
TEST REPORT

Client: DURAPROOF Dichtungssysteme GmbH
Eisenbahnstraße 24
66687 Wadern Büschfeld

Order issued by: Mr Jurkewitz
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Order dated: 10.10.2003

Order No.: 172000336

Test report Ref. No.: 0291/172000336/04

Subject matter of the order: Testing of Long term durability of roof waterproofing membrane types SGlaminat and SGtan

Date of test: KW 13 – KW 15/04

Copy: 2nd

This report comprises 6 pages with an additional 2 appended pages with illustrations and relates exclusively to the subject matter of the order.

Eine auszugsweise Wiedergabe des Berichtes zum Zwecke der Veröffentlichung ist unzulässig.

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1. BACKGROUND

On 10.10.03 through Mr Jurkewitz, DURAPROOF Dichtungssysteme GmbH commissioned DEKRA Industrial Services Testing & Inspection GmbH, Werkstofftechnik und Schadensanalytik, in Saarbrücken to carry out testing of the long-term durability of roof waterproofing membrane types "SGLaminat" and "SGtan". For this purpose, a member of staff of DEKRA ISTI GmbH took the following samples from the following buildings:

Building	Roof waterproofing membrane type	Year of installation	Thickness [mm]	With gravel layer
Dillinger Hütte	SGLaminat	1974	1,23	No
Karlsberg Brewery, Homburg	SGLaminat	1976	1,49	No
Swimming Baths at Wadern	SGtan	1974	1,33	Yes
Army Clothing Depot at Primstal	SGtan	1977	1,43	Yes
Vocational Training Centre at Wadern	SGtan	1974	1,30	Yes

Before each sample was taken, a piece of NOVOPROOF® DA-K roof waterproofing membrane was welded to it in order to carry out peel and shear tests.

2. INFORMATION ON PROCEDURE

As part of the testing, the following tests were carried out:

- Hardness test Shore A
- Tensile test in accordance with DIN 53504
- Tear propagation test in accordance with DIN 53507
- Density determination in accordance with DIN 53497
- Shear test in accordance with DIN 7864-1
- Peel test in accordance with DIN 7864-1

Arrangements were made to take the samples on 09.10.03 and 23.03.04 at the above buildings: The following people were present at the taking of the samples:

- Mr Kasper - DURAPROOF Dichtungssysteme GmbH
- Mr Kelter - DEKRA ISTI GmbH

A 40 x 40 cm² sample strip was taken from each roof membrane. The samples were clearly labelled and taken away by the attending staff member.

3. TEST RESULTS

3.1 LONG-TERM BEHAVIOUR WITH RESPECT TO TENSILE STRENGTH AT BREAK AND ELONGATION AT BREAK

The following table gives the average values of the individual test results from the specimens taken from the sample pieces summarised for each product, SGLaminat and SGtan.

Table 1: Results of the long-term tests on the products SGLaminat and SGtan in respect of tensile strength at break, elongation at break and Shore hardness

Description	Age [Years]	Tens strength at break [MPa]*	Elongation at break [%]	Hardness Shore A
Requirement DIN 7864 T1	0	≥ 4.0	≥ 250	-
New membrane SGLaminat	0	8.3	520	60
Dillinger Hütte	12 years	6.1	370	60
Dillinger Hütte	19 years	5.5	400	60
Dillinger Hütte	23 years	4.0	327	70
Dillinger Hütte	29 years	4.4	257	80
Karlsberg Brewery	28 years	8.1	264	70

Description	Age [Years]	Tensile Str. at break [MPa]*	Elong. at break [%]	Hardness Shore A
New membrane SGtan	0	10.0	439	-
Swimming Baths at Wadern	30 years	7.6	233	78
Army Premises at Primstal	27 years	9.2	261	78
Training Centre Wadern	30 years	7.5	245	78

* 1 MPa = 1 N/mm²

In Appendices 1 and 2, Figures 1 and 2 show the test results for the individual buildings related to the length of time the waterproofing membrane had been in place. In addition, the graphs are drawn for the properties of the products SGlaminat and SGtan over a period of 50 years.

3.2 LONG-TERM BEHAVIOUR WITH RESPECT TO TEAR PROPAGATION RESISTANCE , PEEL RESISTANCE AND SHEAR STRENGTH

3.2.1. DESCRIPTION OF THE PROCESS OF THERMOFAST SEAM WELDING

In order to carry out peel and shear tests, pieces of NOVOPROOF® DA-K 1.3 mm were attached using the Thermofast® Fügetechnik seam welding technique before the samples were taken from the old roof membrane. After removal of the old roof membrane in the area of the seam by abrasion, the pieces for testing were welded together over a length of about 40 cm using hot air and a pressure roller at a temperature of 420 °C.

3.2.2 TEST RESULTS

Specimens were prepared from the samples in accordance with the standards to determine the resistance to tear propagation and separation in the peel or shear tests. The following table gives the average values of the individual test results from the specimens taken from the sample pieces and summarised for each product, SGLaminat and SGtan.

Table 2: Results of the long-term tests on the products SGLaminat and SGtan in respect of resistance to tear propagation, separation from substrate in peel or shear tests

Description	Age [Years]	Resistance to tear propagation [N/mm]	Shear resistance stand [N/mm]	Peel resistance [N/mm]
Requirement DIN 7864 T1	0	≥ 5	≥ 3.5	≥ 1
Dillinger Hütte	29 years	11.4	3.9	2.0
Karlsberg Brewery	28 years	9.8	6.6	3.5
Swimming Baths at Wadern	30 years	8.6	10.5	2.4
Army, Primstal	27 years	7.2	8.3	4.7
Training Centre Wadern	30 years	9.7	7.5	3.2

3.3 ASSESSMENT OF THE ROOF PARAPETS

The roof parapets of each building were inspected and assessed during the visit to take the samples. The edge areas were assessed irrespective of the means of attachment with respect to the presence of tension at the roof edge.

Taking into account the length of time the membrane had been in place and the changes of the material of the whole roof construction it can be stated that the roof edge constructions had no or in some areas only very slight tensions that could be linked with shrinkage of the waterproofing membrane. The pictures of the individual buildings can be viewed in a separate appendix.

The roofing sheets provided for testing with the current quality name NOVOPROOF® DA-K (previous name SGLaminat) and NOVOPROOF® DA-P (previous name SGtan) with a nominal thickness of 1.3 mm were also used on roof areas with a roof pitch of $\leq 2\%$ with no detrimental effects on the long-term behaviour.

Saarbrücken, 20.05.05

**DEKRA Industrial Services
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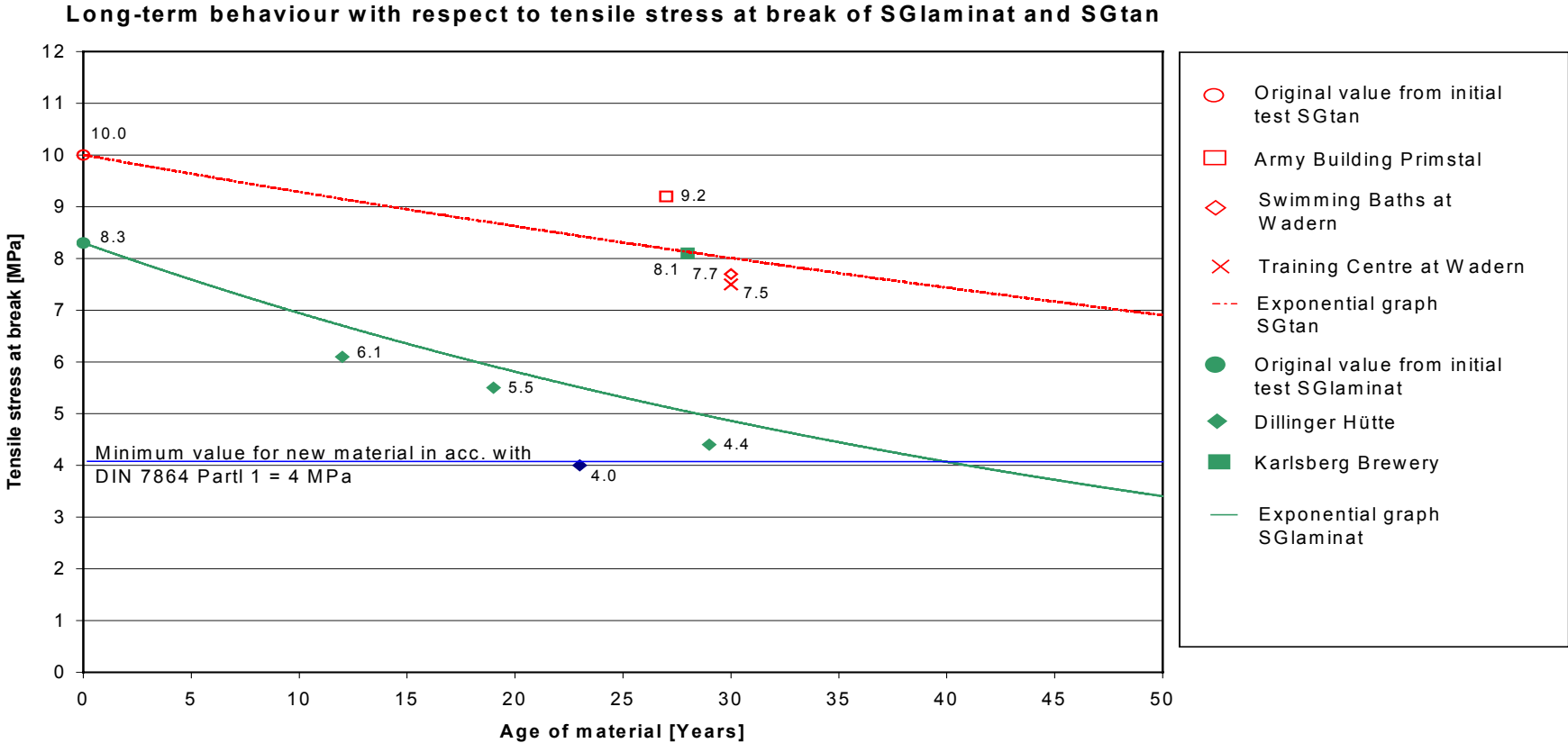


Fig. 1: Graph of tearing stress against age of material

Long-term behaviour with respect to elongation at break of SGlaminat and SGtan

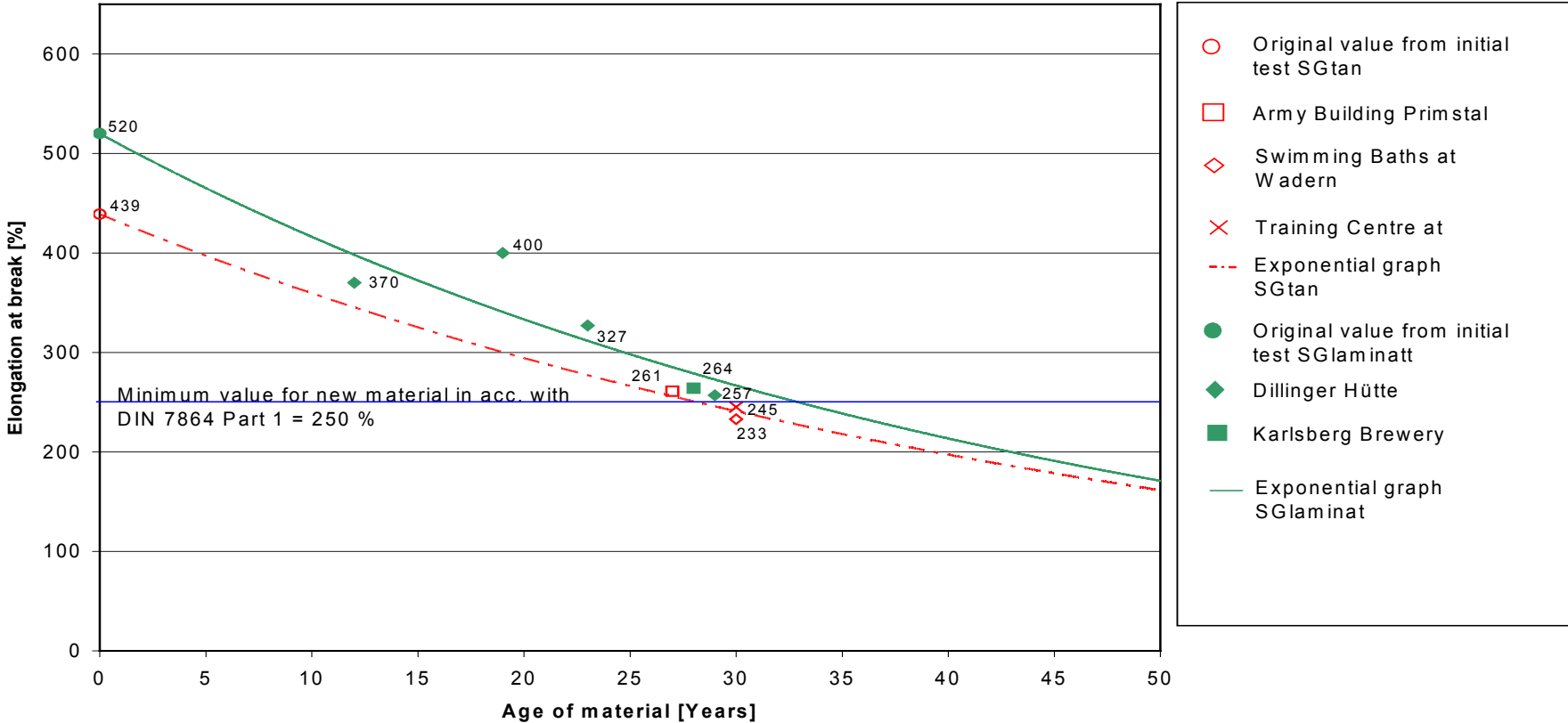


Fig. 2: Graph of elongation at break against age of material