GEOMEMBRANES

Alvatech®

sotrafa | GEOSYNTHETICS DIVISION

About **Us**

The **Armando Alvarez Group** was founded in 1964, and comprises of 14 factories that are all equipped with the latest technology, which has helped the Group to position itself as the leading polyethylene converter in the Spanish and European markets. It has a production in excess of **400,000 tons** per annum for the environmental, agricultural, mining and industrial sectors.

Thanks to its use of the most advanced technologies, the Group manufactures a wide range of high-quality plastic products, including **Alvatech® geomembranes**, which meet the most stringent market requirements.

Sotrafa is a manufacturer that belongs to the Armando Alvarez Group, and has extensive experience in a wide range of sectors. Since 2005 it has manufactured and supplied geomembranes to four main sectors: mining, hydraulics, environmental and civil.

Sotrafa sells in over 60 countries worldwide with commercial offices situated in our core markets, and has manufactured and supplied over 100 million m^2 of geomembranes since 2005.

Our **Geomembranes**

Alvatech® geomembranes fully comply with the quality standards required by the regulations applicable to each market.

European regulations:

ISO 9001
UNE-EN 13361: 2013 (reservoirs) // UNE-EN 13362:2013 (canals)
UNE-EN 13491 : 2013 (tunnels and underground structures)
UNE-EN 13492 : 2013 (liquid waste disposal sites)
UNE-EN 13493: 2013 (solid waste disposal sites)
UNE-EN 15382 : 2013 (transportation infrastructure)
And quality certificates such as **ASQUAL.**

- GRI GM13 specification: smooth and textured HDPE geomembranes.
- GRI GM17 specification: smooth and textured LLDPE geomembranes.

Sotrafa guarantees the perfect performance of **Alvatech® geomembranes** thanks to its use of the best polyethylene resins which, together with the primary and secondary antioxidants, significantly increase the useful life of the sheets.

armando alvarez GROUP

sotrafa | GEOSYNTHETICS DIVISION

GEOMEMBRANES

Alvatech®

Quality, commitment and responsibility.

When manufacturing our **Alvatech®** geomembranes for the waterproofing and containment of toxic waste we use the most advanced materials and technology, as part of our ongoing commitment to quality and environmental protection.

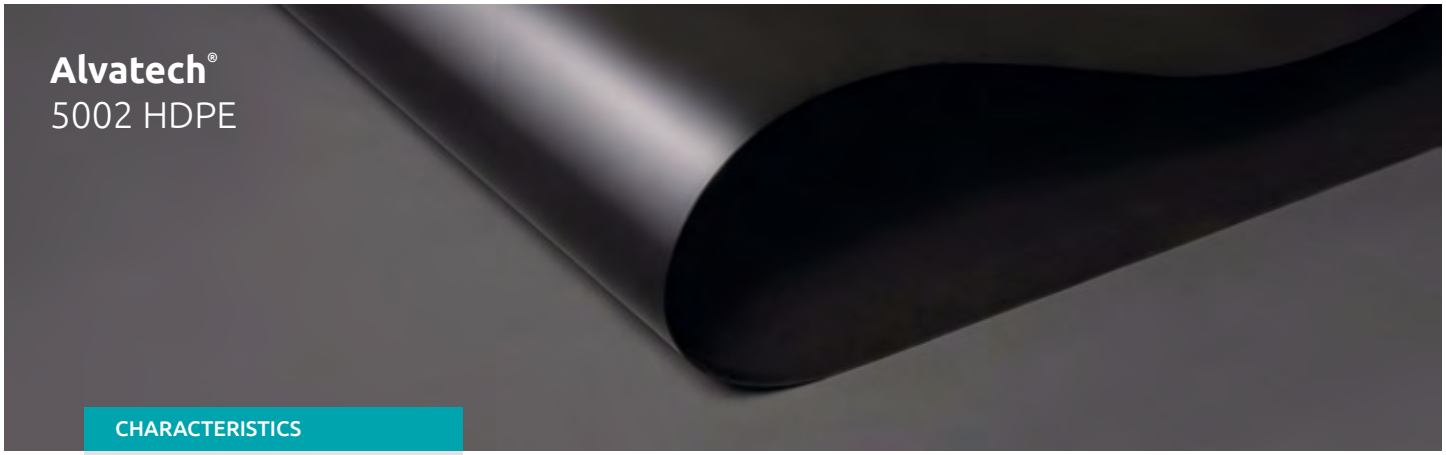
Advantages of **Alvatech®**

Waterproofing with polyethylene geomembranes has several advantages over other waterproofing solutions, such as:

	High chemical resistance. It is possibly the polymer with the highest chemical resistance to attacks by acids, alkalis, and organic and inorganic solvents.
	High mechanical resistance in a wide range of temperatures.
	Durability: numerous studies have shown that the useful life of a HDPE geomembrane is over 100 years, even when used in an exposed environment.
	It is possible to verify the air and watertightness of the welding seams.
	The use of sheets with very large widths reduces the number of welding seams required to attach the membrane to the structure.
	Flexibility and versatility with a wide range of applications.
	Very competitive product and application prices.
	Recommended for drinking water.

Products & specialities

Alvatech®



Alvatech®
5002 HDPE

CHARACTERISTICS

- Excellent chemical resistance.
- High mechanical resistance.
- Durability.
- Excellent weldability.
- Flexibility and versatility.
- Enhanced structural performance.

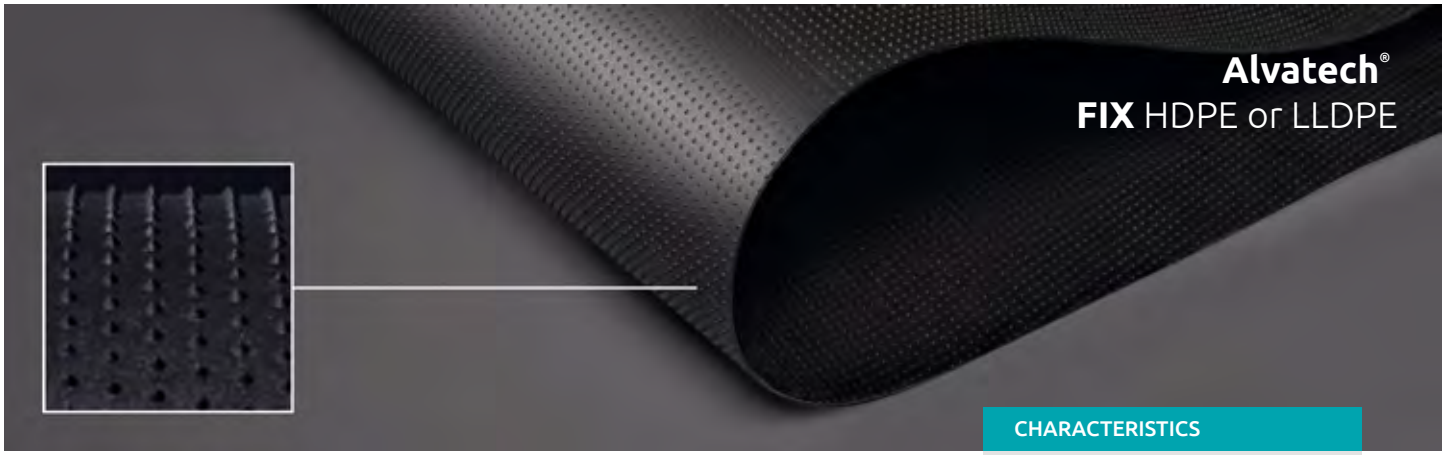
A smooth waterproofing membrane made of high-density polyethylene (HDPE). The specific formulation of this product gives it excellent weldability, enhancing its mechanical properties and chemical resistance. It is manufactured by a flat die extrusion process (calendering system) using the latest technology, which ensures excellent thickness control and a uniform surface finish (with a slight relief to make the product easier to install on the structure).

The 7.50 m width optimises installation costs and quality control on site, and significantly reduces the number of welding seams required to attach the membrane to the structure, when compared with a narrower sheet.

TECHNICAL SPECIFICATIONS	
Thicknesses	From 0.75 mm to 3.00 mm
Width	7.50 m and 5.80 m – Other widths available upon request.

Advantages of the calendering system compared to the blown film extrusion method:

- Better surface finish and greater flatness.
- More uniform thicknesses, and consequently more uniform properties and greater control in the post-welding process.
- Absence of the two marks introduced when unrolling geomembranes manufactured using the blown film extrusion method. The thicker the HDPE geomembrane, the greater the fatigue suffered along the two marks. The marks introduced when unrolling the geomembrane create tensions, which affect the thickness and external appearance of the roll.
- Most civil project engineers prefer HDPE geomembranes manufactured using the calendering system.



Alvatech®
FIX HDPE or LLDPE

A waterproofing membrane made of high-density polyethylene (HDPE) or linear low-density polyethylene. The surface is structured on one or both sides, with a large number of spikes (57,000 spikes/m2) over 0.9 mm in height, which makes the membrane extremely stable when waterproofing steep slopes (high coefficient of friction and angle of friction).

We are the only company that offers a structured geomembrane with a width of 7.5 metres, which optimises installation costs as it reduces the number of welding seams required.

Recommended for slopes of approximately 20% -12º or more.

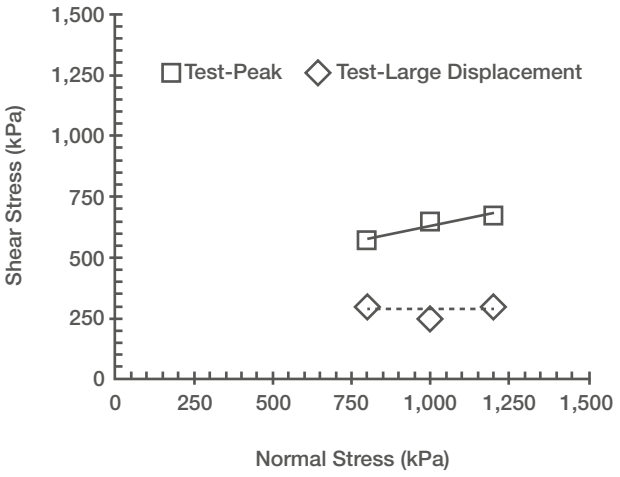
CHARACTERISTICS

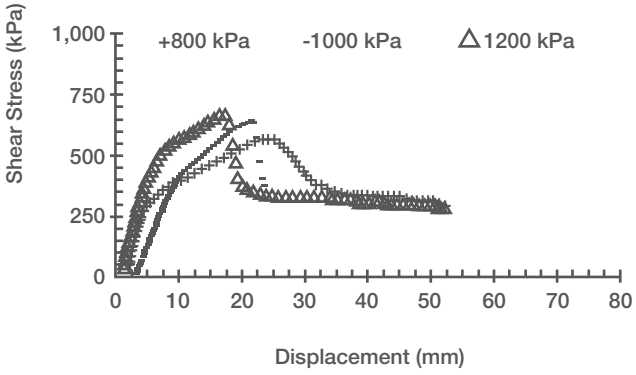
- High coefficient of friction.
- One of the largest widths in the world: 7.5 m.
- Height of spikes > 0.90 mm.
- Excellent sheet-thickness control.
- Uniform surface.
- Smooth borders for easy welding.

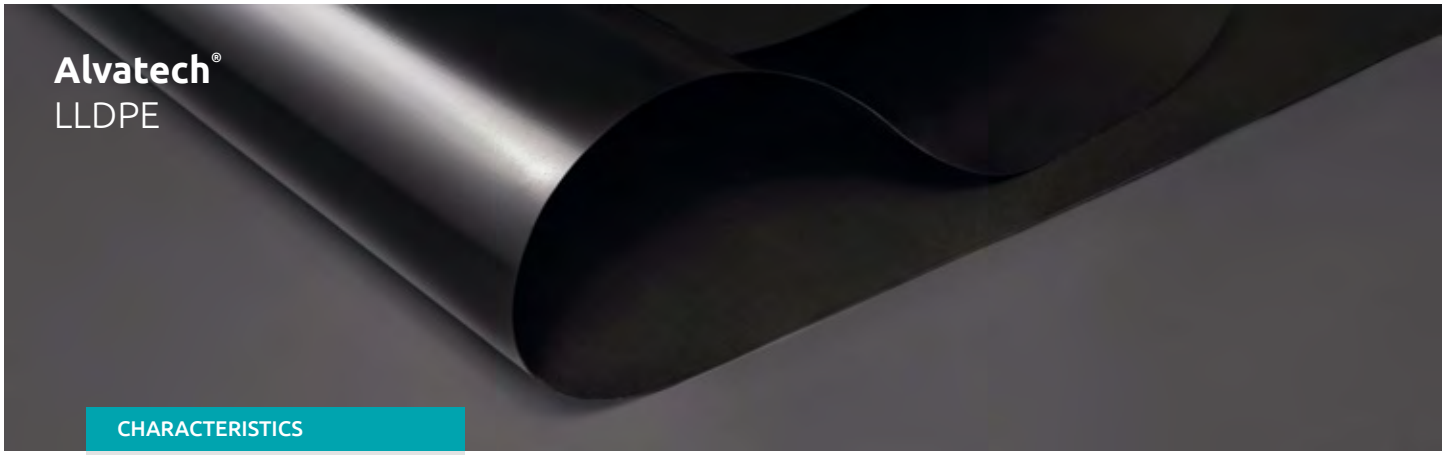
TECHNICAL SPECIFICATIONS	
Thicknesses	From 1.30 mm to 3.00 mm
Width	7.50m

Advantages of Alvatech FIX with respect to the angle of friction:

- It permits the construction of more vertical structures, thereby optimising storage capacity.
- The height and density of the spikes on the surface increase the friction angle.
- Poor adhesion between the geomembrane and other geosynthetics or the ground is the main cause of embankment instability and collapse.
- **Alvatech®FIX** provides an angle of friction higher than that of textured geomembranes manufactured using the blown film extrusion method.
- **Alvatech®FIX** provides friction angles greater than 35º compared to geotextiles, and greater than 30º compared to drainage geocomposites.







Alvatech®
LLDPE

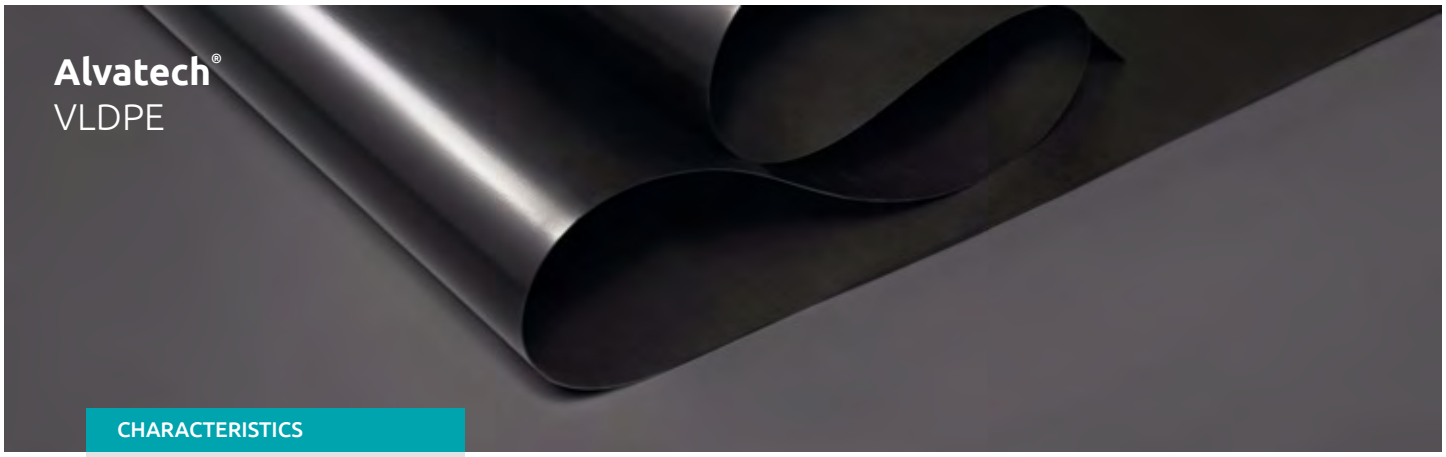
CHARACTERISTICS

- High chemical resistance.
- High mechanical resistance.
- Durability.
- Very easy installation.
- Extremely flexible.

A waterproofing membrane made with a formulation based on linear polyethylene which gives it excellent flexibility and weldability. It is used to seal disposal sites, floating covers and, in general, structures that require a waterproof barrier that is more elastic than high-density polyethylene.

We also offer a structured version: **Alvatech® LLDPE FIX**, which is structured on one or both sides and is 7.5 metres wide. It has a high coefficient of friction on steep slopes.

TECHNICAL SPECIFICATIONS	
Thicknesses	From 0.75 mm to 3.00 mm
Width	7.50 m and 5.80 m – Other widths available upon request.



Alvatech®
VLDPE

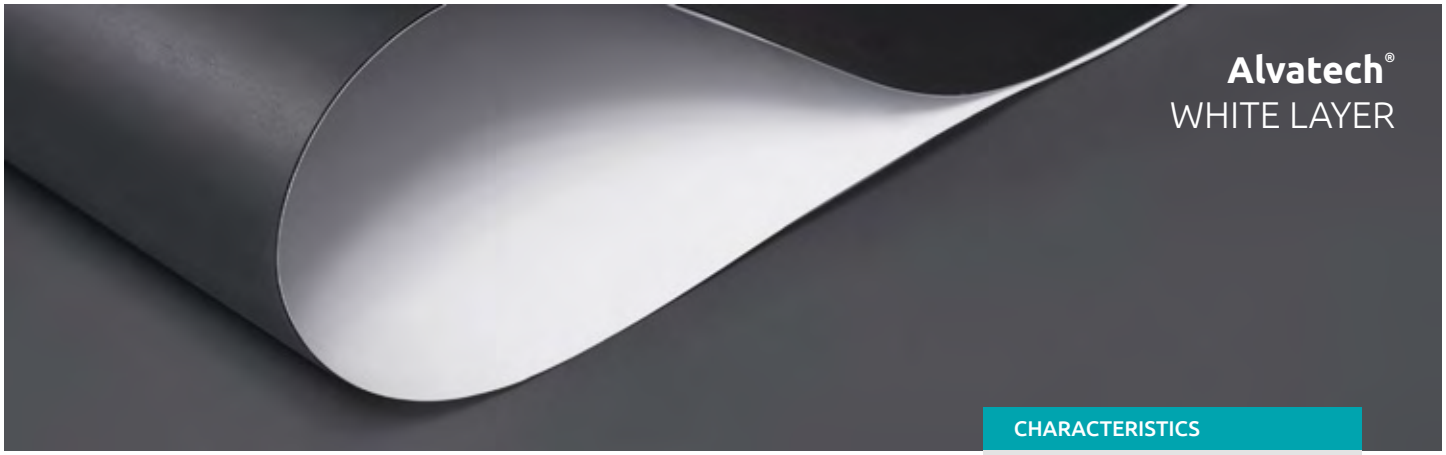
CHARACTERISTICS

- Extremely flexible.
- Good chemical resistance.
- Good mechanical properties.
- Weather resistant.

A waterproofing membrane made with a formulation based on very low density polyethylene, which gives it excellent flexibility and weldability. This membrane is even more flexible than the **LLDPE** geomembrane.

It is used in structures with irregular surfaces, as it can stretch and conform to irregular surfaces. Some examples of these structures include bladder tanks, floating covers, underground structures, green roofs, perimeter kerbs in reservoirs, etc.

TECHNICAL SPECIFICATIONS	
Thicknesses	1.00 mm, 1.30 mm and 1.50 mm
Width	7.50 m and 5.80 m – Other widths available upon request.



Alvatech®
WHITE LAYER

CHARACTERISTICS

- Greater visibility in closed spaces (tunnels and water tanks).
- Enhanced structural performance.
- Less thermal ageing.
- Facilitates visual inspections during installation.
- Greater flatness.

A waterproofing membrane made of polyethylene (HDPE or LLDPE), bicolour, with a white upper surface and black underside.

The white surface accumulates less heat than a black surface, with a difference between the two of between 20 and 23º C. As a result, it is possible to work for longer periods, and the number of geomembrane waves or wrinkles is reduced.

TECHNICAL SPECIFICATIONS	
Thicknesses	From 0.75 mm to 3.00 mm
Width	7.50 m and 5.80 m – Other widths available upon request.

ADDITIONAL INFORMATION

Ambient air temperature ºC	Geomembrane lining (HDPE)	Temperature of geomembrane lining (HDPE) ºC	ºC difference with smooth Black lining
30	Smooth black	67	-
	Structured black	64	-3
	Grey/White	49	-18
	White	43	-24
18	Smooth black	25	-
	White	17	-8

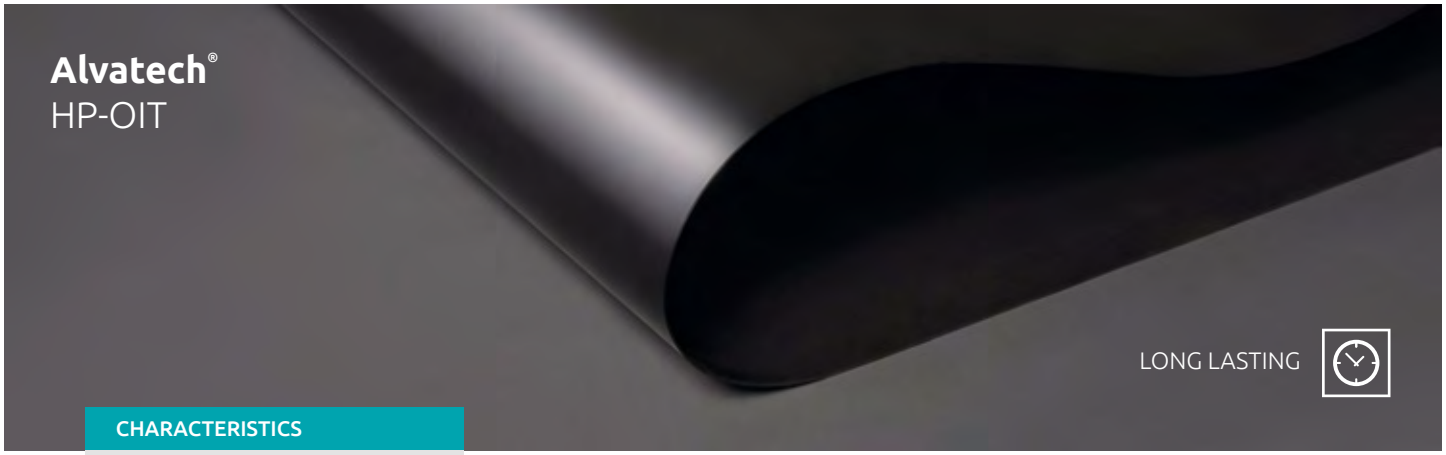
Geomembrane lining (HDPE)	C (X10 / ºC)	ΔT (ºC)	L (mm)	ΔL (mm)	δ AL (mm)
Black	$2,4 \times 10^{-4}$	67-25=42	100×10^{3}	630mm	-
White	$2,4 \times 10^{-4}$	43-17=26	100×10^{3}	390mm	-240mm

C= linear expansion coefficient / ΔT= geomembrane temperature change
ΔL= geomembrane length change / δ AL= difference between ΔL black and ΔL white

The most significant advantages of **Alvatech® White Layer** geomembranes are as follows:

- Improved geomembrane contact with the ground, resulting in better leak detection.
- Less thermal stress on the polymer, and minimalisation of wrinkles when heated (natural characteristics of polyethylene).
- Facilitate the control and detection of any damage while the product is being installed.
- The white surface is ideal for structures which require greater visibility.
- Excellent for ornamental lakes and floating covers to prevent evaporation.

Source: Cadwallader, Cranston and Peggs 1993



CHARACTERISTICS

- High chemical resistance.
- Excellent mechanical properties.
- Extremely durable
- Greater UV resistance.

A waterproofing membrane made of high-density polyethylene (HDPE) or low-density polyethylene (LLDPE) with an additional antioxidant additive package which extends its useful life.

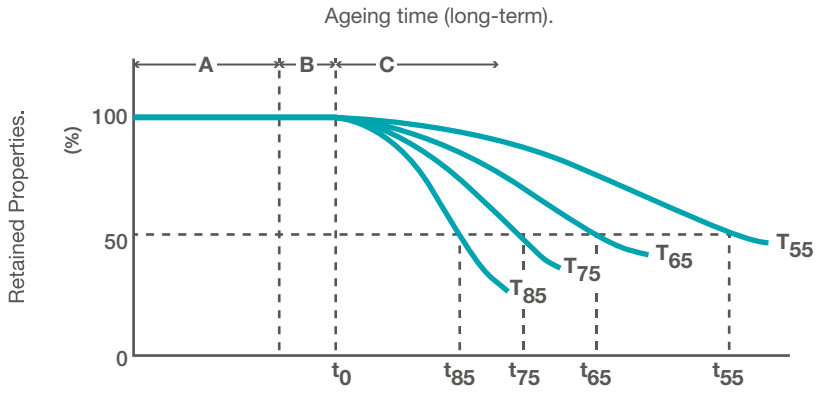
This additional stabilisation means the geomembrane can be used in projects with more abrasive chemical products or more extreme service conditions. The additional antioxidants are more resistant in this type of environment, and are retained inside the polymer matrix. Consequently, the mechanical properties of the **Alvatech® HP-OIT** geomembrane will not deteriorate over time.

TECHNICAL SPECIFICATIONS

Thicknesses	From 0.75 mm to 3.00 mm
Width	7.50 m and 5.80 m – Other widths available upon request.

ADDITIONAL INFORMATION

3 stages in the ageing of most geomembranes:



A = Antioxidant depletion time. B = Induction time. C = Time to reach 50% degradation of properties.

Lifetime prediction of HDPE (nonexposed) at various field temperatures.

In service temperature (°C)	Stage "A" (years)			Stage "B" (years)	Stage "C" (years)	Total prediction (years)
	OIT Standard	OIT High press.	OIT Average			
20	200	215	208	30	208	446
25	135	144	140	25	100	265
30	95	98	97	20	49	166
35	65	67	66	15	25	106
40	45	47	46	10	13	69

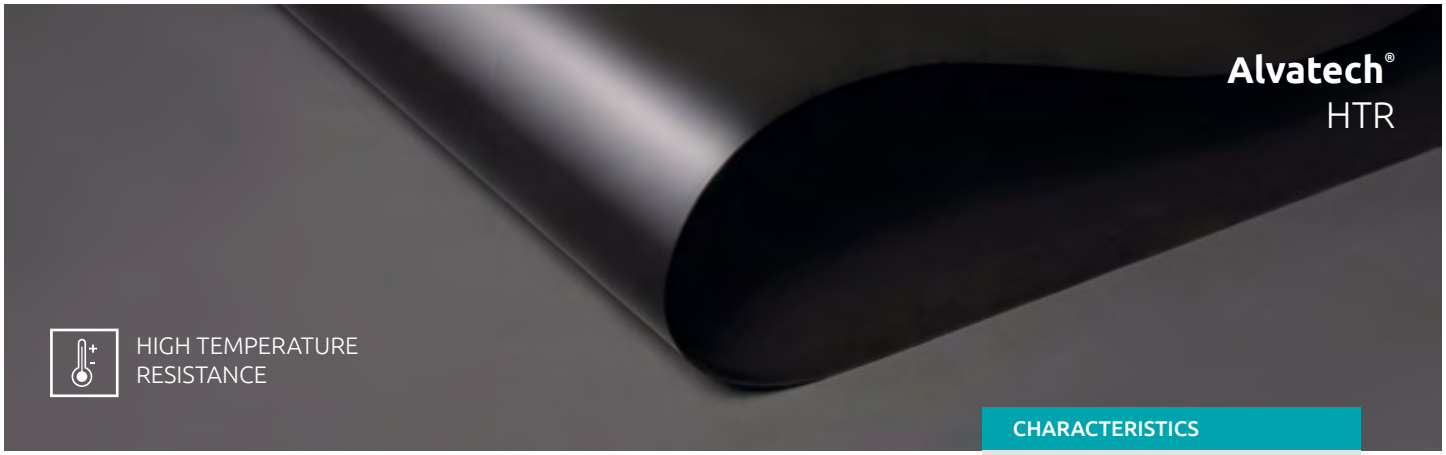
* Total = Stage A (average) + Stage B + Stage C

Source: Koerner, Robert "In-situ temperature monitoring of geomembranes".

Exposed lifetime prediction results of selected geomembranes to date.

Type	Specification	Prediction in a Dry and Arid Climate
HDPE	GRI-GM13	> 36 years (ongoing)
LLDPE	GRI-GM17	≈36 years (halflife)

Source: GRI White Paper 6, June 2005, updated February 2011



A high density polyethylene membrane designed for applications where the waterproofing barrier has to withstand high temperatures (over 60º Celsius). It is mainly used in food industry processes, hot springs, wastewater treatment, etc.

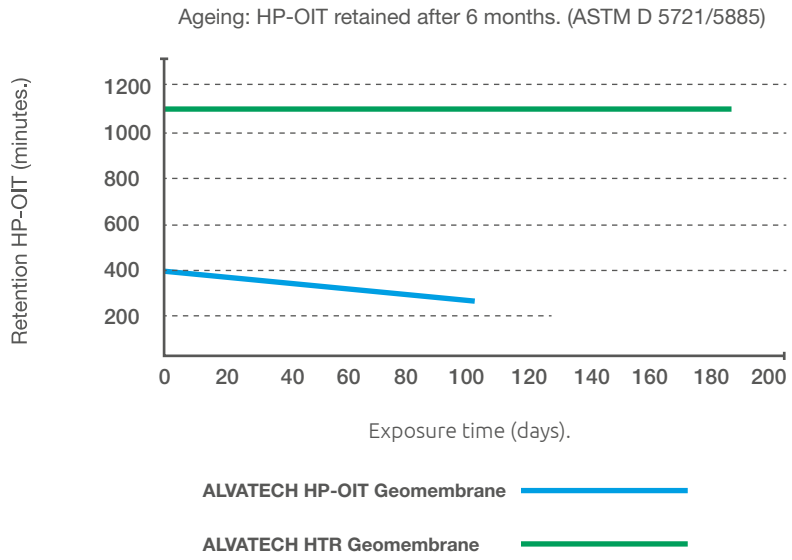
The **Alvatech® HTR** geomembrane has a smooth or structured surface, with spikes on both sides for waterproofing on steep slopes, and a sheet width of 5.80 metres and 7.50 metres.

CHARACTERISTICS

Resistant up to 100º C.
High chemical resistance.
Extremely durable.
Excellent mechanical resistance.

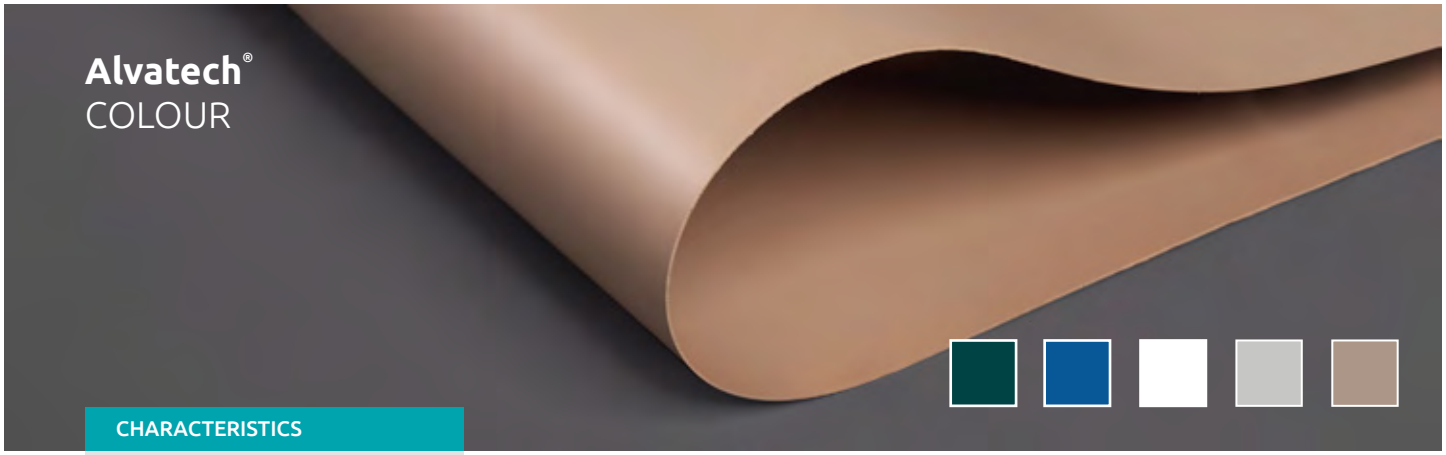
TECHNICAL SPECIFICATIONS	
Thicknesses	From 1.50 mm to 3.00 mm
Width	7.50 m and 5.80 m – Other widths available upon request.

ADDITIONAL INFORMATION



Alvatech® HTR geomembranes are designed to provide the same level of chemical resistance and performance as HDPE geomembranes, while also providing the solution required for applications which require high temperature resistance:

- Mining operations and heap leaching.
- Petroleum and gas industries.
- Wastewater pollution and wastewater processing.
- Power plants and geothermal systems.
- Landfills.



Alvatech®
COLOUR

CHARACTERISTICS

- Blend in with the surroundings.
- Reduce visual impact.
- Less thermal stress of the polymer.
- Extremely durable.
- Greater flatness.
- Easy installation.

Alvatech® Colour geomembranes are specifically designed to enhance the surroundings and reduce visual impact. They are most commonly used for: landscaping and garden projects, waterproofing artificial snow ponds, reservoirs, canals, ornamental lakes, tunnels and galleries etc.

TECHNICAL SPECIFICATIONS	
Thicknesses	From 0.75 mm to 3.00 mm
Width	7.5 m and 5.8 m – Other widths available upon request.
Colours	Green, blue, white, grey and ochre brown– Other colours available upon request.

Ornamental lake
Alvatech® 5002
(blue)

Reservoirs and canals
Alvatech® 5002
(brown)

Artificial snow ponds **Alvatech® 5002** (grey)

Alvatech® THERMOFILM
ANTI-EVAPORATION

This bioleaching membrane, also called **Thermofilm**, is a polyethylene sheet used in the bioleaching of sulphide metals in low-grade mining.

The sheet is placed on the drip irrigation network and has the following advantages:

1. Promotes microbial activity during metal leaching as it maintains the temperature in mineral heaps, thereby enhancing performance.

2. Prevents significant evaporation from the drip irrigation in mineral leaching heaps, as the vapours condense on the film and fall back onto the earth.

CHARACTERISTICS

Reduces water evaporation by around 80%.

Lower operating costs.

High thermal conductivity which improves the uptake kinetics by up to 4%.

Very easy extraction.

Sheets with very large widths that can cover large surfaces.

More uniform irrigation.

TECHNICAL SPECIFICATIONS	
Thicknesses	140 Micras
Width	From 10 m to 20 m

Bioleaching process:

Leaching: this is a metallurgical process which allows copper to be obtained from the oxidised minerals that contain it, by applying a solution of sulphuric acid and water.

Bioleaching is a technique where metals are dissolved in an aqueous medium using bacteria such as acidithiobacillus ferrooxidans. The bacterial culture functions in a temperature range of 45-60º, at levels of pH<2, and requires an air supply which is injected into the heap.

The heap leach pad is the surface which is waterproofed with HDPE geomembrane, and the process is as follows. First the mineral is prepared in a crushing plant to achieve a grading which ensures a good coefficient of permeability.

Next the mineral is arranged in heaps for bioleaching. The drip irrigation system which supplies the lixiviant (around 30gr/l of sulphuric acid) is installed on the heap. Lastly the bioleaching membrane is installed on the irrigation system.

Alvatech® Thermofilm creates a "greenhouse effect", generating a higher reproduction of the bacterial flora and consequently reducing the process cycle times. For example, if 200,000 tn/year are produced in the leaching process, production can be increased by up to 4% with the film.

A heap covered with **Alvatech® Thermofilm** can increase water savings from between 70% to 80%, due to a decrease in the acid solution evaporation.

Alvatech®
RADON BARRIER

CHARACTERISTICS

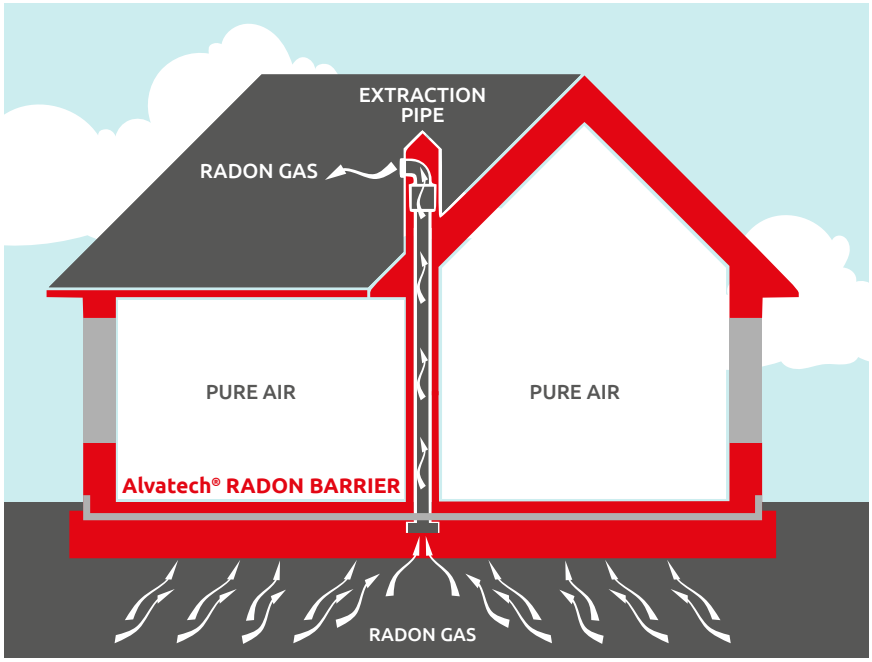
- May be used in both existing buildings and new builds.
- Extremely flexible and adaptable.
- Extremely durable
- Easy to install widthwise.

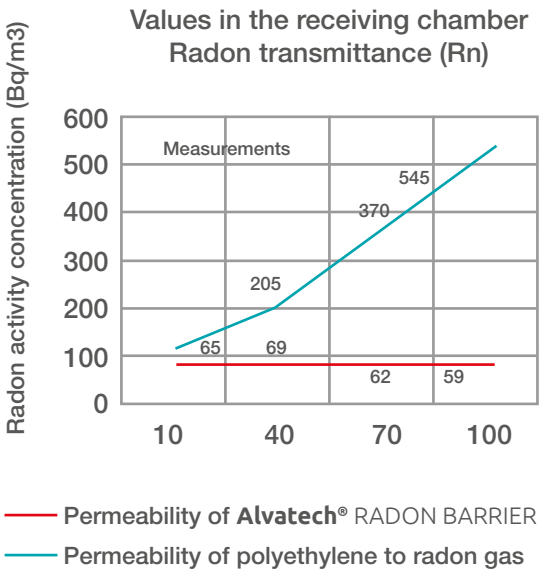
A waterproofing membrane based on the EVOH ethylene copolymer, which is specifically designed to act as a radon gas barrier, preventing the harmful gases from entering buildings.

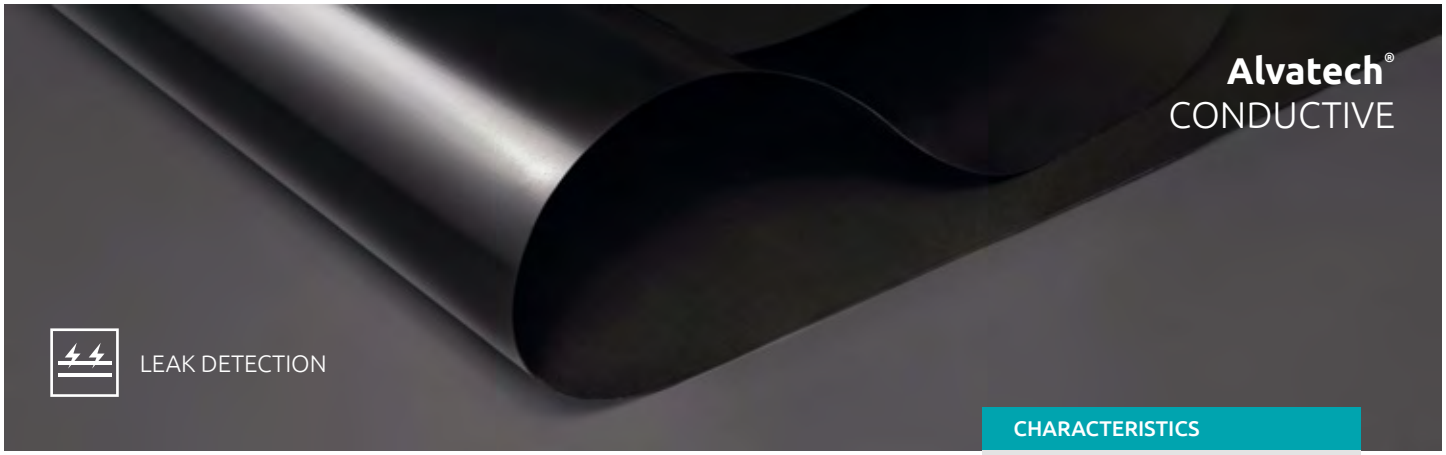
TECHNICAL SPECIFICATIONS	
Thicknesses	0.30 mm
Width	From 1 m to 8 m

ADDITIONAL INFORMATION

The recommended levels of radon concentration are those set by the WHO (World Health Organisation): 100 Bq/m3.







A waterproofing membrane made of high-density polyethylene **(HDPE)** or linear low-density polyethylene **(LLDPE)**, with a structured or smooth surface. The underside has a fine conductive film, which allows the air and watertightness of the geomembrane to be easily tested in two ways:

1) The **Spark-Test** method, in accordance with the **ASTM D 7240** standard, after the geomembrane has been installed on site and the surface has not yet been covered.

2) The **Electric Dipole** method, in accordance with the **ASTM D7007** standard, after the installed geomembrane has been covered with water or minerals.

CHARACTERISTICS

Excellent thermofusion weldability.

Durability of over 25 years in an exposed environment.

Manufactured using a flat die extrusion process, which ensures excellent thickness control.

The 7.5 m width reduces the number of welding seams required to attach the membrane to the structure.

TECHNICAL SPECIFICATIONS	
Thicknesses	From 0.75 mm to 3.00 mm
Width	7.50 and 5.80 m - Other widths available upon request.

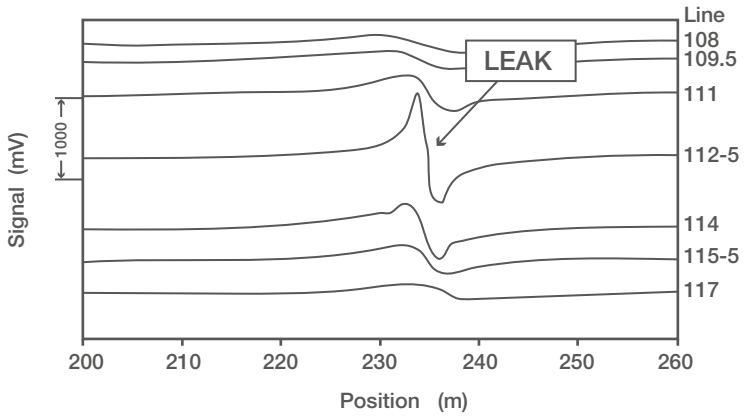
ADDITIONAL INFORMATION

Applications:

The **CONDUCTIVE Alvatech®** geomembrane is designed for structures that require meticulous installation and an excellent leak detection system for the waterproof barrier, in cases where the ground is not very conductive, or the material is not completely in contact with the ground.

This geomembrane is recommended in all of the following cases:

- Tailing ponds in mining.
- Leaching pads in metallic mining.
- Toxic / dangerous waste disposal sites.
- Double waterproofing layer, which is necessary when the upper geomembrane has to be conductive.
- Buildings, so there is no need to use the flooding method.



Leak detection graph (Source: TRI Environmental Inc, 2013)

Accessory Products

E-shaped bar

This is a connecting piece which fastens HDPE geomembranes to a concrete structure, and guarantees complete air and watertightness. It has three anchors which are inserted into the concrete, and a 140 mm wide band to which the geomembranes are welded by extrusion. It comes in 2.5 ml bars.

This high density polyethylene profile is used to attach the impermeable barrier (HDPE geomembrane) to a horizontal or vertical concrete surface (walls or floors), and guarantees complete air and watertightness. The profile is inserted into the finished surface of fresh concrete, and its 3-anchor design with striation on the inner side ensures that it completely adheres to the concrete. The HDPE geomembrane should be welded to the profile through the centre by extrusion.

Alvatech® welding wire

Extrusion welding wire with a formulation based on polyethylene, which provides excellent weldability and makes it extremely compatible with **Alvatech®** geomembranes. It is ideal for welding HDPE and LLDPE geomembranes by extrusion. It is available in 4 mm and 5 mm.

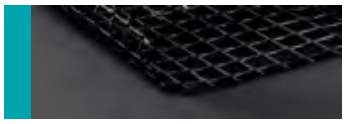
Geotextiles

Alvafelt PP/PET
This is a NON-woven geotextile that has been developed using high-tenacity polymeric fibres. It is used in a wide range of civil engineering applications which require the separation, filtration, and protection functions that it provides to maintain or improve the properties of the system.

Alvatex / Alvapol
This geotextile is manufactured using 100% virgin high-tenacity polypropylene raffia filaments. It has been designed for engineering projects where earthworks and foundations are required, such as the construction of roads, car parks, etc.

Geogrids

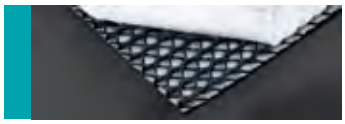
Alvagrid PET (polyester)
This flexible reinforcement geogrid is manufactured using-high tenacity polyester yarn, which is protected by a polymeric coating. It has been designed specifically to provide reinforcement and stabilisation for low-bearing-capacity soils, and in the construction of reinforced earth walls.



Alvagrid PP (polypropylene)
This reinforcement geogrid is manufactured using 100% virgin polypropylene. Its main applications are for soil reinforcement and stabilisation, where adverse environmental conditions require a geogrid that is stable when exposed to chemical or biological agents.

Geonets

Alvadrain M
This geonet is made up of two interwoven high-density polyethylene fibres (HDPE), with intersecting ribs 60° apart which form channels with a high water-drainage capacity, even when subject to heavy loads or on terrain with slight slopes.



Alvadrain T
This is a triaxial drainage geonet made of high-density polyethylene (HDPE), and comprises a robust inner core and two outer layers, which provide stability and significantly increase tensile and compression strength.

Applications

Alvatech®

Reservoirs

Agricultural irrigation, golf courses, in high mountain areas for artificial snow,
solar thermal power plants, hydroelectric power plants, and other industrial applications.

Mining

Waterproofing heap leach pads in leach mining (Au, Ag, Cu etc.) and non-leach mining,
to optimise extraction performance.

Disposal sites

Municipal solid waste disposal sites, farm manure heaps, industrial tanks etc.

Canals

Agricultural irrigation and inter-basin transfers.

Waterproofing for fish farms

Intensive production of shrimps, tilapia, and basa fish. It is designed for shallow ponds that are waterproofed as a prophylactic measure, to increase production.

Floating covers

To eliminate evaporation in reservoirs, and deodorise tailings ponds that give off unpleasant-smelling gases.

Environmental projects

Land decontamination, sewage sludge dehydration, industrial wastewater treatment plants, sea-port dredging, secondary waterproofing barriers for pipelines, petrol stations etc.

Underground structures

Road and railway tunnels, waterproofing building foundations to prevent damp, and to act as a radon gas barrier.

sotrafa
GLOBAL SOLUTIONS

GEOMEMBRANES
Alvatech®

(+34) 950 405 600

Paraje Cartabona, 12
Apdo. de correos 73
04710 Sta. Mª del Águila
El Ejido (Almería)

info@sotrafa.com / **www.sotrafageo.com**

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AENOR
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