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Test Report No. 1.1 / 13525 / 0037.0.1-2016e

General

Issued : 28 October 2016

Order by : **Dörken GmbH & Co. KG**
Wetterstraße 58
58313 Herdecke, GERMANY

Material : Composite consisted of a PEHD dimpled sheet (grey) and a PP nonwoven (grey)
DELTA-TERRAXX
 (declaration by customer)

Order date : 15 January 2016

Samples delivered : 17 November 2015

Tests	Standard	Issue	Results as Enclosure No.
1. Wide-width tensile test	DIN EN ISO 10319	09.2015	A1 - A2
2. Determination of the resistance to weathering	DIN EN 12224	11.2000	A3
3. Combined ageing for PE/PP (test for declared service life up to 25 years)	DIN EN 12447 DIN EN ISO 13438 DIN EN 13249 (Annex B)	03.2002 02.2005 2014	A4
4. Combined ageing for PE/PP (test for declared service life up to 50 years)	DIN EN 12447 DIN EN ISO 13438 DIN EN 13249 (Annex B)	03.2002 02.2005 2014	A5
5. Combined ageing for PP (test for declared service life up to 100 years)	DIN EN 12447 DIN EN ISO 13438 DIN EN 13249 (Annex B)	03.2002 02.2005 2014	A6

The results apply exclusively to the specimens submitted.
 The date of testing is reported on the enclosed enclosure/-es.
 Results are reported to the accuracy given in the standards. In statistical evaluation, the measured accuracy is taken.

This test report contains 3 pages and 6 enclosure/-es (enclosure/-es A1 - A6).
 It may not be published in parts.

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Summary of results

Date / Ref. : 28 October 2016 / mk

Order by : Dörken GmbH & Co. KG , Wetterstraße 58 , 58313 Herdecke, GERMANY

Material : Composite consisted of a PEHD dimpled sheet (grey) and a PP nonwoven (grey)
DELTA-TERRAXX
 (declaration by customer)

Test		Standard	Unit	Mean \bar{x}	Standard- deviation s	Coef. of variation v in %
Wide-width tensile test		DIN EN ISO 10319 09.2015				
Tensile strength	MD		kN/m	14,9	0,71	4,8
	CMD		kN/m	15,2	0,54	3,5
Strain at maximum load	MD		%	38,7	4,42	11,4
	CMD		%	38,9	5,36	13,8

Test		Standard	Unit	Result
Determination of the resistance to weathering		DIN EN 12224 11.2000		
residual tensile strength	MD		%	76,7
residual strain	MD		%	42,6
residual tensile strength	CMD		%	95,3
residual strain	CMD		%	76,3
Combined ageing for PE/PP (test for declared service life up to 25 years)		DIN EN 12447 03.2002 DIN EN ISO 13438 02.2005 DIN EN 13249 2014 (Annex B)		
Residual tensile strength	MD		%	102,7
Residual strain	MD		%	72,1
Residual tensile strength	CMD		%	113,6
Residual strain	CMD		%	117,6
Combined ageing for PE/PP (test for declared service life up to 50 years)		DIN EN 12447 03.2002 DIN EN ISO 13438 02.2005 DIN EN 13249 2014 (Annex B)		
Residual tensile strength	MD		%	101,6
Residual strain	MD		%	88,1
Residual tensile strength	CMD		%	112,5
Residual strain	CMD		%	94,6

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Summary of results


Date / Ref. : 28 October 2016 / mk


Order by : Dörken GmbH & Co. KG , Wetterstraße 58 , 58313 Herdecke, GERMANY

Material : Composite consisted of a PEHD dimpled sheet (grey) and a PP nonwoven (grey)
DELTA-TERRAXX
(declaration by customer)

Test	Standard	Unit	Result
Combined ageing for PP (test for declared service life up to 100 years)	DIN EN 12447 03.2002		
	DIN EN ISO 13438 02.2005		
	DIN EN 13249 2014		
	(Annex B)		
Residual tensile strength MD		%	108,2
Residual strain MD		%	87,3
Residual tensile strength CMD		%	116,2
Residual strain CMD		%	92,8

The residual tensile strength (mean of MD- and CMD-direction) is more than 50 %.


i.V. Matthias Käsekamp, B. Eng.
(Vice head of test laboratory)



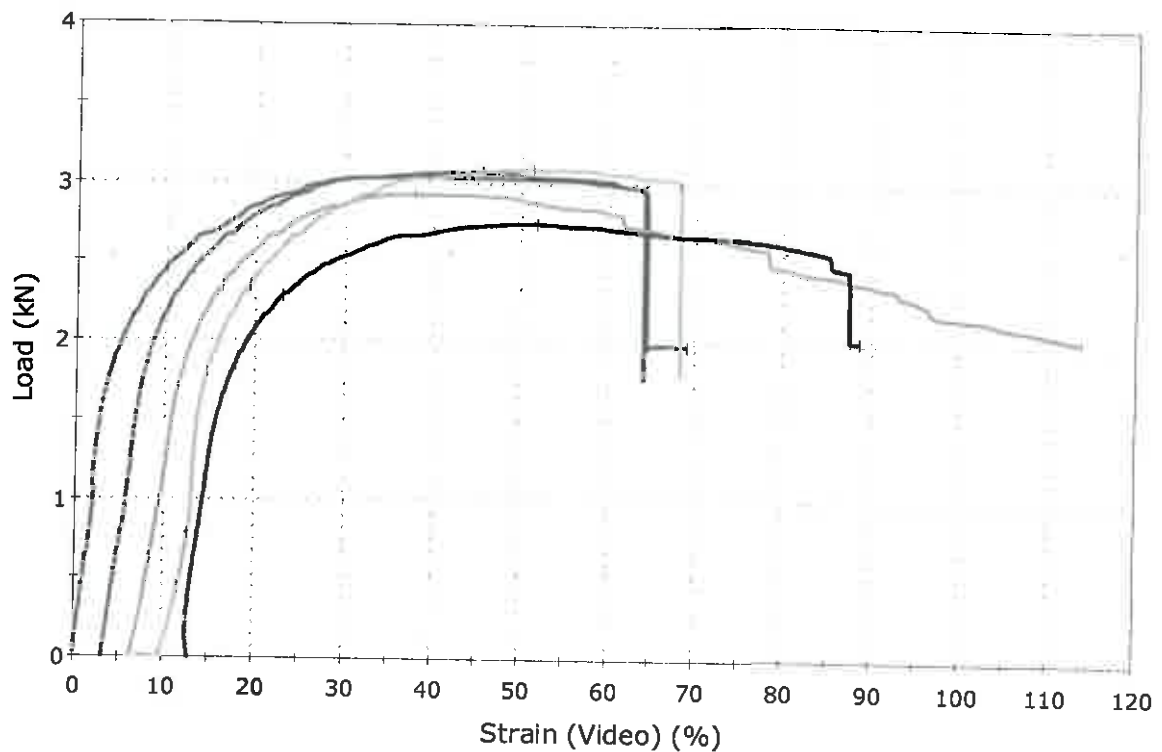

i.A. Friederike Schmale
(Physiklaborantin, staff of test laboratory)



Kiwa GmbH - TBU

Test standard:	DIN EN ISO 10319 (09.2015)
Order number:	1.1/13525/0037.0.1-2016
Customer:	Dörken GmbH & Co. KG
Material:	DELTA TERRAXX
Test direction:	MD
Climate:	23°C / 47% rel. humidity
Date:	03.03.2016
Tester:	FD/MK
Machine:	Instron 5567
Load cell:	30 kN
Extensometer (path):	standard Video Extensometer, Type 2663-822
Pre-load:	1% of Fmax.
Clamping system:	M-50-HJ-ME-2XL (100mm x 240mm)
Specimen width:	200,0 mm
LE:	100,0 mm
Remarks:	nonwoven to extensometer
Test condition:	dry

DIN EN ISO 10319



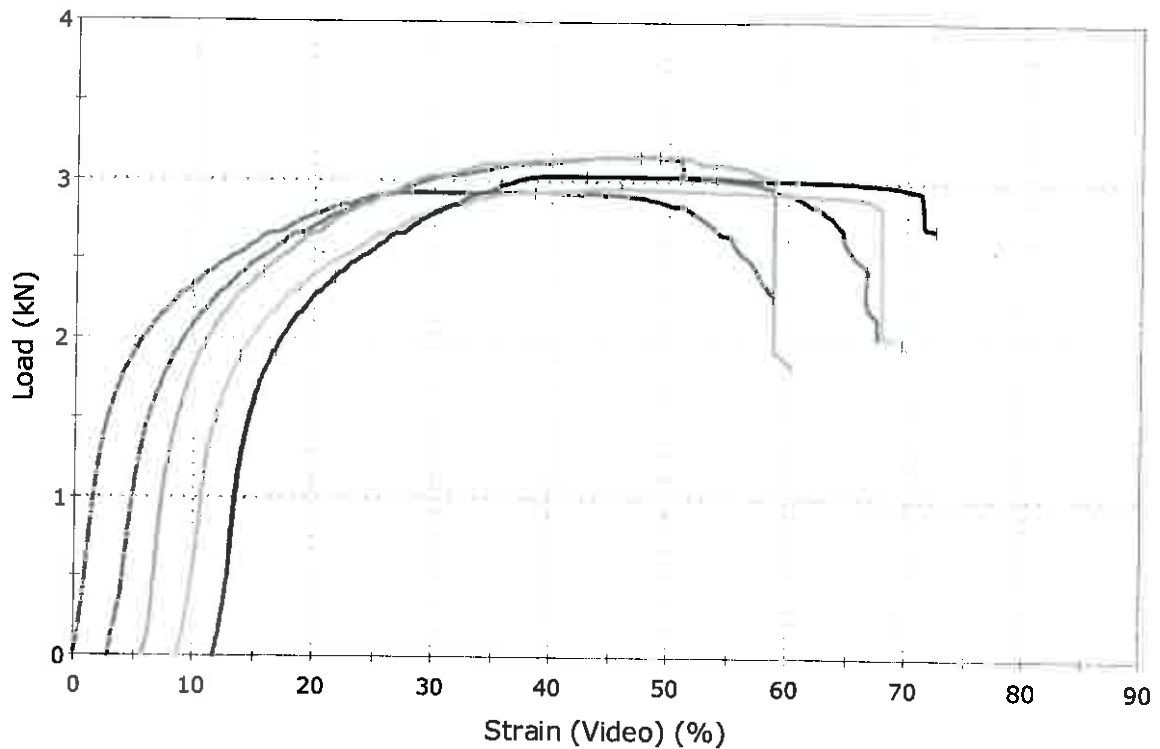
	max Load (kN)	Fm (kN/m)	Am (%)	Test speed (%/min)
1	3,04	15,18	39,36	17,88
2	3,07	15,36	42,36	18,97
3	2,92	14,62	31,26	23,01
4	3,09	15,45	41,69	18,91
5	2,75	13,73	38,95	21,40
Mean	2,97	14,87	38,72	20,03
Standard deviation	0,14	0,71	4,42	2,11
Coef. of variation	4,79	4,79	11,42	10,53



Kiwa GmbH - TBU

Test standard:	DIN EN ISO 10319 (09.2015)
Order number:	1.1/13525/0037.0.1-2016
Customer:	Dörken GmbH & Co. KG
Material:	DELTA TERRAXX
Test direction:	CMD
Climate:	23°C / 47% rel. humidity
Date:	03.03.2016
Tester:	FD
Machine:	Instron 5567
Load cell:	30 kN
Extensometer (path):	standard Video Extensometer, Type 2663-822
Pre-load:	1% of Fmax.
Clamping system:	M-50-HJ-ME-2XL (100mm x 240mm)
Specimen width:	200,0 mm
LE:	100,0 mm
Remarks:	nonwoven to extensometer
Test condition:	dry

DIN EN ISO 10319



	max Load (kN)	Fm (kN/m)	Am (%)	Test speed (%/min)
1	2,93	14,63	38,49	17,44
2	3,15	15,76	44,51	21,11
3	3,15	15,77	43,17	17,06
4	2,95	14,76	37,02	19,78
5	3,03	15,15	31,06	19,83
Mean	3,04	15,21	38,85	19,04
Standard deviation	0,11	0,54	5,36	1,73
Coef of variation	3,53	3,53	13,80	9,07



Determination of the resistance to weathering DIN EN 12224 (11.2000)

Test Report No. : 1.1/13525/0037.0.1-2016
Company : Dörken GmbH & Co. KG
Material : DELTA TERRAX
Operator : hs/fd

Date: 09.06.2016

Test parameters

Weathering Tester : UV tester, Type QUV / SPRAY
 Luminous intensity : 50 MJ/m²
 Test cycle : 5 h drycycle (50 ± 3 °C)
 1 h wetcycle (25 ± 3°C black sensor panel)
 Number of cycles : 71
 Test direction : MD (machine direction) /CMD (cross machine direction)
 Size of specimen : MD: 60 x 300 mm /CMD: 60 x 300 mm
 Duration : 424 h (04-Apr-16 to 22-Apr-16)
 Test method : DIN EN ISO 10319 (09.2015)
 Evaluation : DIN EN 12226 (03.2012)

Results

MD Specimen No.	Tensile strength in N		Strain at max. Force in %	
	ref. specimen	exp. specimen	ref. specimen	exp. specimen
1	870	586	48,0	25,4
2	762	689	43,2	22,4
3	926	651	53,5	20,1
4	856	690	57,4	21,7
5	871	672	50,9	18,1
Mean \bar{x}	857	657	50,6	21,6
Standard deviation s	59,8	43,0	5,38	2,72
Coefficient of variation v	7,0%	6,5%	10,6%	12,6%
residual strength/strain %	76,7		42,6	

CMD Specimen No.	Tensile strength in N		Strain at max. Force in %	
	ref. specimen	exp. specimen	ref. specimen	exp. specimen
1	769	670	36,6	25,1
2	841	766	38,2	28,2
3	875	759	56,4	33,5
4	722	844	37,9	33,4
5	734	717	29,6	31,4
Mean \bar{x}	788	751	39,7	30,3
Standard deviation s	67,1	64,4	9,97	3,61
Coefficient of variation v	8,5%	8,6%	25,1%	11,9%
residual strength/strain %	95,3		76,3	

Note :-



**Combined durability test consisting of
Screening test method for determining the resistance to hydrolysis
DIN EN 12447 (03.2002)**

and

**Screening test method for determining the resistance to oxidation
DIN EN ISO 13438 (02.2005)**

Test Report No. : 1.1/13525/0037.0.1-2016
Company : Dörken GmbH & Co. KG
Material : DELTA TERRAXX
Operator : hs/ fd

Date: 09.06.2016

Test parameters

Test direction : MD (machine direction) and CMD (cross machine direction)
Size of specimen : 60 x 300 mm
Number of specimen : 5 reference (ref.) specimen in MD and CMD direction
5 exposed (exp.) specimen in MD and CMD direction
Raw material : PE / PP

Exposure conditions/ durations

Reference : no treatment
Test period 1 (DIN EN 12447) : Hydrolysis (deionised water, class 3)
Test temperature : 80 ± 1°C
Time of duration : 28 d (16.03.2016 - 13.04.2016)
Test period 2 (DIN EN ISO 13438) : Oxidation
Test temperature : 100 ± 1°C
Time of duration : 28 d (13.04.2016 - 11.05.2016)
Apparatus : Binder FED 115
Test method : DIN EN ISO 10319 (09.2015)
Evaluation : DIN EN 12226 (03.2012)

Results

Specimen No.	Tensile strength in N				Strain at max. tensile strength in %			
	Ref.	Exp.	Ref.	Exp.	Ref.	Exp.	Ref.	Exp.
	MD		CMD		MD		CMD	
1	870	877	769	860	48,0	32,3	36,6	40,9
2	762	859	841	904	43,2	35,4	38,2	53,9
3	926	864	875	929	53,5	44,3	56,4	51,0
4	856	928	722	853	57,4	35,4	37,9	40,9
5	871	872	734	932	50,9	35,1	29,6	47,0
Mean \bar{x}	857	880	788	896	50,6	36,5	39,7	46,8
Standard deviation s	60	28	67	37	5,4	4,6	10,0	5,9
Coefficient of variation v	7,0%	3,1%	8,5%	4,2%	10,6%	12,5%	25,1%	12,5%
Residual strength/strain %	102,7		113,6		72,1		117,6	

Note : The test conditions (temperature and duration) were taken out of EN 13249 (annex B, durability aspects).



**Combined durability test consisting of
Screening test method for determining the resistance to hydrolysis
DIN EN 12447 (03.2002)
and
Screening test method for determining the resistance to oxidation
DIN EN ISO 13438 (02.2005)**

Test Report No. : 1.1/13525/0037.0.1-2016
Company : Dörken GmbH & Co. KG
Material : DELTA-TERRAXX
Operator : hs/fd

Date: 09.06.2016

Test parameters

Test direction : MD (machine direction) and CMD (cross machine direction)
Size of specimen : 60 x 300 mm
Number of specimen : 5 reference (ref.) specimen in MD and CMD direction
5 exposed (exp.) specimen in MD and CMD direction
Raw material : PE / PP

Exposure conditions/ durations

Reference : no treatment
Test period 1 (DIN EN 12447) : Hydrolysis (deionised water, class 3)
Test temperature : 80 ± 1°C
Time of duration : 28 d (16.03.2016 - 13.04.2016)
Test period 2 (DIN EN ISO 13438) : Oxidation
Test temperature : 100 ± 1°C
Time of duration : 56 d (13.04.2016 - 08.06.2016)
Apparatus : Binder FED 115
Test method : DIN EN ISO 10319 (09.2015)
Evaluation : DIN EN 12226 (03.2012)

Results

Specimen No.	Tensile strength in N				Strain at max. tensile strength in %			
	Ref.	Exp.	Ref.	Exp.	Ref.	Exp.	Ref.	Exp.
	MD		CMD		MD		CMD	
1	870	881	769	924	48,0	46,3	36,6	45,2
2	762	833	841	848	43,2	44,5	38,2	41,2
3	926	822	875	830	53,5	37,4	56,4	32,1
4	856	915	722	879	57,4	48,4	37,9	33,6
5	871	902	734	951	50,9	46,2	29,6	35,8
Mean \bar{x}	857	871	788	886	50,6	44,6	39,7	37,6
Standard deviation s	60	41	67	51	5,4	4,2	10,0	5,5
Coefficient of variation v	7,0%	4,8%	8,5%	5,7%	10,6%	9,5%	25,1%	14,6%
Residual strength/strain %	101,6		112,5		88,1		94,6	

Note : The test conditions (temperature and duration) were taken out of EN 13249 (annex B, durability aspects).



**Combined durability test consisting of
Screening test method for determining the resistance to hydrolysis
DIN EN 12447 (03.2002)
and
Screening test method for determining the resistance to oxidation
DIN EN ISO 13438 (02.2005)**

Test Report No. : 1.1/13525/0037.0.1-2016
Company : Dörken GmbH & Co. KG
Material : DELTA- TERRAXX
Operator : hs/fd

Date: 11.08.2016

Test parameters

Test direction : MD (machine direction) and CMD (cross machine direction)
Size of specimen : 60 x 300 mm
Number of specimen : 5 reference (ref.) specimen in MD and CMD direction
5 exposed (exp.) specimen in MD and CMD direction
Raw material : PE / PP

Exposure conditions/ durations

Reference : no treatment
Test period 1 (DIN EN 12447) : Hydrolysis (deionised water, class 3)
Test temperature : 80 ± 1°C
Time of duration : 28 d (16.03.2016 - 13.04.2016)
Test period 2 (DIN EN ISO 13438) : Oxidation
Test temperature : 100 ± 1°C
Time of duration : 112 d (13.04.2016 - 03.08.2016)
Apparatus : Binder FED 115
Test method : DIN EN ISO 10319 (09.2015)
Evaluation : DIN EN 12226 (03.2012)

Results

Specimen No.	Tensile strength in N				Strain at max. tensile strength in %			
	Ref.	Exp.	Ref.	Exp.	Ref.	Exp.	Ref.	Exp.
	MD		CMD		MD		CMD	
1	870	959	769	930	48,0	45,3	36,6	41,0
2	762	965	841	949	43,2	40,3	38,2	34,6
3	926	894	875	881	53,5	41,1	56,4	35,6
4	856	984	722	935	57,4	51,3	37,9	39,2
5	871	834	734	883	50,9	42,9	29,6	34,1
Mean \bar{x}	857	927	788	916	50,6	44,2	39,7	36,9
Standard deviation s	60	62	67	32	5,4	4,4	10,0	3,0
Coefficient of variation v	7,0%	6,7%	8,5%	3,4%	10,6%	10,0%	25,1%	8,2%
Residual strength/strain %	108,2		116,2		87,3		92,8	

Note : The test conditions (temperature and duration) were taken out of EN 13249 (annex B, durability aspects).