General - Materials

AGRU HDPE Liners are manufactured since 20 years in a high-precision calendering extrusion process in compliance with the highest quality standards.

In addition to the renowned AGRU HDPE Liners other polyolefin Liner types are produced to have a liner types for manifold application areas

LLDPE - Linear Low Density Polyethylen
VLDPE - very low density Polyethylen
PP-FLEX- flexible Polypropylen
FPO - Flexible Polyolefin
TPO - Thermoplastic Polyolefin

Depending on the application area the adequate material can be choosen.
For special applications like sealing of flat roofs thermoplastic alloys FPO/TPO are used, which are adjusted to the requirements for this application.
Those liners can additonally be reinforced with a glass fibre fabric, scrim reinforcement or both.
AGRU offers additonal to polyolefin geomembranes a complete supply range for flat roofs, wich is distributed under the brand name AUSTROPLAN. Separate Product catalagous are available and the AUSTROPLAN supply range is included to the product group building engineering.

Process Engineering

Each raw material, which is selected in accordance to the rigorous AGRU Delivery standards, is subject of the quality assurance from the delivery to the finished product.
The quality assurance starts with a sample of raw material taken directly from the silo truck, the release for stocking in the silos, the complete recording of the batch/lot which are manufactered and the product tests and the final control of the Liner roll before shipping.

Manufacturing

For processing the raw material is plastified and homogenized by means of temperature and pressure buildup in the single-screw extruder. The forming of the melt is performed by a heated flat die, which is equipped with costly distribution and centering systems. The pressed out extruded material is flattened by a secondary three-roll calendar. Afterwards, the take-off unit, the edge trimming unit, the marking facility and the coiling device are placed.

The thickness of the liner is permanently in line controlled during the production process over the entired production width.

The flat die calendering technology enables to manufacture liners with a homogenous structure. Those structured liners at slopes of different layers construction as **AGRU MICRO-SPIKE MST/MSB** ensure a safe design with excellent interface friction properties

Reports and Research studies in close cooperation with well known geotechnical institutes to determine the stability of different combinations are available. Shearing Diagrams are available of various combiantions to predetermine the optimum liner structure combination.
Our technical department can assist to choose the best surface combination for precise applications.

Also **coextruded** liners are available,e.g. for minimizing heating up by sun radiation and for visual leakage control (white) or for optical reasons (green).

HDPE Liners
Material characteristics of HDPE

Due to a permanent enhancement of PE moulding materials in the last years the efficiency of HDPE liners was improved substantially.
This circumstance was acommodated with test standards like the FNCT test according to EN14 576 or NCTL test according ASTM D 5397, the test methods which describe the resistance against environmental affected stress cracking.

Nowadays therefore critisism on the stress cracking of HDPE liners is not vindicable because only highest quality raw material types, which are designated for gomembrane manufacturing developed together with well known raw material suppliers, are in use.
Also evaluations on installed systems showed absolutely perfect behaviour and performance of HDPE geomembranes after 20 years of use.

The properties which are neccessary for lining technology like good flexibility, high strength and elongation properties in combination of high chemical resistance and verified long life expectations are standard at AGRU.

Lasting Containment

Concerning the life expectasions of HDPE Liners many expert opinions, expertises and technical surveys have been published.
The tests for thermal oxidizing stability are performed by oven aging at an increased temperature. According to the known ratios (Arrhenius´ Law) it is possible to estimate sevice life for the PEHD-types used in landfill construction.
Based on temperature evaluations typically measured above the base liner of exisiting municipal waste disposals in between 20° C and 30° C for which an extrapolated calculation for 25°C service life of 300-400 years can be expected even if the leachate is saturated with oxygen.
(out of OFI (Austrian Research Institute) expert opinion for the use of AGRU-PEHD liners landfill and hydraulic engineering
expert opinion N° 47.814 / 2003)

Advantages of HDPE Liners

Compared to other thermoplastic materials HDPE shows a high resistance against diffusion.
Therefore beside the use of geomembranes for ground water protection, aquacultural and civil engineering as piping systems for the secure transportatin of gases out of HDPE are in use.

By adding of 2-3% fine dispersed carbon to the natural PE-raw material liners are UV- and weathering resistant.
After 15 years outdoor exposure AGRU HDPE liners show no change of the mechanical properties compared with reference specimens.

Typically HDPE liners show following advantages:

- high chemical resistance
- high strength and elongation at break
- high puncture resistance
- flexible at low temperatures
- high compression strength
- Resistant to UV- and Weathering
- Resistant against roots and rodents
- good weldability
- physiolical harmless

HDPE is superior compared to PVC for :

- 25% lower density
- free of plasticizers
- halogen free
- free of heavy metals
- generally better chemical resistance
- varios applications in the food industry and storage of potable water
- no dangerous HCL gases at burning or welding
- HDPE keeps its mechanical properties (no volatile additives)

Field of Applications

HDPE Liners are commonly used for:

- Sealing of base and capping at municipal, industrial and hazardous waste disposals
- Sealing at groundwater endangering media
- Detention Basins for industrial and municipal waste water and mire
- Ground water protection at railways and roads
- Storage basins for oil, industrial and sewage sludge
- Spill containment for chemical and petrochemical industries
- Sealing of heap leach pads at mining applications
- Storage of agricultural slurries
- Lining of canals and rivers
- Erosion protection
- AGRULOCK sealing of vertical cut-off walls
- Water reservoirs
- Balancing lakes
- Sealing of aquacultural basins
- Flood or rain water detention basins

Simple Installation

The proper installation and welding of the AGRU HDPE Liners are of paramount importance since integrity and long term performance are dependent upon it.
Typically seaming the liners is carried out by hot wedge welding that provides a double welded seam with a test channel.
The installation of AGRU HDPE Liners is performed by qualified and authorized installers.

Quality Assured

Applying a strict Quality Managment program summerized by internal quality control, ISO 9001:2000 certification, frequent external quality inspections by state authorized testing institutes such as MPA, SKZ, ÖFI etc. and approval quality marks by BAM, DIBt, OENORM, KIWA, Asqual... ensures continuous high quality of AGRU products.
Tracing and control from the incoming raw materials to the finished liners allow work certificates to be issued linked to the used raw material batch (acc. to EN 10204/DIN 50049).

AGRU HDPE Supply Range

The various approvals for AGRU HDPE liners and differences on the requirements for national regulations a modification for our supply range has been introduced for quick and easy finding of the proper type of liners and reuqired approval for our customers.The new supply range for HDPE is split in three main groups for harmization of our stock data
Project specific tender documents needs to be agreed by special order with project data sheets issued by our technical department.

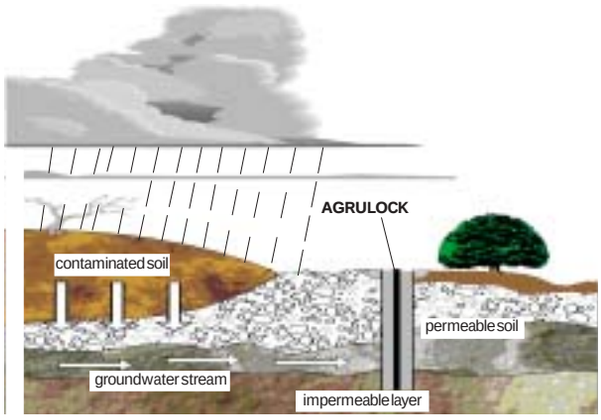
Liner with Aluminium Barrier

The AGRU CHC/CFC barrier-liner is manufactured in the same extrusion process as HDPE liners in 1,35m width. A special PE-coated 0,15mm thin aluminium liner is laminated in between two HDPE liner layers wich provides a diffusion barrier for CHC/CFC and FCHC.

AGRULOCK Vertical Sealing System

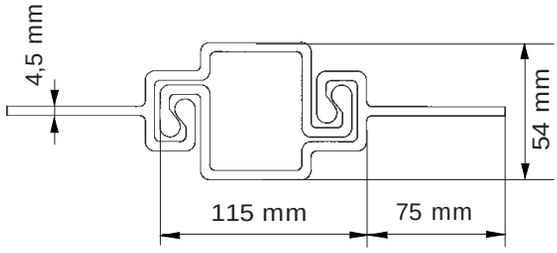
Sealing of cut off walls by bentonite only gives certain permeation reduction but no permeation stop. Using AGRU LOCK systems a laminar permeation stop is achieved and percolation only is possible at panel joints for which the AGRU LOCK design has elongated percolation path.
AGRU LOCK Systems are installed where contaminated groundwater streams needs to be stopped or treated by "gate & fence" systems but also for encapsulation of construction sites for lowering groundwater table.

Function



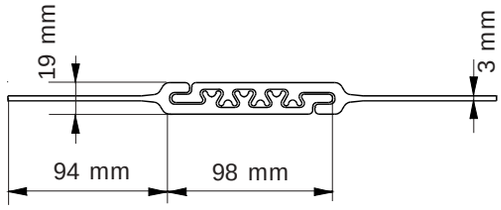
Special Features of Type A Code 590.5

- ❑ outstanding high horizontal elongation of the interlock
- ❑ robust design
- ❑ easy downfeed into each other
- ❑ possibility of filling the hollow with a special sealing compound
- ❑ identical male and female profile
- ❑ horizontal separation load:
  > 25 kN/m run of interlock



Special Features of Type B Code 591.5

- ❑ horizontal separation load:
  > 45 kN/m run of interlock
- ❑ flat design
- ❑ easy downfeed into each other
- ❑ identical male and female profile
- ❑ delivered as straight strips or on rolls



Special Features of Type B.Q Code 591.Q

- ❑ the insertion of a Hydrotite expansion seal makes the interlock watertight
- ❑ horizontal separation load:
  > 37 kN/m run of interlock
- ❑ flat design
- ❑ easy downfeed into each other
- ❑ identical male and female profile
- ❑ delivered as straight strips or on rolls