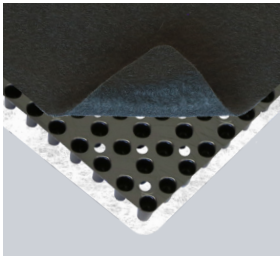


## TECHNICAL DATA SHEET

### ND 4+1h Drainage System

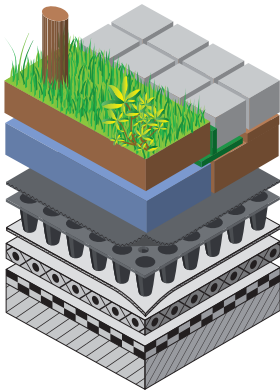
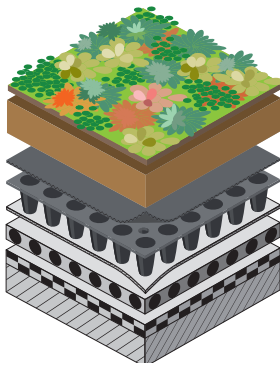


ND 4+1h Drainage System

High-performance CE-marked drainage system with an innovative dimple design made out of recycled high impact polystyrene. The core of the ND Drainage System is a perforated, vapour-permeable dimpled sheet with a high compressive strength, an excellent creep resistance guaranteeing a consistent long term drainage capacity, a construction height of approx. 17 mm and a water reservoir of approx. 4.3 l/m<sup>2</sup>. A non-woven geotextile is glued to the back of the dimpled sheet as a filter layer and a vapour-permeable geotextile is bonded to each dimple as a protection and separation layer. The geotextiles are glued and not thermally bonded to the dimpled core to avoid damage to the mechanical and hydraulic properties of the geotextile and the drainage system. It also prevents the geotextile to be pushed in between the dimples obstructing the drainage capacity.

#### Application

The ND 4+1h Drainage System is a component of the Nophadrain Extensive and Intensive Green Roof System that acts as a filter, drainage and protection layer. The build-up height (approx. 17 mm) prevents waterlogging in the substrate layer and the risk of frost heave affecting the paving and allows longer drainage length. The ND 4+1h Drainage System is suitable for warm roof and inverted roof constructions.



Composition Nophadrain Extensive and Intensive Green Roof

#### Technical specifications

- Material dimpled sheet: recycled high impact polystyrene (HIPS)
- Material geotextile filter: polypropylene (PP)
- Material vapour-permeable geotextile: polypropylene (PP) and polyethylene (PE)
- Construction height: approx. 17 mm
- Compressive strength: approx. 450 kPa
- Perforations/m<sup>2</sup>: approx. 1,540 / ø 6.3 mm
- Water reservoir: approx. 4.3 l/m<sup>2</sup>
- Weight: approx. 1,017 g/m<sup>2</sup>
- Drainage capacity at i = 1 at 20 kPa: approx. 7.86 l/[s.m]
- Drainage capacity at fall ratio 2 % at 20 kPa: approx. 0.96 l/[s.m]

Product	Dimensions (L x W)	Packaging
ND 4+1h Drainage System	approx. 30 x 1.25 m	approx. 37,5 m <sup>2</sup> , roll

**nophadrain**<sup>®</sup>  
SMART GREEN ROOF SYSTEMS

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**Data sheet**
**DoP4+1h-004**
**ND 4+1h**

Material Properties	Standard	Unit	Performance
Core	-	-	HIPS
Filter geotextile	-	-	PP
Separation film	-	-	-
Separation geotextile	-	-	PP/PE
<b>Mechanical Properties (mean values)</b>			
Compressive strength	hEN ISO 25619-2	kPa	450
Tensile strength* (MD/CMD)**	hEN ISO 10319	kN/m	10/10
CBR puncture resistance*	hEN ISO 12236	kN	1.6
Dynamic perforation (cone drop)	hEN ISO 13433	mm	28.0
Resistance to weathering***	hEN ISO 12224	%	60/80
<b>Physical Properties</b>			
Construction height at 2 kPa	-	mm	17.0
Dimple height at 2 kPa	-	mm	15.5
Perforations per m <sup>2</sup>	-	-	1540
Diameter perforations	-	mm	6.3
Water reservoir	-	l/m <sup>2</sup>	4.3
Material dimensions (L x W)	-	m	30 x 1.25
Mass per unit area	-	g	1020
Surface area per roll	-	m <sup>2</sup>	37.5
Roll diameter	-	cm	85.0
Roll weight	-	kg	38.2
<b>Hydraulic Properties (mean values)</b>			
Opening size O <sub>90</sub> *	hEN ISO 12956	µm	100
Water permeability H <sub>50</sub> *	hEN ISO 11058	mm/s	95
<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 ISO 12958	l/(s.m)
30 kPa	3.0 m	hEN ISO 12958	l/(s.m)
50 kPa	5.0 m	hEN ISO 12958	l/(s.m)
100 kPa	10.0 m	hEN ISO 12958	l/(s.m)
200 kPa	Exceptional	hEN ISO 12958	l/(s.m)
<b>Horizontal drainage / Roof</b>			
<b>Fall = 0 % - Exceptional case*****</b>			
≤ 2 kPa - extensive green roof	FH Karlsruhe (D)	l/(s.m)	-
≤ 10 kPa - intensive green roof	FH Karlsruhe (D)	l/(s.m)	-
<b>Fall = 1 % - Exceptional case</b>			
≤ 10 kPa - extensive green roof	hEN ISO 12958	l/(s.m)	0.66
≤ 20 kPa - intensive green roof	hEN ISO 12958	l/(s.m)	0.64
100 kPa - podium roof deck	hEN ISO 12958	l/(s.m)	0.57
200 kPa - parking roof deck	hEN ISO 12958	l/(s.m)	0.55
<b>Fall = 1.5 %</b>			
≤ 10 kPa - extensive green roof	hEN ISO 12958	l/(s.m)	0.85
≤ 20 kPa - intensive green roof	hEN ISO 12958	l/(s.m)	0.84
100 kPa - podium roof deck	hEN ISO 12958	l/(s.m)	0.75
200 kPa - parking roof deck	hEN ISO 12958	l/(s.m)	0.67
<b>Fall = 2 %</b>			
≤ 10 kPa - extensive green roof	hEN ISO 12958	l/(s.m)	0.99
≤ 20 kPa - intensive green roof	hEN ISO 12958	l/(s.m)	0.96
100 kPa - podium roof deck	hEN ISO 12958	l/(s.m)	0.88
200 kPa - parking roof deck	hEN ISO 12958	l/(s.m)	0.75
<b>Fall = 2.5 %</b>			
≤ 10 kPa - extensive green roof	hEN ISO 12958	l/(s.m)	1.14
≤ 20 kPa - intensive green roof	hEN ISO 12958	l/(s.m)	1.09
100 kPa - podium roof deck	hEN ISO 12958	l/(s.m)	1.01
200 kPa - parking roof deck	hEN ISO 12958	l/(s.m)	0.84
<b>Fall = 3 %</b>			
≤ 10 kPa - extensive green roof	hEN ISO 12958	l/(s.m)	1.25
≤ 20 kPa - intensive green roof	hEN ISO 12958	l/(s.m)	1.23
100 kPa - podium roof deck	hEN ISO 12958	l/(s.m)	1.10
200 kPa - parking roof deck	hEN ISO 12958	l/(s.m)	0.90

\* Performance expressed of the filter/geotextile only

\*\* MD = Machine direction / CMD = Cross Machine Direction

\*\*\* Material has to be completely covered within 14 days after installation

\*\*\*\* hEN ISO 12958 tested hard/soft

\*\*\*\*\* 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.

Nophadrain BV excludes any liability for errors, omissions or otherwise arising from the contents of this document. The reader must satisfy himself or herself as to the principles and practices described in this document in relation to any particular application and take appropriate, independent, professional advice.

V08.2015