

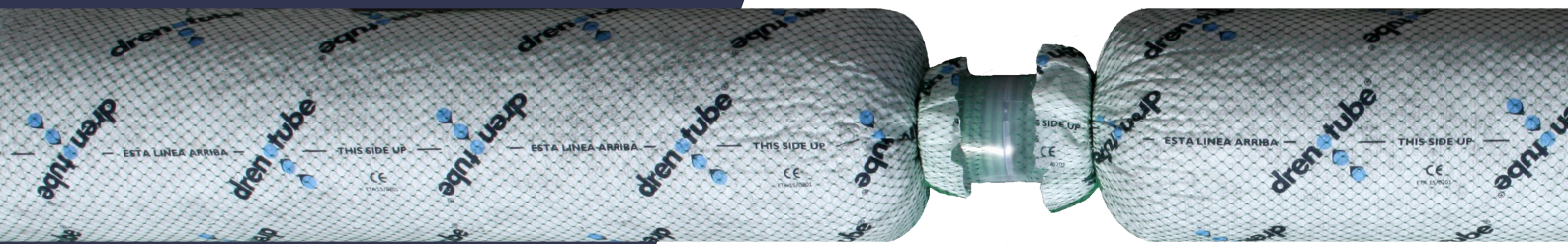
GEOSYNTHETIC GRAVEL AND GEOTEXTILE INCLUDED

drenotube®



T R E A T E D   W A S T E W A T E R   I N F I L T R A T I O N   S Y S T E M

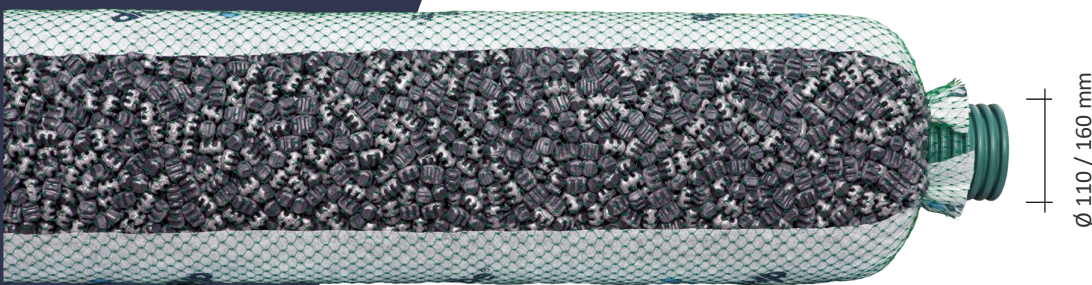
In compliance with Code of Practice CEN/TR 12566-2:2005



TOP VIEW



BOTTOM VIEW



Opening along the bottom side to avoid clogging and extend service life over 25 years.

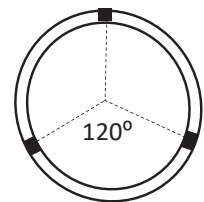
BD300/370



IF300/370



Geosynthetic aggregate



Corrugated pipe 3 holes  
15 mm Ø spaced 100mm  
along the pipe length

# drenotube® is a preassembled system used for underground infiltration applications.

drenotube® preassembled drainage segments consists of a double wall drilled corrugated pipe surrounded by a geosynthetic aggregate enclosed in a high strength polyethylene netting that is clamped to both ends of the pipe.

There is a fabric geotextile filter in between the netting and aggregate. The fabric is used to prevent soil intrusion. Geotextile covers 3/4 of the perimeter section. The uncovered part is installed facing the bottom of the trench to ensure water flow.

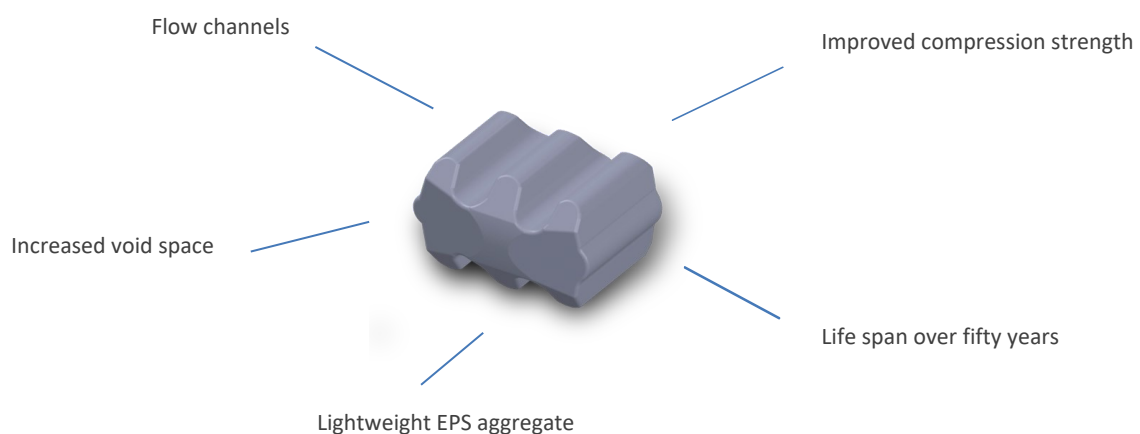
The drenotube® BD reference is used to increase infiltration capacity and void space. This reference contains geosynthetic particles and geotextile filter but without the corrugated tube. It can only be used in combination with the drenotube® IF reference.

## Characteristics of drenotube®

- No gravel needed
- Available in SN4 or SN8 ring stiffness
- 100 times lighter than gravel
- Joined with a fast click fit connector included
- Non-clogging system
- Made with 70% recycled plastic

## EPS Geosynthetic Gravel

EPS aggregates, which replace gravel, can remain buried in a humid environment for decades without degrading. Lightweight material. It is not attacked by fungi, mold and/or mildew. EPS geosynthetic particles are designed to achieve high water flow and void spaces. The cellular structure of the foam allows high compressive strength. It does not break and withstands freezing temperatures.



# Guideline to size infiltration fields with **drenotube®**

For household wastewater which exit to a micro station septic tank, where the water is treated and directed to the distribution box where is evenly distributed through the drenotube® infiltration system. For infiltration of treated wastewater we follow five (5) criteria for sizing installations with drenotube®.

## **1. WATER RETENTION CAPACITY OF drenotube®**

The water retention capacity of drenotube® varies depending on the diameter and type of product, see table 1.

## **2. INFILTRATION SURFACE OF drenotube®**

This will depend on the trench configuration chosen in each case. See table 2.

## **3. SOIL INFILTRATION CAPACITY**

The infiltration capacity of the soil depends on the permeability of the soil. It is given by the coefficient K, expressed in millimeters per hour (mm/h)

## **4. NUMBER OF INHABITANTS**

Infiltration loading per day and inhabitant based on 150 litres. Inhabitant expressed in PE

## **5. PEAK AND SAFETY COEFFICIENT**

A peak factor of 2 is applied when water consumption is highest. A safety factor of 2.5 is applied to guarantee any unexpected events.

**The measurements below are given for information only and may vary depending on the technical and/or administrative constraints of the concerning project. The hydrogeological engineer will determine the rules to be followed.**

CE Mark Certificate



European Assessment Document EAD 280001-00-0704 ETA 15/0201






Table 1. General characteristics and water retention capacity of drenotube®

drenotube® Ref	Corrugated Pipe Ø	Ø drenotube®	Ring Stiffness SN	Length meters	Water retention capacity liters/linear meters
IF300	110	300	SN4 or SN8	3 / 6	31
IF370	160	370	SN4 or SN8	3 / 6	51
BD300	without pipe	300	-	3 / 6	23
BD370	without pipe	370	-	3 / 6	43

drenotube® modular system allows all kinds of configurations, the following charts offer sizing for 3 different possibilities to choose depending on the available surface area and the permeability of the soil.

Table 2. drenotube® infiltration surface according to trench configuration

Type of trench configuration	Infiltration surface per linear meter	
Diameter drenotube® Ø (mm)	<b>300</b>	<b>370</b>
ref. IF <b>A</b> 	0,60	0,74
ref. IF + BD <b>B</b> 	0,90	1,11
ref. BD + IF + BD <b>C</b> 	1,20	1,48

## Meters of drenotube® needed based on soil permeability and number of inhabitants

### drenotube® IF300 - Configuration A

n° PE	< K 10	Silty clay loam	Silt or sandy silt	Fine or silty sand	Fine gravel+coarse sand mixture		K 200 >
		Poor permeability	Moderately Permeable	Permeable Soil	High Permeability	Very Permeable	
		K 15	K 30	K 50	K 100	K 200	
		<b>drenotube® linear meters</b>					
2	Permeability too low	5	3	2	1	1	Permeability too high
4		9	6	4	2	1	
6		13	8	6	3	2	
8		17	11	7	4	2	
10		21	13	9	5	3	
12		25	16	11	6	3	
14		29	18	12	7	4	
16		33	21	14	8	4	
18		37	23	16	9	5	
20		41	26	18	10	5	

### drenotube® IF370 - Configuration A

n° PE	< K 10	Silty clay loam	Silt or sandy silt	Fine or silty sand	Fine gravel+coarse sand mixture		K 200 >
		Poor permeability	Moderately Permeable	Permeable Soil	High Permeability	Very Permeable	
		K 15	K 30	K 50	K 100	K 200	
		<b>drenotube® linear meters</b>					
2	Permeability too low	3	2	2	1	1	Permeability too high
4		6	4	3	2	1	
6		9	6	4	3	2	
8		12	8	6	3	2	
10		15	10	7	4	2	
12		18	12	8	5	3	
14		21	14	10	6	3	
16		24	16	11	6	4	
18		26	18	12	7	4	
20		29	20	14	8	4	

For other trench configurations please contact us for technical support

## Types of applications

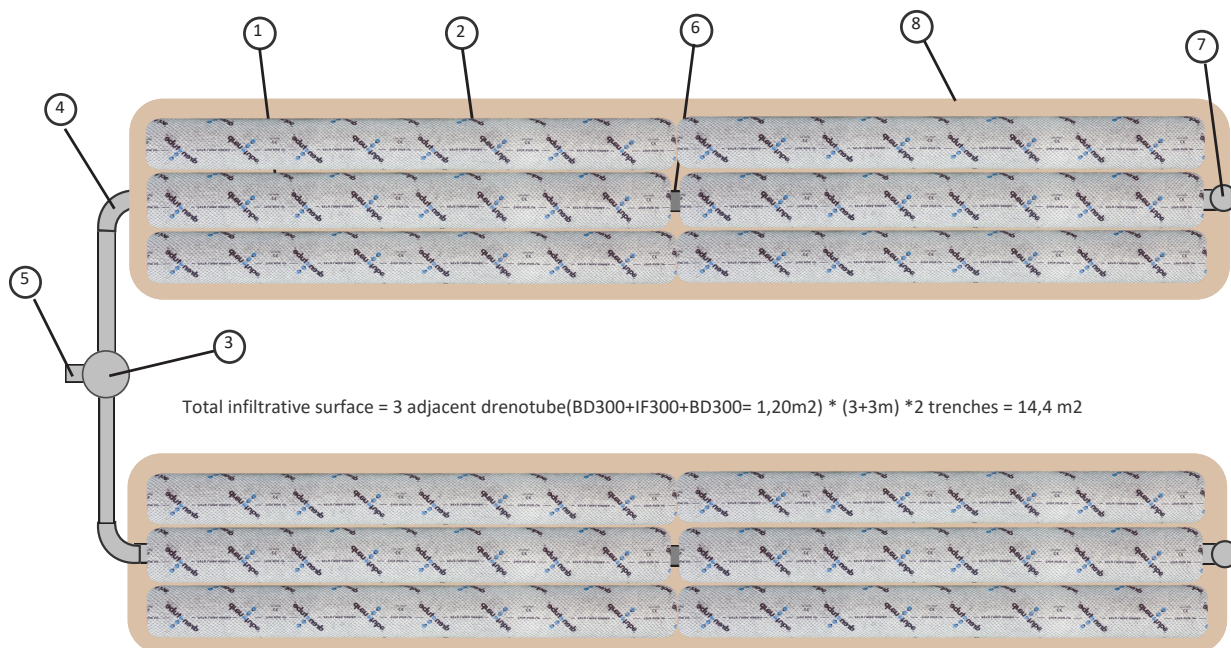
Choose the more convenient infiltration system according to the Code of Practice CEN/TR 12566-2:2005 (Small Wastewater treatment systems for up to 50 PT)

- 1- Individual trenches (more preferred) 2- Shallow Infiltration Bed (non-cohesive soil)  
3- Vertical Infiltration Bed (fissured ro. ck, steep slope) 4- Infiltration Mound (high water table)

Variations in requirements depending on the infiltration system chosen:

Requirement	Individual trenches	Shallow Infiltration Bed	Vertical Infiltration Bed	Infiltration Mound
Total depth m	0,6 to 1	0,6 to 1	1,1 to 1,6	1 to 1,6
Backfill depth m	≥0,2	≥0,2	≥0,1	≥0,2
Granular fill over the infiltration pipe m	0 to 0,1	0 to 0,1	0 to 0,1	0 to 0,1
Distribution layer under infiltration pipe m	0,15 to 0,30	0,15 to 0,30	0,15 to 0,30	0,1 to 0,3
Total distribution layer width m	0,5 to 1,5	≤8	≤5	≤5
Distribution layer length m	≤30	≤30	4 to 30	4 to 30
Ground width between trenches m	≥1	--	--	--
Spacing between pipes	--	0,5 to 1,5	1	0,5 to 1,5
From distribution chamber to base of bed m	--	--	≥0,9	--

### Example of an individual infiltration trench using drenotube®



- |                                    |                                 |                   |
|------------------------------------|---------------------------------|-------------------|
| 1 – drenotube® bundle with pipe    | 4 – Distribution pipe           | 7 – Aeration pipe |
| 2 – drenotube® bundle without pipe | 5 – Line from treatment station | 8 – Trench        |
| 3 – Distribution box               | 6 – Click-fit connector         |                   |



### **COST EFFECTIVE**

- Saves time, money and avoids trouble-shooting.
- Easier and cheaper transport.
- Easily hand-carried into position reducing time and labor.
- Reduces the volume of excavation.
- No gravel is needed. Easier cleanup at job site.

### **PERFORMANCE**

- Superior water flow rate and higher storage capacity compared with gravel.
- Test and certificates for the finished product and all components (Compressive strength, creep in compression, ageing, flow capacity, etc.)
- Product has been monitored and evaluated on-site and approved through most US States since 1991 with thousands of installations in use.
- CE approval ETA number 15/0201
- FDES LCA (Life Cycle Assessment) NF EN 15804 + A1 and its national supplement NF EN 15804 / CN Verification No: 7-418: 2019

### **INSTALLATION**

- Quick and easy installation without skilled labour.
- No trucks or heavy equipment are needed to bring the product to the construction site.
- Secure handling. Its lightness entails no labour risk.
- It is clean and fines free.
- Ability to contour along sloped sites and around trees, corners or other obstacles.
- Faster installation. Placement rate 10 meters per minute. Joined with a rapid click fit connection.
- Pre-assembled modules provides entire on-site implementation. Central pipe is surrounded by uniform thickness of aggregate throughout the way. The geotextile filter is perfectly centered.
- Lightweight system is perfect for repairs in tight job sites. About 100 times lighter than gravel. It can be installed quickly with limited site disruption.
- No need of shoring when working in deep trenches. Segments can be joined in the surface and pulled down without entering.

### **SUSTAINABILITY**

- Manufactured from post-industrial recycled environmentally friendly materials.
- All components are recyclable.
- Avoids environmental impact of aggregate quarrying, preserving the landscape.
- Durable. Expected life span of all components is over 50 years.





## drenotube® infiltration references



Micro station complemented with drenotube® system - Colomars, France



Wastewater treatment plant installed in Opio, France



Installation of a compact station followed by drenotube® system - Nice, France

TREATED WASTEWATER INFILTRATION SYSTEM

## Technical Data IF300SN04–SN08ST6/3 Preassembled soil infiltration systems

Corrugated pipe	Standard	Unit	Value
Outer diameter	UNE EN 61386-1	mm	110
Inner diameter	UNE EN 61386-2-4	mm	SN04 : 93 SN08 : 91
Ring stiffness	UNE EN ISO 9969	kN/m <sup>2</sup>	SN04 : 4 SN08 : 8
Perforation type		ø	360
Perforation surface		cm <sup>2</sup> /m	48
Polymer	UNE 53994 :2011		Polyethylene
Geosynthetic aggregate	Standard	Unit	Value
Bulk density	UNE 92120-2:1998	kg/m <sup>3</sup>	10
Specific weight	UNE 83134	kg/m <sup>3</sup>	20
Void space		%	50
Specific surface		m <sup>2</sup> /m <sup>3</sup>	230
Particle number		units/m <sup>3</sup>	~115.000
Water absorbtion 7 days	UNE EN 12087:1997	%	2,0
Water absorbtion 21 days	UNE EN 12087:1997	%	2,2
Particle size distribution	UNE EN 933-1	% pass	<8 mm: 0 <20 mm: 73
Working temperature	-	°C	-20 a +65
Color	-	-	Graphite
Geotextile filter	Standard	Unit	Value
Polymer	-	-	Polypropylene
Bonding technique	-	-	Needle punched
Mass per unit area	UNE EN ISO 9864	g/m <sup>2</sup>	100
Thickness 2 kPa	UNE EN ISO 9863-1	mm	0,7
Tensile strength MD/CMD	UNE EN ISO 10319	kN/m	8,0/8,0
Elongation at max. load MD/CMD	UNE EN ISO 10319	%	90/80
Static puncture resistance (CBR)	UNE EN ISO 12236	N	1300
Cone drop test	UNE EN ISO 13433	mm	28
Water permeability	UNE EN ISO 11058	m <sup>3</sup> /s/m <sup>2</sup>	0,120
In plane capacity @ 20 kPa	UNE EN ISO 12958	m <sup>3</sup> /s/m	1x10-6
Opening size O90	UNE EN ISO 12956	µm	80
UV protection			Yes
Net	Unit	Value	
Polymer	-	Polyethylene	
Weight per unit	g/m	67	
Semiperimeter	cm	51	
Net type	-	Oriented tubular	
drenotube <sup>®</sup>	Unit	Value	
Length	m	3 or 6	
Weight	g/m	SN04 ~ 1300 SN08 ~ 1592	
Water retention capacity	ml/ l	31,5	
Bundle diameter	mm	300	
Maximum installation depth	m	SN04 : 3 SN08 : 5	
Minimum installation depth	m	0,40	

## Technical Data IF370SN04–SN08ST6/3 Preassembled soil infiltration systems

Corrugated pipe	Standard	Unit	Value
Outer diameter	UNE EN 61386-1	mm	160
Inner diameter	UNE EN 61386-2-4	mm	SN04 : 140 SN08 : 136
Ring stiffness	UNE EN ISO 9969	kN/m <sup>2</sup>	SN04 : 4 SN08 : 8
Perforation type		ø	360
Perforation surface		cm <sup>2</sup> /m	48
Polymer	UNE 53994 :2011		Polyethylene
Geosynthetic aggregate	Standard	Unit	Value
Bulk density	UNE 92120-2:1998	kg/m <sup>3</sup>	10
Specific weight	UNE 83134	kg/m <sup>3</sup>	20
Void space		%	50
Specific surface		m <sup>2</sup> /m <sup>3</sup>	230
Particle number		units/m <sup>3</sup>	~115.000
Water absorption 7 days	UNE EN 12087:1997	%	2,0
Water absorption 21 days	UNE EN 12087:1997	%	2,2
Particle size distribution	UNE EN 933-1	% pass	<8 mm: 0 <20 mm: 73
Working temperature	-	°C	-20 a +65
Color	-	-	Graphite
Geotextile filter	Standard	Unit	Value
Polymer	-	-	Polypropylene
Bonding technique	-	-	Needle punched
Mass per unit area	UNE EN ISO 9864	g/m <sup>2</sup>	100
Thickness 2 kPa	UNE EN ISO 9863-1	mm	0,7
Tensile strength MD/CMD	UNE EN ISO 10319	kN/m	8,0/8,0
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In plane capacity @ 20 kPa	UNE EN ISO 12958	m <sup>3</sup> /s/m	1x10-6
Opening size O90	UNE EN ISO 12956	µm	80
UV protection			Yes
Net	Unit	Value	
Polymer	-	Polyethylene	
Weight per unit	g/m	76	
Semiperimeter	cm	63	
Net type	-	Tubulaire orientée	
drenotube <sup>®</sup>	Unit	Value	
Length	m	3 or 6	
Weight	g/m	SN04 ~ 2150 SN08 ~ 2482	
Water retention capacity	ml/l	51	
Bundle diameter	mm	370	
Maximum installation depth	m	SN04 : 3 SN08 : 5	
Minimum installation depth	m	0,40	



TREATED WASTEWATER INFILTRATION SYSTEM



EASY INSTALLATION



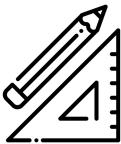
PERFORMANCE



COST EFFECTIVE



SUSTAINABILITY



Technical assistance :

drenotube® provides support in measurement studies to integrate our solutions into your projects.



ETA 15/0201



FUMOSO INDUSTRIAL S.A. LIMITED WARRANTY

drenotube® when installed and operated in a drainage system in accordance with Fumoso Industrial S.A. instructions, is warranted to the original purchaser "Holder" against defective materials and workmanship. Fumoso liability specifically excludes the cost of removal and/or installation of the drenotube® "Units"

The limited warranty is exclusive. There are no other warranties with respect to the Units.

This Limited Warranty shall be void if any part of the drenotube® system is manipulated by anyone other than Fumoso. The Limited Warranty does not extend to incidental, consequential, special or indirect damages. Fumoso shall not be liable for penalties or liquidated damages, including loss of production and profits, labor and materials, overhead costs, or other losses or expenses incurred by the Holder or any third party. Specifically excluded from Limited Warranty coverage are damage to the Units due to ordinary wear and tear, alteration, accident, misuse, abuse or neglect of the Units; the Units being subjected to vehicle traffic or other conditions which are not permitted by the installation instructions; failure to maintain the minimum ground covers set forth in the installation instructions; the placement of improper materials into the system containing the Units; failure of the Units due to improper siting or improper sizing or improper operation; or any other event not caused by Fumoso. This Limited Warranty shall be void if the Holder fails to comply with all of the terms set forth in this Limited Warranty. Further, in no event shall Fumoso be responsible for any loss or damage to the Holder, the Units, or any third party resulting from installation or shipment, or from any product liability claims of Holder or any third party. For this Limited Warranty to apply, the Units must be installed in accordance with all site conditions required by the local authorities and normatives and all other applicable laws and Fumoso Industrial S.A. installation instructions.

No representative of Fumoso Industrial S.A. has the authority to change or extend this Limited Warranty. No warranty applies to any party other than the original Holder.