GREEN INSULATION
PRIVATE LIMITED

TECHNICAL PRODUCT BROCHURE

GEOMEMBRANE LINING SYSTEMS

HDPE | LLDPE | PVC

Engineered low-permeability barrier systems for water containment, environmental protection, mining, waste management and civil infrastructure.

HDPE
Chemical and UV resistance

LLDPE
Flexibility and settlement tolerance

PVC
Conformability and factory panelization

PRODUCT FAMILY OVERVIEW

Selecting the Right Geomembrane

Geomembranes are synthetic, very-low-permeability barrier sheets used to control liquid or gas migration. Polymer selection must be matched to chemical exposure, temperature, deformation, slope stability, installation method and design life.

1 HDPE

Stiffest of the three; strongest general chemical and UV resistance; normally field welded.

2 LLDPE

High elongation and flexibility; suited to differential settlement and irregular subgrades.

3 PVC

Very flexible and factory-fabricable; commonly selected for buried or backfilled water-retaining systems.

Performance and design profile

Criterion	HDPE	LLDPE	PVC
Chemical resistance	Excellent	Very good	Good - verify media
UV / exposed service	Excellent	Good to very good	Formulation specific
Flexibility	Moderate	Excellent	Excellent
Settlement tolerance	Moderate	Excellent	Very good
Factory panelization	No - field welding	Limited / supplier specific	Excellent

Typical thickness framework

- HDPE: GRI-GM13 scope commonly covers 0.50-3.00 mm.
- LLDPE: GRI-GM17 scope commonly covers 0.50-3.00 mm.
- PVC: ASTM D7176 covers 0.25-1.50 mm unreinforced sheet for buried applications.
- Final thickness is a design decision, not a catalogue default.

Selection principle

The correct membrane is the one that meets the project-specific chemical compatibility, strain demand, interface shear, puncture protection, exposure and service-life requirements. Final values must be confirmed in the approved product TDS and project submittal.

MATERIAL PROFILE

HDPE Geomembrane

High-density polyethylene geomembrane is a stiff, durable polyolefin barrier selected where broad chemical resistance, UV stability and long-term containment performance are primary design requirements.

Key characteristics

- Smooth, single-textured or double-textured surfaces
- High chemical and UV resistance
- High stiffness and good puncture resistance
- Best suited to field welding and large installations
- White/black conductive or specialty surfaces may be available

Engineering considerations

- Thermal expansion can produce wrinkles; deployment sequencing matters.
- Not generally factory-fabricated into large panels; thermal field welding is standard.
- Textured sheet may be required on slopes to achieve interface shear capacity.
- Chemical compatibility must be confirmed for concentrated or unusual media.

Typical applications

- Municipal and hazardous waste landfill liners and caps
- Mining heap-leach pads, tailings and process-water ponds
- Wastewater lagoons and industrial effluent containment
- Secondary containment and chemical storage areas
- Reservoirs, canals and exposed water-management works

Specification and testing

- Reference specification: GRI-GM13 or approved equivalent.
- Thickness: ASTM D5994/D5994M for smooth and textured geomembranes; ASTM D5199 remains applicable to other geosynthetics.
- Tensile: ASTM D6693/D6693M; puncture: ASTM D4833/D4833M.
- Stress-crack resistance: ASTM D5397; seam peel/shear: ASTM D6392.
- Final acceptance values shall follow the approved TDS, COA and project specification.

MATERIAL PROFILE

LLDPE Geomembrane

Linear low-density polyethylene geomembrane combines strong chemical resistance with high elongation and flexibility. It is selected where differential settlement, cyclic movement or irregular subgrade geometry requires greater strain accommodation than HDPE.

Key characteristics

- Formulated sheet density of 0.939 g/cm3 or lower under GRI-GM17.
- Smooth and textured grades; typical specification scope 0.50-3.00 mm.
- High elongation and excellent conformability.
- Better accommodation of differential settlement and complex geometry.
- Thermally weldable using approved wedge and extrusion equipment.

Best-fit applications

Ponds, flexible cover systems, landfill caps, secondary containment, canals, reservoirs and projects where subgrade movement or local deformation is expected.

Engineering considerations

- Lower stiffness than HDPE can improve conformance but may increase sensitivity to handling and local indentation.
- Puncture protection and support geotextile design must be project specific.
- Chemical compatibility shall be reviewed for the actual fluid concentration and temperature.
- UV endurance depends on formulation and exposure conditions; do not assume equivalence between products.
- Interface shear testing may be required on slopes or composite liner systems.

Specification and testing

- Reference specification: GRI-GM17 or approved equivalent.
- Common MQC tests include thickness, density, tensile, tear, puncture, carbon black and oxidative-induction-time properties.
- Textured sheet evaluation includes core thickness and asperity-height control.
- Field seams are qualified by trial seams and tested using non-destructive and destructive methods.
- Final numerical values must come from the approved product data sheet and manufacturer quality records.

MATERIAL PROFILE

PVC Geomembrane

Flexible polyvinyl chloride geomembrane is produced from PVC resin compounded with plasticizers, stabilizers and performance additives. It offers excellent conformability, factory panelization and detailing around complex geometry.

Key characteristics

- Very high flexibility and low-temperature conformability.
- Can be factory fabricated into large panels to reduce field seams.
- Available in unreinforced and reinforced constructions.
- Thermal wedge, hot-air, RF or approved chemical-fusion methods may be used depending on product.
- Standard long-term PVC applications are commonly buried or backfilled unless the formulation is specifically rated for exposure.

Typical applications

Irrigation canals, reservoirs, agricultural ponds, decorative ponds, wastewater containment, landfill caps and buried civil-water systems.

Specification framework

- ASTM D7176-22 covers unreinforced PVC geomembranes from 0.25 to 1.50 mm for buried applications.
- FGI 1126 (2025) provides an industry material specification for new PVC geomembranes.
- Products for exposed service, hydrocarbons or special chemicals require a dedicated formulation and written compatibility approval.
- Potable-water use requires product-specific certification, such as NSF/ANSI/CAN 61 where specified.

Design and handling notes

- Factory-fabricated panels can materially reduce field seam length and installation time.
- PVC should not be exposed beyond the approved product rating.
- Compatibility with oils, fuels, solvents and concentrated chemicals must be checked.
- Subgrade smoothness and protection layers remain critical despite high flexibility.
- Seam method, panel size and anchorage shall follow the manufacturer installation manual.

ENGINEERING SELECTION

Application Matrix and Material Choice

Polymer selection is only one element of liner design. The complete system must address subgrade condition, puncture protection, drainage, gas management, anchorages, slopes, seams, cover materials and quality assurance.

1 Water storage
reservoirs, ponds, canals

2 Wastewater
lagoons and treatment cells

3 Mining
heap leach, tailings, process water

4 Waste containment
landfill base liners and caps

5 Industry
secondary and chemical containment

6 Civil works
tunnels, channels and buried barriers

Comparative selection guide

Design criterion	HDPE	LLDPE	PVC
Aggressive chemistry	Preferred starting point	Verify formulation	Project-specific check
Long-term exposed use	Strong candidate	Formulation specific	Only if exposed-rated
Settlement / irregular subgrade	Moderate	Excellent	Excellent
Steep slope interface	Textured grade often used	Textured grade may be used	Interface testing required
Factory-fabricated panels	Generally no	Supplier specific	Strong advantage
Typical long-term position	Exposed or covered	Exposed or covered per TDS	Usually buried / backfilled

Final selection must be project specific.

Chemical immersion data, interface shear results, puncture assessment, service temperature, exposure, design life and installation constraints must be reviewed before approval.

ENGINEERING PRACTICE

Installation, Seaming and Quality Assurance

Reliable performance depends on material quality and disciplined installation. The sequence below is a general framework; the approved method statement and project CQA plan govern the work.

01 — Subgrade acceptance

Smooth, stable, compacted and free of sharp objects, debris and standing water.

02 — Protection layer

Install geotextile or prepared bedding where required by puncture design.

03 — Panel deployment

Use the approved panel layout; minimize wrinkles, drag and unnecessary traffic.

04 — Anchorage and details

Form anchor trenches, penetrations and terminations to approved drawings.

05 — Trial and field seams

Set welding parameters using trial seams before production seaming.

06 — Non-destructive testing

Air-channel, vacuum-box or other approved continuity tests.

07 — Destructive testing

Peel and shear testing at the specified frequency; repair and retest defects.

08 — Protection and records

Place cover carefully; issue seam logs, repair maps and as-built documentation.

Common seam quality references

ASTM D4437/D4437M - non-destructive seam integrity; ASTM D5820 - pressurized air-channel evaluation; ASTM D5641/D5641M - vacuum-chamber evaluation; ASTM D6392 - destructive peel and shear testing of nonreinforced thermofusion seams.

TECHNICAL REFERENCE & PROJECT SUBMITTALS

The following documents form a practical reference framework for specification, manufacturing quality control and installation quality assurance. Always use the current controlled edition required by the project.

Material specifications

- GRI-GM13 - HDPE smooth and textured geomembranes.
- GRI-GM17 - LLDPE smooth and textured geomembranes.
- ASTM D7176-22 - unreinforced PVC geomembranes for buried applications.
- FGI 1126 (2025) - material specification for new PVC geomembranes.
- NSF/ANSI/CAN 61-2024 - health-effects evaluation for products in contact with drinking water, where required.

Selected test standards

- ASTM D5994/D5994M-26 - geomembrane thickness.
- ASTM D6693/D6693M-25 - tensile properties of nonreinforced polyethylene, flexible polypropylene and PVC geomembranes.
- ASTM D4833/D4833M - index puncture resistance.
- ASTM D5397 - stress-crack resistance of polyolefin geomembranes.
- ASTM D6392-25 - peel and shear integrity of thermofusion seams.
- ASTM D4437/D4437M-16(2023), D5820-95(2023) and D5641/D5641M-25 - non-destructive seam evaluation.

Recommended project submittal package

- Approved product TDS and SDS
- Manufacturer certificate of analysis / roll certificates
- Resin and formulation declaration where specified
- Roll identification and traceability schedule
- Panel layout and shop drawings
- Installation method statement and welding procedures
- Installer qualifications and equipment calibration records
- CQA plan, inspection forms, seam logs and repair maps
- Product and installation warranties where contractually required

Technical disclaimer

This brochure describes material families and common engineering practice. It does not replace a project design, an approved product technical data sheet, a chemical compatibility review or site-specific construction quality assurance requirements. Numerical acceptance values shall be taken only from the approved product submittal and current controlled standards.