

# nophADRAIN<sup>®</sup>

SMART GREEN ROOF SYSTEMS

## TECHNICAL DATA SHEET ND DRAINAGE SYSTEMS

GREEN ROOFS  
PODIUM ROOF DECKS  
PARKING ROOF DECKS

0.7



ND Drainage Systems			ND 100 / 120	ND 200 / 220	ND 200h / 220h	ND 200sv	ND 600 / 620	ND 600sv	ND 600hdsv	ND 620hd	ND 800	ND 4+1	ND 4+1h	ND 5+1	ND 6+1	
<b>Material Properties</b>																
	Standard	Unit														
Core	-	-	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	HIPS	
Filter geotextile	-	-	PP, PE	PP, PE	PP, PE	PP, PE	PP-woven	PP-woven	PP-woven	PP-woven	PP, PE	PP	PP	PP	PP, PE	
Separation film	-	-	- / PP	- / PP	- / PP	-	- / PP	-	-	PP	-	-	-	-	-	
Separation geotextile	-	-	-	-	-	PP, PE	-	PP, PE	PP, PE	-	-	PP, PE	PP, PE	PP, PE	-	
<b>Mechanical Properties (mean values)</b>																
Compressive strength	hEN EN ISO 25619-2	kPa	500	700	450	700	900	900	1.200	1.200	480	700	450	480	300	
Tensile strength <sup>1</sup> (MD / CMD) <sup>2</sup>	hEN EN ISO 10319	kN/m	8 / 8	8 / 8	8 / 8	8 / 8	48 / 41	48 / 41	48 / 41	48 / 41	8 / 8	10 / 10	10 / 10	10 / 10	8 / 8	
CBR puncture resistance <sup>1</sup>	hEN EN ISO 12236	kN	1.5	1.5	1.5	1.5	4.3	4.3	4.3	4.3	1.5	1.6	1.6	1.6	1.5	
Dynamic perforation <sup>1</sup> (cone drop)	hEN EN ISO 13433	mm	38	38	38	38	8.8	8.8	8.8	8.8	38	28	28	28	38	
Resistance to weathering <sup>3</sup>	hEN EN ISO 12224	%	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	60 / 80	
<b>Physical Properties (typical values)</b>																
Construction height at 2 kPa	-	mm	8	12.5	16	13	12.5	13	13	12.5	26.5	13.5	17	27.5	26.5	
Dimple height at 2 kPa	-	mm	7.5	12	15.5	12	12	12	12	12	26	12	15.5	26	26	
Perforations per m <sup>2</sup>	-	-	-	-	-	1,540	-	1,540	1,540	-	-	1,540	1,540	575	1,048	
Diameter perforations	-	mm	-	-	-	6.3	-	6.3	6.3	-	-	6.3	6.3	15.8	2.8	
Water reservoir	-	l/m <sup>2</sup>	-	-	-	-	-	-	-	-	-	3.6	4.3	5.8	7.6	
Material dimensions (L x B)	-	m	32 x 1.25	32 x 1.25	30 x 1.25	32 x 1.25	32 x 1.25	32 x 1.25	32 x 1.25	32 x 1.25	20 x 1.25	32 x 1.25	30 x 1.25	20 x 1.25	20 x 1.20	
Mass per unit area	-	gr/m <sup>2</sup>	653 / 658	908 / 913	908 / 913	995	1,189 / 1,194	1,269	1,431	1,364	1,226	1,017	1,017	1,252	1,224	
Surface area per roll	-	m <sup>2</sup>	40	40	37.5	40	40	40	40	40	25	40	37.5	25	24	
Roll diameter	-	cm	60	70	85	70	75	75	75	75	83	75	85	83	85	
Roll weight	-	kg	26	36 / 37	34	40	48	51	57	55	31	41	38	31	29	
<b>Hydraulic Properties (mean values)</b>																
Opening size O <sub>90</sub> <sup>1</sup>	hEN EN ISO 12956	µm	150	150	150	150	173	173	173	173	150	100	100	100	150	
Water permeability H <sub>50</sub> <sup>1</sup>	hEN EN ISO 11058	mm/s	100	100	100	100	51	51	51	51	100	95	95	95	100	
<b>Drainage capacity (mean values)</b>																
<b>Vertical Drainage / Wall - gradient i = 1</b>																
<b>Surface load</b>		<b>Build-in-depth</b>														
20 kPa	2.0 m	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	2.93	5.17	7.37	5.17	5.45	5.45	5.44	5.44	13.63	5.49	7.86	15.70	8.94
30 kPa	3.0 m	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	2.81	5.15	7.33	5.15	5.41	5.41	5.41	5.41	13.45	5.41	7.79	15.55	8.52
50 kPa	5.0 m	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	2.66	4.89	6.98	4.89	5.28	5.28	5.18	5.18	12.57	5.31	7.55	15.53	7.96
100 kPa	10.0 m	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	2.31	4.39	6.35	4.39	4.52	4.52	4.26	4.26	11.14	4.98	7.27	14.25	4.64
200 kPa	Exceptional case	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	1.80	3.55	3.86	3.55	4.00	4.00	3.77	3.77	9.77	4.44	5.88	11.75	-
<b>Horizontal Drainage / Roof</b>																
<b>Fall = 0 % - Exceptional case</b>																
≤ 2 kPa - extensive green roof	FH Karlsruhe [D] <sup>5</sup>	U/(s.m)	-	-	-	-	-	-	-	-	-	0.36	-	-	0.36	-
≤ 10 kPa - intensive green roof	FH Karlsruhe [D] <sup>5</sup>	U/(s.m)	-	-	-	-	-	-	-	-	-	0.30	-	-	0.30	-
<b>Fall = 1 % - Exceptional case</b>																
10 kPa - extensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.20	0.37	0.51	0.37	0.62	0.62	0.62	0.62	0.92	0.49	0.66	1.67	0.58	
20 kPa - intensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.19	0.35	0.44	0.35	0.53	0.53	0.51	0.51	0.89	0.49	0.64	1.61	0.51	
100 kPa - podium roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.07	0.25	0.40	0.25	0.46	0.46	0.36	0.36	0.68	0.46	0.57	1.44	0.14	
200 kPa - parking roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.04	0.19	0.31	0.19	0.36	0.36	0.36	0.36	0.51	0.44	0.55	1.19	-	
<b>Fall = 1.5 %</b>																
10 kPa - extensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.25	0.44	0.61	0.44	0.69	0.69	0.69	0.69	1.17	0.63	0.85	1.98	0.71	
20 kPa - intensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.24	0.43	0.61	0.43	0.59	0.59	0.64	0.64	1.14	0.63	0.84	1.88	0.66	
100 kPa - podium roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.12	0.34	0.50	0.34	0.51	0.51	0.38	0.38	0.81	0.59	0.75	1.70	0.16	
200 kPa - parking roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.08	0.23	0.38	0.23	0.38	0.38	0.37	0.37	0.67	0.54	0.67	1.45	-	
<b>Fall = 2 %</b>																
10 kPa - extensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.32	0.55	0.81	0.55	0.79	0.79	0.79	0.79	1.48	0.69	0.99	2.22	0.89	
20 kPa - intensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.32	0.52	0.75	0.52	0.67	0.67	0.68	0.68	1.37	0.69	0.96	2.14	0.81	
100 kPa - podium roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.20	0.40	0.62	0.40	0.56	0.56	0.52	0.52	1.06	0.67	0.88	1.91	0.28	
200 kPa - parking roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.11	0.32	0.52	0.32	0.43	0.43	0.51	0.51	0.85	0.59	0.75	1.55	-	
<b>Fall = 2.5 %</b>																
10 kPa - extensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.42	0.68	0.95	0.68	0.89	0.89	0.85	0.85	1.79	0.78	1.14	2.45	1.10	
20 kPa - intensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.37	0.62	0.91	0.62	0.76	0.76	0.78	0.78	1.70	0.78	1.09	2.34	1.03	
100 kPa - podium roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.22	0.49	0.74	0.49	0.61	0.61	0.53	0.53	1.28	0.74	1.01	2.04	0.35	
200 kPa - parking roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.11	0.38	0.67	0.38	0.49	0.49	0.52	0.52	1.08	0.66	0.84	1.70	-	
<b>Fall = 3 %</b>																
10 kPa - extensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.45	0.75	1.07	0.75	0.95	0.95	0.95	0.95	2.05	0.89	1.25	2.60	1.29	
20 kPa - intensive green roof	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.42	0.72	1.06	0.72	0.89	0.89	0.81	0.81	1.96	0.89	1.23	2.50	1.18	
100 kPa - podium roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.28	0.57	0.85	0.57	0.69	0.69	0.62	0.62	1.46	0.80	1.10	2.21	0.43	
200 kPa - parking roof deck	hEN EN ISO 12958 <sup>4</sup>	U/(s.m)	0.13	0.43	0.69	0.43	0.57	0.57	0.59	0.59	1.20	0.72	0.90	1.83	-	

<sup>1</sup> Performance expressed of the filter geotextile only  
<sup>2</sup> MD = Machine direction / CMD = Cross machine direction  
<sup>3</sup> Material has to be completely covered within 14 days after installation  
<sup>4</sup> hEN EN ISO 12958 tested soft / hard  
<sup>5</sup> FH Karlsruhe [D] tested hard / hard

The values correspond to average results obtained in our laboratories and outside institutes and are indicative. The right is reserved to make changes at any time without notice. Standard variations in mechanical properties of 15 % and in hydraulic properties of 20 % and in physical properties of 2 % are normal.

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Possible applications	ND 100 / 120	ND 200 / 220	ND 200h / 220h	ND 200sv	ND 600 / 620	ND 600sv	ND 600hdsv	ND 620hd	ND 800	ND 4+1 / 4+1h	ND 5+1	ND 6+1
<b>Basements / Retaining walls</b>	Standard											
<b>Extensive green roofs</b>												
- Roof pitch $\geq 15^\circ$	Standard											
- Roof fall $\geq 1\%$									Standard			
- Roof fall $< 1\%$										Standard		
- Inverted roof									Standard			
<b>Intensive green roofs</b>												
- Roof fall $\geq 1\%$									Standard			
- Roof fall $< 1\%$										Standard		
- Inverted roof									Standard			
<b>Podium roof decks load class 1</b>												
- Roof fall $\geq 1\%$		Standard	Standard									
- Roof fall $< 1\%$									Standard			
- Inverted roof				Standard								
<b>Parking roof decks load class 2</b>												
- Roof fall $\geq 1\%$					Standard							
- Roof fall $< 1\%$					Standard							
- Inverted roof						Standard						
<b>Parking roof decks load class 3</b>												
- Roof fall $\geq 1\%$								Standard				
- Roof fall $< 1\%$								Standard				
- Inverted roof							Standard					

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