

Test report

Nr. Q MBL N 938 1821e

Reported to: PT RubberFoam Indonesia
Kawasan Industri Sentul
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16810 Kab. Bogor Jawa Barat
INDONESIA

Object: "Latexmattresscore" Art. No. SZF 20090
(1 sample supplied by the client)

Order: Durability test and evaluation of the
resilience characteristics according to
LGA-Guidelines and DIN EN 1957: 08.2000

Findings

The "Latexmattresscore" has been tested in a durability test rig with a roller load of 1400 N in two test stages with a total of 30 000 cycles. In the centre of the area three measurements of the characteristic curves of resilience have been taken as follows:

- a) after 200 strokes
- b) after 30 000 strokes
- c) after 60 000 strokes

The characteristic curves of resilience allow an assessment of the resilience and durability characteristics as well as the subjective hardness rating and the hysteresis.

Characteristics before the test

Hardness index:	2.74
Hysteresis:	17.2 %
Height of the system:	133 mm

Characteristics after the test

Change in height after the test:	2.2 mm
Change in hardness after 30 000 strokes:	8 %
Change in hardness after the test:	9 %
Resilience loss factor after the test:	3.4

(deviating from DIN EN 1957)

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The data are determined based on the LGA-rating system limited to a maximum of 100 points.

The requirement for an increased quality level is 80 points.¹⁾

The reached total number of points for the 4 characteristic data is 99 points.

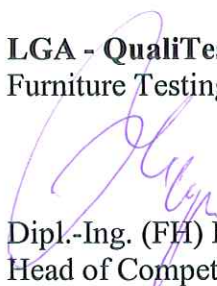
Change in height after test:	25 points
Change in hardness after 30 000 strokes:	25 points
Change in hardness after test:	25 points
Resilience loss factor after test:	24 points

The results of the test refer solely to the tested sample.

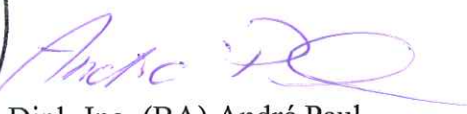
The following pages contain further information about test parameters and geometry of the roller, measurement conditions and design of the loading pad, modalities of assessment and rating system.

Nuremberg, 12-11-2008
QMBLN hy/pa/şe

LGA - QualiTest GmbH
Furniture Testing Institute


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Head of Competence Centre




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Specialist

¹⁾ **note:** The minimum value for performance is 50 points. More than 70 points specific a good quality. At this the area under test has to be free of any damages / changes related to the mattress core.

Test Results

Object

Article:	latex core for mattresses
Article denomination:	"Latexmattresscore"
Article Number:	SZF 20090
Number of samples:	1
Delivered:	21-10-2008
Delivered by:	Client
Reg.-No.:	1002

Scope of tests

General examination

Durability test in two stages according to LGA-Guidelines 33003 and according to DIN EN 1957: 08.2000

- Stage 1: 30 000 strokes with 15 000 cycles
- Stage 2: 30 000 strokes with 15 000 cycles

Evaluation of resilience characteristic curve

- after 200 strokes = 100 cycles
- after 30 000 strokes = 15 000 cycles
- after 60 000 strokes = 30 000 cycles

Assessment of the Force-Displacement-Plot according to LGA-Guidelines 33003 and the actual state of art of the European Standardization. Determination according to the LGA-rating system limited to a maximum of 100 points.

Applicability of test results

The test results refer solely to the samples tested. The digital photos - if any - serve only for additional explanation and do not constitute any part of the test report.

Tolerances

Unless otherwise stated dimensions are measured to an accuracy according to DIN 7168-g for old design and DIN ISO 2768, Part 1 "c" for new design. For all other physical values the measurement uncertainty < 5 %. The tests were carried out under standard indoor conditions unless otherwise stated.

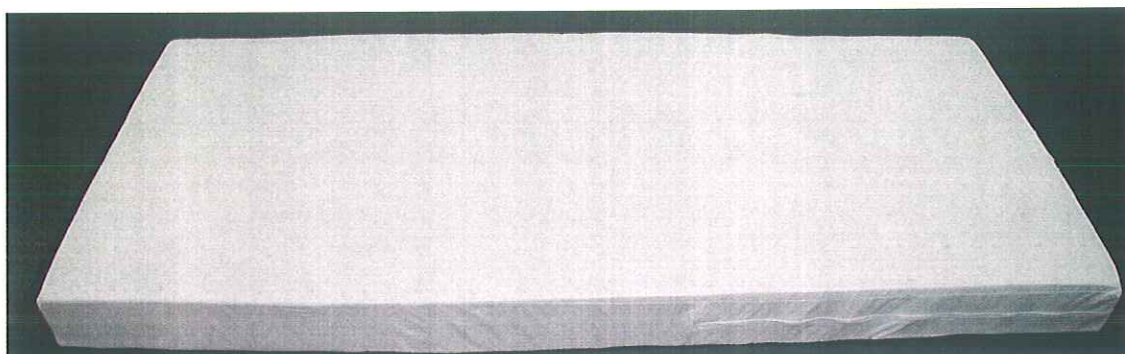
General examination of the pocket spring unit

Dimensions

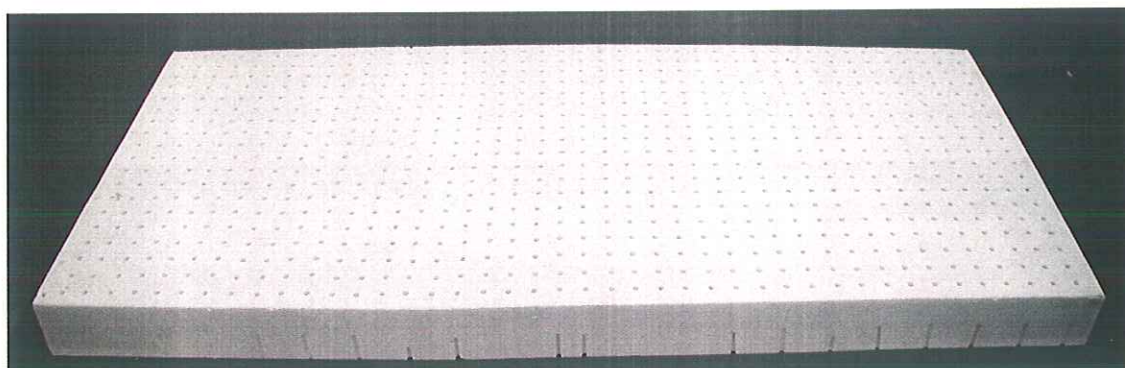
Length:	1950 mm
Width:	890 mm
Height:	133 mm
Weight:	21.5 kg

Design

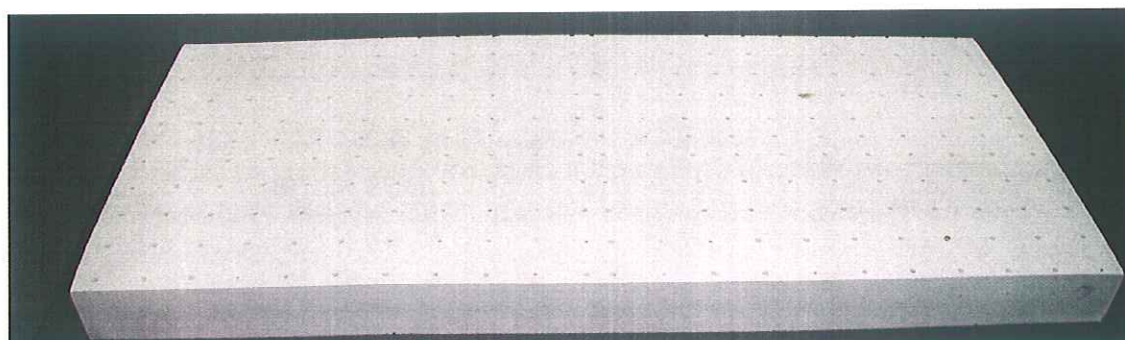
133 mm latex foam with textile cover, pin holes on both lying areas, one lying area with pinholes with a diameter of about 10 mm, a length of 60 mm in a distance of about 48 mm, other lying area with pinholes with a diameter of about 10 mm, a length of 70 mm in a distance of about 95 mm



Latex core with textile cover



Latex core without textile cover, lying area with pinholes in a distance of about 48 mm



Latex core without textile cover, lying area with pinholes in a distance of about 95 mm

Durability Test - Roller Test

Test Rig

The durability test is carried out by means of an electromotive driven roller test device.
A specified roller made of lacquered hard wood rolls over the latex core that is placed on a levelled, rigid, flat base and fixed to prevent slipping.²⁾

Rotation symmetric roller

- Length 1000 mm
- Length of the medium section 400 mm, Ø 300 mm
- Spherical ends reduced to Ø 250 mm
- Outer edges with radius: 20 mm
- Roller load 1400 N

Test parameters

Length of stroke: 500 mm

Cycle: 1 cycle consists of one forward and one backward stroke in sinusoidal motion

Rolling strain: symmetric over the width of the pocket spring unit
Stage 1 for 30 000 strokes = 15 000 cycles
Stage 2 for 30 000 strokes = 15 000 cycles

Total test for 60 000 strokes = 30 000 cycles

Roller drive: horizontal directed force

Test rate: 16 ± 2 cycles per minute

Condition in the test bay: Standard climate, 23/50-2, DIN 50 014

Visual examination

The latex core has been checked before, during and after the durability test. A necessary interior check is carried out after test and evaluation.

²⁾ **note:** The tests we done one the lying area with a subjective firmer hardness.

Determination of resilience characteristics (Force-Displacement-Plot)

Measuring set-up and conditions

A loading pad as specified applies and removes a load to the latex core at the area of its centre of gravity with linear speed.

The characteristic curves of resilience have been taken at the latex core, without any coverage.

The load is measured by means of a piezoelectric load cell at the loading pad, the actual compression by means of an inductive displacement sensor.

The fourth characteristic curve after 3 loads applications of 1000 N and removal of the load will be recorded.

Measurement uncertainty: $\pm 1 \%$

Design of the loading pad:

Spherical pad, diameter 355 mm
Curvature radius 800 mm (surface 1000 cm²)

Travel speed: 90 mm/min

The resilience characteristic curves as Force-Displacement-Plots with the axes compression force and depth of impression are taken

- a) after 200 strokes = 100 cycles
- b) after 30 000 strokes = 15 000 cycles
- c) after 60 000 strokes = 30 000 cycles

with a recuperation time of at least 5 hours each.

Assessment of the Force-Displacement-Plot

Change in height and **change in hardness** as well as **resilience loss** are dimensions of durability as measurable functional characteristics.

Change in height

The change in height is determined after testing under a load of 50 N applied by the loading pad.

The change in height in mm indicates how intensive the mattress will visibly deform under frequent use.

Hardness rating

The hardness rating is calculated as mean inclination of the Force-Displacement-Plot at a load of 210 N, 275 N and 340 N.

$$H = \frac{C_1 + C_2 + C_3}{3} \text{ N/mm}^2$$

C₁ Inclination at a load of 210 N

C₂ Inclination at a load of 275 N

C₃ Inclination at a load of 340 N

Resilience loss factor (deviating to DIN EN 1957)

It is calculated from the quotient of the areas between curve a) and c) and the rectangle that is formed by the perpendiculars from the end point of curve c) and the coordinate axes multiplied by the factor 100.

Also the resilience loss factor indicates how the resilience and elasticity of the latex core changes during the test. It shows especially how the characteristic curve deviates in the curvature after test from the one before testing.

Determination and change of subjective hardness rating H_s

The rating of the subjective hardness is determined by means of hardness value H , that is based on results of empiric studies and indicates the subjective valuation by the user. The subjective hardness rating H_s is a figure on a scale from 1 to 10 that indicates the hardness of the resilience.

$H_s = 1$ is a hard resilience, $H_s = 10$ is a soft resilience

H_s is determined according to the following function:

$$H_s = 10 \left(1 - e^{-(K \cdot a + b)} \right)^2$$

K is calculated with the following equation from the Force-Displacement- Plot

$$K = \frac{A}{H}$$

Where:

A = Area under the curve from 0 to 450 N from the Force-Displacement-Plot

H = Hardness rating

$a = 5.92 \times 10^{-4}$

$b = 0.148$

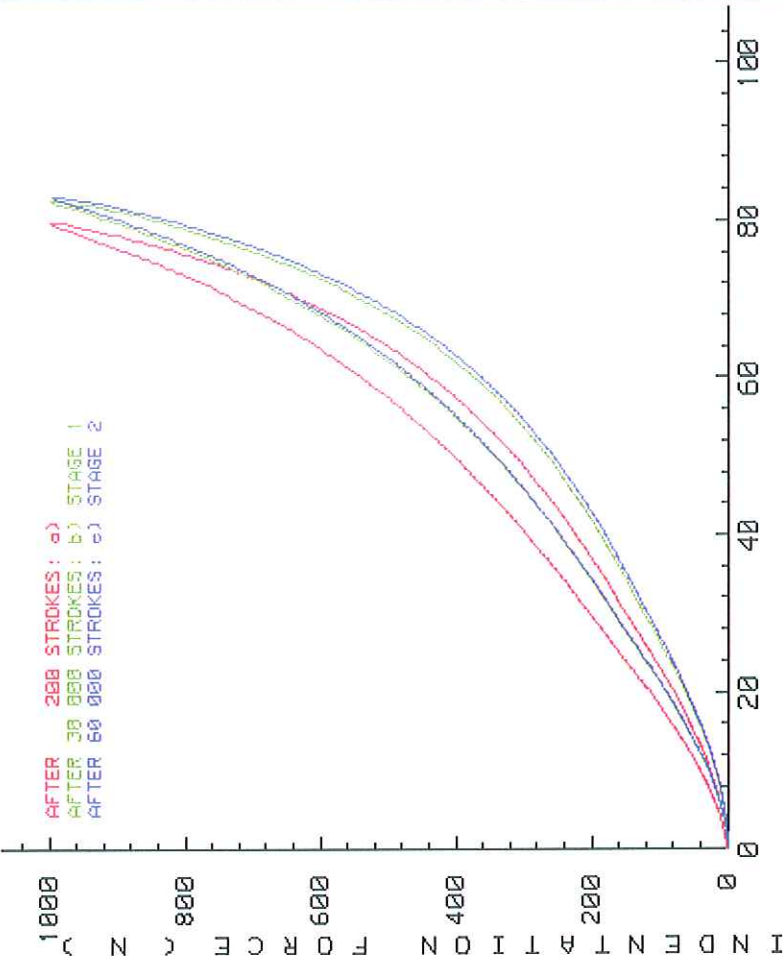
Determination of the hysteresis

The per cent hysteresis is calculated from the quotient of the area enclosed by the load and reload curves and the area below the load curve (up to max. depth of indentation at 1000 N) multiplied by a factor of 100.

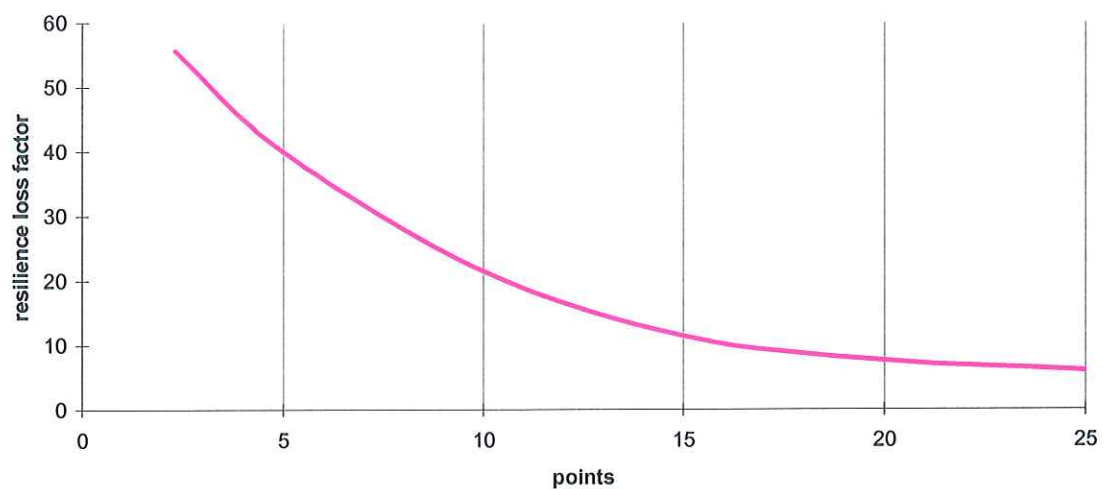
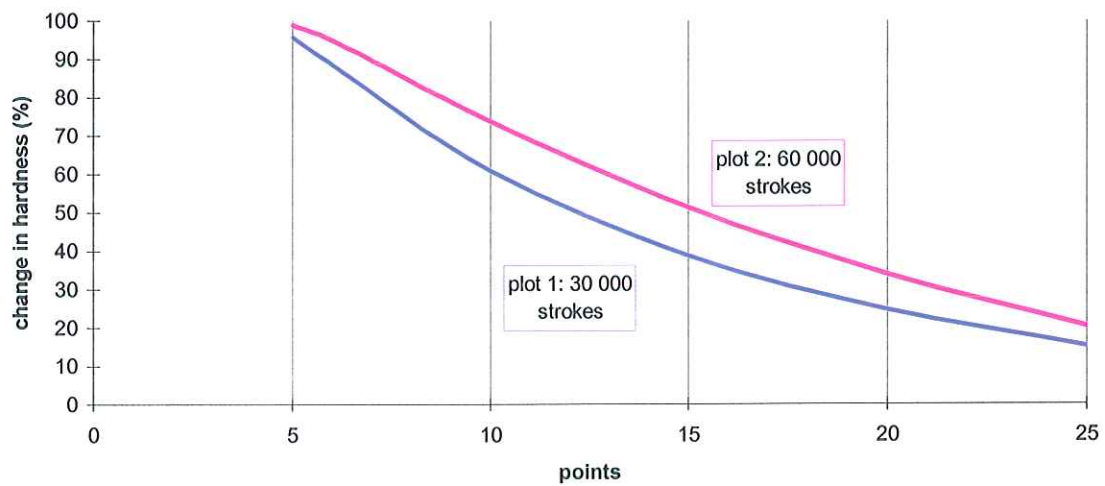
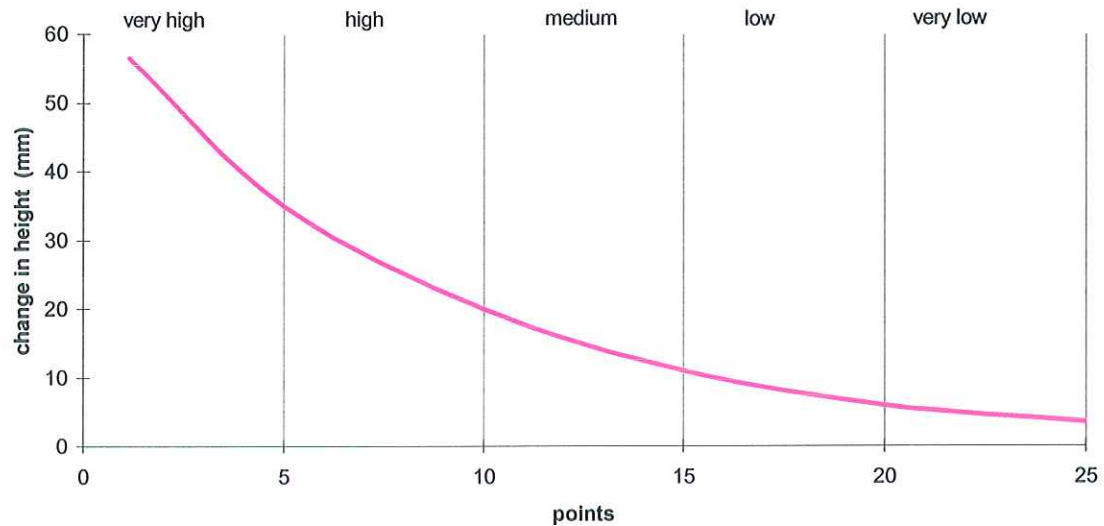
The hysteresis value is a measure of the ratio of applied force and withdrawn force and characterizes how freely the user can move on the mattress (change in sleeping position).

Results of measurement and assessment

The following pages contain the Force-Displacement-Plot, results of measurement and assessment as well as rating points according to LGA-rating system.

MATTRESS RESILIENCE CHARACTERISTICS	
 Legend: a) 200 STROKES (red) b) 30 STROKES (green) c) 600 STROKES (blue) Y-axis: INDENTATION FORCE (N) X-axis: INDENTATION DEPTH (mm)	DETERMINATION OF CHARACTERISTICS DATA AFTER 200 STROKES HARDNESS RATING H 10.02 N/mm AREA A (0-450N) 10060 Nmm HARDNESS VALUE K 1003 mm² SUBJECTIVE HARDNESS H_s 2.74 HYSTERESIS 17.2 % DURABILITY CHARACTERISTICS CHANGE IN HEIGHT 2.2 mm CHANGE IN HARDNESS (STAGE 1) 8 % CHANGE IN HARDNESS (STAGE 2) 9 % RESILIENCE LOSS FACTOR 3.4 DURABILITY RATING CHANGE IN HEIGHT 25 CHANGE IN HARDNESS (STAGE 1) 25 CHANGE IN HARDNESS (STAGE 2) 25 RESILIENCE LOSS FACTOR 24 TOTAL NUMBER OF POINTS (MAX. 100 POINTS) 99
LGA-MÖBELPRÜFINSTITUT DATE: 2008-11-03 SPECIALIST: Paul	OBJECT: Latex mattress core CLIENT: Co. PT RubberFoam Indonesia

LGA Rating System



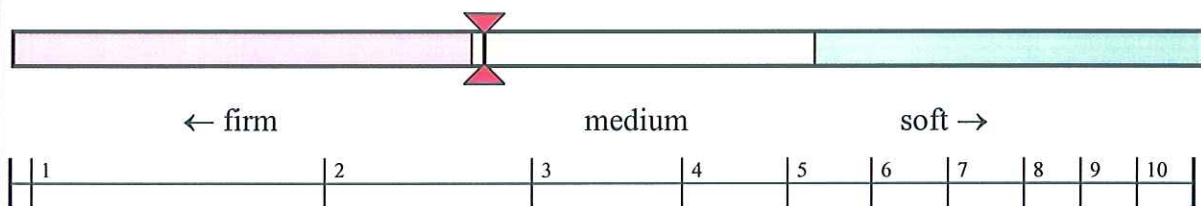
Results of the visual examination

The area under test did not show any damages to the latex core.

Results and evaluation according to DIN EN 1957

Data	Start	15 000 cycles	30 000 cycles
Hardness H_S	2.74	2.97	3.03
Change in hardness	/	8 %	9 %
Change in height	/	2.2 mm	2.2 mm

Assessment of firmness rating (proposal) ³⁾



Attachment to LGA – Rating scale

The results obtained under durability testing (loss in height, changes in hardness and resilience loss factor) were evaluated analogous to the weighting curves and provided with rating scores (points).

Considering the significant influence of the lying hardness factor H_S on the evaluation, the single results of the changes in hardness and the resilience loss factor were weighted with a corrective factor which is calculated by using the following formula:

$$P = P' \left(\frac{25}{P'} \right)^{\left[\left(\frac{1}{10H_S} + 0,99 \right)^4 - 1 \right]}$$

P = Corrected score

P' = Score / weighting curves

H_S = Medium lying hardness value determined of measurements a, b and c

³⁾ **proposal:** The assessment of firmness rating is not part of DIN EN 1957. The proposal is based on empiric data of LGA and is not mandatory.