agru

The Plastics Experts.

Lining Systems

GEOMEMBRANES FOR PROTECTING STRUCTURES AND THE ENVIRONMENT

The Plastics Experts.

AGRU geosynthetic liners are manufactured with only the highest-grade polyethylene resins using the calendared flat-die extrusion process. This manufacturing technique allows for coextruded liners with multiple features such as surface textures and secondary properties. The benefit of this process is liner with consistent textures, stud and spike heights, thickness, and an array of secondary features without compromising liner integrity. Geomembranes measuring 23 feet in width and between 30 mil and 120 mil in thickness are offered. The materials available include HDPE (high-density polyethylene), LLDPE (linear low-density polyethylene), VLDPE (very low-density polyethylene), and FPP (flexible polypropylene).

The AGRU success story has been unfolding for seven decades. Founded in 1948 by Alois Gruber, who set the company on the course for plastic manufacturing, AGRU has become one of the world's most important single-source suppliers for piping systems, semi-finished products, concrete protection liners, and lining systems made from engineered plastics. We use only top-grade thermoplastic polymers as our raw materials. When it comes to application-technical consulting, we are your best partner in the field.

Quality

Customer satisfaction comes first at AGRU. Technical consultations are an essential component of our customer service. The AGRU quality assurance system is compliant with multiple international and U.S. standards and AGRU's procedures help ensure that products meet these standards. AGRU's start-to-finish attention to quality ensures that the products meet the strictest technical requirements.

Universally Deployable Lining Systems

AGRU Lining Systems offer the right solution for every application through an array of products made of many different combinations of surfaces and materials while being supported by an extensive range of accessories. AGRU Lining Systems are found wherever geomembranes are used, such as in landfill and hydraulic engineering, groundwater protection, and building and tunnel sealing.

Soil and Groundwater Protection

With geomembranes for mining, hydraulic, and landfill engineering as well as liquid manure and retention basins.

AGRU Lining Systems offer solutions for every requirement:

- Available in HDPE, LLDPE, VLDPE, and FPP
- Available in different surface structures (e.g., smooth, anti-slip, and structured)
- Signal layers enable visual control of the sealing system.

Efficient Corrosion Protection in Tunnels

AGRUFLEX protects the inner concrete shell.

AGRUFLEX made of VLDPE is the optimum solution:

- For bored and cut-and-cover tunnels
- Provides protection from aggressive mountain water
- Perfectly matches the tunnel shape thanks to high flexibility.

Excellent Product Properties

Thanks to the use of the chemically resistant materials PE and PP.

AGRU Lining Systems will last decades:

- Plasticiser-free plastics guarantee long-term performance
- High tensile strength, elasticity, and flexibility
- Excellent static puncture resistance.

Economic Installation

Simple and permanent welding technologies.

Suitable for any application:

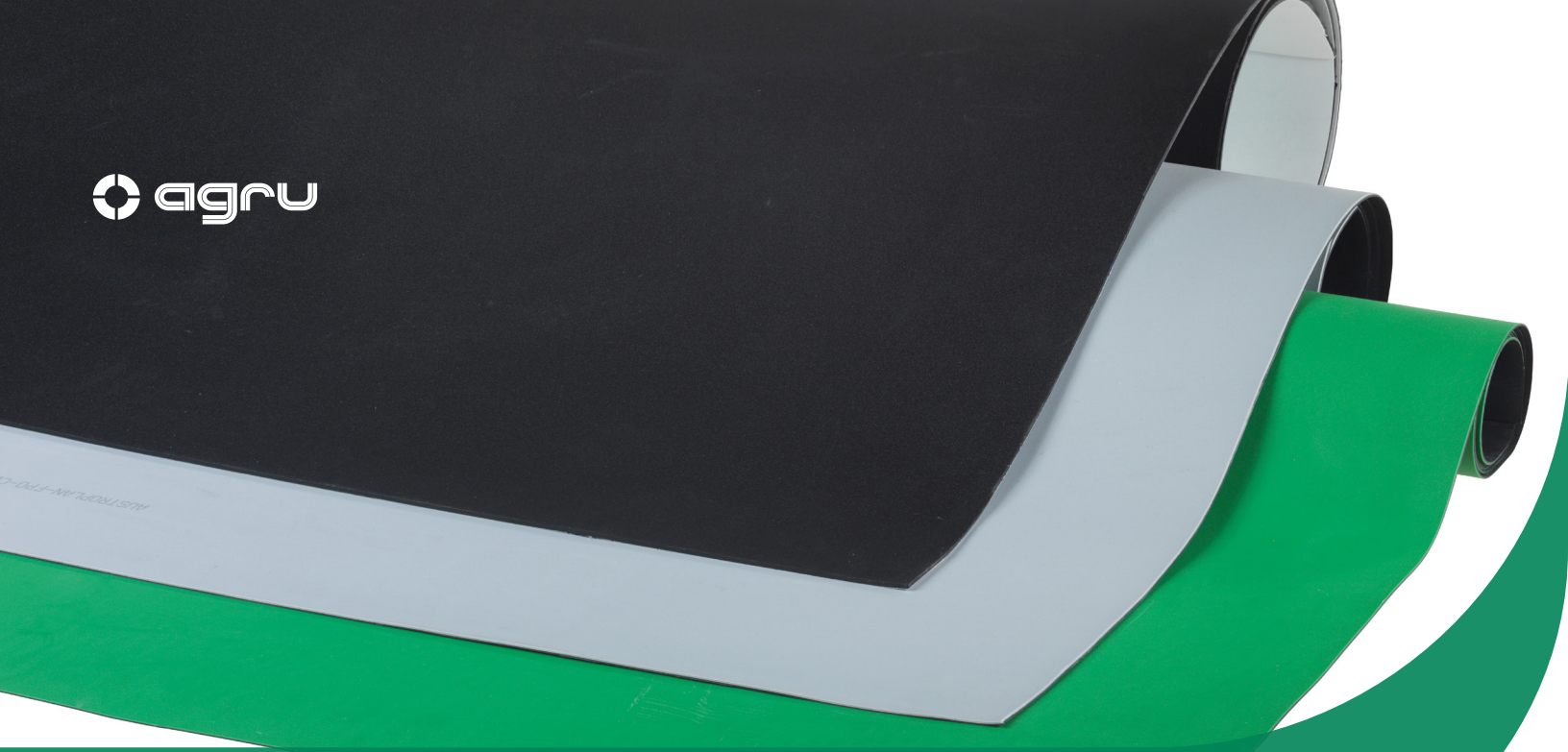
- Physiological safe welding
- Innovative installation methods (e.g., induction welding)
- The membranes are easy to install thanks to excellent elongation and flexibility.

One-Stop Shopping

Liner, water stop profiles, discs, and drainage pipes.

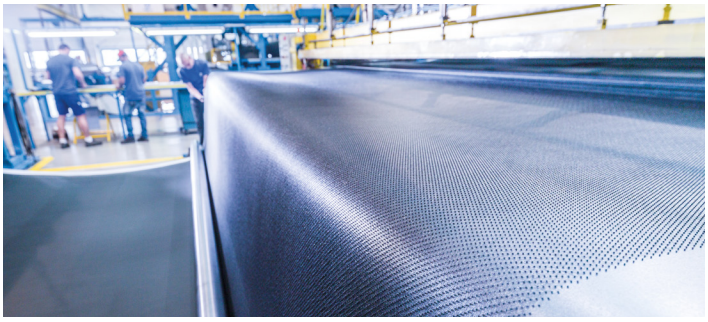
A complete system for the perfect watertight sealing:

- Welding rods, waterstop profiles, and cleaner
- Drainage systems in PE and PP for area and strip drainage
- Compatible with concrete protective liners, semi-finished products, and piping systems made by AGRU.



Excellent Product Properties Include Chemical and Mechanical Resistance

Lining material attributes are produced to meet the specific requirements of each application. AGRU application engineers are happy to advise you on finding the solution that meets your needs.

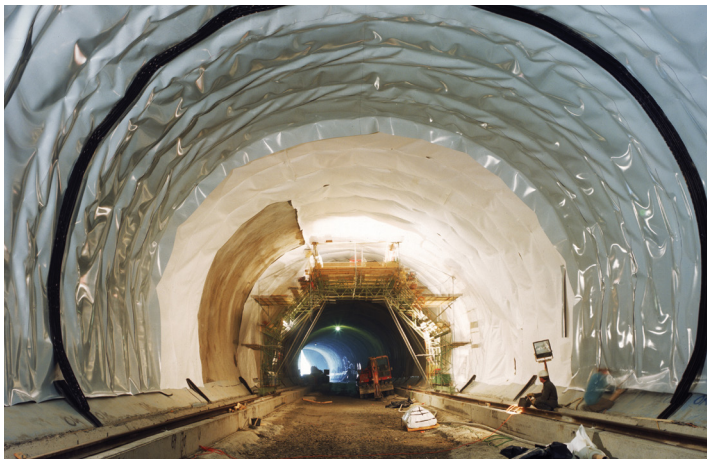


High-Density Polyethylene (HDPE)

The ongoing development of HDPE molding compounds in the recent years has improved the performance of HDPE geomembranes significantly. AGRU HDPE geomembranes meet sealing technology requirements, providing best-in-class flexibility, good strength, and good elongation behavior. Additionally, the liner offers high chemical resistance and proven long-term durability. This state-of-the-art lining material is able to meet the project requirements of a variety of applications.

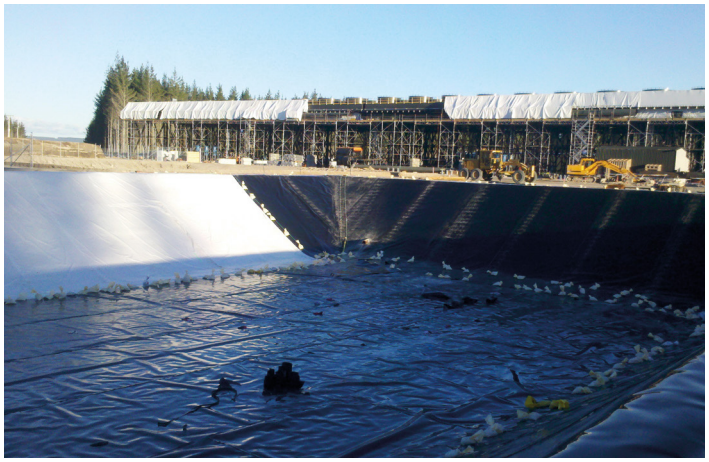
Linear-Low Density PE (LLDPE)

LLDPE has a higher proportion of comonomers than HDPE, which means a higher degree of branching in the main chain. As a result, the crystalline content and the density are lower than those of HDPE. Plastic geomembranes made of LLDPE are more flexible than HDPE membranes and have a higher elongation at break under biaxial stresses. Plastic geomembranes made of LLDPE are used in hydraulic engineering and also for applications that are sensitive to setting, such as the closure of landfill sites.



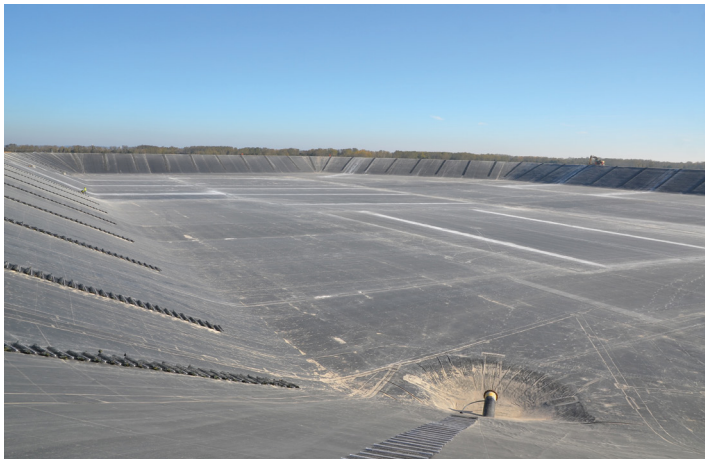
Very Low-Density PE (VLDPE)

The PE product line is complemented by the AGRUFLEX VLDPE geomembranes, which combine the advantages of a HDPE geomembrane with a high degree of flexibility. Due to its excellent chemical, physical, and biological properties, this product is suitable for many applications including tunnel and pond construction.



High-Temperature-Resistant PE (HTRPE)

The maximum continuous operating temperature of HDPE geomembranes has been limited to a temperature of 140°F (60°C) until now. At higher temperatures, thermo-oxidative degradation occurs, resulting in a relatively short service life. AGRU has many years of experience in piping for hot water and has now incorporated this knowledge into the development of the HTRPE membrane, which is able to cope with continuous operating temperatures of up to 212°F (100°C) and has excellent long-term stability.



Flexible Polypropylene (FPP)

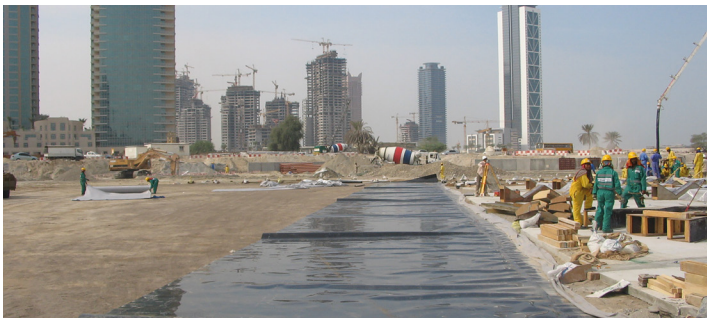
FPP is the latest polyolefin material and was only introduced at the end of the last millennium. Because FPP does not need to be manufactured with plasticizers, it is completely homogenous with very low crystallinity, high strength, and maximum flexibility. In addition, FPP has a lower coefficient of thermal expansion than PE-based materials. Thanks to these properties, AGRUFLEX FPP membranes adapt to the substrate perfectly and are therefore ideally suited to pond construction.

Soil, Groundwater, and Corrosion Protection with AGRU Lining Systems

AGRU Lining Systems are suitable for virtually any application. Chemical-, root-, rodent-, and UV-resistant, these tear-proof and extensible geomembranes are designed to last a long time.

Temperature Resistant Up to 212°F (100°C)

High-temperature–resistant geomembranes made of HTRPE by AGRU can be used at temperatures of up to 212°F (100°C) because of their special molecular structures. Areas of application include solar thermal systems, hot-water storage tanks, bioreactors, and cooling basins. These temperature resistant geomembranes can be installed and welded using the same technology as that used for conventional geomembranes made of PE.



Corrosion Protection

Waterproofing ground-contact constructions involve the protection of buildings from moisture/water. For example, the foundation slab can be protected from damp/water rising from the ground by means of a horizontal seal with AGRU geomembranes. This durable material is root- and rodent-resistant, resistant to aggressive groundwater, and suitable for use in the supply of drinking water.

Water Reservoirs

Protecting the Most Important Resource for Our Future

Water reservoirs with steep embankments are reliably and permanently sealed with plasticiser-free, textured geomembranes from AGRU. Thanks to the geomembrane's excellent UV resistance and resistance to root penetration and rodents, they possess a very long service life.

AGRU geomembranes have been used in snowmaking ponds in alpine terrain to help ensure water supply for artificial ski slopes, an essential factor in drawing people for skiing holidays.

Hydraulic Engineering with MicroSpike

AGRU MicroSpike has a high grip with more than 20,000 studs/m², which makes it the ideal solution for steep slopes when combined with protection or drainage geomembranes. A stud-free welding area makes it easier to install.

Landfill Engineering
Effective Groundwater Protection

Landfill lining systems are chosen depending on the materials expected to be stored on site. In some cases, a second layer of HDPE or LLDPE geomembranes is installed alongside other geosynthetics. In every case, however, the geomembrane is always the primary lining element at a landfill to prevent rainwater penetration when the surface of the cell is being lined, and to prevent groundwater from being contaminated via the landfill cell's base liner.

Landfill Capping

A landfill body consists of highly contaminated waste that should be prevented from leaching into groundwater and the surrounding environment. To keep rainwater from permeating into the landfill body, the site must be covered promptly after the landfill cell has been closed. Closure can only be postponed where further settling is expected as a result of insufficient compaction. Depending on the degree of contamination of the deposited materials, geosynthetic composite systems are used for the surface closure.

Landfill Base Liner

Pollutants must be prevented from leaching out of the landfill cell in order to protect the surrounding soil and groundwater from contamination. Geosynthetic composite systems are also used at the base of the cell, which significantly reduces the work involved and costs compared with traditional systems.

Drainage Pipes

Drainage of a landfill body requires the use of piping material that meets special resistance requirements during the construction phase, because the drainage pipes are in continuous contact with the aggressive dissolved media. Once the landfill cell has been closed, no water is expected to flow in; the drainage therefore acts as control drainage and the pipes are exposed to concentrated amounts of landfill leaching.

HDPE Pipes

The landfill leachate has to be transported from the outlet structures to the treatment units in order to be treated. AGRU HDPE pipes of the highest quality are used here to prevent contamination of the environment.

Pipe Penetration

The combination of AGRU pipes, fittings, and sheets with our HDPE and LLDPE geomembranes ensures that they all can be welded to the landfill body permanently with stable, leak-proof joints. As a one-stop system supplier, AGRU is able match the various components optimally in terms of welding capability.

ClosureTurf®

ClosureTurf, a Watershed Geo patented product, is a final cover system comprising AGRU's Super Gripnet® or MicroSpike® geomembrane overlain by an engineered synthetic turf and specified infill material. It is a proven "hybrid" composite closure system that outperforms earlier closure methodologies and is the only system that provides a predictable level of performance when subjected to severe weather conditions that occur in a post-closure timeframe. Based on several years of real-world experience on over 900 acres of installation, and extensive university and ASTM lab evaluations, the ClosureTurf system has shown to have a leakage rate over 40 times less than Subtitle D prescriptive and an erosion loss of over 100 times less than subtitle D prescriptive cover.

ClosureTurf®
A Watershed Geo Patented Product

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AGRUFLEX Tunnel Liners

Efficient Corrosion Protection for Tunnel Constructions

Tunnels are intended to be used for a very long time. For this reason, the sealing system requirements set by authorities are very strict. AGRUFLEX tunnel liners are made of highly flexible VLDPE with thicknesses ranging from 47 mil (1.2 mm) to 165 mil (4.2 mm) and widths between 6 ft. (2 m) and 16 ft. (5 m) and can also be laminated with nonwoven textiles if required. This tunnel liner possesses excellent flexibility, high chemical resistance, and is suitable for drinking water applications. With its light-reflecting properties, the white signal layer not only enhances safety in a tunnel, but also offers an easy visual inspection to identify and remedy damage.

New Austrian Tunnel Method

With the boring approach, the rock is secured with rock bolts, steel arches, or other construction elements after excavation. These are then covered with shotcrete and the tunnel shape is created. The seal carrier, which is a "finely graded" shotcrete, forms the surface for the interior construction work. To protect the liner and for drainage purposes, nonwoven textiles are often installed between the shotcrete and the liner.

Cut-and-Cover Approach

With the cut-and-cover method, either a HDPE geomembrane or the flexible VLDPE tunnel membrane is used, depending on the project requirements. In most cases, the liner can simply be spread over the tunnel without being attached, but in certain cases, it is fixed to the outer wall of the tunnel. Fastening by means of water stop profiles is a cheap and technically sophisticated option in such cases.

Standard Installation

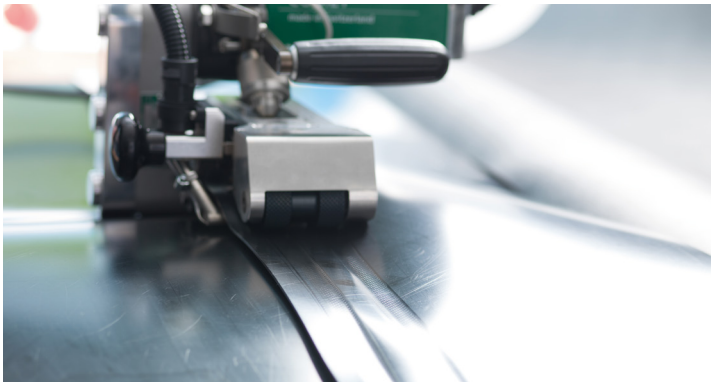
The protection and drainage nonwoven textile is fastened to the wall of the tunnel using mounting discs anchored to the seal carrier in a specified pattern. Following this, the liner is attached to the mounting discs using the penetration-free hot-air welding method. The VLDPE tunnel membranes are joined using hot-wedge welding. The white signal layer reliably indicates any damage that occurs during the installation. The tunnel can be segmented by partitioning off the block joints using the AGRU water stop profile.

Installation Using EASYFIX

AGRUFLEX EASYFIX tunnel membranes are manufactured with a protective nonwoven textile layer. This protects the tunnel membrane against point loads and damage, enabling easy installation using hook-and-loop discs.

Installation Using Induktofix

The AGRU Induktofix system was developed so that thermoplastic linings could be fastened to concrete structures using electromagnetic induction without the need to penetrate the lining system. In a tunnel, this enables wider membranes to be installed, which in turn offers speed benefits and increased system safety during installation by reducing the number of welds required.



Welding

The membranes are normally welded using hot-wedge welding. In case of penetration, defects that have to be repaired or difficult geometrics, extrusion welding is also possible. Subsequent pressure testing of the hot-wedge welds using a test channel is carried out in accordance with the national requirements or the sealing solution.

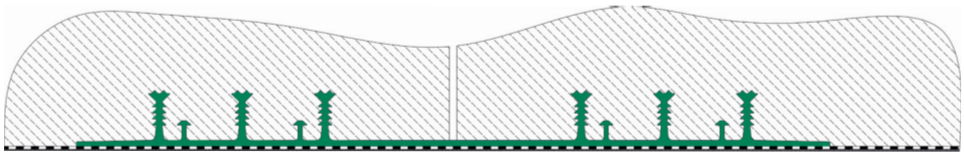
Water Stop Profiles

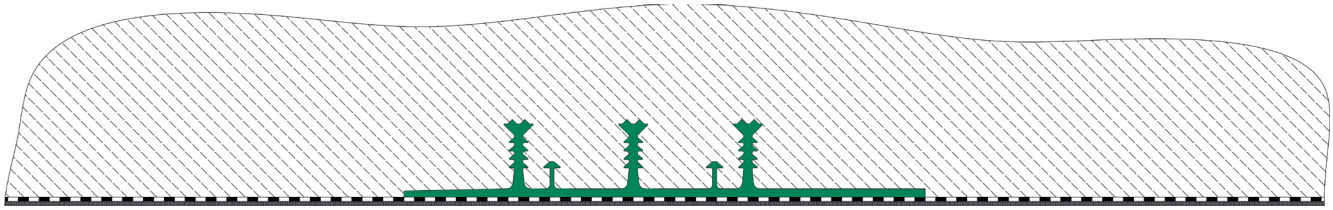
Tunnel Construction and Concrete Structure Connection Accessories.

To supplement its geomembranes, AGRU also offers external water stop profiles. These are made of specially selected, highly flexible VLDPE materials. The arrangement of the anchor studs allows them to be anchored optimally in concrete. The main application for water stop profiles is sealing construction joints and block joints in concrete structures.

Advantages of AGRU Water Stop Profiles

- Contain no plasticizers or halogens
- Integrated support for injection hoses
- Excellent flexibility
- Multiple configurations





Product Range

(mm)

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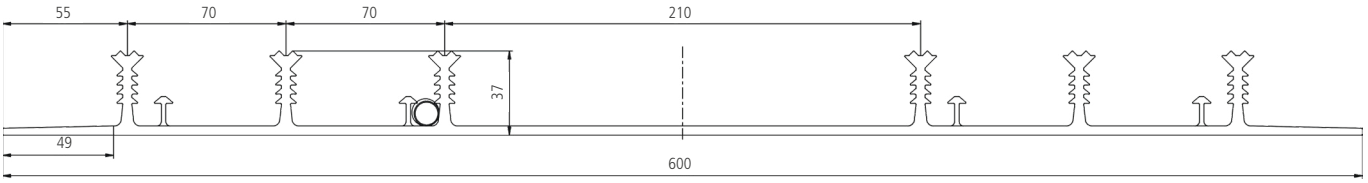
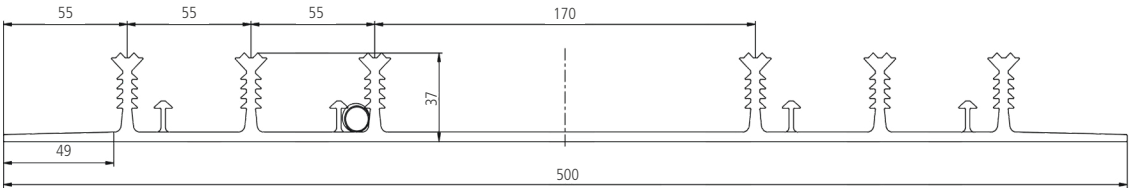


SAA 500/6



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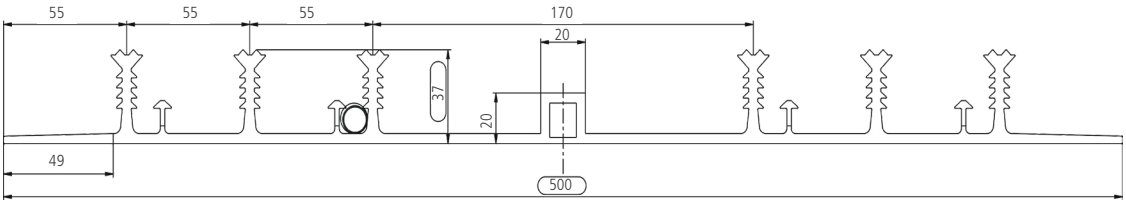
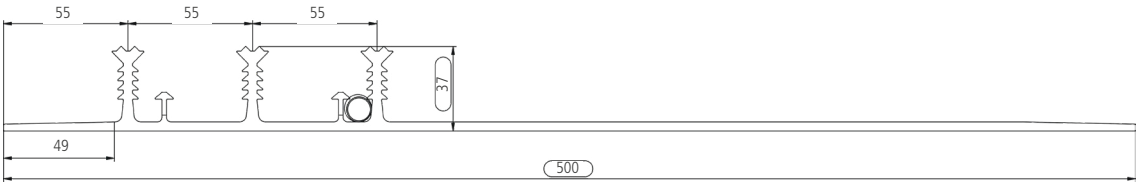
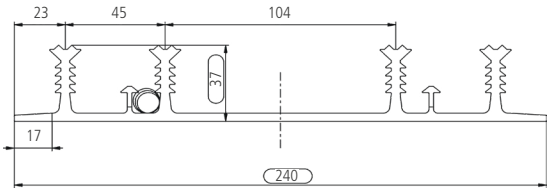


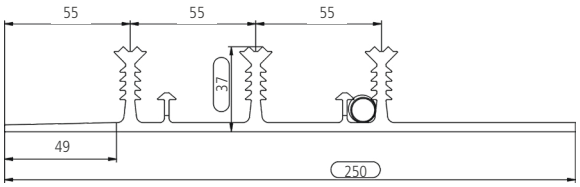
SAA 500/3



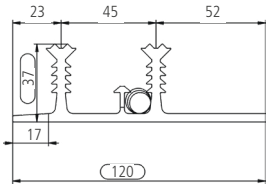
SAA 240/4

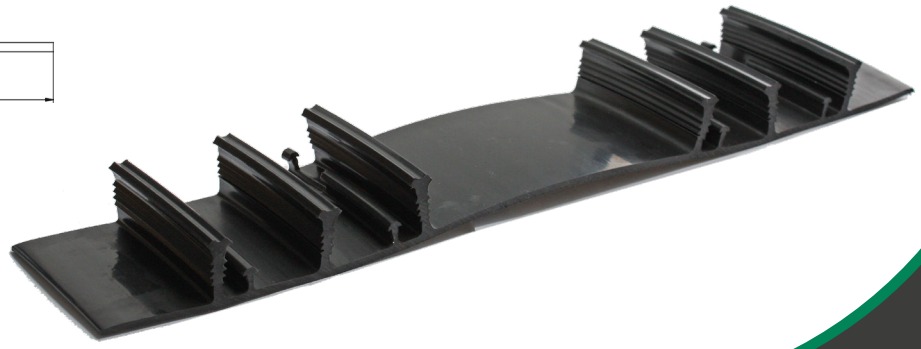


SAA 250/3



SAA 120/2



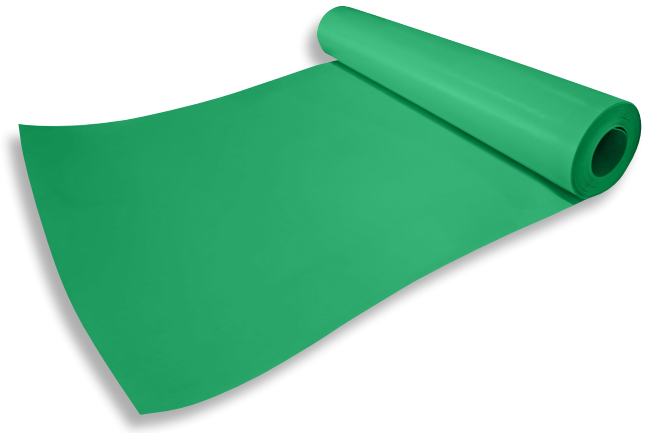


AGRUFLEX Pond Liners

AGRUFLEX pond liners made of FPP an VLDPE meet the highest ecological sustainability standards. This applies to their production, installation, and throughout their service life.

As a one-stop system supplier, AGRU offers accessories for every challenge. Thanks to AGRU's wide product portfolio, we are able to provide membrane widths of up to 16 ft. (5 m), but we can also make your own private dream of a swimming pond in your back garden at home come true just as easily.

All our geomembranes are free of diffusing plasticizers and therefore allow you to enjoy a swim without any worries.



Product Range

A liner thickness of 0.059 in (1.5 mm) is recommended for pond liners. We offer the following products:

VLDPE

- Roll size: 16.4 ft (5 m) x 328 ft (100 m) - color: black
- Roll size: 6.6 ft (2 m) x 82 ft (25 m) - color: turquoise

(Turquoise signal layer on black base membrane)

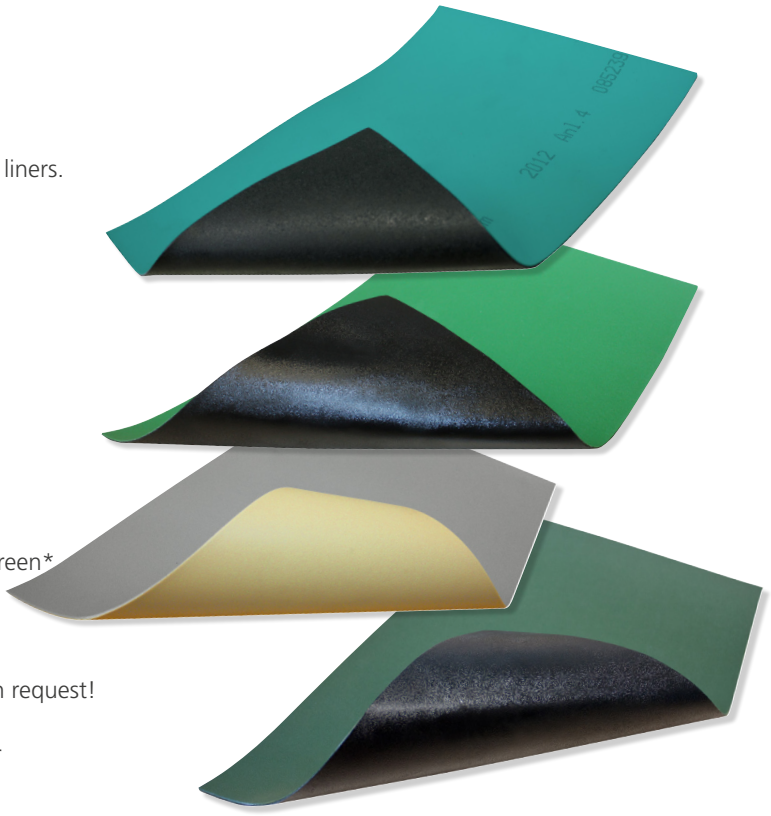
FPP

- Roll size: 16.4 ft (5 m) x 328 ft (100 m) - color: black
- Roll size: 6.6 ft (2 m) x 82 ft (25 m) - color: emerald green*
- Roll size: 6.6 ft (2 m) x 82 ft (25 m) - color: chromium oxide green*
- Roll size: 6.6 ft (2 m) x 82 ft (25 m) - color: grey/beige*

(Grey/beige only available in 0.047 in (1.2mm))

Other thicknesses, widths, roll lengths and colors are available on request!

* Signal layer on black base membrane with glass-fiber fabric for optimal dimensional stability.



Welding

Installation is essential for permanently leakproof swimming ponds. The following methods are used for welding:

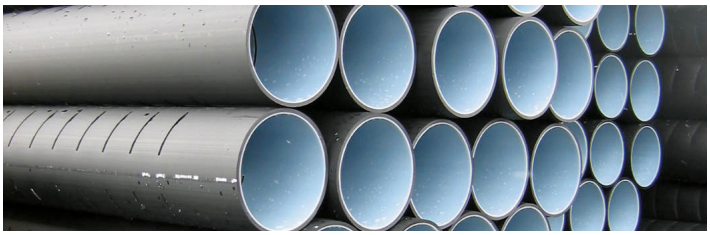
- Hot-wedge welding
- Hot-air welding
- Extrusion welding

Accessories

- Colaminated steel sheets
- Welding rod
- Drainage pipes
- Homogeneous membranes with a non-slip surface and a width of 6.6 ft (2 m) available in FPP and VLDPE.

Geomembranes and Accessories From a Single Source

Whether you need welding accessories, drainage pipes, water stop profiles, or interlocking profiles, AGRU provides all the components you need to install permanently leak-proof AGRU Lining Systems quickly.



Drainage Pipes

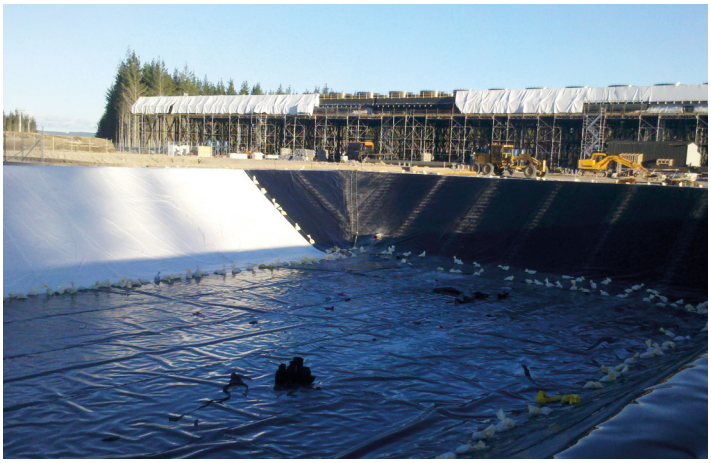
Drainage is especially essential in tunnel and landfill cell construction. Our piping system consists of not only full pipes, but also perforated or slotted pipes made of PE or PP. Dimensioning is project-specific. You can choose bright, inspection-friendly interior surface if you wish. For reproducible welding results, AGRULINE E-fittings round off the range of products here.

AGRULOCK

This vertical sealing system is ideal for the separation of contaminated groundwater. AGRULOCK is also the product of choice for construction sites where the groundwater level must be kept at a certain level. The water-impermeable barrier is easy to install. The profiles can be welded to the geomembrane using conventional welding machines.

Electrically Conductive Geomembranes

Coextrusion techniques can be used to produce HDPE, LLDPE, and VLDPE geomembranes with electrically conductive signal layers. On one hand, this can help prevent static charging so that the membranes can be used in explosion-protected areas. On the other hand, these membranes are used as part of leakage detection systems.



High-Temperature Resistant Geomembranes

Due to its improved durability at elevated temperatures, the HTRPE geomembrane has created new possibilities for industry and other applications where processes are carried out at higher temperatures:

- Energy production from renewable sources (solar thermal, biomass and geothermal energy)
- Hot-water tanks
- Bioreactors
- Leaching ponds
- Oil and gas industry
- Industrial water and waste water

Studded Drain Liner

In the case of double seals or controlled drainage, a three-layer system consisting of two smooth geomembranes and a drainage product is typically used. The use of AGRU studded Drain Liner makes it possible to reduce the system to two components, which saves material and installation costs. In addition, the system remains stable at high loads.

Lining Systems References

Airport Seal

Germany's Berlin Brandenburg Airport, commonly known as Willy Brandt Airport, was the largest airport construction site in Europe. AGRU Lining Systems were used here for various purposes.

HDPE geomembranes act as a seal for central ground filters that collect rain water from flight operation areas with contamination from surface de-icing.

Local ground filters are also being made from HDPE geomembranes to go next to the runways and taxiways. These are being used to treat rainwater with impurities from flight operations and surface de-icing before it is transferred to the central ground filters.

Landfill Base Liner

AGRU supplied the landfill base seal for a community landfill. More than 540,000 ft² (50,000 m²) of 78 mil (2 mm) HDPE geomembranes, both smooth and textured, were installed here.

Landfill Capping

HDPE geomembranes with a thickness of 98 mil (2.5 mm) and BAM (Germany's Federal Institute for Materials Research and Testing) approval were used to seal the surface of this landfill.

The Plastics Experts.

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Illustrations are generic and for reference only.

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