Weldable laminated GCL

GCL-W S37U-075 and S37U-100 | 0.75 mm and 1.00 mm LLDPE

A needle-punched sodium bentonite powder GCL bonded to smooth black LLDPE specified to GRI-GM17. Factory weld margins support hot-wedge or extrusion welding, with EdgeProtect™ removable strips protecting the weld faces from bentonite dust.

Values are specified minimum and maximum supply requirements. Production acceptance uses roll and lot test records. The GM17 schedule applies to the smooth black LLDPE membrane component. GCL-core, lamination and installed-seam properties are declared separately.

GCL construction and properties

Property	Test method or basis	Unit	Requirement
Bentonite	Source and formulation declaration	-	Sodium bentonite
Bentonite polymer dosing	Formulation declaration	-	None
Dry bentonite mass at 0% moisture	ASTM D5993 plus records	g/m²	≥3,700
Cover nonwoven polypropylene	ASTM D5261	g/m²	≥200
Carrier woven polypropylene	ASTM D5261	g/m²	≥100
Additional carrier nonwoven	Construction declaration	-	Not included
Swell in reagent water	ASTM D5890	mL/2 g	≥24
Fluid loss	ASTM D5891	mL	≤18
Moisture content	ASTM D5993	%	≤13
GCL tensile strength MD / CMD	ASTM D6768	kN/m	≥10 / ≥10
Internal GCL peel	ASTM D6496	N/m	≥360
GCL static puncture CBR	EN ISO 12236	N	≥1,600
Hydrated peak internal shear at 10 kPa normal stress	ASTM D6243	kPa	≥30
PE to cover peel in bonded field	Agreed PE/nonwoven procedure	N/m	≥300
Core freshwater hydraulic conductivity	ASTM D5084 GCL setup	m/s	$\leq 5 \times 10^{-11}$
Core freshwater index flux q10	ASTM D5887	m³/(m²·s)	$\leq 2.7 \times 10^{-9}$

Dry bentonite mass excludes geotextiles, adhesive and membrane. Both grades use the Standard 37 GCL construction with sodium bentonite powder, no bentonite polymer dosing and no additional bottom nonwoven.

GCL hydraulic values apply to the clay core, excluding the LLDPE and joints. Specify hydration liquid, confinement, gradient and equilibrium criteria. The Standard-grade index flux is a construction-specific acceptance target. Use ASTM D5887 for acceptance and ASTM D6766 within scope with representative liquids for chemical compatibility.

GCL CBR puncture, membrane index puncture, internal GCL peel and laminate peel are separate tests. Peak shear is not a residual or interface design value. Supply roll dimensions, mass, core and edge configuration are order-specific.

LLDPE membrane requirements

Smooth black membrane specified to GRI-GM17 Revision 17

Separate membrane properties for the two weldable laminates. Minimum MQC frequencies below apply to membrane manufacture.

Membrane property	Method	Unit	0.75 mm	1.00 mm	Minimum MQC
Minimum average thickness	D5199	mm	≥0.75	≥1.00	Each roll
Lowest of ten thickness readings	D5199	mm	≥0.675	≥0.900	Each roll
Formulated sheet density	D1505 / D792	g/cm³	≤0.939	≤0.939	90,000 kg
Break strength MD / CMD	D6693 Type IV	kN/m	≥20	≥27	9,000 kg
Break elongation MD / CMD	D6693 Type IV	%	≥800	≥800	9,000 kg
2% secant modulus	D5323	MPa	≤414	≤414	Each formulation
Tear resistance	D1004	N	≥70	≥100	20,000 kg
Membrane index puncture	D4833	N	≥190	≥250	20,000 kg
Axisymmetric break strain	D5617	%	≥30	≥30	Each formulation
Carbon black content	D4218	%	2.0-3.0	2.0-3.0	20,000 kg
Carbon black dispersion	D5596	-	9 of 10 views Category 1 or 2; ≤1 Category 3	Same	20,000 kg
Initial standard OIT OR	D8117	min	≥100	≥100	90,000 kg
Initial high-pressure OIT	D5885	min	≥400	≥400	90,000 kg
90-day oven ageing at 85°C: retained standard OIT OR	D5721 + D8117	%	≥35	≥35	Each formulation
90-day oven ageing at 85°C: retained HP-OIT	D5721 + D5885	%	≥60	≥60	Each formulation
1,600-hour UV: retained HP-OIT	D7238 + D5885	%	≥35	≥35	Each formulation

Basis: GRI-GM17 Revision 17, 11 June 2025, smooth black LLDPE Table 1(b). Values follow the stated minimum averages, maxima or ranges; GM17 does not define these as MARV or MaxARV. Tensile averages use five specimens in each direction; break elongation uses a 50 mm gauge length and 50 mm/min.

Use either listed initial OIT route and either listed oven-ageing retention route. Standard OIT is not the UV acceptance route. UV exposure uses 20 hours at 75°C followed by 4 hours condensation at 60°C; HP-OIT retention is assessed relative to its initial value. Intermediate oven checks at 30 and 60 days are recommended.

Virgin resin with no more than 10% same or approved-formulation rework; no post-consumer resin. Alternative carbon-black methods D1603 or D6370 need correlation with D4218. ASTM prefixes apply to all methods. Incoming-sheet MQC and post-lamination checks must establish that processing preserves the specified membrane properties.

Reference: https://geosynthetic-institute.org/grispecs/gm17r.pdf

Welded joints and weld protection

Hot-wedge and extrusion-fillet seam requirements

Seam property	Method	Unit	0.75 mm	1.00 mm
Hot-wedge shear strength	ASTM D6392	N/25 mm	≥197	≥263
Hot-wedge peel strength	ASTM D6392	N/25 mm	≥166	≥219
Extrusion-fillet shear strength	ASTM D6392	N/25 mm	≥197	≥263
Extrusion-fillet peel strength	ASTM D6392	N/25 mm	≥150	≥190
Laboratory shear elongation, both methods	ASTM D6392	%	≥50	≥50
Maximum peel separation, both methods	ASTM D6392	%	≤25	≤25

Seam requirements follow the GM17 Revision 17 appendix, Table 3(b). Require compliant strength and acceptable ductile break behaviour; all five shear specimens must meet the strength and laboratory elongation requirements, and all five specimens must show acceptable break patterns. Test both tracks of a dual-track weld. Field elongation measurements are omitted under the appendix.

Wedge welding forms primary seams; extrusion fillet welding forms compatible details, repairs and connections. Qualify the actual membrane, filler, machine and laminated assembly with site trial welds. Use non-destructive testing compatible with the seam geometry and destructive testing at the project CQA frequency. Seam compliance is the installer's responsibility.

EdgeProtect weld zone strips

1. Factory-supplied EdgeProtect™ removable film strips protect both mating LLDPE weld faces at the designated welding margins during rolling, transport and deployment.

2. Leave the strips in place until immediately before preparation and welding. Bentonite dust in the seam can disrupt fusion and reduce weld quality.

3. Peel the strips away completely, contain loose bentonite and inspect both faces. Weld faces must be clean, dry and free of adhesive or film residue. Clean any recontamination and prepare extrusion areas under the qualified procedure.

4. Keep clay, geotextiles and lamination adhesive out of the weld path. Use factory-released margins with sufficient free LLDPE width for the welder, tracking and seam testing.

5. Retain at least 300 mm direct GCL contact beneath the membrane joint and a separate at least 300 mm LLDPE overlap at designated longitudinal joints. End laps, cut edges, penetrations and repairs use the issued welded-system detail.

System selection and supply records

Assess subgrade protection, hydration, contact chemistry, cover loading and hydrated internal/interface shear for the complete lining system. No added bottom nonwoven or bentonite polymer treatment is included. EdgeProtect™ reduces contamination exposure; it does not replace cleaning, trial welds or CQA. GM17 applies to the membrane component; the project design defines whole-system acceptance and exposed-service requirements.

Link membrane and GCL manufacturing records to each roll and lot, including the membrane formulation, thickness, lamination process and EdgeProtect margins. Record factory bond and film-integrity checks and the project seam CQA results.

kontainsolutions.com | ben.lewis@kontainsolutions.com | +61 405 812 770

Bentonite quality and Australian BPEM criteria

Minimum order: 20,000 m²

Indian sodium bentonite powder, without polymer modification. Supplier-declared specification limits are shown below.

Bentonite property	Supplier declaration
Origin and form	Indian sodium bentonite powder
Polymer modification	None
Montmorillonite content	≥75%
Methylene blue adsorption	≥300 mg/g
Swelling	≥25 mL (supplier reporting basis)
Fluid loss	≤18 mL
Water adsorption capacity	≥550%; DIN 18132 Enslin–Neff
Particle size	≥80% passing 75 µm
Cation exchange capacity	≥70 meq/100 g
Moisture content	≤13%
Calcium concentration	<2%

BPEM property	BPEM requirement	Supplier specification
Montmorillonite	>70 wt%	≥75%
Powder particle size	e.g. 80% passing 75 µm	≥80% passing 75 µm
Cation exchange capacity	≥70 meq/100 g	≥70 meq/100 g

The supplier-declared montmorillonite content, cation exchange capacity and powder grading meet the corresponding numerical criteria in EPA Victoria's BPEM Appendix E6.1. These source properties apply to the non-polymer range.

The bentonite supplier reports more than nine years supplying an established Malaysian GCL manufacturer whose products are supplied into Australia.

For BPEM projects, specify source certification, carbonate content, bentonite quality criteria, swell-test conditions and batch verification in the project quality plan. Link the bentonite and GCL quality records to the supplied rolls, with project-specific chemical compatibility, design and installation CQA.

Source data are supplier-declared specification limits. Swelling is quoted on the supplier's reporting basis; the GCL schedule defines the acceptance methods and units. Reference: EPA Victoria Publication 788.3, Appendix E6.1.