Texel®
BY/PAR ALKEGEN

Texel F Series

Filtration geotextiles for fine and clay soils

Technical brochure

ALKEGEN

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Technical Brochure

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1. Problem

Soil is often composed of coarse particles that are in contact with each other, thereby forming a porous environment that smaller free particles can penetrate. These fine particles can be freed by the presence of hydraulic (running water) or mechanical (vehicle movements, etc.) constraints, thereby destabilizing the structure.

2. Solution

Accordingly, the use of a Texel F series geotextile filter is necessary to limit the washout of free particles and facilitate the flow of liquids towards the drainage system. By its range of products, Texel F series offer solutions with hydraulic, physical and mechanical characteristics best suited for your filtration and separation requirements.

Benefits of the Texel F Series

- Excellent fine particle retention under different flow conditions;
- Good permeability;
- Consistent filtration openings even under significant constraints;
- The geotextile performs as well for filtration as it does for separation under a variety of mechanical constraints.

Figure 1 - Road structure without F series

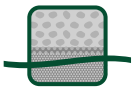
Figure 2 - Road structure with F series

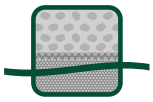
3. Differenciate the filtration opening types (FOS – AOS)

There are two main types of filtration openings in North America: Apparent opening size (AOS) per ASTM D4751 and filtration opening size (FOS) per CAN/CGSB 148.1 No.10. AOS and FOS values can not be compared one to another. The AOS is determined by dry sifting quantities of glass breads while the FOS is determined by sifting glass beads under hydrodynamic conditions. The hydrodynamic condition used for FOS testing simulates the migration of soil particles in the presence of water. Knowing that the migration of fine particles mainly occurs in the presence of water, Texel opted for the evaluation of FOS on F series geotextiles.

4. Multiple purposes of geotextiles

F Series geotextiles (F-200, F-300 and F-500) are optimized to filter fine particles (D_{50} < 70 μ m) while also serving as a separation geotextile when criterion $D_{15\ filter} < 5\ d_{85\ soil}$ is not met. Particularities and principal functions of Texel geotextiles are given below.

	 Separation	 Filtration	 Filtration <70 μ m	 Drainage	 Reinforcement	 Protection
C Series	■	■		■	■	■
E Series	■	■	■	■	■	■
F Series	■	■	■	■	■	■
Texel Geo-9 R1	■	■		■	■	
Texel Geo-9 R2	■	■	■	■	■	



Separation: the geotextile between two layers of different types of materials prevents their interpenetration and prevents the contamination and deterioration of the structure.

Filtration: the geotextile in the soil allows liquid to flow through while preserving, due to its different filtration openings, the uncontrolled migration of particles.

Drainage: geotextiles are the preferred solution for liquids because they collect, channel, and transport these, thereby monitoring the water content of the works.

Reinforcement: with its mechanical properties, geotextile is resistant to constraints and prevents deformities that can impact structures, thereby helping to stabilize and/or increase the soil's bearing capacity.

Protection: the geotextile serves as a local constraint reduction layer to prevent or lessen potential damage that could occur to another layer of materials.

5. Approach to the selection of an optimal geotextile filters

In order to select the appropriate filter as accurately as possible, numerous parameters must be measured. The type of flow must be known as well as the characteristics of the site soil. Based on these parameters, it will be possible to determine the appropriate Filtration Opening Size (FOS). The optimal opening of a geotextile can be determined using the selection chart for a geotextile filter and following the steps below:

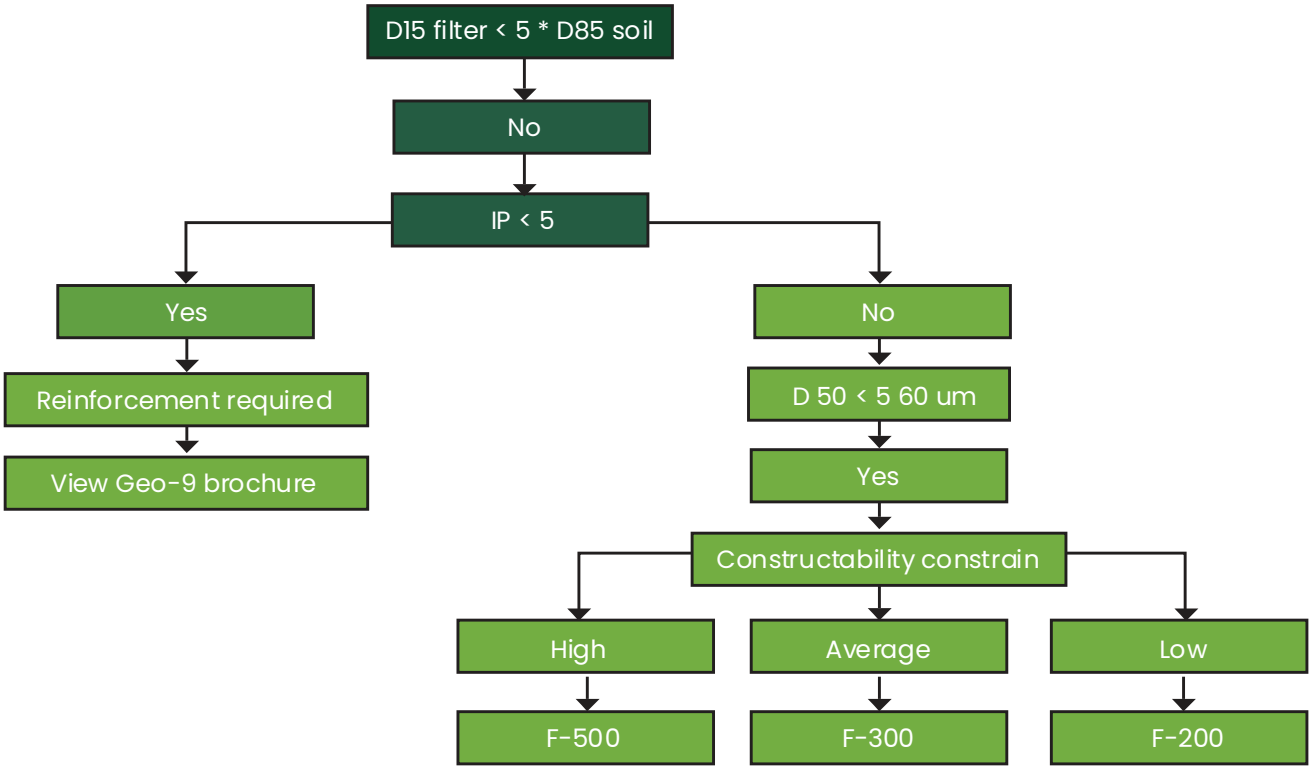
Identification of hydraulic parameters	
One-way flow (towards the filter)	Two-way flow (towards the filter and inversely, towards the soil)

Assessment of potential soil behavior				
Soil grain size	Soil cohesiveness	Internal stability of non-cohesive soil	Plasticity index	Soil dispersion index

Selection of the optimal filtration opening size (FOS)		
F-200	F-300	F-500

The more the hydraulic parameters are restrictive and soil conditions are difficult, the more the F series geotextile need to be resistant.

6. Texel's geotextile selection tool



Scale of constructability constraints

	Low	Average	High
Tensile strength	400 to 500 N	500 to 1 000 N	1 000 to 1 500 N
Trapezoid tear	150 to 250 N	250 to 400 N	400 to 800 N
CBR Puncture	1 000 to 1 550 N	1 550 to 2 500 N	2 500 to 5 000 N

Figure 3 – Excerpt from the geotextile selection guide

Alkegen has developed a selection tool designed to determine the type of geotextile to use according to the project constraints and the surrounding granular materials. The following illustration presents an excerpt of the selection tool adapted for F Series geotextiles. These geotextiles are optimized to satisfy specific filtration requirements.

Construction projects are subject to time constraints as well as to budget imperatives that pose challenges from the design stage up to production. In the presence of fine and clay soils, it is essential to select materials that satisfy the specific conditions of this particular type of soil in order to save time and money. The use of an F Series geotextile will ensure the longevity of the structure monetary, and generate environmental, and social project savings.

7. Economic advantages of geotextiles

Using a geotextile can allow you to replace a layer of granular material of at least 150 mm thick or reduce the amount of landfill required. A geotextile can allow you to separate soils in order to preserve their distinct intrinsic mechanical and hydraulic properties, as well as protecting the project.

Depending on its use, the desired filtration criteria may necessitate the use of more than one layer of granular filtering material (reversed filtering technique). Drainage criteria may also require a thicker layer of granular material. In both situations, a judicious choice of geotextile can allow you to use significantly less granular material.

Using less granular material allows you to save money on material and transportation, as well as reducing the time needed for installation.

Example of the calculation of monetary savings
Let us consider the potential monetary savings for a 1 000 m^2 project for which the thickness of each granular filter layer was evaluated to be 0.150 m in order to satisfy the separation, filtration and drainage requirements. The cost of the granular material for filtration was evaluated at $18.00 /tonne and the density of the material is 2.2 tonne/m^3. The cost of the geotextile that makes it possible to achieve the same separation, filtration and drainage criteria is evaluated at $3.00/$m^2$. The following table shows the values achieved.

As well as saving money, geotextiles can simplify the work process and quality control.

Thickness of a layer of filtration material	0.150 mm
Surface to be covered	1 000 m^2
Cost of aggregate filtration material	18.00 $/t
Density of aggregate material	2.2 t/m^3
Unit cost of aggregate filtration layer	5.94 $/$m^2$
Cost of aggregate filtration layer	**5 940.00$**

Unit price of geotextile	3.00 $/$m^2$
Surface to be covered	1 000 m^2
Cost of geotextile filtrat ion layer	**2 000.00 $**
Savings per 150 mm of aggregate layer	**3 940.00$**

8. Environmental advantages of geotextiles

The environment benefits from the extraction of less granular material, less material transport and simplified installation. This reduction of CO_2/m^2 equivalent reduces the environmental impact of your project.

Example of the calculation of environmental savings

Let us determine the potential environmental savings for the same project by considering the installation of aggregate material at a rate of 65 tonnes an hour by two men and the installation of geotextile at the rate of 571 m^2 an hour by three men. The CO_2 equivalence factors are from: ADEME (2009), *Carbon Balance Method Version 6* and Koerner, B. (2013) *Carbon footprint of geosynthetics.*

Source	Aggregates	Geotextile
Material		
Mass per unit area	0.33 t/m^2	0.475 kg/m^2
Factor	10	2.7
kg equivalent CO_2/m^2	3.33	1.28
Transport material		
Distance to travel	5 km	200 km
Mass per unit area	0.33 t/m^2	0.475 kg/m^2
CO_2 Equivalence factor	1.0782	0.2572
Transport equivalence factor	20 tons / truck	0.001 kg/t
kg equivalent CO_2/m^2	0.089	0.024
Installation worksite equipment		
Diesel consumption	40 l/h	20 l/h
Quantity installed	65 t/h	571 m^2/h
Mass per unit area	0.33 t/m^2	-
Factor	2.9425	2,9425
kg equivalent CO_2/m^2	0.60	0.10
Setup labour		
Workers' hourly wages	30$/h	30$/h
Number of workers	2	3
Quantity installed	65 t/h	571 m^2/h
Factor	0,0367	0,0367
Kg équivalent CO_2 /m^2	0.034	0.006
Total emissions in kg CO_2/m^2 equivalent	**4,02**	**0,63**
Environmental savings with geotextile	**2.61 kg CO_2/m^2 equivalent**	

9. Social avantages of geotextiles

As well as saving money and reducing the environmental impact, reducing the amount of granular material needed also has an unquantifiable impact on social costs. Social costs include the inconvenience and discomfort to those living near the worksites, which is caused by increased traffic, risk of accidents, noise and several other factors (CERIU, 2010)

10. Technical documents available for geotextiles

Consult the following documentation for examples of geotextile performance.

- Performance brochure
- Performance brochure F series
- Geotextile selection tool and guide
- Selection of a protection geotextile
- Product data sheets
- Installation guide
- Technical specifications
- Standard technical drawings
- Site inspection guide
- Fiber resistance table
- Comparison of puncture resistance tests
- Comparison of typical, minimum, and minimum average roll value
- Definition of standards and test procedures

In addition to the information presented here, Texel also provides access to:

- An offer that goes far beyond your project thanks to our consulting services, technical support, and in-house training given free of charge;
- A research and development team that custom designs products that comply with the requirements of the many market imperatives.

WANT TO LEARN MORE?

Feel free to contact one of our representatives to discuss your project. 1 800 463-8929 | texel.ca | info.geosynthetiques@alkegen.com

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