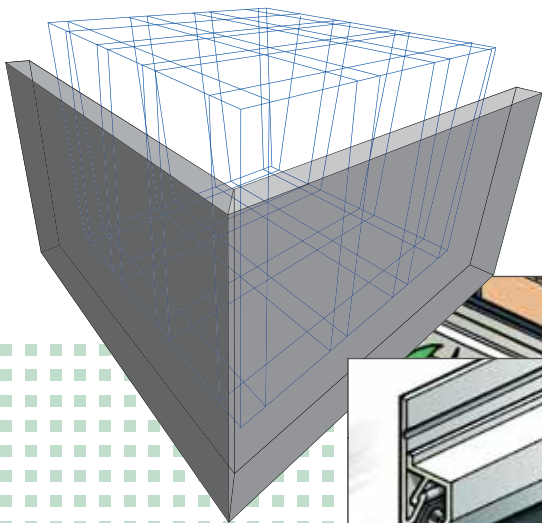


## NOPHADRAIN<sup>®</sup> "CLIC" DRAINAGE AND PROTECTION SYSTEM



system

"CLIC"

protection

drain

**TESTED**

DIN 18195 "WATERPROOFING OF BUILDINGS AND STRUCTURES"

DIN 4095 "DRAINAGE AND PROTECTION OF SUB-STRUCTURES"

GUIDELINES FOR THE DESIGN AND APPLICATION OF SYNTHETICALLY  
MODIFIED LIQUID BITUMINOUS WATERPROOFING MEMBRANES

## 1. NOPHADRAIN® "CLIC" DRAINAGE AND PROTECTION SYSTEM



The Nophadrain "Clic" Drainage and Protection System has been developed to protect and drain waterproofed sub-structures during construction and after completion.

When developing the system, Nophadrain has taken into account the requirements as set forth in the DIN 18195 "Waterproofing of buildings and structures", the DIN 4095 "Drainage and protection of sub-structures" and the German guidelines for the design and application of synthetically modified liquid bituminous waterproofing membranes.

The Nophadrain "Clic" Drainage and Protection System consists of a high pressure resistant dimpled sheet with a special filter and sliding fabric plus a stable pressure dividing backing film – Nophadrain ND 120 Drainage Composite – combined with a specially developed fixing and protection profile – Nophadrain ND "Clic" Profile.

The ND "Clic" Profile is mounted against the sub-structure at the finished level allowing a simple installation of the ND 120 Drainage Composite and giving optimal protection of the waterproofing membrane during construction and throughout the life span of the sub-structure.

An important aspect of the ND "Clic" Profile is the permanent fixture of the ND 120 Drainage Composite against the sub-structure. |

## 2. HOW DOES THE SYSTEM WORK?



ND "Clic" Profile prevents ND 120 Drainage Composite from folding and sliding

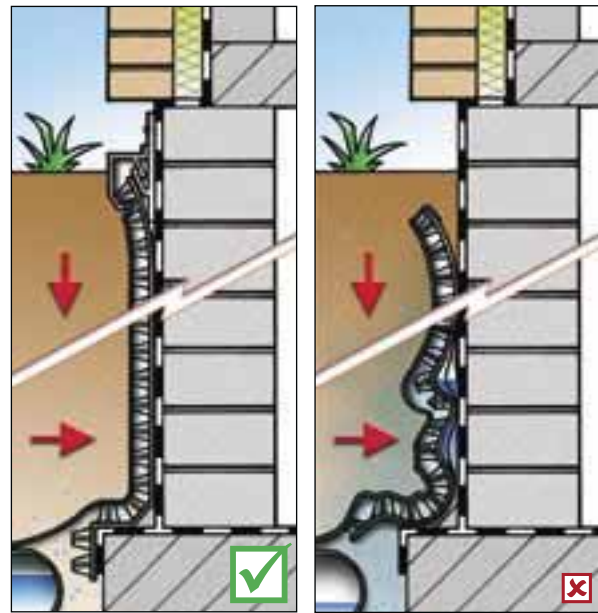


By using the ND "Clic" Profile the ND 120 Drainage Composite is quickly and securely installed against the waterproofed sub-structure. During construction the profile prevents mortar, broken bricks and other construction debris from entering between the ND 120 Drainage Composite and the waterproofing membrane. The waterproofing membrane is protected against mechanical damage from the start.

The profile permanently fixes the ND 120 Drainage Composite against the sub-structure at the finished level. During backfilling and compaction, as well as by future soil settlements, the profile prevents the ND 120 Drainage Composite from folding and sliding along the sub-structure damaging the waterproofing membrane. Any movement or settlement of the soil is transferred away from the waterproofing membrane along the special filter and sliding fabric of the ND 120 Drainage Composite. >

Testing by Pleyers Bauinstitut as well as in the Institut für Bauforschung of the RWTH Aachen (ibac) by Prof. Dr. Ing. H.R. Sasse, proved that permanent fixture of the drainage composite against the sub-structure is necessary to protect the waterproofing membrane. If the drainage composite is not fixed permanently it will lead to failure of the drainage composite and subsequent damage to the waterproofing membrane.

The Nophadrain "Clic" Drainage and Protection System secures the drainage composite permanently to the sub-structure guaranteeing continuous drainage capacity, and protection of the waterproofing membrane against mechanical damage as specified in the DIN 4095 and the DIN 18195. ■



With ND "Clic" Profile

Without ND "Clic" Profile

### 3. NOPHADRAIN® "CLIC" DRAINAGE AND PROTECTION SYSTEM IN DETAIL



#### ND "Clic" Profile

The profile is manufactured from a durable weather resistant metal. The chosen material and the special robust design of the profile, secure the ND 120 Drainage Composite to the sub-structure in such a way, that it can withstand tensile forces of more than 800kg/m (equals an installation depth of 3metres).

A durable protection of the waterproofing membrane is guaranteed through all phases of construction and the life span of the sub-structure.

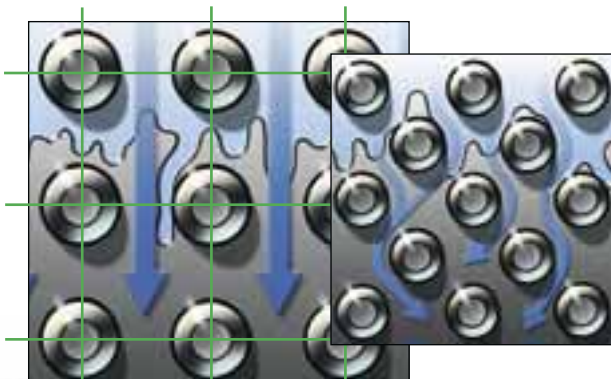
#### ND 120 Drainage Composite

The use of High Impact Polystyrene (HIPS) as a base material for the dimpled sheet gives the ND 120 Drainage Composite a high compressive strength.

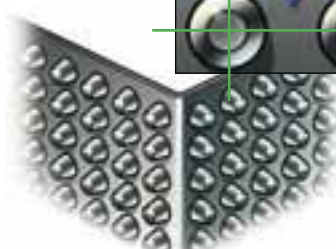
Even when the material is put under high pressure over a longer period of time the dimples show minimal signs of creep and therefore provide a constant drainage capacity throughout its service life.

The manufacturing process developed by Nophadrain guarantees a constant wall thickness of each dimple. Together with the conical dimple geometry the drainage composite achieves a high compressive strength to resist shear forces caused by backfill and soil settlements.

The quadratic placement of the dimples creates an unobstructed water flow and allows easy installation of the drainage composite around external and internal corners of the sub-structure. ➤



Unobstructed water flow due to quadratic placement of the dimples



## Installation

Nophadrain "Clic" Drainage and Protection System	Traditional
Securing the ND "Clic" Profile against the sub-structure with hammer screws or similar proprietary fixings	Securing the drainage composite against the sub-structure with hammer screws or similar proprietary shot fired fixings, masonry nails, wood battens, hammer fixings screws, etc.
Hanging ("Clic") the ND 120 Drainage Composite in the ND "Clic" Profile	Removal of broken bricks and other construction debris between the ND 120 Drainage Composite and the waterproofing membrane
Backfill and compaction	Backfill and compaction
-	Removal of shot fired fixings, masonry nails, wood battens, hammer screws, etc.
-	Cutting the top of the drainage composite in a straight line at the finished level
-	Installing covering profile at the finished level with hammer screws
The result: <ol style="list-style-type: none"> <li>1. Less material waste</li> <li>2. Less labour costs</li> <li>3. Simple and secure installation</li> <li>4. Fulfills the requirements as specified in the DIN 18195 and the DIN 4095</li> </ol>	

*Nophadrain ND "Clic" Drainage and Protection System compared with traditional installation*

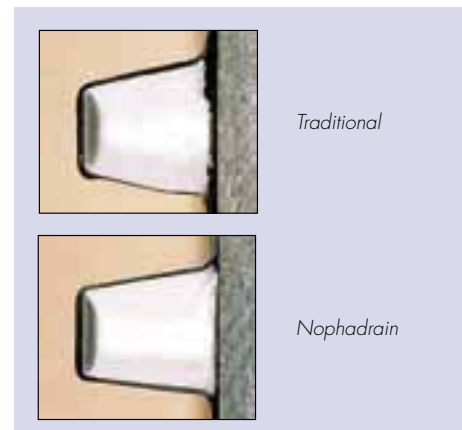
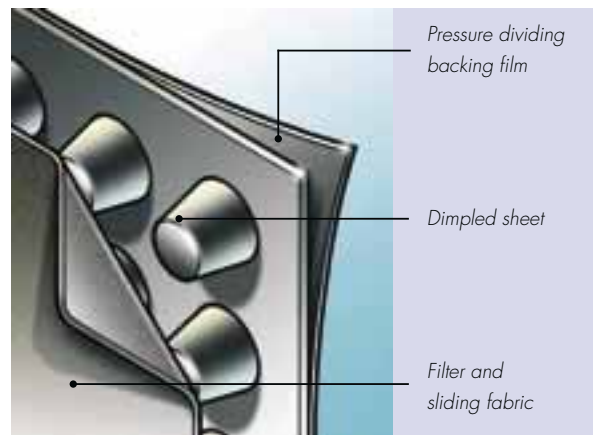
The special pressure dividing backing film prevents transfer of loadings from soils avoiding indentation or extrusion of the waterproofing membrane. The waterproofing membrane keeps its optimal thickness in accordance to the manufacturer's specifications.

The stable filter and sliding fabric prevents clogging of the dimpled drainage composite. Furthermore, any movement of the backfill caused by compaction or settlement is transferred along the filter and sliding fabric of the ND 120 Drainage Composite away from the waterproofed sub-structure.

The filter and sliding fabric is glued to each dimple of the ND 120 Drainage Composite with a special pressure sensitive hot melt glue. This prevents the filter and sliding fabric being distorted by the backfill into the flow channels of the ND 120 Drainage Composite obstructing the required drainage capacity.

During installation the pressure sensitive glue allows the filter and sliding fabric to be peeled off easily. The filter and sliding fabric can be re-attached to the dimples by simple hand pressure.

The choice of High Impact Polystyrene (HIPS) as base material in combination with the manufacturing process and the geometry of the dimples provides a long-term guarantee for the protection and drainage of the sub-structure. ■



#### 4. PROPERTIES OF THE NOPHADRAIN® “CLIC” DRAINAGE AND PROTECTION SYSTEM

##### High long-term drainage capacity

The ND 120 Drainage Composite exceeds the drainage requirements of the DIN. With a drainage capacity of 2.0l/(s.m) it exceeds the 0.3l/(s.m) specified in the DIN 4095 at an installed depth of 3m by several times. Even at a depth of 10m the requirement will be met by the ND 120 Drainage Composite.

##### The base material

The reason for the excellent drainage properties, at almost any practical installed depth, is the High Impact Polystyrene (HIPS) used in the manufacturing of the dimpled sheet.

##### The geometry

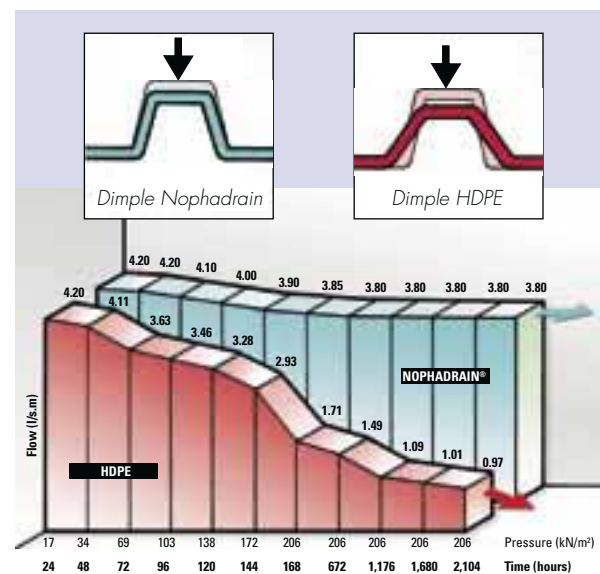
The structural geometry of the dimples has an essential influence on the mechanical properties of the drainage composite. The optimal shape of the dimples, formed as cones and the constant wall thickness of the dimples give the drainage composite the very high compressive strength to withstand the horizontal and vertical soil pressures.

##### Compressive strength and creep resistance

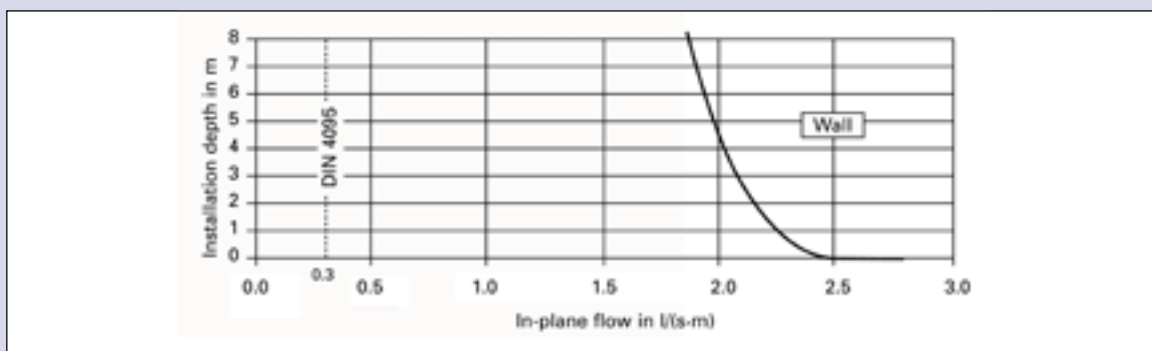
The compressive strength and the inherent creep resistance of High Impact Polystyrene (HIPS) against long term loading are decisive factors for the long term protection and drainage performance properties. The advantages of the combined structural geometry and physical strength of the base material are shown in the graph.

##### Drainage capacity ND 120 Drainage Composite

Installation depth	Pressure	Deformation %	In-plane flow
m	kN/m <sup>2</sup>	after 50 years	l/(s.m)
0	0	0	2.8
3	30	5	2.0
5	50	7	1.9
10	100	10	1.8
Exceptional case	200	16	1.6



##### ND 120 Drainage Composite measurement monogram



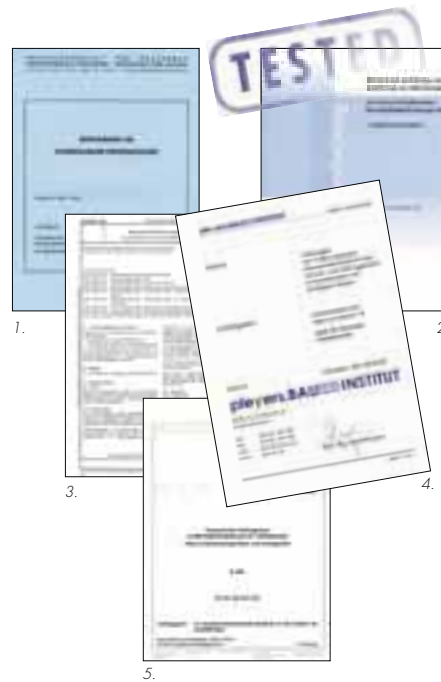
## 5. SPECIFICATIONS NOPHADRAIN® “CLIC” DRAINAGE AND PROTECTION SYSTEM

Products	Materials	Dimensions L x W	Weight	Packaging	Installation depth
1. ND “Clic” Profile			467g/lm	24lm	Up to 3m
a. Wall profile	Aluminium	2,400mm x 42mm	213g/lm	-	-
b. Front profile	Aluminium	1,200mm x 25mm	254g/lm	-	-
2. ND 120 Drainage Composite	Plastic	32m x 1.25m	750g/m <sup>2</sup>	40m <sup>2</sup>	-
3. ND “Pix” to secure geotextile overlaps	Plastic	-	-	20 pcs.	-



## 6. TESTING, STANDARDS AND GUIDELINES

1. Nophadrain ND 120 Drainage Composite “Hydraulic testing per norm DIN 4095”
2. Guidelines for the design and application of synthetically modified liquid bituminous waterproofing membranes
3. DIN 18195 “Waterproofing of buildings and structures”
4. Tests on a drainage and protection composite installed against a waterproofed brick wall in combination with a heavy clay soil
5. DIN 4095 “Drainage and protection of sub-structures”



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