

DLG-Test Report 6817

DeLaval

DeLaval rubber mat RM21BS

Deformability/Elasticity, Permanent Tread Load, Abrasion,
Slip resistance, Acid resistance, Cleaning distance



Overview

A quality mark "DLG-APPROVED for single value-determining criteria" is awarded to agricultural products which successfully passed a smaller-scope DLG usability test according to independent and recognized evaluation criteria. The test intends to highlight special innovations and key criteria of the test item. The test can focus on criteria from the DLG testing framework for full tests or on other individual features or qualitative criteria. The minimum requirements, the test conditions and procedures as well as the evaluation guidelines of the test results are determined in consultation with a DLG expert group. They comply with the generally recognized technology rules as well as with scientific and agricultural knowledge and requirements. The successful test concludes with the publishing of a test report and the awarding of a quality mark which is valid for five years following the award date.



DELAVAL RUBBER MAT RM21BS

- ✓ Deformability/Elasticity
- ✓ Permanent Tread Load
- ✓ Abrasion
- ✓ Slip resistance
- ✓ Acid resistance
- ✓ Cleaning distance

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The DLG-APPROVED Test "Deformability/Elasticity, Permanent Tread Load, Abrasion, Slip resistance, Cleaning distance" includes technical measurements on test benches of the DLG Test Center. The deformability and elasticity, the abrasion resistance, the slip resistance, the cleaning distance were measured and a permanent tread load was applied. The test was based on the DLG Testing Framework for elastic stable flooring, as of April 2015. Other criteria were not investigated.

Assessment – Brief Summary

The DeLaval rubber mat tested here, an elastic floor covering for the resting area in cubicle houses, was investigated with regard to durability and comfort properties on test stands in the DLG-APPROVED test for single value-determining criteria.

The deformability and elasticity of the cubicle mat, the abrasion resistance, the slip resistance, the acid resistance, the cleaning distance were measured and a permanent tread load was applied.

*Table 1:
Overview of results*

Test characteristic	Test result	Evaluation*
Deformability and elasticity		
– in new condition	6.6, satisfactory	○
– following endurance test	6.7, satisfactory	○
Permanent tread load		
	no lasting deformation	++
	no noticeable wear	+
Abrasion test		
	satisfactory resistance	○
Slip resistance **		
	good slip resistance on dry and wet mat surface	+
Cleaning distance		
	20 cm with flat jet nozzle	○
	40 cm with flat jet nozzle	○
Acid resistance*		
Feed acid mixture	resistant	+
Uric acid	resistant	+
Sulfurous acid	resistant	+
Ammonia solution	resistant	+
Disinfection liquid	resistant	+
Peracetic acid	resistant	+

* Evaluation range: + / + / ○ / - / -- (○ = standard, n.a. = not applicable/evaluated) / ** Evaluation range: + / -

The Product

Manufacturer and Applicant

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Product:
DeLaval rubber mat RM21BS

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Description and Technical Data

Black, profiled cubicle rubber mat, ca. 20.5 mm thick, surface with a triangle structure, underside with conical knobs ca. 5 mm high (diameter at the bottom ca. 19 mm).

Laid as single mat.
Shore A: ca. 72

The Method

Deformability and elasticity

The deformability is measured in new condition and following permanent tread load using ball penetration tests with a calotte ($r = 120$ mm) and a penetration force of 2,000 N (corresponding to approx. 200 kg).

Permanent tread load

The permanent tread load is measured on a test stand with a round steel foot in the standard test programme with 100,000 alternating loads at 10,000 N (corresponding to approx. 1,000 kg).

The steel foot is adapted to the natural conditions as an "artificial cow foot". The foot has a diameter of 105 mm and therefore a contact area of 75 cm²; the carrying edge of the hoof is simulated by a 5 mm wide ring on the periphery of the sole that projects 1 mm above the rest of the surface.

Abrasion test

In a standardised abrasion test with 10,000 cycles the top cover was grinded with an emery cloth (granulation 280) and a grinding

pressure of 500 N (= 8.13 N/cm² surface pressure).

The friction element was cooled continuously with water to prevent an influence of the generated heat during the abrasion test. The size of the grinded area was 61.5 cm².

Slip resistance

The measurements were carried out with the Comfort Control test rig of the DLG Test Center.

A loaded (10 kg) round plastic foot (105 mm diameter, with a contact area of 75 cm², 3 mm wide ring at the periphery of the ground) was pulled with a velocity of 20 mm/s across the mat.

Acid resistance

A permanent dipping test in accordance to DIN EN ISO 175:2000 (performance of synthetic material against liquid chemicals) was carried out. Test samples (size 30 mm x 30 mm) were completely dipped into different test liquids for 24 hours and 28 days (room temperature 20° Celsius). In the 28 days test the liquids were changed weekly.

After the 28 days the samples were washed with distillate water and dried for 24 hours. Before and after the dipping the weight, the dimensions and the shore hardness (shore A) of the test samples were measured. Additional visual evaluation was done for alterations like colour changing, swelling, destruction or crystallisation.

All samples were evaluated in comparison to the standard water.

Cleaning distance

In test bench trials with a high pressure cleaner (approximately 145 bar, exposure period 1 minute with a 25° flat jet nozzle and a coarse dirt remover) the distance was measured where no damage occurs.

The Test Results in Detail

Deformability and elasticity

In the ball penetration tests in new condition with a calotte ($r = 120$ mm), penetration depth was 6.6 mm. The resulting calculated bearing pressure of 40.2 N/cm^2 indicates a satisfactory load on the carpal joints when lying down and getting up.

Elasticity was measured following a permanent tread load exerted by a steel foot (contact area: 75 cm^2) with 100,000 alternating loads at 10,000 N. Following the endurance test, the penetration depth of the calotte increased from 6.6 mm to 6.7 mm. The bearing pressure decreased from 40.2 N/cm^2 to 39.6 N/cm^2 (see Fig. 2). This means that deformability and elasticity slightly increase.

Permanent tread load

After the Transition Mat had been exposed to a permanent tread load exerted with 250,000 alternating loads of 5,000 N (corresponding to approx. 500 kg), the mat showed no noticeable wear. Lasting deformation could not be observed.

Abrasion test

The abrasion depth after 10,000 cycles amounted to 3.7 mm, this corresponds to approximately 18.5 % of the mat thickness. From the ground surface 24.4 grams were rubbed off. The abrasion depth and the slight grit implicate a satisfactory wear resistance of the rubber mat.

Slip resistance

The slide pulling tests showed a good slip resistance on the dry or wet mat surface in new condition. The measured friction coefficients (μ) all surpassed the minimal value of $\mu = 0.45$ which speaks for a good foothold.

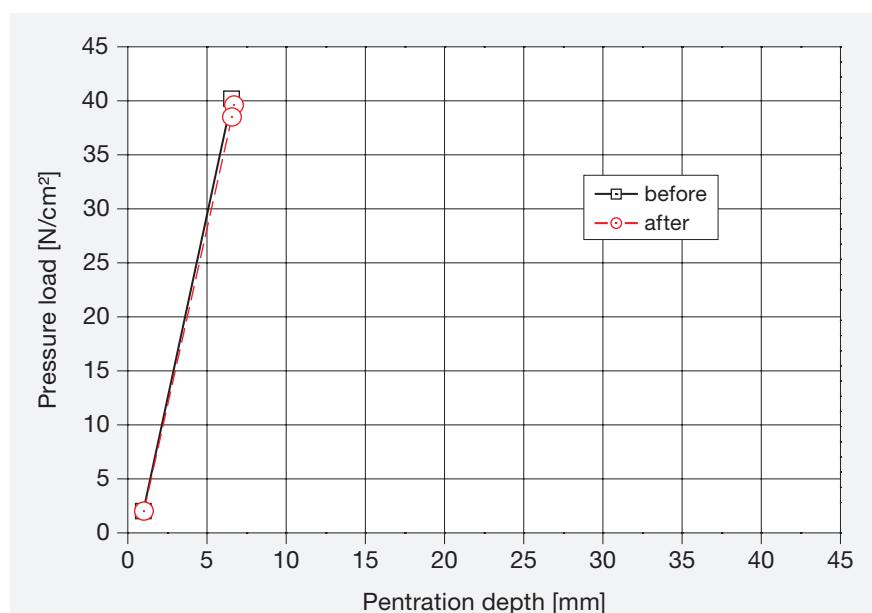


Figure 2:
Deformability as a function of bearing pressure

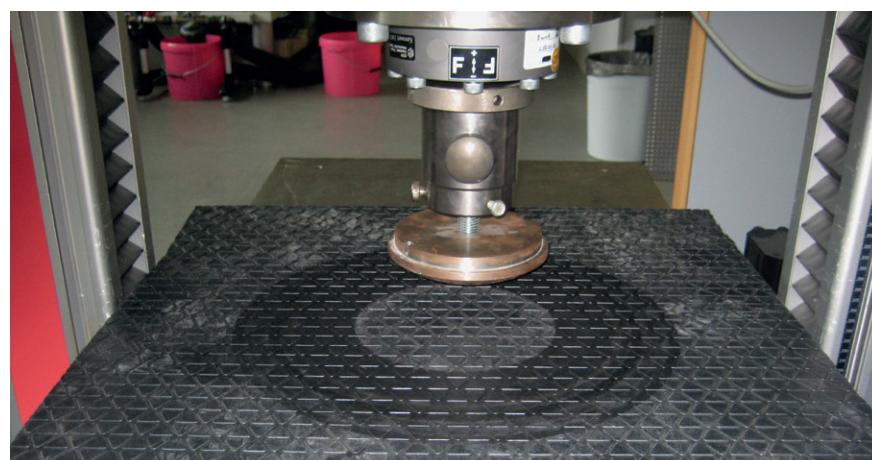


Figure 3:
Measuring the deformability

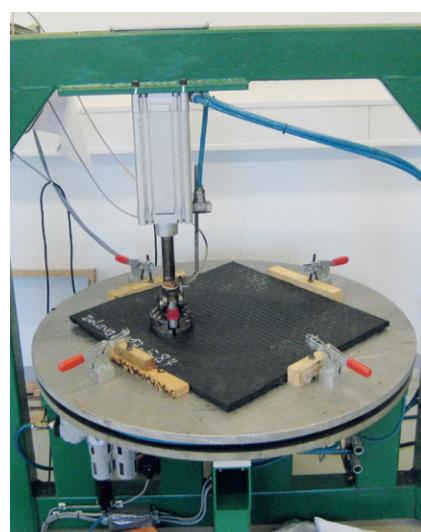


Figure 4:
Permanent tread load



Figure 5:
Test sample after abrasion test

Cleaning distance

In test bench trials with a high pressure cleaner damage to the mat only occurred when a minimum distance of 40 cm (with a coarse dirt remover) and 20 cm (with a flat jet nozzle) was not kept.

For cleaning and disinfection of the floor cover only the cleaning agents permitted by the manufacturer should be used.

Acid resistance

The rubber mat was resistant against the used test liquids. The differences in weight, thickness and Shore A hardness between the acid treated and not acid treated samples were minor and lay in the range of water as standard. Against the used liquids the rubber mat seems to be good suited for the described use.

All evaluations see table 1.



Figure 6:
Slip resistance
measurement



Figure 7:
Samples after
acid resistance
test

Table 2:
Test liquids and results acid resistance

Test liquid	Concentration	Result after 24 hours residence time	Result after 25 hours residence time	Evaluation
Feed acid mixture				
	concentrate, pH 2	no changing	no changing	resistant
Excrement acids				
Uric acid	saturated urea solution (0,4 %)	no changing	no changing	resistant
Sulfurous acid	5-6 % SO ₂	no changing	no changing	resistant
Ammonia solution	32 % solution	no changing	no changing	resistant
Disinfection liquid				
Barn Disinfection liquid	2 %-solution of a product with formic acid and glyoxyl acid	no changing	no changing	resistant
Peracetic acid	3000 ppm	no changing	no changing	resistant

Summary

Based on test-stand investigations, the criteria tested in this DLG-APPROVED test for single value-determining criteria evaluate the comfort and durability properties of the DeLaval rubber mat RM21BS for use in the resting area of high cubicles in cubicle houses.

The tested DeLaval rubber mat RM21BS met the requirements of the Testing Framework with respect to the investigated criteria.

More information

Further test results for alley mats are available for download at: www.dlg-test.de/stalleinrichtungen

The relevant DLG committees have published various instruction leaflets on the topics of animal welfare and cattle farming. These are available free of charge in PDF format at: www.dlg.org/merkblaetter.html

Test performed by

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DLG test scope

DLG-approved single criteria test
“Elastic Stable Flooring” (current as of 04/2016)

Department

Indoor operations

Head of Department

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Test engineer(s)

Dr. Harald Reubold*

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The DLG

In addition to being the executing body of well-known tests for agricultural engineering, farm inputs and foods, the DLG is also an open forum for the exchange of knowledge and opinions in the agricultural and food industry.

Some 180 full-time employees and more than 3,000 volunteer experts are developing solutions to current problems. The more than 80 committees, working groups and committees thereby form the basis of expertise and continuity for the professional work. At the DLG, a great deal of specialist information for agriculture is created in the form of information leaflets and working papers, as well as articles in journals and books.

DLG organises the world's leading professional exhibitions for the agriculture and food sector. This contributes to the transparent presentation of modern products, processes and services to the public. Secure the competitive edge as well as other bene-

fits, and contribute to the expert knowledge base of the agricultural industry. Further information can be obtained under www.dlg.org/mitgliedschaft.

The DLG Test Center Technology and Farm Inputs

The DLG Test Center Technology and Farm Inputs in Groß-Umstadt is the benchmark for tested agricultural products and farm inputs, as well as a leading testing and certification service provider for independent technology tests. The DLG test engineers precisely examine product developments and innovations by utilizing state-of-the-art measurement technology and testing methods gained from practice.

As an accredited and EU registered testing laboratory the DLG Test Center Technology and Farm Inputs offers farmers and practitioners vital information and decision support for the investment planning for agricultural technology and farm inputs through recognized technology tests and DLG testing.

Internal test code DLG: 17-584
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