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Test Report No. 1.1 / 13525 / 1356.0.1-2013e

General

Issued : 12 March 2014

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

Material : HDPE dimpled sheet (brown) combined with a PP nonwoven (white)
DELTA MS-DRAIN
(declaration by customer)

Order date : 12 November 2013

Samples delivered : 12 November 2013

Tests	Standard	Issue	Results as Enclosure No.
1. Resistance to tearing (nail shank)	DIN EN 12310-1	11.1999	A1 - A2
2. Compressive creep	DIN EN ISO 25619-1	06.2009	A3
3. Determination of flexibility at low temperatures	DIN EN 1109	07.2013	A4
4. Determination of short-term compression behaviour	DIN EN ISO 25619-2	06.2009	A5
5. Determination of compressive properties	DIN EN ISO 604	12.2003	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 2 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It may not be published in parts.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. : 12 March 2014 / mar

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

Material : HDPE dimpled sheet (brown) combined with a PP nonwoven (white)
DELTA MS-DRAIN
(declaration by customer)

Test	Standard	Unit	Mean x̄	Standard- deviation s	Coef. of variation v in %
Resistance to tearing (nail shank)	DIN EN 12310-1 11.1999				
Tensile strength MD		N	239	26,2	11,0
CMD		N	230	19,4	8,4
Compressive creep	DIN EN ISO 25619-1 06.2009				
Normal stress 100,0 kPa					
Shear stress					
Specimen 1					
Thickness after 1 h stress		mm	4,26	-	-
Thickness after 1003 h stress		mm	4,14	-	-
Specimen 2					
Thickness after 1 h stress		mm	4,31	-	-
Thickness after 1003 h stress		mm	4,18	-	-
Determination of flexibility at low temperatures*	DIN EN 1109 07.2013	-	The material has passed the test at -40 °C.		
Note: The dimple sheet side was tested.					
Determination of short-term compression behaviour	DIN EN ISO 25619-2 06.2009				
Compression stress 1. Peak		kPa	700,5	3,00	0,4
Compression strain 1. Peak		%	27,0	1,05	3,9
Compression strain at 1 MPa		%	81,1	0,20	0,2
Determination of compressive properties	DIN EN ISO 604 12.2003				
Compression stress 1. Peak		kPa	776,0	37,9	4,9
Compression strain 1. Peak		%	28,3	1,4	5,0

* The test was performed by an external, accredited laboratory.


i.A. Dipl.-Ing. (FH) Christoph Stauber


i.A. B. Sc. Anne-Kathrin Marwedel

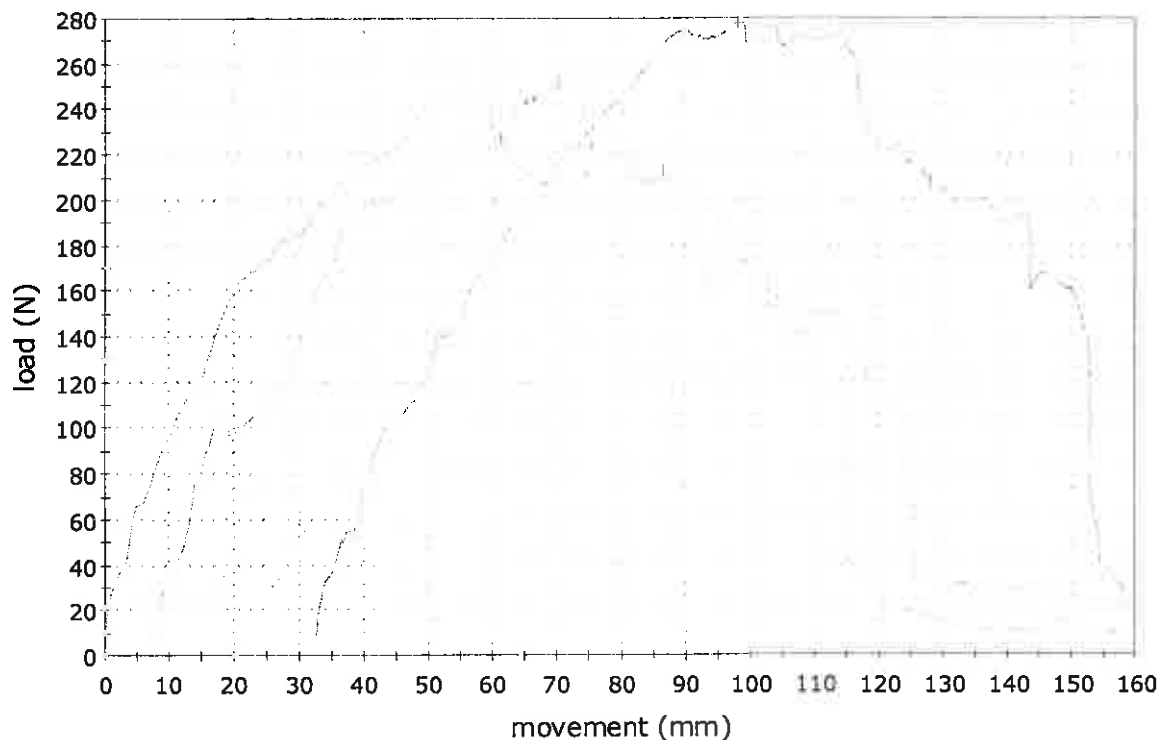
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Kiwa MPA Bautest GmbH, Department TBU Greven

Test standard:	DIN EN 12310-1 (11.1999)
Order number:	1.1/13525/1356.0.1-2013
Customer:	Dörken GmbH & Co.KG
Material:	DELTA MS-DRAIN
Test direction:	MD
Climate:	23°C / 49% rel. humidity
Date:	12.02.2014
Tester:	jt
Load cell:	30 kN
Extensometer (path):	crosshead
Clamping system:	hydr. clamps
Strands / m:	-
Teststrands:	-
Specimen width:	100,0 mm
LE:	100,0 mm
Remarks:	-

DIN EN 12310-1



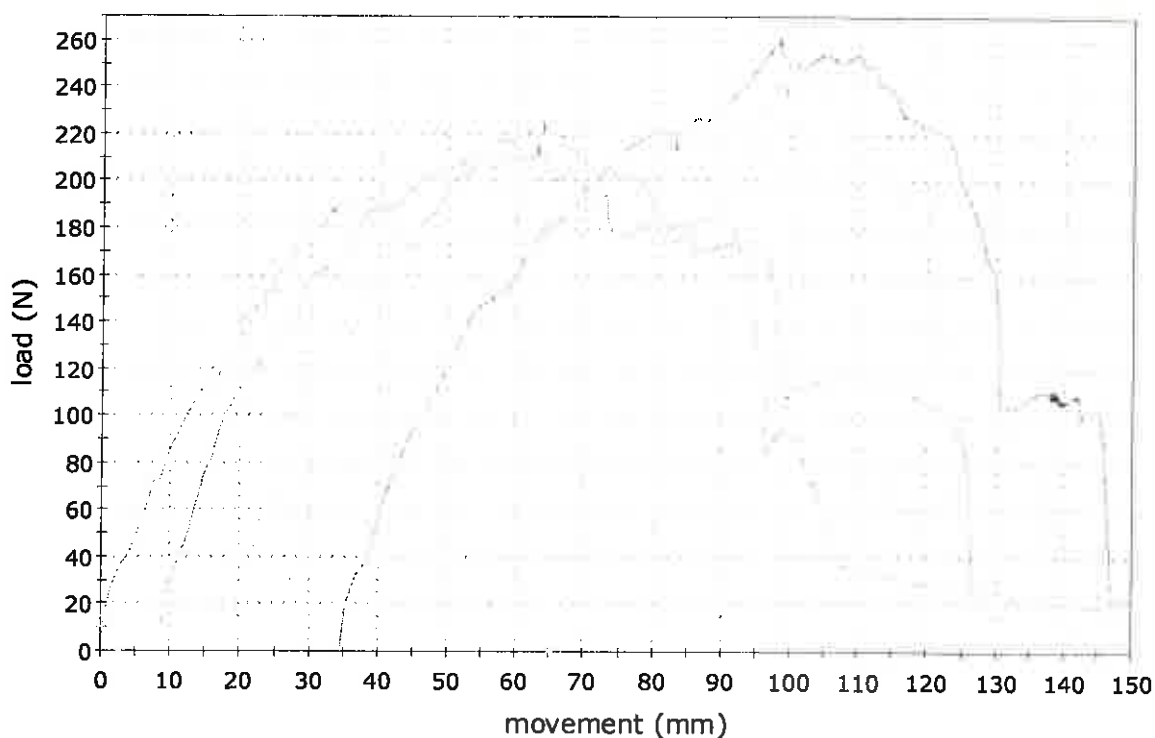
	Fm (N)	movement (mm)
1	251,3	70,1
2	227,2	53,0
3	223,0	59,1
4	213,5	62,2
5	278,2	65,5
mean	238,6	62,0
standard deviation	26,16	6,48
coeff. of variation	11,0	10,5



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Test standard:	DIN EN 12310-1 (11.1999)
Order number:	1.1/13525/1356.0.1-2013
Customer:	Dörken GmbH & Co.KG
Material:	DELTA MS-DRAIN
Test direction:	CMD
Climate:	23°C / 49% rel. humidity
Date:	12.02.2014
Tester:	jt
Load cell:	30 kN
Extensometer (path):	crosshead
Clamping system:	hydr. clamps
Strands / m:	-
Teststrands:	-
Specimen width:	100,0 mm
LE:	100,0 mm
Remarks:	-

DIN EN 12310-1



	Fm (N)	movement (mm)
1	213,2	62,9
2	223,2	55,1
3	239,8	81,9
4	215,7	57,2
5	259,7	63,7
mean	230,3	64,2
standard deviation	19,41	10,58
coeff of variation	8,4	16,5

Test Report No.	:	1.1/1325/1356.0.1-2013
Company	:	Dörken GmbH & CO. KG
Material	:	DELTA MS-DRAIN
Operator	:	br/sc/cs

Normal stress	:	100 kPa
Shear stress	:	-
Shear direction	:	-
MD - machine direction, CMD - cross machine direction		

Specimen 1	Specimen 2
100 x 100	= 0,01 m ²
4,26	4,31
486	480

 $20^{\circ}\text{C} \pm 2^{\circ}\text{C}$

:
:
:
:
:
:

Specimen size [mm x mm]

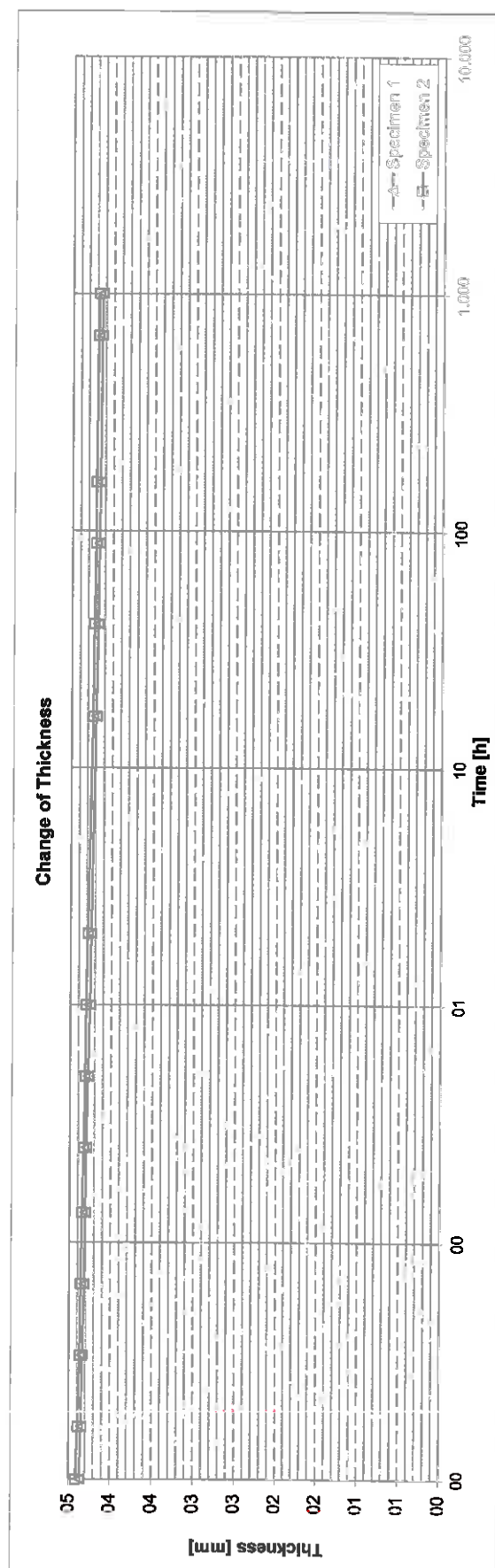
Thickness after 1 h [mm]

Mass per unit area [g/m^2]

Test temperature^a

Remarks

Begin of the test: 14.01.2014

[illegible]



Determination of flexibility at low temperature DIN EN 1109 (07.2013)

Test Report No. : 1.1/13525/1356.0.1-2013
Company : Dörken GmbH & Co. KG
Material : DELTA MS-DRAIN
Operator : external, accredited laboratory

Date: 31.01.2014

Test parameters

Number of tested specimen : 5
Size of specimen : 140 mm x 50 mm
Climatisation : 4 h at 23 ± 2 °C
Storage in test liquid before testing : 1 h $\pm$ 5 min.
Test temperature : -40 °C

Results

None specimen of the 10 test pieces showed a break neither on the upper side nor on the underside.
The material has passed the test of the flexibility at low temperature at the given temperature of - 40 °C.

Note : The dimple sheet side was tested.



Determination of compression creep behaviour DIN EN ISO 25619-2 (06.2009)

Test Report No.: 1.1/13525/1356.0.1-2013 Date : 19.02.2014
 Company : Dörken GmbH & Co. KG Material : DELTA MS-DRAIN
 Operator : ml Test direction : -

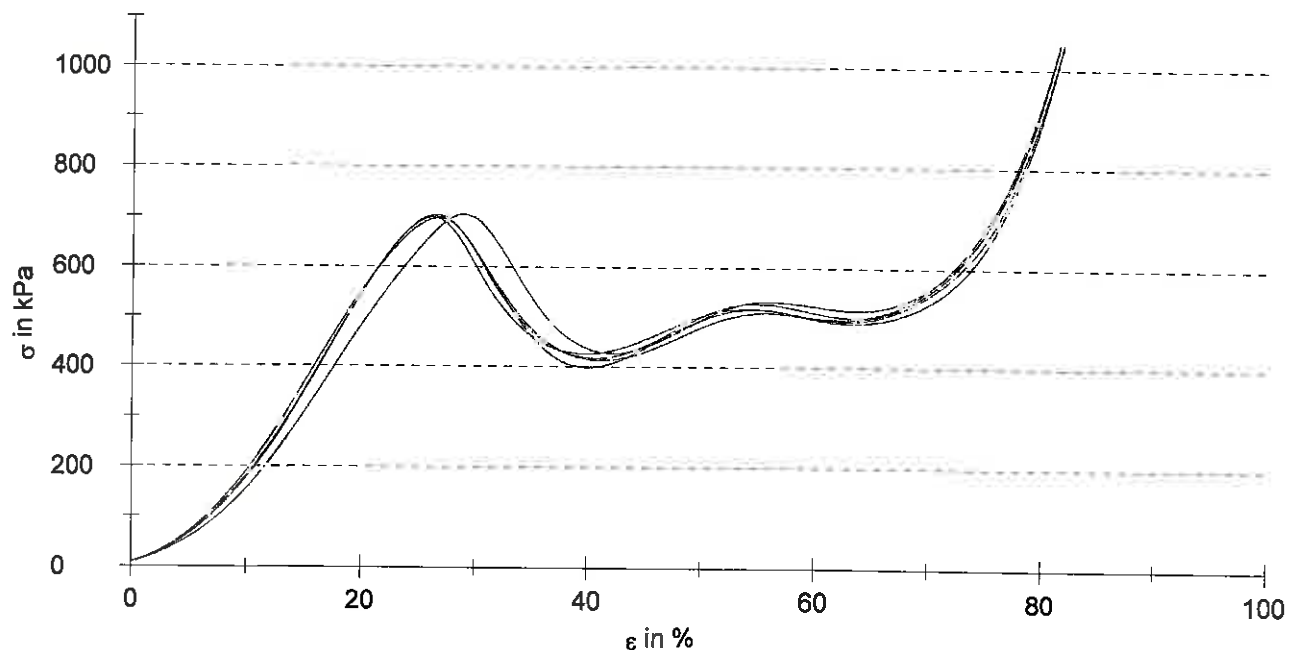
Test parameters

Climate : 20 °C / 46 % rel. humidity Lower pressureplate: 400 mm x 400 mm
 Machine : Zwick Z050 Knob/m MD : 67
 Load cell : 50 kN Knob/m CMD : 137
 Extensometer (path): crosshead Test knobs : 7 x 14
 Upper pressureplate: 120 mm x 120 mm Pre-load : 5 kPa

Results

Nr	A mm ²	σ 1. Peak kPa	ε 1. Peak %	ε @ 1 MPa %
1	10660	700,74	26,49	80,89
2	10660	702,88	26,65	80,95
3	10660	696,93	26,76	81,25
4	10660	698,14	26,16	81,31
5	10660	703,98	28,81	80,94

Series graphics



Statistics

Serie n = 5	A mm ²	σ 1. Peak kPa	ε 1. Peak %	ε @ 1 MPa %
$\bar{x}$	10660	700,53	26,97	81,07
s	0,000	3,00	1,05	0,20
v	0,00	0,43	3,90	0,24



Determination of compressive properties DIN EN ISO 604 (12.2003)

Test Report No.: 1.1/13525/1356.0.1-2013 Date : 19.02.2014
 Company : Dörken GmbH & Co. KG Material : DELTA MS-DRAIN
 Operator : ml Test direction : -

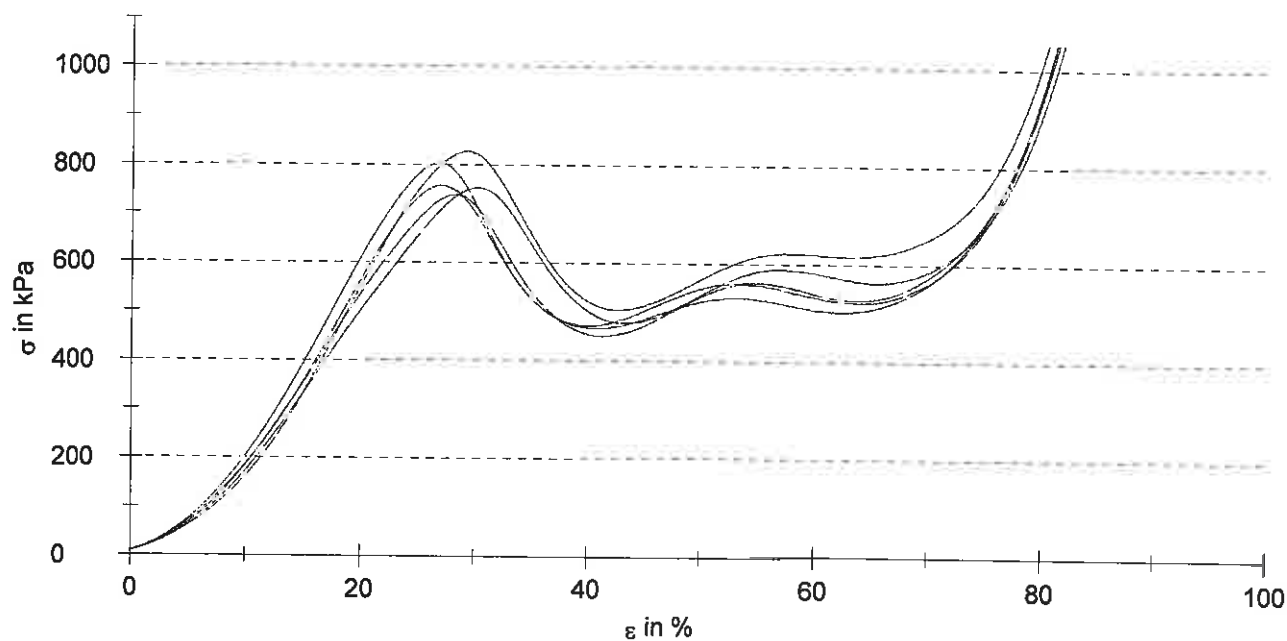
Test parameters

Climate : 20 °C / 46 % rel. humidity Knob/m MD : 67
 Machine : Zwick Z050 Knob/m CMD : 137
 Load cell : 50 kN Test knobs : 7 x 14
 Extensometer (path): crosshead Pre-load : 5 kPa
 Upper pressureplate: 120 mm x 120 mm Test speed : 2 mm/min
 Lower pressureplate: 400 mm x 400 mm Thickness : 5,0 mm

Results

Nr	A mm ²	σ_y 1. Peak kPa	ε_{cy} 1. Peak %
1	10660	828,15	29,24
2	10660	803,19	26,80
3	10660	738,50	28,32
4	10660	752,81	30,02
5	10660	757,44	26,89

Series graphics



Statistics

Serie n = 5	A mm ²	σ_y 1. Peak kPa	ε_{cy} 1. Peak %
$\bar{x}$	10660	776,02	28,25
s	0,000	37,90	1,42
v	0,00	4,88	5,02