REPORT

issued by an Accredited Testing Laboratory

Contact person RISE
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Date
2018-06-21

Reference
7P08588
Final Report

Testing

Protan AS
Postboks 420 Brakeroya
NO-3002 DRAMMEN
Norge

Test of tunnel PVC-membrane

(3 appendices)

Commission

Test of tunnel membrane.

Test according to:

- Visual defects, EN 1850-2
- Thickness, EN 1849-2
- Tensile properties, EN 12311-2
- Tear resistance, EN 12310-1, -2
- Static puncture, EN 12236
- Dimension stability, EN 1107-2
- Foldability at low temperature, at -25°C, EN 495-5
- Water tightness, EN 1928 method A at 10kPa
- Fire resistance, EN ISO 11925-2 and classification EN 13501-1
- Shear resistance of joint, EN 12317-2
- Peel resistance of joint, EN12316-2
- Resistance to leaching, modified method EN 14415 method A, water solution 180d at 70°C, evaluation with tensile properties for use in 25 years as in EN 13491:2018 (PVC)
- Resistance to micro-organism, EN 12225, evaluation with tensile properties for use in 25 years as in EN 13491:2018 (PVC)

Test object

The test object consisted of about 5 meter part of a roll, two meter wide, of grey-coloured PVC-coated textile geomembrane for tunnels and a 2 meter welded joint of the membrane. The object, membrane and welded joint, designated Protan 514-940, was selected and sent by the commissioner to RISE Research Institute of Sweden AB. The test object was marked 514-940 at the arrival at RISE.

Object	Appearance	Arrival at RISE
Tunnel membrane, thickness of nominal 0,55 mm, nominal area weight of 700 kg/m^2, length <10m, width of about 2 meter	grey-coloured PVC-coated textile geomembrane	20/11-2017
Welded end lap joint of the tunnel membrane length of about 2 meter, seal is about 30 mm in width	grey-coloured PVC-coated textile geomembrane, welded end lap joint	27/12-2017

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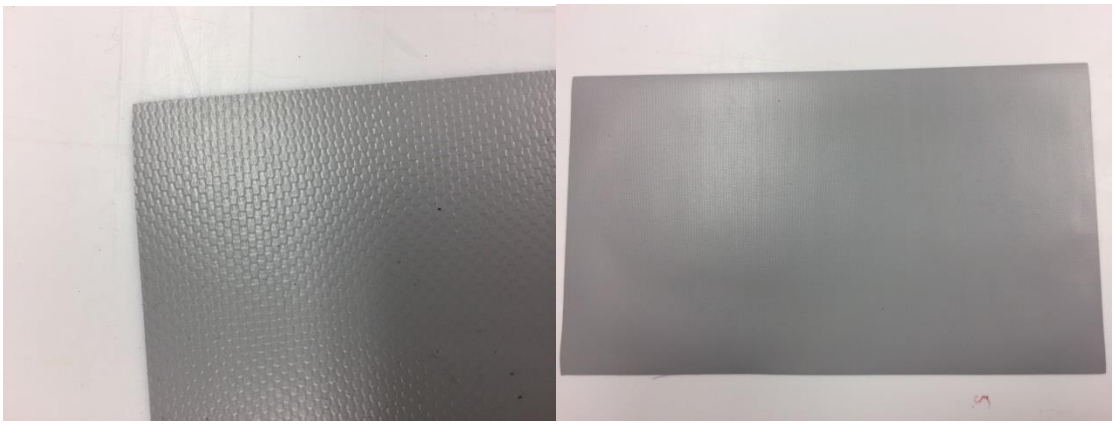
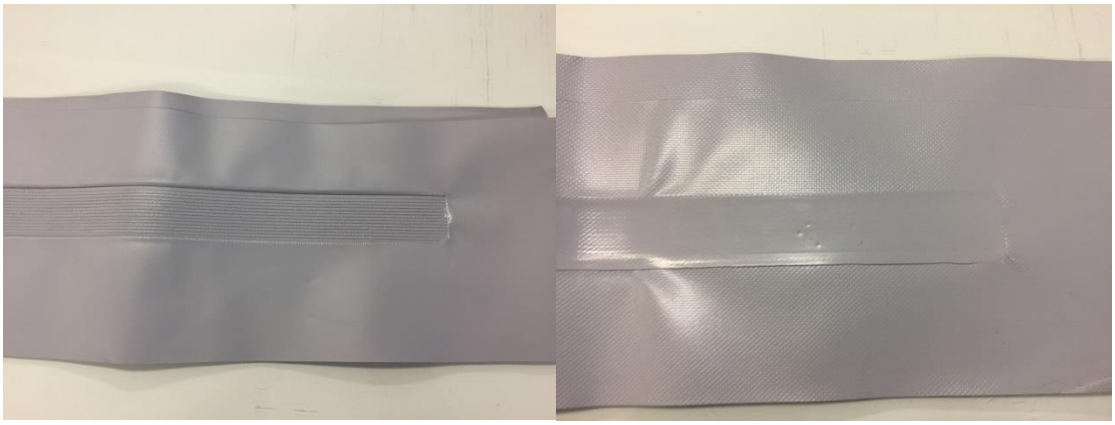
ISO/IEC 17025



Picture 1. Tunnel membrane Protan 514-940, near view to the left and overview on the right



Picture 1. Welded joint of tunnel membrane Protan 514-940, front side to the left and back side on the right.

Test Performance

The tests were performed during November 2017 – June 2018. All the tests are performed at 23 ±1 °C and 50 ±5 % RH if nothing else is specified. The test according to EN 14415, EN 12225, EN 495-5, EN 1107-2, EN 12310-2, EN 12316-2 is not accredit test. Details of test performance and results will be found in appendix 1 and a statement on measurement uncertainty can be found in the appendix 2.

Summary of Results

Protan 514-940

Characteristics	**Test method**	**Unit**	**Result**
Visual defects	EN 1850-2	-	No visible defects
Thickness, Mass per unit area	EN 1849-2	m, g/m^2	0,57 710
Maximum tensile force	EN 12311-2	N/50 mm	MD 3090 TD 2160
Tensile elongation at maximum force	EN 12311-2	%	MD 31 TD 39

Tear resistance (nail Shank)	EN 12310-1	N	MD 490 TD 630
Tear resistance	EN 12310-2	N	MD 363 TD 417
Static Puncture	EN ISO 12236	kN	6,29
Dimension stability	EN 1107-2	%	MD -0,2 TD +0,1
Foldability at low temperature	EN 495-5, at -25°C	Pass/Fail	Pass, no cracks at -25°C
Water tightness	EN 1928 method A at 10 kPa	Pass/Fail	Pass, Watertight
Reaction to fire*	EN ISO 11925-2	Classification EN 13501-1	Class E
Shear resistance	EN 12317-2	N/50 mm	2866
Peel resistance	EN12316-2	N/50 mm	153
Resistance to leaching	modified method EN 14415 method A, hot water solution 180d at 70°C	Pass/Fail**	Pass
Resistance to micro-organism	EN 12225	Pass/Fail**	Pass

MD = Sample is taken in machine direction
TD = Sample is taken in transverse machine direction
* = Performed by RISE Fire research test lab
** = acceptance criteria after exposure/ageing as in standard, EN 13491:2018 for 25 year of use

The test results are only valid for the membrane tested.

RISE Research Institutes of Sweden AB
Chemistry and Materials - Polymer Technology

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Appendices Test performance and results in detail, Statement of measurements uncertainty, Result of Fire resistance performance and classification report, reaction to fire

Appendix 1

Test Performance and Results

Visible defects

The first 5 meters of the sheet was examined for visible defects with naked eye according to standard EN 1850-2:2001 *Flexible sheets for waterproofing - Determination of visible defects - Part 2: Plastic and rubber sheets for roof waterproofing.*

No visible defects were found.

Thickness and mass per unit area

The thickness was determined according to standard EN 1849-2:2009 *Flexible sheets for waterproofing - Determination of thickness and mass per unit area - Part 2: Plastic and rubber sheets.* Four samples specimens of 10000 ± 100 mm^2 were punched out equally spread over the width of the membrane and the membrane and the weight was determined at an analytical balance. Mean value is calculated. The result is rounded to the nearest 5 g/m^2. The membrane thickness was there after determined at the test specimens. The upper measuring face had a radius of 10 mm. The applied measuring force was 20kPa. At least 10 single spot thickness measurement was determined on each test. Mean value is calculated. The result is rounded to the nearest 0,01 mm.

Mean value [g/m^2]	**Mean value rounded off [g/m^2]**	Standard deviation [g/m^2]	Lowest value [g/m^2]	Highest value [g/m^2]
707,6	**710**	8,8	695	716

Mean value [mm]	**Mean value rounded off [mm]**	Standard deviation [mm]	Lowest value [mm]	Highest value [mm]
0,566	**0,57**	0,004	0,558	0,573

Tensile properties, Maximum tensile force and elongation at maximum force

The tensile properties were determined according to standard EN 12311-2:2013 *Flexible sheets for waterproofing - Determination of tensile properties-part 2: Plastic and rubber sheets for roof waterproofing.* The machine used was Zwick Z100, Inv. nr. BX32748, with load cell BX32800 force accuracy class 0,5 ISO 7500-1:2018 and elongation class 1 according to standard ISO 9513:2012. The elongation was measured between the grips. The test was performed according to method A. The maximum tensile force in N/50 mm is stated together with tensile elongation at maximum tensile force. Samples were cut out with a stripe cutter. The test was performed the 1st of June 2018.

The following parameters were used during performance:
Test specimen: 50 mm wide, 200 mm long, template cut
Initial grip separation: 120 mm
Rate of grip separation: 100 mm/min
Preload: 5 N

Appendix 1

Machine direction

Sample No.	Maximum tensile force [N/50 mm]	Tensile elongation at maximum tensile force [%]
1	3060	30,5
2	2970	29,6
3	2970	29,9
4	3160	31,1
5	3300	32,6
Mean value	**3090**	**30,8**
Standard deviation	140	1,2

Transverse direction

Sample No.	Maximum tensile force [N/50 mm]	Tensile elongation at maximum tensile force [%]
1	2190	39,7
2	2220	40,1
3	2000	36,4
4	2290	40,3
5	2120	39,4
Mean value	**2160**	**39,2**
Standard deviation	110	1,6

Tear strength (”nail shank”)

The tear strength was performed according to standard EN 12310-1:1999 *Flexible sheets for waterproofing - Part 1: Bitumen sheets for roof waterproofing – Determination of resistance to tearing (nail shank)*. The width of the test piece was 100 mm and the distance between the nail and the free end was 50 mm. The distance from the nail to the upper grips was 100 mm. The test was carried out at a constant speed of 100 ± 10 mm/min. The maximum force required to tear the test specimen pierced by nail shank is stated. The test was performed in both manufacturing directions.

Sample No.	Machine direction (MD) [N]	Transverse machine direction (TD) [N]
1	493	634
2	447	633
3	488	608
4	526	694
5	495	579
Mean value	**490**	**630**
Standard dev.	28	42
Result (rounded off to the nearest 5 N)	490	630

Appendix 1

Tear strength

The tear strength was performed according to standard EN 12310-2:2000 *Flexible sheets for waterproofing – Determination of resistance to tearing – Part 2: Plastic and rubber sheets for roof waterproofing*. The tear distance is 25 mm. The test was carried out at a constant speed of 100 ± 10 mm/min. The maximum force required to tear the test specimen is stated. The test was performed in both manufacturing directions.

Sample No.	Machine direction (MD) [N]	Transverse machine direction (TD) [N]
1	347	409
2	376	426
3	367	380
4	367	434
5	359	435
Mean value	**363**	**417**
Standard dev.	11	23

Static Puncture

The static puncture test was determined according to EN ISO 12236:2006 *Geosynthetics – Static puncture test (CBR test) (ISO 12236:2006)*. The standard climate 23±2°C and 50±5%RH, were used that is a deviation from standard that describes 20±2°C and 65±5%RH. The test specimens were conditioned in the same climate as tested. A preload of 20 N was used. The puncturing speed was 50±5 mm/min. The test was performed the 13th of December 2017.

Sample No.	Puncture resistance [kN]	Displacement to maximum force from preload of 20 N [mm]
1	6,155	41
2	6,545	42
3	6,263	40
4	6,183	42
5	6,315	42
Mean	**6,29**	**41**
Standard deviation	0,15	0,7
Variation coefficient	2,5	1,8

Appendix 1

Dimension stability

The dimension stability was performed according to standard EN 1107-2:2001 *Flexible sheets for waterproofing – Determination of dimensional stability – Part 2: Plastic and rubber sheets for roof waterproofing*. Trippletest were performed at samples 250 x 250 mm in length and transverse direction. Exposure, heat 80°C for 6 hours. The mean value of change is rounded to nearest 0,1 %.

Sample No.	Machine direction (MD) [%]	Transverse machine direction (TD) [%]
1	-0,16	+0,10
2	-0,14	+0,09
3	-0,20	+0,10
Mean value	**-0,2**	**+0,1**
Standard dev.	0,03	0,01

Foldability at low temperature, at -25°C

The cold flexibility at –25°C was determined according to EN 495-5:2013 *Flexible sheets for waterproofing - Determination of foldability at low temperature –Part 5: Plastic and rubber sheets for roof waterproofing* , at four test specimen. Two specimen in machine direction and two test specimen in transverse direction was determined. The coolant used for the test was a mixture of water and ethanol.

Cold flexibility at –25°C	machine direction	transverse direction
Result	No cracks were detected	No cracks were detected

Watertightness

The watertightness was determined according to EN 1928:2000 *Flexible sheets for waterproofing - Bitumen, plastic and rubber sheets for roof waterproofing - Determination of watertightness, method A*, with 10 kPa (200 mm water columns) and duration of 24 hours. Triple test was performed.

Sample No.	Result
1	Watertight
2	Watertight
3	Watertight

Fire resistance performance and classification, reaction to fire

Is performed by RISE Fire research test lab. See report in appendix 3

Appendix 1

Shear resistance

The shear resistance of the welded joints was performed according to standard EN 12317-2:2010 *Flexible sheets for waterproofing – Determination of shear resistance of joints – Part 2: Plastic and rubber sheets for roof waterproofing*. The width of the test piece was 50 mm taken perpendicular to the joint, end lap joint. The distance between grips was 120 mm, four times the width of the seal. The test was carried out at a constant speed of 100 ± 10 mm/min. The maximum shear force is recorded to the nearest newton/50 mm.

Sample No.	Shear resistance [N/50 mm]
1	2842
2	2866
3	2915
4	2920
5	2790
Mean value	**2866**
Standard dev.	54

The mode of failure was in the membrane outside the joint.

Peel resistance

The peel resistance of the welded joints was performed according to standard EN 12316-2:2013 *Flexible sheets for waterproofing – Determination of peel resistance of joints – Part 2: Plastic and rubber sheets for roof waterproofing*. The width of the test piece was 50 mm taken perpendicular to the joint, end lap joint. The distance between grips was 100 mm. The test was carried out at a constant speed of 100 ± 10 mm/min. The first and last quarter of the peel is discarded and the mid-section of peel is evaluated. The average peel resistance is calculated, to the nearest newton/50 mm, of ten equidistance values in mid-section, according to standard. The average peel resistance is also calculated, to the nearest newton/50 mm, of all recorded values in mid-section.

Sample No.	Peel resistance [N/50 mm]	Peel resistance [N/50 mm]
	Average of ten equidistance values in mid-section	Average of all recorded values in mid-section
1	158	160
2	130	147
3	138	151
4	167	166
5	172	155
Mean value	**153**	156
Standard dev.	18,1	7,4

The mode of failure was peel adhesion in joint, PVC adhesion to the textile.

Appendix 1

Resistance to leaching

The chemical resistance was tested according to standard EN 14415:2004 *Geosynthetic barriers- Test method for determining the resistance to leaching.* Procedures A (hot water) was performed. Test samples were immersed in a glass container containing deionized water at 70°C for 180 days. Water was changed every week until 28 days and after that every 14 days during the exposure time. The exposure was carried out between 29th of November 2017 to 28th of May 2018. After the exposure the tunnel membrane was evaluated by comparing tensile properties EN 12311-2 A and change in mass EN 1849-2 before and after the exposure. The tensile test was performed the 1st of June, 2018, as above.

Machine direction after 180 days hot water immersion at 70°C

Sample No.	Maximum tensile force [N/50 mm]	Tensile elongation at maximum tensile force [%]
1	2740	27,2
2	2760	27,3
3	2880	28,8
4	2930	29,9
5	2980	29,1
Mean value	**2860**	**28,5**
Standard deviation	104	1,2

Transverse direction after 180 days hot water immersion at 70°C

Sample No.	Maximum tensile force [N/50 mm]	Tensile elongation at maximum tensile force [%]
1	2010	33,7
2	1890	32,5
3	1850	30,8
4	1790	29,9
5	1940	29,9
Mean value	**1900**	**31,4**
Standard deviation	85	1,7

The change in mass after exposure was performed as EN 1849-2:2009 Flexible sheets for waterproofing - Determination of thickness and mass per unit area - Part 2: Plastic and rubber sheets), as above.

Sample 180 days hot water immersion at 70°C	Mass per unit area before immersion [g/m^2]	Mass per unit area after immersion [g/m^2]
1	716,31	715,07
2	699,98	698,93
2	686,18	685,17
4	714,26	713,25
5	710,22	708,85
Mean value	**705,39**	**704,25**
Standard deviation	12,4	12,4

Appendix 1

The result of exposed material compared to the unexposed material after 180 days hot water immersion at 70°C	Compared to initial value [%]
Tensile strength,	
Machine direction	93
Transverse direction	88
Tensile elongation,	
Machine direction	93
Transverse direction	80
Change in mass	-0,2

The acceptance criteria according to EN 13491:2018 for PVC-P is retained values of at least 75% of the original tensile strength and elongation at break. Both criteria shall pass. The acceptance criteria according to EN 13491:2018 for PVC-P for change in mass after exposure is ≤10 %.

That means pass for both the tensile properties and change in mass.

Visual inspection

The exposed tunnel membrane material shows a slight yellowish tone of the membrane after leaching EN 14415, 180 days immersed in hot water at 70°C. The slight yellowish tone could not be seen after resistance to micro-organism, EN 12225 exposure or at unaged virgin tunnel membrane material.

Resistance to micro-organism

The resistance to micro-organism was tested according to standard EN 12225:2000 *Geotextiles and geotextile - related products – Method for determining the microbiological resistance by soil burial test.*
The exposure time was 16 weeks between 4th of December 2017 and 26th of Mars 2018.

Test procedure – exposure to soil

The performance of the test was based on EN 12225 with the following deviations:

Whole plates of the material were exposed to soil. The samples for the tensile strength test were cut out after the exposure to soil.
The determination of the tensile strength was performed at 23 °C and 50 % RH.
The test object and the reference samples were stored in 23 °C and 50 % RH.
Biodegradable paper was used as reference material.

Two bought soils and one compost originated from different sources were mixt.
One compost was collected from a home composting facility at Brämhult in Borås, collected 2017-11-27, with the age of 6 – 12 month.
Soil was bought from ICA Maxi in Borås 2017-03-16 with the brand “ICA Garden, Godkänd för ekologisk odling” and from Plantagen in Borås 2017-12-01 intended for the cultivation of herbs and vegetables. Both bought soils are approved for ecological cultivation.
The compost collected in Borås, located in the south-west part of Sweden, was sieved on a screen of about 0.5 cm. The bought soil needed no sieving.

Approximately equal parts of the compost and the two soils were mixed.

Glass tanks were prepared by adding 5 cm compost/soil mixture, placing the samples horizontally, adding 2 cm compost/soil mixture, adding the reference material and adding 10

Appendix 1

cm compost/soil mixture. This implies that the samples were covered with approximately 12 cm compost/soil mixture during the exposure.

The glass tanks were put in big plastic trays filled with approximately 10 cm water at the bottom and covered with lids to keep the climate at 23 ± 2 °C and > 90 % RH during the exposure.

The compos/soil mixture was adjusted at the start to keep moisture content of the compost/soil mixture to 60 % of the WHC. The pH of the soil was 6.0 at the start and 6.0 at the end of the test.

The assessments of the biological activity of the compos/soil mixture were measured by using a biodegradable paper called "Kraft Paper" as a reference material. The assessments were performed at start and every fourth week i.e. after 4, 8 and 12 weeks The reference material was controlled after 1 weeks exposure each assessment.
Only small parts of the reference material was to be seen after one week in the compost/soil mixture showing a high biological activity of the compost/soil mixture all the performed assessments of the biological activity.

The assessment of the level of microbial activity of the compost/soil mixture to the reference material, untreated cotton, according to the standard was not performed since an appropriate reference material with known properties is not available.

After the exposure the samples were cleaned with ethanol-water solution (70:30) for 5 minutes, rinsed under running water, dried and conditioned at 23 °C and 50 % RH. No visible sign of degradation could be seen.

After the exposure the tunnel membrane was evaluated by comparing tensile properties and change in mass before and after the exposure. The tensile test after exposure to microorganism was performed the 1st of June, 2018.

Machine direction after 16 weeks microorganism exposure

Sample No.	Maximum tensile force [N/50 mm]	Tensile elongation at maximum tensile force [%]
1	2980	26,3
2	2950	26,5
3	3010	26,9
4	3080	27,4
5	3140	28,0
Mean value	**3030**	**27,0**
Standard deviation	77	0,7

Transverse direction after 16 weeks microorganism exposure

Sample No.	Maximum tensile force [N/50 mm]	Tensile elongation at maximum tensile force [%]
1	2600	38,0
2	2280	35,3
3	2250	33,2
4	2650	37,7
5	2380	34,7
Mean value	**2430**	**35,8**
Standard deviation	182	2,0

Appendix 1

The change in mass after exposure was performed as EN 1849-2:2009 Flexible sheets for waterproofing - Determination of thickness and mass per unit area - Part 2: Plastic and rubber sheets), as above.

Sample 16 weeks microorganism exposure	**Mass per unit area before exposure [g/m^2]**	**Mass per unit area after exposure [g/m^2]**
1	710,57	697,66
2	724,84	708,39
2	695,43	682,94
4	705,34	691,10
5	715,48	701,91
Mean value	**710,33**	**696,40**
Standard deviation	11,0	9,8

The result of exposed material compared to the unexposed material after 16 weeks microorganism exposure	Compared to initial value [%]
Tensile strength, Machine direction	98
Transverse direction	113
Tensile elongation, Machine direction	88
Transverse direction	91
Change in mass	-2,0

The acceptance criteria according to EN 13491:2018 for PVC-P is retained values of at least 75% of the original tensile strength and elongation at break. Both criteria shall pass. The acceptance criteria according to EN 13491:2018 for PVC-P for change in mass after exposure is ≤10 %.

That means pass for both the tensile properties and change in mass.

Appendix 2

Statement on measurement uncertainty

EN ISO 12336: Puncture Resistance	± 0,22 N	2)
ISO 11357-6: Oxidation Induction Time	± 8,7 min	2)
EN 12 311-2: Tensile strength	± 2,4 %	1)
EN 12 311-2: Elongation at break	± 2,1 %	1) 3)
EN 12316-2: Peel Resistance	± 2,4 %	1)
EN 12317-2: Shear Resistance	± 2,4 %	1)
EN 1849-2: Mass per unit area	± 0,04 %	1)
EN 1849-2: Thickness	± 0,6 µm	1)
EN 12310-1: Tear resistance - Nail shank	± 2,1 %	1)

The reported uncertainty is an expanded uncertainty (U), based on a standard uncertainty multiplied by a coverage factor, k=2, which provides a level of confidence of approximately 95 %.

[1)]The uncertainty of measurement applies for a single measurement value. The spread in results due to variations in sample characteristics is not accounted for in the given uncertainty of measurement.

[2)]The uncertainty of measurement has been obtained from results from an inter laboratory test.

[3)]Uncertainty in percent of measurement value.

Appendix 3

Fire resistance performance and classification

REPORT

issued by an Accredited Testing Laboratory

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Date 2017-12-19 | Reference 7P08588-01 | Page 1 (2)

SP Testing

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Ignitability according to EN ISO 11925-2
(1 appendix)

Introduction

RISE has by request of Protan AS performed a fire test according to EN ISO 11925-2. The purpose of the test is to form a basis for technical fire classification.

Product

According to the client: Product called "Protan Kvalitet 514-940", consisting of following:

	Content	Thickness [mm]
Layer 1	PVC (back side)	0.25
Layer 2	Polyester textile	0.05
Layer 3	PVC (front side)	0.25

The product has a nominal area weight of 0.700 kg/m^2, and a nominal thickness of 0.55 mm.

The product is fire retardant treated with Sb_2O_3 and ATH mixed into the PVC material. The colour of the products is grey. End use of the material: Tunnel liner.

Manufacturer

Protan AS, Drammen, Norway.

Sampling

The sample was delivered by the client. It is not known to RISE Safety – Fire Research if the product received is representative of the mean production characteristics.

The sample was received on November 30, 2017 at RISE Safety – Fire Research.

Test results

The product was tested with surface exposure and edge exposure.

The test results are given in appendix 1.

The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

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Appendix 3

REPORT

Date
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7P08588-01

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Note

The accreditation referred to is valid for EN ISO 11925-2.

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Safety - Fire Research, Fire Dynamics

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Appendix

1 Test results

RISE Research Institutes of Sweden AB

Appendix 3

Appendix 1

Test results – EN ISO 11925-2:2010/AC:2011

Product

According to the client: Product called "Protan Kvalitet 514-940", consisting of following:

	Content	Thickness [mm]
Layer 1	PVC (back side)	0.25
Layer 2	Polyester textile	0.05
Layer 3	PVC (front side)	0.25

The product has a nominal area weight of 0.700 kg/m^2, and a nominal thickness of 0.55 mm.

The product is fire retardant treated with Sb_2O_3 and ATH mixed into the PVC material. The colour of the products is grey. End use of the material: Tunnel liner.

Application

Edge exposure. Flame exposure time was 15 seconds.

Test results

Test no	1	2	3	4	5	6
Direction	↑	↑	↑	→	→	→
The sample ignited, s	1	1	1	1	1	1
The flames reach 150 mm, s	-*	-*	-*	-*	-*	-*
Burning droplets	No	No	No	No	No	No
Time when filter paper ignited, s	-	-	-	-	-	-

*Flaming ceased before the flame tip reached 150 mm.

RISE Research Institutes of Sweden AB

Appendix 3

Appendix 1

Application

Surface exposure. Flame exposure time was 15 seconds.

Test results

Test no	1	2	3	4	5	6
Direction	↑	↑	↑	→	→	→
The sample ignited, s	8	8	9	8	8	9
The flames reach 150 mm, s	-*	-*	-*	-*	-*	-*
Burning droplets	No	No	No	No	No	No
Time when filter paper ignited, s	-	-	-	-	-	-

*Flaming ceased before the flame tip reached 150 mm.

Deviation from standard

The relative humidity in the test room was too low according to standard but it is deemed to be a worst case scenario.

Measured data

Thickness 0.6 mm, approximately.

Area weight 0.700 kg/m^2, approximately.

Conditioning

According to EN 13238:2010.

Temperature (23 ± 2) °C.

Relative humidity (50 ± 5) %.

Date of test

December 18, 2017.

RISE Research Institutes of Sweden AB

Appendix 3

REPORT

issued by an Accredited Testing Laboratory

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SP Testing

Protan AS
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Reaction to fire classification report

1 Introduction

This classification report defines the classification assigned to the product "Protan Kvalitet 514-940" in accordance with the procedure given in EN 13501-1:2007+A1:2009.

2 Details of classified product

2.1 General

The product "Protan Kvalitet 514-940" is defined as a tunnel liner. Its classification is valid for the following end use application: Tunnel liner

2.2 Product description

The product, Protan Kvalitet 514-940, is fully described in the test report provided in support of classification listed in Clause 3.1.

3 Test report

3.1 Test report

This classification is based on the test report listed below:

Name of laboratory	Name of sponsor	Test report ref no	Accredited test method
RISE	Protan AS	7P08588-01	EN ISO 11925-2

RISE Research Institutes of Sweden AB

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Accred. No. 1002
Testing
ISO/IEC 17025

Appendix 3

3.2 Test results

Test method	Parameter	Number of tests	Results	
			Continuous parameter mean (m)	Compliance with parameters
EN ISO 11925-2		12		
Edge/Surface flame attack*				
15 s exposure	$Fs \leq 150$ mm		(-)	Compliant
Flaming droplets/particles	Ignition of filter paper		(-)	No ignition of filter paper

* : as required to the end use application of the product

(-) : not applicable

4 Classification and field of application

4.1 Reference and direct field of application

This classification has been carried out in accordance with clause 11 and 15 of EN 13501-1:2007+A1:2009.

4.2 Classification

The product called "Protan Kvalitet 514-940" in relation to its reaction to fire behaviour is classified:

E

The format of the reaction to fire classification for construction products excluding floorings and linear pipe thermal insulation product is:

Fire Behaviour
E

Reaction to fire classification: *E*

RISE Research Institutes of Sweden AB

Appendix 3

4.3 Field of application:

This classification is valid for the following product parameters:

Nominal thickness: 0.55 mm.

Nominal area weight: 0.700 kg/m^2.

The sample was delivered by the client. RISE Safety – Fire Research was not involved in the sampling procedure.

5 Limitations

This classification document does not represent type approval or certification of the product.

RISE Research Institutes of Sweden AB
Safety - Fire Research, Fire Dynamics

Performed by

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