

## Test report

**Customer:** DURAPROOF technologies GmbH  
Eisenbahnstraße 24  
D-66687 Wadern Büschfeld

**Order issued by:** Ms. Sabine Schmitt  
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**Order dated:** 06.12.2011

**Test report Ref. N°:** 0760/17219971/12

**Subject matter of the order:** Testing of long term durability of roof water-proofing membrane types SGLaminat and SGtan

**Date of inspection:** Week 01 – Week 02/12  
**Copy:** 1.

This test report consists of 7 pages plus an appendix of 2 pages and 3 pages of separate appendix and exclusively refers to the subject matter of the order.

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**1. BACKGROUND**

On 06.12.2011 through Ms. Schmitt, Duraproof technologies GmbH commissioned DEKRA Industrial 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 Industrial GmbH took the hereunder mentioned samples from the following buildings:

<b>Building</b>	<b>Roof waterproofing membrane type</b>	<b>Year of installation</b>	<b>Thickness [mm]</b>	<b>With gravel layer</b>
Dillinger Hütte	SGlaminat	1974	1,23	No
Karlsberg Brewery, Homburg	SGlaminat	1976	1,49	No
Indoor swimming pool, Wadern	SGtan	1974	1,33	Yes
German Army Clothing Depot, Primstal	SGtan	1977	1,43	Yes
Vocational Training Centre, Wadern	SGtan	1974	1,30	Yes
SaarGummi Hall 22	SGlaminat	1975	1,30	No

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. The building SGW Hall was an exception; no material was attached here.

## **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, 23.03.04 and 06.12.2011 at the above buildings. The following people were present at the taking of the samples:

- Mr. Kasper - DURAPROOF technologies GmbH
- Mr. Laux - DURAPROOF technologies GmbH
- Mr. Kelter - DEKRA Industrial GmbH

A 40 x 40 cm<sup>2</sup> sample strip was taken from each roof membrane. The samples were clearly labelled and taken away by the attending staff member.

## **3. TEST METHODOLOGY AND 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, SGIaminat and SGTan.

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

Description	Age [years]	Tensile strength at break [MPa]*	Elongation at break [%]	Hardness Shore A
<b>Requirement in accordance with DIN 7864 T1</b>	0	≥ 4,0	≥ 250	-
<b>New membrane SGlaminat</b>	0	8,3	520	60
<b>Dillinger Hütte</b>	12 years	6,1	370	60
<b>Dillinger Hütte</b>	19 years	5,5	400	60
<b>Dillinger Hütte</b>	23 years	4,0	327	70
<b>Dillinger Hütte</b>	29 years	4,4	257	80
<b>Karlsberg Brewery</b>	28 years	8,1	264	70
<b>SaarGummi Hall 22</b>	36 years	7,5	203	80
<b>New membrane SGtan</b>	0	10,0	439	-
<b>Indoor swimming pool, Wadern</b>	30 years	7,6	233	78
<b>German Army, Primstal</b>	27 years	9,2	261	78
<b>Vocational Training Centre, Wadern</b>	30 years	7,5	245	78

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 THERMOFAST SEAM WELDING TECHNIQUE**

In order to carry out peel and shear tests, pieces of Novotan direct 1.3 mm were attached using the Thermofast® 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 from substrate 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 summarised for each product, SGlaminat and SGtan.

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

Description	Age [years]	Resistance to tear propagation [N/mm]	Shear resistance [N/mm]	Peel resistance [N/mm]
<b>Requirement in accordance with DIN 7864 T1</b>	0	$\geq 5$	$\geq 3,5$	$\geq 1$
<b>Dillinger Hütte</b>	29 years	11,4	3,9	2,0
<b>Karlsberg Brewery</b>	28 years	9,8	6,6	3,5
<b>Indoor swimming pool, Wadern</b>	30 years	8,6	10,5	2,4
<b>German Army, Primstal</b>	27 years	7,2	8,3	4,7
<b>Vocational Training Centre, Wadern</b>	30 years	9,7	7,5	3,2
<b>SaarGummi Hall 22</b>	36 years	7,4	6,1	3,8

### 3.3 ASSESSMENT OF THE ROOF PARAPETS

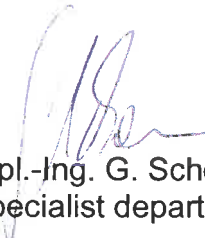
The roof parapets of each building were inspected and assessed during the visit to take the samples. The edge areas were assessed irrespective of the means of attachment with respect to the presence of tension at the roof edge.

Taking into account the length of time the membrane had been in place, the build quality 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.

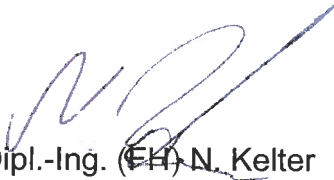
The roofing sheets provided for testing with the current quality name NOVOPROOF® (previous names SGLaminat / SGTan) with a nominal thickness of 1.3 mm were used on roof areas with a roof pitch of  $\leq 2\%$  with no detrimental effects on the long-term behaviour.

Saarbrücken, 04.09.12

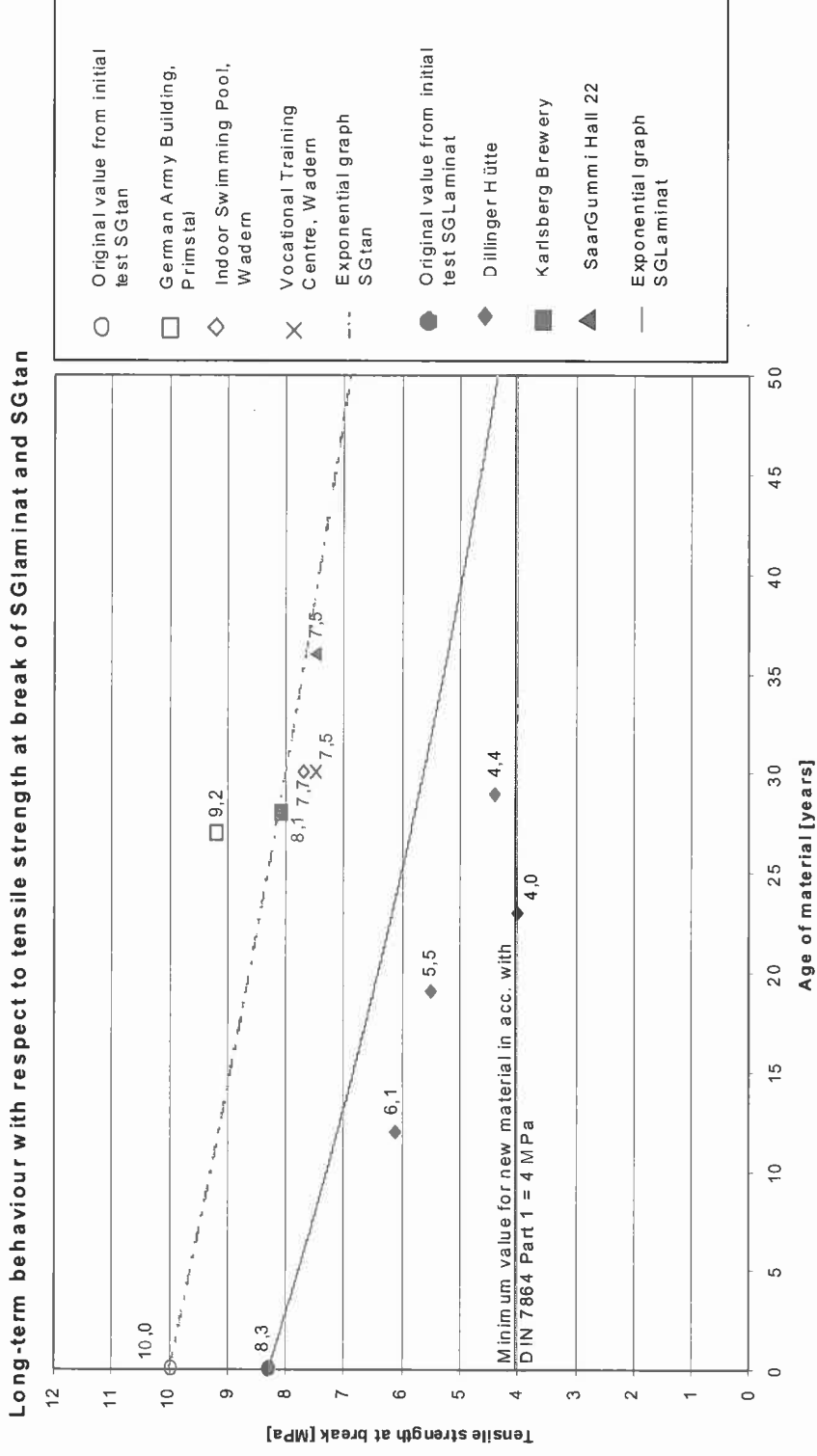
**DEKRA Industrial GmbH**



Dipl.-Ing. G. Schon  
Specialist department



Dipl.-Ing. (FH) N. Kelter  
Specialist department



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



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

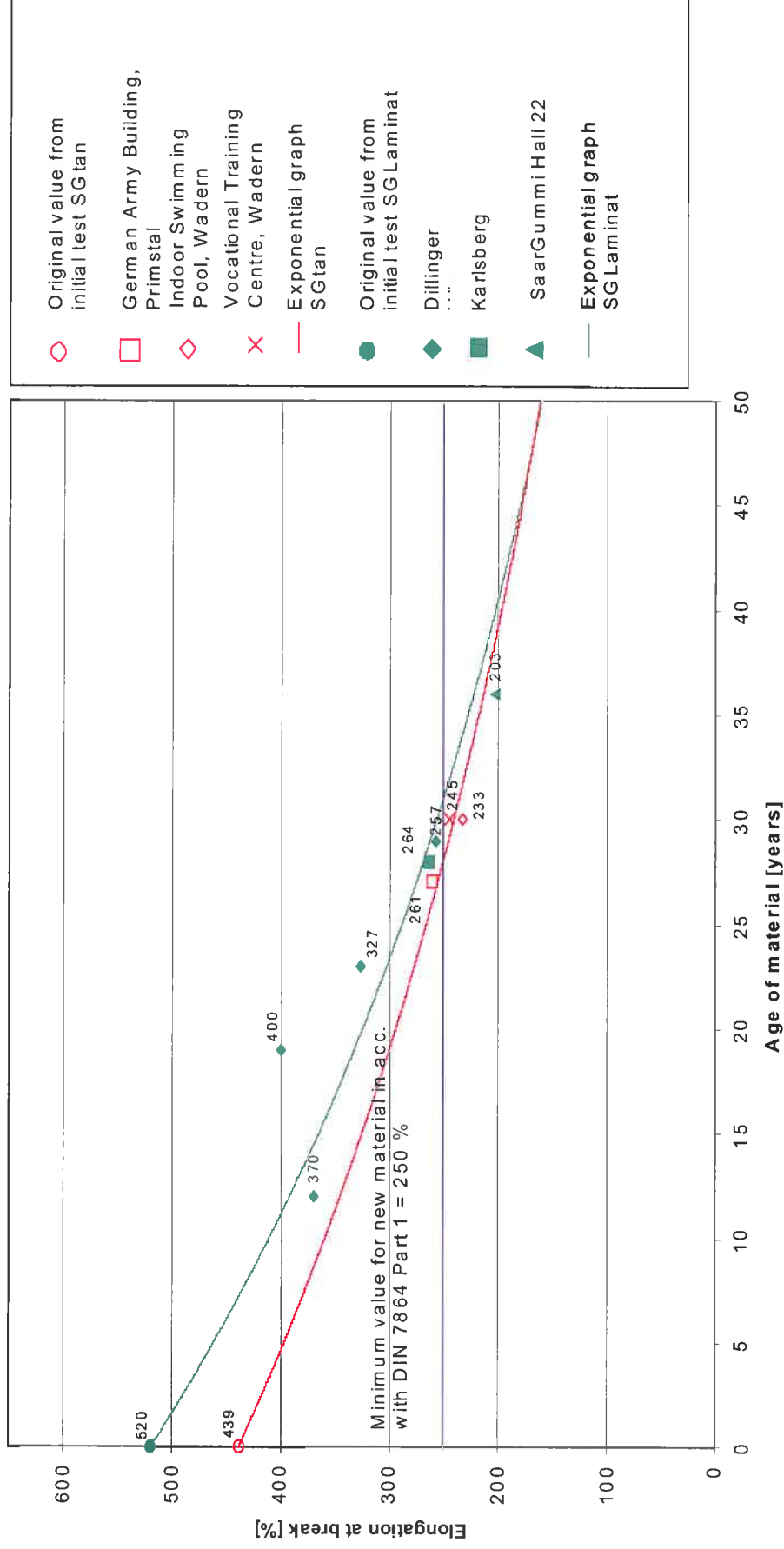


Fig. 2: Graph of elongation at break against age of material

# Special Appendix to Test Report No. 0760/172199771/12



0404A01158

**Fig. 1:** General photograph of the channel of the Dillinger Hütte building after 29 years in place; no signs of shrinkage stresses



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**Fig. 2:** General photograph of the roof parapet of the Karlsberg Brewery building at Homburg after 28 years in place; only slight signs of shrinkage stresses



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**Fig. 3:** General photograph of the roof parapet of the Swimming Baths Building at Wadern after 30 years in place; no signs of shrinkage stresses



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**Fig. 4:** General photograph of the roof parapet of the Army Building at Primstal after 27 years in place; no signs of shrinkage stresses



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**Fig. 5:** General photograph of the roof parapet of the Training Centre Building at Wadern after 30 years in place; no signs of shrinkage stresses



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**Fig 6:** General photograph of the roof parapet of Saar Gummi hall 22 after 36 years in place; no signs of shrinkage stresses