de boer
waterproofing solutions

Duo
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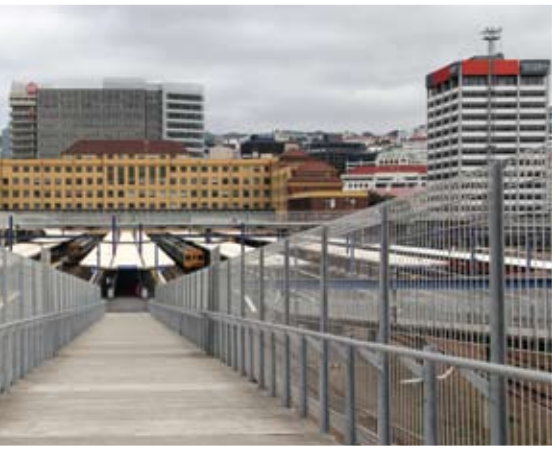
3rd Life expectancy DuO-roofs international



YOUR
ROOF
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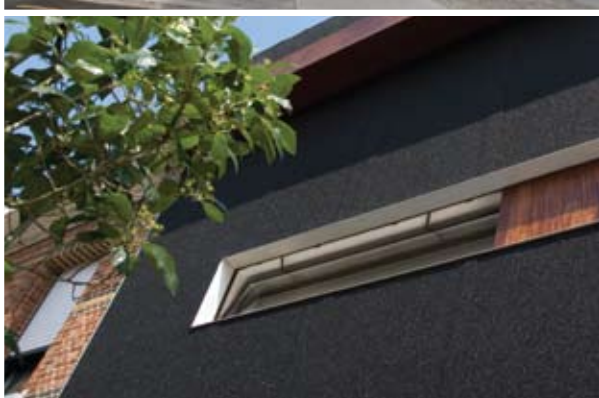

DuO life expectancy report 2012

preface

The development of the DuO roofing membrane as a new concept for high-quality bituminous roofing membranes goes back to 1989. DuO was first used on roofs of a considerable size in 1990.

The DuO roofing membrane had been on the market as a revolutionary concept for roofing membranes since ten years, De Boer plc decided to have an objective, international study carried out to assess the quality of this roofing membrane.

This study was coordinated by SGS and by the BBRI (BELGIAN BUILDING RESEARCH INSTITUTE).
The scope was a global one, whereby roofs in different climate zones:

- four in Belgium (Western Europe),
- one in Denmark (Northern Europe) and
- and one in Thailand (Asia)

were inspected and large pieces of “naturally aged” membranes were cut out.

The study ensured representativeness in terms of climate zone, but also in terms of age, roof surface, roof system (new construction v. refurbishment) and installation technique (full surface torch-applied v. mechanically fixed).

Under the supervision of SGS, the DuO membrane samples taken from the roof were sent to reputed laboratories in Belgium, the Netherlands, Germany and Sweden where they were tested in accordance with the latest official testing methods.

This study concluded that ten years of natural ageing of the DuO roofing membrane on roofs in different climatological conditions and in different roofing systems was unproblematic and that a life expectancy of at least 20 years could be expected.

The study from 2000 also concluded that DuO could be further enhanced by improving the adhesion at the overlap joints. This led to the DuO manufacturing process being changed in 2001. With this change, the bitumen coating at the upper side of the overlap joint could now be made in the same high-quality modified bitumen (SBS) as the membrane’s underside.

Adhesion tests have shown that this investment improved the technical and qualitative performance of the overlap joint, far beyond the traditional concept of APP/APAO and SBS membranes.

As indicated in the previous study, it was our intention to repeat the study after five years.

SGS and the BBRI were, therefore, commissioned in 2005 to conduct the same type of study. This study also included DuO roofs in the Netherlands, Sweden, Japan and Singapore.

The study concluded that naturally aged DuO roofing membranes continued to perform well, in different climate zones and with different installation techniques. A life expectancy of 20 to 30 years was deemed to be realistically achievable.
In 2010, it was decided to conduct yet another similar life expectancy survey with the same parties (SGS and BBRI).

Nine roofs were included in the study, including three roofs in Belgium from the first report in 2000 (including the 34,000 sq.m. roof of the Antwerp Wholesale Market, installed in 1990 and thus the oldest major DuO roof in the world) and the oldest DuO roof in Denmark (1990), as well as the same roofs in Sweden, Japan and Singapore that had already been assessed in the 2005 study.

The fourth roof in Belgium from the 2000 study could not be included in the 2010 study as the building’s owner (the company Coplac) was sold and taking samples was not possible anymore with the new owner.

The roofs in the Netherlands and in Thailand were not included anymore either. The one in the Netherlands is one of the oldest DuO roofs which exist, but it is quite small (300 sq.m.) and it is no longer efficient to take the required big samples. The roof in Thailand is covered with a DuO membrane on which the hotel’s logo has been glued. As this logo is visible from certain hallways, it is no longer possible to take large samples.

Two new roofs were added to the study, though. In Germany, De Boer obtained the approval of landlord NDR (Nord Deutsche Rundfunk, the North German Broadcasting Corporation) to have SGS take large samples from the roof, which is one of Germany’s oldest roofs (1997), and to include it in the study.

The study also includes a roof in New Zealand where DuO has been used in roofing projects since about ten years.

The outcome of the study follows in the report below.

This report contains xx pages, numbered 1 to and including xx, and can only be copied in its entirety.

DuO life expectancy report 2012

WHAT IS DuO?

DuO is a flexible waterproof membrane with double reinforcement and a double polymer bitumen coating. Since it was first developed in 1989, it has been applied on many roofs and in many constructions across the world.

The top coating consists of APAO plastomer bitumen which is UV resistant and which has high mechanical resistance. Since approximately 2006 the top coating consists of TPO plastomer bitumen which has an even higher performance both in terms of hardness and in terms of UV resistance. The undercoating is made of SBS elastomer bitumen with a high elasticity and strong adhesive power. This makes the material easy to use and results in extremely tight seams.

The internal composite reinforcement of polyester and glass scrim (180 g/m²) combines strength and stability. Thickness 4 or 5 mm, measured on the weld.

The top of the membrane is finished with mechanically rolled in mineral slates. The membrane has a burn-away film underneath.
Since 2001, the bitumen coating on the top surface, where the membrane overlaps, is made of the same elastomer coating which is also used across the bottom of the membrane. No filler is added to the material. The bitumen compounds consist of 100% modified bitumen compounds.

The product is ATG-BUtgb certified in Belgium. This certificate has been confirmed by the certification bodies in many other countries (CTG The Netherlands, BBA UK, Byggforsk Norway, SITAC Sweden, ETA Denmark, BRANZ Australia and New Zealand ...). DuO also complies with the new EN 13707 standard.

Criteria	unit / tolerance	test method	technical values membrane
tensile strength	N/5cm ± 20%	EN12311-1	880 (L) / 880 (B)
elongation	% ± 15%abs		60 (L) / 60 (B)
tear resisitance	N/5cm ± 20%	ISO 34-1 Methode B	≥ 110
flexibility at low temperature	°C (new)	EN 1109	≤ -15 (APAO-TPO) / ≤ -20 (SBS)
	°C (after 28days / 80°C)		≤ -10 (APAO-TPO) / ≤ -15 (SBS)
	°C (after 6 months / 70°C)		≤ -5 (APAO-TPO) / ≤ -5 (SBS)
flow resistance	°C (new)	EN 1110	≥ 110
	°C (after 28 days / 80°C)		≥ 110
	°C (after 6 months / 70°C)		≥ 100
dimensional stability	%	EN 1107-1 Methode B	≤ 0,30

LABORATORIES AND TESTS CARRIED OUT

SGS COATING SERVICES (SOCIETE GENERALE DE SURVEILLANCE)

SGS Belgium Nv
Noorderlaan 87
2030 Antwerp

Role in this project:

- taking the roofing membrane samples across the world
- inspection reports of all the roofs
- inspection and coordination of the cutting, the preparation, the packing and the sending of the samples to the different laboratories
- general coordination of the project

WTCB (BBRI BELGIAN BUILDING RESEARCH INSTITUTE) – BELGIUM

Lozenberg 7
B 1932 Sint Stevens-Woluwe
Belgium
www.bbri.be

Role in this project:

- assessment of the laboratories' test reports and of SGS' inspection reports
- drafting the report with the final conclusion

TUM – Technische Universität München – Zentrum Baustoffe- und Materialprüfung (Technical University Munich – Center for Building Material Testing) – Germany

MPA Bau
Baumbachstrasse 7
D – 81245 München
Germany
www.tum.de

Role in this project:

- nail tear strength testing (according to EN 12310-1)
- angle tear strength testing (according to ISO 34-1 method B)
- tear resistance testing (rivestyrke) (according t34-1 method A)

SP – Sveriges Provnings och Forskningsinstitut (Technical Research Institute of Sweden) – Sweden

SP Swedisch National Testing and Research Institute
Västerasen
Brinellgatan 4
SE 501 15 Boras
Sweden
www.sp.se

Role in this project:

- taking the roofing membrane samples across the world
- inspection reports of all the roofs
- inspection and coordination of the cutting, the preparation, the packing and the sending of the samples to the different laboratories
- general coordination of the project
  Accredited by the Swedish Board for Accreditation and Conformity Assessment (Swedac) for the following test:
- dimensional stability (according to EN 1107-1 method B)

BDA – Bureau Dak Advies (BDA Roof Consultancy) – The Netherlands

BDA Keuringsinstituut
Avelingen West 33
NL – 4200 AJ Gorinchem
The Netherlands
www.bda.nl

Role in this project:

- microscopic examination (according to BDA method 123 version 3)
- tensile strength and elongation at rupture (according to EN 12311-1)
- weld seam shear test (according to EN 12317-1)
- flexibility at low temperature (according to EN 1109)

De Boer – plant laboratory – Belgium

Metropoolstraat 33
B 2900 Schoten
België
www.deboer.be

Role in this project:

- flow resistance - under supervision of an SGS-Axamed inspector (according to EN 1110)

ON SITE OBSERVATIONS AND SAMPLING

Roofers in the different countries, customers of De Boer nv, have cut out the samples in the area designated by the SGS inspector.

Flat pieces of approximately 300 cm x 80 cm from the middle of the roll were cut out, as were pieces of approximately 300 cm x 80 cm with an overlap seam.

The sampling was done between November 2010 and April 2011.

The samples which had been cut out from the roof were then clearly and irrefutably marked by the SGS inspector and sent to the laboratory of De Boer nv. SGS photographically recorded the inspection, the sampling and the identification of the samples on site.

Under the supervision of the SGS inspector, NV De Boer WS' laboratory cut all samples to the required size (depending on the requirements of the respective tests), identified and signed them and sent them to the respective external laboratories for testing.

The results of these tests are reflected in the present report and are compared to the findings of the studies of 2000 and 2005.

The main purpose of this study is to assess the impact of the natural ageing of DuO roof membranes on a large variety of roofs in various climatological conditions across the world.

Although the purpose is not to assess in detail the impact of the execution, the roof inspections by SGS did offer the opportunity to assess the execution of the roofing and the maintenance situation. Where needed, remarks about these were made.

The attachment to this report contains a brief overview of SGS' findings during the roof inspections. With some of the nine roofs included in this study, prior observations have been made with respect to the execution and the sampling; these need to be taken into consideration when interpreting the results.

TEST RESULTS AND EVALUATION

The test methods used in the 2010 study are identical to the ones used in the previous study (2005).

For some tests, however, the then valid test method was used in 2000 (period prior to European standard EN 13707, version 2004).

When evaluating the test results, it is also important to take into consideration the construction of the different roof surfaces.

In systems with an additional underlayer e.g. this layer has a big influence on certain tests. Compared to a roof system with an SBS bitumen underlayer, an underlayer in oxidized bitumen welded to the DuO top layer adversely impacts flexibility at low temperature.

Compared to an underlayer in perforated glass membrane, an underlayer reinforced with polyester membrane or glass fiber welded to the DuO top layer will favorably impact the roof system's overall strength in the tensile strength testing.

DuO life expectancy report 2012

Introduction

The development of DuO as a new concept for a high value, bituminous waterproofing membrane dates back to 1989. De first substantial DuO roofs were installed in 1990.
In 2000, after DuO had been launched as a revolutionary new roof membrane concept for over 10 years, De Boer nv decided to do an objective, international investigation of the quality of this waterproofing membrane. This happened in coordination with SGS and BBRI (Belgian Building research Institute) and evaluated samples form roofs in Western & Northern Europe and Asia.
In 2005, another DuO durability test was performed and test roofs from other countries were added to the list. (Netherlands, Sweden, Japan and Singapore)
In 2010, De Boer nv instructed SGS and BBRI to test the ageing DuO membranes again and two more roofs located in Germany and New Zealand were added.
This document provides you a conclusion of the general test results and a summary of the results of the DuO membrane.

CRITERIA OF THE TESTS PERFORMED:

CRITERION : STRENGTH AND CREEP RESISTANCE OF THE MEMBRANE

1. TENSILE STRENGTH AND ELONGATION AT RUPTURE - BDA LABO
2. NAIL TEAR STRENGTH - TUM LABO
3. ANGLE TEAR STRENGTH - TUM LABO
4. RESISTANCE TO TEARING (RIVESTYRKE) - TUM LABO
5. DIMENSIONAL STABILITY - SP LABO

CRITERION : QUALITY OF THE BITUMEN COATINGS

1. FLEXIBILITY AT LOW TEMPERATURE - BDA LABO
2. FLOW RESISTANCE - DE BOER LABORATORY UNDER SUPERVISION OF SGS
3. MICROSCOPIC EXAMINATION

CRITERION : QUALITY OF THE SEAMS (CERTAINTY OF WATER-TIGHTNESS)

1. ADHESION TEST / SHEAR TEST - BDA LABO

GENERAL CONCLUSION OF ALL THE TEST RESULTS:

- The samples indicate that there is no significant reduction regarding tensile strength, elongation and the other different strength tests (nail, butterfly, rive)
- If a membrane is installed as a single layer, then the norm stipulates that the membrane shall have a composite reinforcement and that the total membrane can have a shrinkage of maximum 0.3%. In all cases (one layer or two-layer DuO roofs) the results are lower than the 0.3% , concluding that the DuO-membrane is a very stable waterproofing membrane in all those applications.
- The cold flexibility of DuO stays within the norm for artificially aged membranes. In most cases hardly any natural ageing is noticed on the roofs.
- The flow resistance of the DuO-membrane stays within the norm for new and artificially aged membranes. Results of membranes installed in tropical climates show high temperature resistance of 150-155°C , also after ageing.
- The shear resistance of the DuO-joint connection is still within the norm that is stipulated for new membranes.

FINAL CONCLUSION

Laboratory tests on samples taken from the roof covering systems show that the results are still quite comparable with the characteristics which are reported for new membranes. Only a relatively limited ageing can be noted.

On some of the roofs where DuO has been mechanically installed in one layer, and where the DuO membrane could therefore be removed without an underlayer or without damage, ageing is remarkably limited compared to the study five years ago and compared to the values of new membranes.

It also appears that DuO membranes retain their qualities in different climates.

- Western Europe (Belgium and The Netherlands),
- Northern Europe (Denmark and Sweden)
- Asia (Thailand, Japan and Singapore).
- Oceania (New Zealand)

As part of this new series of measurements, new roofs have been tested, including one in Oceania. Based on the results after ten years, one can have high hopes for the future, there as well.

We can conclude that, after another period of five years of natural ageing, the DuO membrane installed in different types of roof covering systems on roofs in different continents across the globe continues to perform very well.

Bearing in mind that the oldest roofs are now more than 20 years old, we can now state that, provided that the roof surface and the roof details are properly maintained, the life expectancy put forward five years ago can be extended by another five years. Meaning: we believe that a life expectancy of 25 to 35 years is realistic

ERIC WINNEPENNINCKX
WTCB CSTC BBRI
Head of department Standards, Specifications and Quality of Products and Systems

MARK DE BUSSCHERE
SGS
Manager & Coordination

WHOLESALE MARKET – ANTWERP – BELGIUM

Surface	:	34.000 m2	built-up/Construction	:	cellular concrete + one-sided covered polyester + DuO 4 mm slate/film
Height	:	12 m	Execution	:	bottom layer mechanically fastened + DuO top layer flame-torched across its entire surface
Wind zone	:	III (industrial area)	construction	:	newly built roof system
Year of construction	:	1990	roof system	:	2-layer PES

TESTS		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	1605N	1203N	1331N	1255N	1330N	1445N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	43	55	40	55	36	43
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	528N	793N	505N	640N	495N	637N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	266N	235N	250N	235N	281N	265N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	328N	242N	160N	185N	192N	259N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	0,28%	0,04%	-0,13%		-0,28%	

	specification				
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	985N	576N	541N	

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	110	155	130	150	115	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	T	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-5	-3	-8	-32	-8	-32	-12	-18	-14	-20

observations during visual inspection :

- The general impression of the roof is still very good. Slate granules are present everywhere.
- With respect to the execution of the work, it needs to be stated that the placing of the membrane has resulted in irregular beads of bitumen across the roof, which shows that different roofing companies / different roofer teams have executed the work. The membrane has in general been well placed.
- Periodic maintenance, inspection of the joints and removal of any algae are all highly recommended.
- The samples were taken on a flat part of the roof, as well as on a slope. Afterwards, the incisions were made water-tight again in a professional manner.

POLDERBUSSEN ANTWERP – BELGIUM

Surface	:	7.500 m2	built-up/Construction	:	concrete + existing covering + DuO 4 mm slate/film
Height	:	10 m	Execution	:	DuO single top layer mechanically fastened
Wind zone	:	IV (urban area)	construction	:	refurbishment
Year of construction	:	1996	roof system	:	1-layer

TESTS		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	699N	718N	785N	734N	815N	765N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	47	53	53	45	43	44
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	383N	388N	345N	320N	295N	337N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	143N	133N	135N	135N	123N	136N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	142N	105N	v105N	110N	148N	151N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	0,18%	0,08%	-0,12%		-0,20%	

	specification					
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	442N		502N		822N	

					OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	new		after aging 6 months at 70°C							
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	125	155	135	155	115	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	T	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-15	-20	-22	-32	-22	-32	-18	-14	-18	-20

observations during visual inspection :

- The general impression of the roof is still very good.
- With respect to the execution of the work, it needs to be stated that the joints of the membrane have been levelled off using a putty-knife whereby on certain joints the bitumen coating of the insert has been wiped away. As a result, the polyester reinforcement has becom visible at the edge of the membrane.
- Important observations need to be made with respect to the maintenance of the roof, in that there is a structural lack of maintenance. Loose objects, such as broken stones and a broken drain pipe, are scattered across the roof.
- Also, a lot of dirt has gathered in certain areas, which has resulted in vegetation growing in those areas.
- The samples were taken from different curved areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner.

COPLAC AALST/EREMBODEGEM – BELGIUM

Surface	:	24.360 m2	built-up/Construction	:	wood fibre cement boards + existing covering + vapour pressure distribution layer VP40/15 + DuO 4 mm slate/film
Height	:	8 m	Execution	:	DuO top layer flame-torched on vapour pressure distribution layer
Wind zone	:	III (industrial area)	construction	:	refurbishment
Year of construction	:	1992	roof system	:	2-layer GVP

TESTS		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	827N	798N	780N	665N	-	-
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	42	44	23	25	-	-
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	443N	464N	355N	450N	-	-
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	159N	149N	165N	155N	-	-
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	157N	181N	100N	125N	-	-
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	0,06%	0,02%	-0,08%		-	

	specification					
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	546N		621N		-

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	125	155	130	150	-	-

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	T	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-5	0	-10	-32	-10	-32	-	-	-	-

observations during visual inspection :

- This roof has no longer been inspected, as the building has been sold and as sample-taking was not possible under the new ownership.

UNILIN – WIELSBEKE – BELGIUM

Surface	:	12.650 m2	built-up/Construction	:	wooden roof floor + existing covering + primer + vapour pressure distribution layer VP40/15 + DuO 4 mm slate/film
Height	:	12 m	Execution	:	DuO top layer flame-torched on vapour pressure distribution layer
Wind zone	:	III (industrial area)	construction	:	refurbishment
Year of construction	:	1994	roof system	:	2-layer GVP

TESTS		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	712N	702N	819N	779N	830N	720N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	53	44	39	40	38	37
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	518N	395N	405N	415N	352N	423N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	155N	164N	170N	160N	144N	125N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	199N	137N	130N	145N	123N	155N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	0,26%	0,03%	-0,15%		-0,28%	

	specification				
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	688N	782N	704N	

					OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	new		after aging 6 months at 70°C							
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	110	155	125	155	120	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	T	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	0	0	-24	-28	-24	-28	-18	-24	-18	-24

observations during visual inspection :

- The general impression of the roof is still very good
- The work on the roof has been done skilfully and with a lot of care. No remarks.
- There has been periodic roof maintenance. There are no remarks, here either.
- The samples were taken from different areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner..

AALBORG INDUSTRIES AALBORG – DENMARK

Surface	:	1.500 m2	built-up/Construction	:	existing covering + underlayer in oxidized bitumen with polyester reinforcement 3mm + DuO 4 mm slate/ film
Height	:	8 m	Execution	:	DuO top layer flame-torched across its entire surface
Wind zone	:	III (industrial area)	construction	:	refurbishment
Year of construction	:	1990	roof system	:	2-layer PES

TESTS		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	1445N	1405N	1365N	1304N	1335N	1365N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	37	48	27	36	37	44
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	482N	603N	465N	525N	532N	558N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	273N	258N	275N	230N	265N	231N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	170N	185N	145N	140N	169N	170N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	0,16	0,06	-0,13%		-0,13%	

	specification				
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	1105N	1184N	946N	

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	120	155	110	150	115	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	T	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-5	-5	-20	-32	-20	-32	-18	-24	-20	-20

observations during visual inspection :

- The general impression of the roof is still very good.
- The roof membrane has been placed skilfully and with a lot of care.
- There has not been any maintenance since a while. Dirt has gathered and vegetation grows in some areas of the roof.
- The samples were taken from different areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner..

DUSIT THANI HOTEL – BANGKOK – THAILAND

Surface	:	1.500 m2	built-up/Construction	:	concrete + primer + DuO 4 mm slate/film (the hotel logo was applied to the roofing membrane using cold glue and slate)
Height	:	8 m	Execution	:	DuO top layer flame-torched across its entire surface
Wind zone	:	IV (urban area)	construction	:	newly built
Year of construction	:	1994	roof system	:	1-layer

TESTS		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	728N	699N	638N	487N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	40	38	3	5
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	377N	424N	315N	355N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	169N	171N	110N	110N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	122N	200N	75N	110N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	0,16	0,03	-0,02%	

	specification		
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	720N	553N

					OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005			
	new		after aging 6 months at 70°C							
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING		
	>100°C	**>140°C**	**>100°C**	**>150°C**	115	160	125	160		
	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2000		OFFICIAL LABORATORY VALUES - 2005			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	T	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-15	-20	-20	-32	-20	-32

observations during visual inspection :

- The roof has no longer been inspected, as the hotel's logo which has been placed on the roof is visible from certain corridors and sample-taking is, hence, not possible anymore.

MUNNIK V.V.E. – KROMMENIE/ZAANSTAD – THE NETHERLANDS

Surface	:	300 m2	built-up/Construction	:	wooden roof floor + PUR insulation + vapour pressure distribution layer VB250A16/VP40/15 + DuO 4 mm slate/film
Height	:	7 m	Execution	:	DuO top layer flame-torched (on vapour pressure distribution layer underneath)
Wind zone	:	II (agricultural area)	construction	:	newly built
Year of construction	:	1993	roof system	:	2-layer GVP

TESTS		OFFICIAL LABORATORY VALUES - 2005	
	specification	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	902N	724N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	33	33
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	380	440N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	175N	165N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	115N	90N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	-0,09%	

	specification	
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	720N

					OFFICIAL LABORATORY VALUES - 2005			
	new		after aging 6 months at 70°C					
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE		TOP COATING	
	>100°C	**>140°C**	**>100°C**	**>150°C**	110		150	
	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2005			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	- 18	- 28	- 18	- 28

observations during visual inspection :

- The roof has no longer been inspected, because it is only 300 m² in size. It is, therefore, no longer efficient to take the required samples from the roof.

RIKSBYGGEN – UDDEVALLA – SWEDEN

Surface	:	3.210 m2	built-up/Construction	:	wooden roof floor + existing covering + DuO 4 mm slate/film
Height	:	10 m	Execution	:	DuO single top layer mechanically fastened
Wind zone	:	II (agricultural area)	construction	:	refurbishment
Year of construction	:	1997	roof system	:	1-layer

TESTS		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	848N	847N	845N	790N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	47	52	43	45
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	300N	325N	300N	329N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	165N	145N	149N	144N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	120N	125N	93N	141N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	-0,08%		-0,17%	

	specification		
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	834N	862N

					OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	new		after aging 6 months at 70°C					
	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	**>100°C**	**>140°C**	**>100°C**	**>150°C**	130	155	130	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	-15°C	-20°C	-5°C	-5°C	-18	-32	-18	-32	-12	-28	-14	-30

observations during visual inspection :

- The general impression of the roof is still very good.
- The work on the roof has been done skilfully and with a lot of care. No remarks.
- Moss can be observed in a number of areas.
- The samples were taken from different areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner.

MITSUBISHI ELECTRIC CO. – AMAGASAKI – JAPAN

Surface	:	2.730 m2	built-up/Construction	:	concrete + primer + PUR insulation + vapour pressure distribution layer + DuO 4 mm T/F + coloured coating
Height	:	24 m	Execution	:	DuO top layer flame-torched (on vapour pressure distribution layer underneath)
Wind zone	:	III (industrial area)	construction	:	newly built
Year of construction	:	2000	roof system	:	2-layer GVP

TESTS		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	779N	773N	885N	770N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	44	47	43	43
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	310N	340N	304N	359N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	130N	120N	152N	150N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	105N	90N	104N	154N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	-0,07%		-0,15%	

	specification		
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	763N	848N

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	115	155	120	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-22	-24	-22	-24	-18	-22	-24	-24

observations during visual inspection :

- The general impression of the roof is still very good.
- The work on the roof has been done skilfully and with a lot of care. No remarks.
- The roof has been periodically maintained. There are no remarks, here either.
- The samples were taken from different areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner.

PANASONIC SEMICONDUCTOR – SINGAPORE

Surface	:	1.600 m2	built-up/Construction	:	concrete + insulation + existing covering + cement roof floor + primer + DuO 4 mm slate/film
Height	:	12 m	Execution	:	DuO top layer flame-torched across its entire surface
Wind zone	:	III (industrial area)	construction	:	refurbishment
Year of construction	:	2000	roof system	:	1-layer

TESTS		OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	732N	665N	715N	610N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	39	39	34	35
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	355N	355N	292N	306N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	125N	120N	136N	122N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	75N	85N	122N	137N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	-0,11%		-0,22%	

	specification		
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	682N	723N

					OFFICIAL LABORATORY VALUES - 2005		OFFICIAL LABORATORY VALUES - 2010	
	new		after aging 6 months at 70°C					
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	115	155	100	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2005				OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	L undercoating	T topcoating	T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-32	-32	-32	-32	-16	-14	-16	-20

observations during visual inspection :

- The general impression of the roof is still good.
- The work on the roof has been done skilfully and with a lot of care. No remarks.
- The roof has not been periodically maintained. Moss could be observed and vegetation blocks the drain pipes. Also, white and rust-coloured marks could be observed on the roof.
- Blistering was observed in four lanes. As the joints were still well sealed, further investigation is needed to determine the cause of this blistering.
- The samples were taken from different areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner.

NDR – NORD DEUTSCHE RUNDFUNK HAMBURG – GERMANY

Surface	:	1.750 m2	built-up/Construction	:	concrete + insulation + existing coverings + primer + DuO 5 mm slate/film
Height	:	5 m	Execution	:	DuO top layer flame-torched across its entire surface
Wind zone	:	III (industrial area)	construction	:	refurbishment
Year of construction	:	1997	roof system	:	2-layer GWT

TESTS		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	775N	735N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	48	43
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	384N	420N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	185N	164N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	162N	164N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	-0,27%	

	specification	
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	694Nv

					OFFICIAL LABORATORY VALUES - 2010	
	new		after aging 6 months at 70°C			
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING
	>100°C	**>140°C**	**>100°C**	**>150°C**	130	155

	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-22	-18	-22	-24

observations during visual inspection :

- The general impression of the roof is still good.
- The work on the roof has been done skilfully and with a lot of care. Only two small openings in the joints could be found.
- There is no periodic roof maintenance. There is a lot of moss.
- The samples were taken from different areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner.

WELLINGTON RAILWAY STATION – NEW ZEALAND

Surface	:	7000 m2	built-up/Construction	:	concrete + insulation + base-sheet underlayer Deboflex 2.5 T/F K180 fully welded + DuO 4 mm slate/film
Height	:	>5 m	Execution	:	DuO top layer flame-torched across its entire surface
Wind zone	:	III (industrial area)	Construction	:	refurbishment
Year of construction	:	2002	roofsystem	:	2-layer PES

TESTS		OFFICIAL LABORATORY VALUES - 2010	
	specification	LONGITUDINAL	TRANSVERSAL
TENSILE STRENGTH *test method (UEAtc – 1984 and EN 12311-1)*	**880N ± 20%**	1145N	895N
ELONGATION *test method (UEAtc – 1984 and EN 12311-1)*	**60 ± 15%abs**	46	47
RESISTANCE TO TEARING (NAIL SHANK) *test method (EN 12310-1)*	**>250N**	253N	275N
RESISTANCE TO TEARING (BUTTERFLY TEST) *test method (DIN 53515 and ISO 34-1 Method B)*	**>110N**	137N	125N
RESISTANCE TO TEARING (NAIL SHANK) *test method (DIN 53515 and ISO 34-1 Method B)*	**>50N**	59N	77N
DIMENSIONAL STABILITY *test method (SP 2187 and EN 1107-1 Method B)*	**<0,30%**	-0,18%	

	specification	
SHEAR RESISTANCE OF THE JOINT *test method (UEAtc – 1982 and EN 12317-1)*	**>500N**	892N

					OFFICIAL LABORATORY VALUES - 2010			
	new		after aging 6 months at 70°C					
FLOW RESISTANCE AT ELEVATED TEMPERATURE *test method (UEAtc - 1984 and EN 1110)*	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE	TOP COATING	TOT. MEMBRANE		TOP COATING	
	>100°C	**>140°C**	**>100°C**	**>150°C**	135		155	
	new		after aging 6 months at 70°C		OFFICIAL LABORATORY VALUES - 2010			
FLEXIBILITY AT LOW TEMPERATUR *test method (UEAtc - 1982 and EN 1109)*	L & T topcoating	L & T undercoating	L & T topcoating	L & T undercoating	L topcoating	L undercoating	T topcoating	T undercoating
	-15°C	-20°C	-5°C	-5°C	-24	-24	-24	-22

observations during visual inspection :

- The general impression of the roof is still good.
- There is insufficient maintenance of the roof. In one area, the membrane no longer adheres and there is moisture under the upper layer. A sample was taken from this zone. Dirt has gathered in several places.
- The samples were taken from different areas of the roof. Afterwards, the incisions were made water-tight again in a professional manner.