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Flexible cellular polymeric materials — Polyurethane foam for load-bearing applications excluding carpet underlay — Specification

Matériaux polymères alvéolaires souples — Mousse de polyuréthanne pour utilisations soumises à des charges, à l'exclusion des revers de tapis — Spécifications

Reference number
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Foreword

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The committee responsible for this document is ISO/TC 45, *Rubber and rubber products*, Subcommittee SC 4, *Products (other than hoses)*.

This third edition cancels and replaces the second edition (ISO 5999:2007), which has been technically revised.

Flexible cellular polymeric materials — Polyurethane foam for load-bearing applications excluding carpet underlay — Specification

1 Scope

This International Standard specifies requirements for flexible load-bearing polyurethane foam of the polyether type.

It is applicable to flexible polyurethane cellular materials manufactured in block, sheet and strip form, in moulded and fabricated shapes, and as reconstituted material, used for load-bearing applications in general, but excluding carpet backing and underlay. It, thus, primarily relates to the quality of polyurethane foam used for comfort cushioning purposes.

The foam is classified according to the type of foam, the performance during a fatigue test, and the indentation hardness index used as a means of grading materials.

This International Standard is not applicable to polyurethane foams foamed in place or to foams for use in heat-welded systems unless for load-bearing purposes.

Recommended applications for the range of flexible polyurethane foams covered by this International Standard are listed in Annex A.

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.

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

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

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

ISO 1923, *Cellular plastics and rubbers — Determination of linear dimensions*

ISO 2439:2008, *Flexible cellular polymeric materials — Determination of hardness (indentation technique)*

ISO 2440, *Flexible and rigid cellular polymeric materials — Accelerated ageing tests*

ISO 3385, *Flexible cellular polymeric materials — Determination of fatigue by constant-load pounding*

ISO 3582, *Flexible cellular polymeric materials — Laboratory assessment of horizontal burning characteristics of small specimens subjected to a small flame*

ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 8307, *Flexible cellular polymeric materials — Determination of resilience by ball rebound*

ISO 23529, *Rubber — General procedures for preparing and conditioning test pieces for physical test methods*

3 Classification

3.1 Type

For the purposes of this International Standard, flexible polyurethane foams are classified in accordance with Table 1.

Table 1 — Types of foam

Type		Description of foam
I	LB	Block foam, slabstock or contour cut [low resilience (known as "viscoelastic")]
	MB	Block foam, slabstock or contour cut (conventional)
	HB	Block foam, slabstock or contour cut (high resilience)
II	LM	Moulded [low resilience (known as "viscoelastic")]
	MM	Moulded (conventional)
	HM	Moulded (high resilience)
III	RE	Reconstituted or bonded

3.2 Class

3.2.1 Materials of the types of foam listed in Table 1, except for type MM (see footnote b to Table 7) and RE (see footnote a to Table 8), are subdivided into five classes based on the performance in the constant-load pounding test described in ISO 3385.

3.2.2 The five classes, their intended types of service and their intended hardness loss ratio are given in Table 2.

Table 2 — Classes and intended types of service

Class	Type of service	Hardness loss ratio P (%)
X	Exceptionally severe	$0 \leq P < 12$
V	Very severe	$12 \leq P < 22$
S	Severe	$22 \leq P < 32$
A	Average	$32 \leq P < 39$
L	Light	$39 \leq P < 45$

NOTE The hardness loss ratio is calculated from the following formula:

$$P = \frac{H - F}{H} \times 100$$

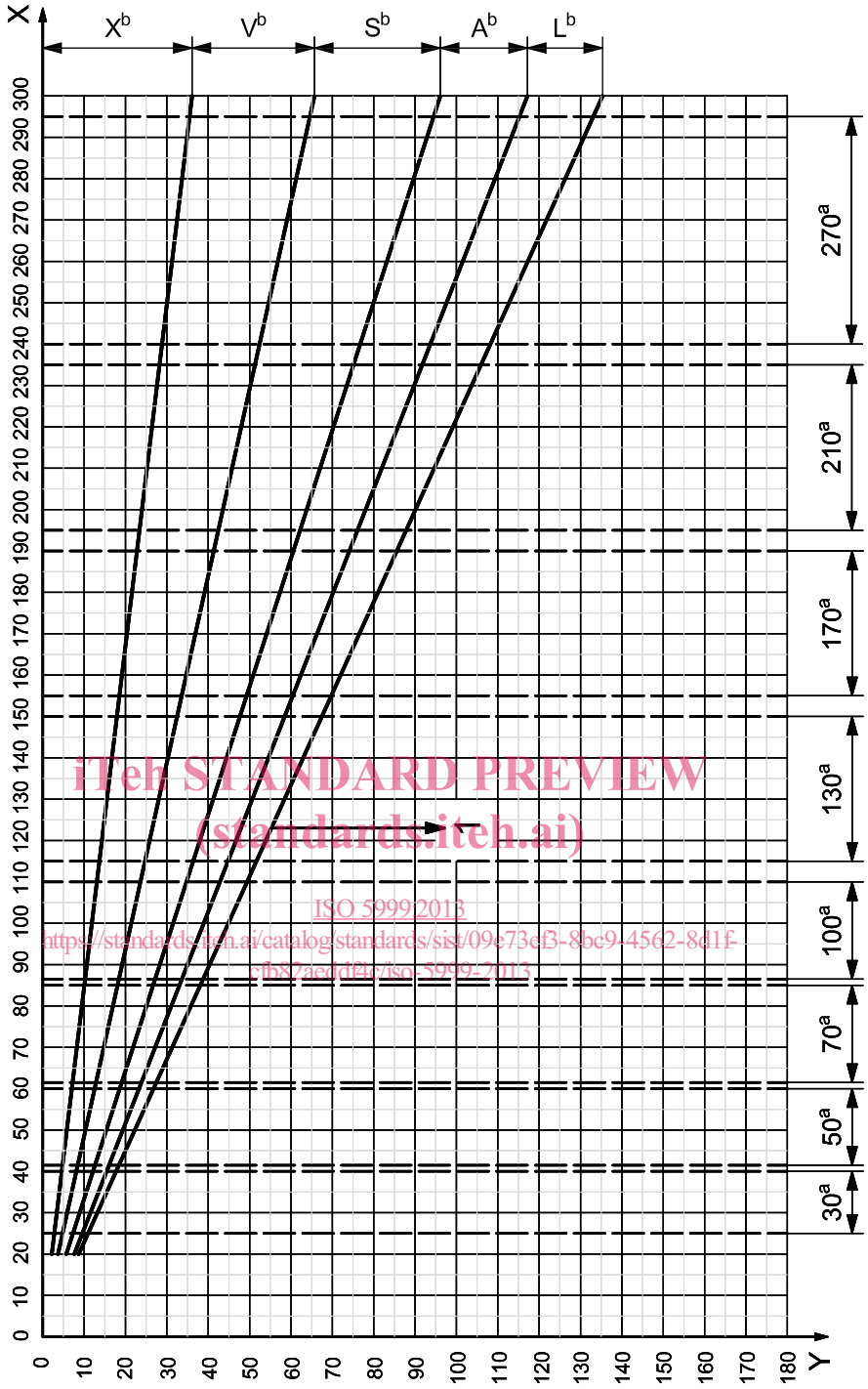
where

P is the hardness loss ratio (%);

H is the initial hardness index (N);

F is the final hardness index (N).

3.2.3 Classes X, V, S, A and L are defined by the indentation hardness loss over the range of hardness index values from 0 N to 650 N, as shown in Figures 1 and 2, provided the requirements for physical properties specified in Table 6, Table 7 and Table 8 are met.



Key

X initial indentation hardness index (N)

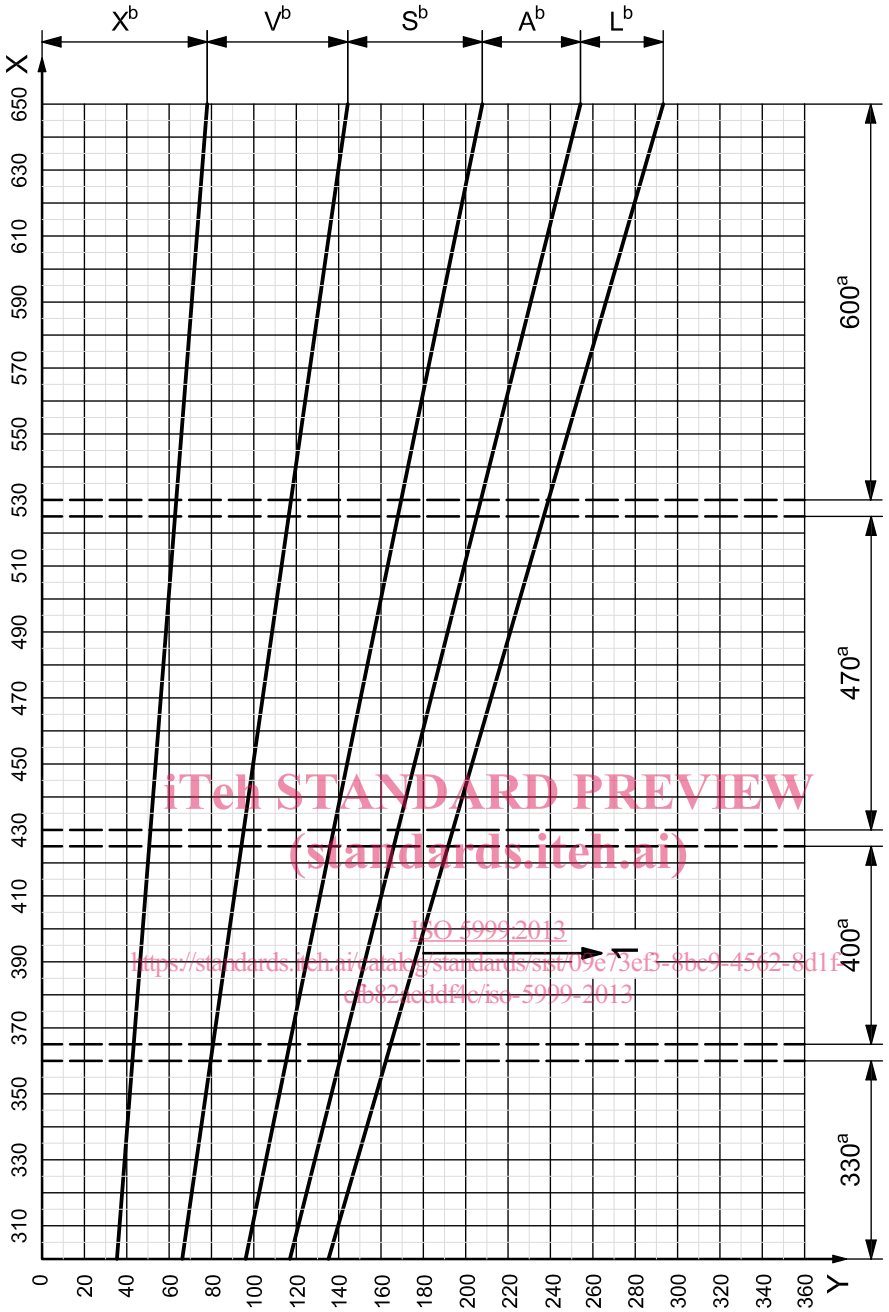
Y indentation hardness loss, ($H - F$) (see the Note to Table 2) (N)

1 below lowest line, material does not comply with this International Standard

a Hardness index grades.

b Classes of material.

Figure 1 — Fatigue classes and indentation hardness index grades — Low hardness values



Key

X initial indentation hardness index (N)

Y indentation hardness loss, (H – F) (see the Note to Table 2) (N)

1 below lowest line, material does not comply with this International Standard

a Hardness index grades.

b Classes of material.

NOTE 1 Class A and class L materials might not be available at all high hardness levels.

NOTE 2 Reconstituted foam (type RE), because of its good fatigue properties combined with poorer compression set, tensile strength and elongation at break properties, is specified separately in Table 8. It is generally used as thin, firm padding or to provide reinforcement for the other foams.

Figure 2 — Fatigue classes and indentation hardness index grades — High hardness values

3.2.4 As an example, in Figure 1, a material of initial hardness indentation index 140 N,

— with an indentation hardness loss greater than or equal to 0 N and less than 17 N is a class X material,

— with a hardness loss greater than or equal to 17 N and less than 31 N is a class V material,

— with a hardness loss greater than or equal to 31 N and less than 45 N is a class S material,

— with a hardness loss greater than or equal to 45 N and less than 55 N is a class A material, and

— with a hardness loss greater than or equal to 55 N and less than 63 N is a class L material,

provided, in all cases, the other property levels are achieved.

3.2.5 Any material having an initial indentation hardness index of 140 N and a hardness loss greater than 63 N does not comply with the requirements of this International Standard (see key item 1 of Figures 1 and 2).

3.3 Grade

Polyurethane foams are further graded by indentation hardness index, as determined by method A described in ISO 2439, in accordance with Table 3.

Table 3 — Grading by indentation hardness index

Grade	Indentation hardness index N
30	25 to 40
50	41 to 60
70	61 to 85
100	86 to 110
130	115 to 150
170	155 to 190
210	195 to 235
270	240 to 295
330	300 to 360
400	365 to 425
470	430 to 520
600	525 to 650

NOTE It can be impossible to manufacture foam falling into all these grades in each of the material classes. To control the hardness of foam within the above-mentioned grades, the selection of material can be carried out, since the typical variation of the hardness of foam within and between productions can be of the order of ±16 %.

4 Requirements

4.1 Material

Flexible polyurethane foam shall consist of a network of cells which are essentially open and interconnecting. It shall be free from abnormalities that are likely to adversely affect its performance.

4.2 Construction

4.2.1 Flexible polyurethane foams may be supplied in block, sheet or strip form, or in moulded or fabricated shapes, which may be cavitied or profiled.

4.2.2 Depending on the manufacturing conditions, the foam may have to be corrected or repaired. Repaired or corrected foam shall be considered to comply with this International Standard if the foam used in such repairs or corrections is of the same composition and quality as the original product, and provided such corrections do not adversely affect performance or alter the size and shape beyond the tolerances agreed upon between the purchaser and the supplier.

4.2.3 When components are repaired, corrected or fabricated, any adhesives used shall be such as to be non-injurious to the foam, and the resulting bonds shall be at least as strong as the foam itself.

4.2.4 The area of the bond should be sufficient to withstand the service conditions, and a thin overlay should be bonded over a large enough area to prevent rucking or wrinkling in service.

4.3 Surface condition

There shall be no loose skin on agreed significant surfaces. Mould parting marks and other surface blemishes shall be no worse than those on standard initial samples agreed upon between the purchaser and the supplier.

4.4 Odour

The odour of the foam shall not be objectionable.

NOTE Tests for odour have been investigated, but none has yet (at the time of publication of this International Standard) been found to be of practical use in this context.

4.5 Colour

The colour shall be as agreed upon between the purchaser and the supplier.

4.6 Component mass and density

4.6.1 The mass of a component, when required, shall be as agreed upon between the purchaser and the supplier, with a tolerance of ±15 %, unless otherwise stated.

4.6.2 The density of a component, when required, shall be as agreed upon between the purchaser and the supplier, with a tolerance of ±15 %, unless otherwise stated. The density shall be determined by the method indicated in 5.4.

4.7 Dimensions

The dimensions of flexible polyurethane foam components shall be as specified by the purchaser, subject to the tolerances given in Tables 4 and 5, unless otherwise agreed between the purchaser and the supplier.

NOTE The trimming allowances are the sole responsibility of the designer. The actual dimensions of a flexible polyurethane foam article used in upholstering are normally greater than the nominal dimensions by a small amount in order to allow the foam to be compressed slightly by a cover made to the nominal dimensions.

Table 4 — Tolerances on length and width

Dimensions in millimetres

Length and/or width	Tolerance
Up to and including 250[a]	$^{+5}_{0}$
Up to and including 250[b]	$^{+10}_{0}$
Over 250 up to and including 500	$^{+10}_{0}$
Over 500 up to and including 1 000	$^{+20}_{0}$
Over 1 000	$^{+30}_{0}$
[a] Excluding fabricated components. [b] Fabricated components only.	

Table 5 — Tolerances on thickness

Dimensions in millimetres

Thickness	Tolerance
Up to and including 25	$^{+3}_{0}$
Over 25 up to and including 100	$^{+4}_{0}$
Over 100	$^{+6}_{0}$

4.8 Physical properties

4.8.1 When tested in accordance with the method described in ISO 3385, the median value of indentation hardness loss of the three test pieces shall be no greater than the maximum specified in Figures 1 or 2 for the class and indentation hardness index of the material supplied. If this requirement is not met, the fatigue test may be repeated with a further four test pieces. In this case, the median indentation hardness loss of all seven test pieces shall be used for the classification.

4.8.2 Flexible polyurethane foam shall comply with the requirements given in Tables 6, 7 or 8, where appropriate, when tested by the methods indicated.

4.8.3 The standard test pieces required for the tests listed in Table 6 shall not include the surface skin, the adjacent layer of denser material or any portion where there is an obvious defect.

The depth of skin to be removed during test piece preparation may vary considerably, depending on the general configuration of the moulded shape. A minimum of 5 mm shall be removed.

Test pieces of moulded materials with skin can be used if the thickness of the moulding is too low to yield test pieces of appropriate size after removal of 5 mm of surface material, or if surface effects are of particular interest. In such cases, the surface condition of the test pieces shall be stated in the test report.

4.8.4 Reconstituted or bonded foam shall conform to cleanliness requirements agreed upon between the purchaser and the supplier.