N/mm using the formula:

Modulus of elasticity = Width of test specimen, in mm *F*

M.4.2.10 Calculate the arithmetic mean,

a) breaking strength in N/mm;

b) percentage extension at break (see **M.6.1**); and

c) modulus of elasticity in N/mm.

M.4.2.11 Repeat the procedure in **M.4.2.2** to **M.4.2.10** for the three test specimens cut in the other principal direction.

M.5 TEST REPORT

Test report includes:

a) reference to this test method;

b) the version of the test conducted, Method 1 or Method 2;

c) a description of the material, including mass per unit area or thickness, if known;

d) in case done by Method 1;

1) whether the specimens were tested wet or dry

2) the mean tensile strength for each principal direction (see **M.4.1.11**).

e) in case done by Method 2;

1) the mean breaking force for each principal direction (see **M.4.2.10**).

2) the mean extension at break for each principal direction (see **M.4.2.11**)

3) the mean modulus of elasticity at 5 percent extension for each principal direction (see **M.4.2.11**).

f) any deviations from this standard test method.

M.6 ADDITIONAL NOTES

M.6.1 Calculating Percentage Extension at Break

The percentage extension at break is numerically equal to the extension at break in mm for an initial jaw separation of 100 mm.

M.6.2 Selecting Jaw Type and Clamping Forces

To minimize the chances of the test specimen slipping in the jaw or the specimen failing at the clamped edge during testing it is important that the clamping force and type of jaw used are suitable for the specimen under test.

M.6.3 Dumb-Bell Shaped Test Specimens

Dumb-bell shaped test specimens are used to reduce the chances of the jaw slippage when testing materials, which have a high modulus of elasticity. The dumb-bell shape increases the area of the specimen held in the clamps and reduces and force required to break the test specimen.

Bibliography

[1] IS 15844:2010, Sports footwear — Specification

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