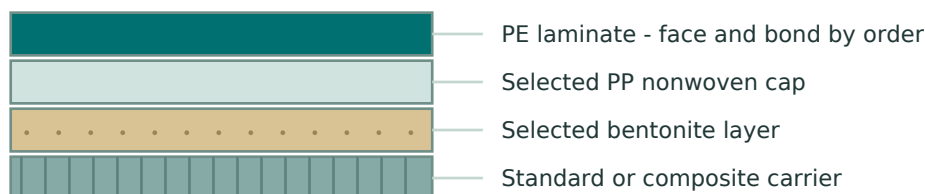


## PRODUCT GCL-L

# Kontain GCL Laminated

A selected GCL core with a bonded polyethylene layer.

GCL-L combines a standard or composite-base GCL with a polyethylene laminate. The polymer layer can reduce direct moisture exchange and provide an additional barrier surface; joints, damage, penetrations and edge details still govern system continuity. It does not remove the need for soil confinement.



Construction schematic. Layers exaggerated; confirm supplied face orientation.

## Proposed range and product status

| Option               | Construction basis                                                                      | Joint approach                                                           |
|----------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| GCL-L02 0.2 mm PE    | Thin laminate option. Resin type, tolerances and whole-product data confirmed by order. | Loose film overlap above direct GCL contact; no default welding claim.   |
| GCL-L05 0.5 mm PE    | Thin laminate option. Resin type, tolerances and whole-product data confirmed by order. | Loose film overlap above direct GCL contact; no default welding claim.   |
| GCL-L10 1.0 mm LLDPE | Custom manufacture / development option. Smooth black membrane targets on page 2.       | Qualified weldable LLDPE flaps, or a loose lap where the design permits. |
| GCL-L15 1.5 mm LLDPE | Custom manufacture / development option. Smooth black membrane targets on page 2.       | Qualified weldable LLDPE flaps, or a loose lap where the design permits. |

1.0 mm and 1.5 mm are proposed custom constructions, not verified stock products. Confirm lamination and winding trials, bond behaviour, edge fabrication, handling and assembled-product test results before manufacture or supply.

## Select the core and the complete construction

Specify GCL-S or GCL-H, dry bentonite mass and granular or powder form; add polymer modification where the actual fluid compatibility requires it. These choices are independent. Whole-GCL tensile, puncture, peel, hydraulic and shear properties must be confirmed for the finished laminate assembly.

Example request: GCL-H-4000-P-L10 = composite base, 4,000 g/m<sup>2</sup> dry bentonite, polymer modification and 1.0 mm LLDPE. This syntax describes a requested construction; it is not evidence of a prequalified grade.

Thin-laminate data must not be used to certify a thicker assembly. Membrane component targets on the next page do not establish complete laminated-GCL compliance.

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# LLDPE membrane targets

Smooth black membrane component only - GRI-GM17 basis.

Specification targets for planned 1.0 mm and 1.5 mm LLDPE laminates. These are not measured results for a supplied GCL. GM17 table values are neither MARV nor MaxARV. Texture, colour or a different formulation requires an appropriate separate schedule.

| Property                                                 | ASTM method        | 1.0 mm                  | 1.5 mm                  |
|----------------------------------------------------------|--------------------|-------------------------|-------------------------|
| Average thickness, minimum                               | D5199              | 1.00 mm                 | 1.50 mm                 |
| Lowest individual thickness (10 readings), minimum       | D5199              | 0.90 mm                 | 1.35 mm                 |
| Formulated density, maximum                              | D1505 / D792       | 0.939 g/cm <sup>3</sup> | 0.939 g/cm <sup>3</sup> |
| Tensile break strength, minimum average, both directions | D6693 Type IV      | 27 kN/m                 | 40 kN/m                 |
| Break elongation, minimum average, both directions       | D6693 Type IV      | 800%                    | 800%                    |
| 2% secant modulus, maximum                               | D5323              | 420 kN/m                | 630 kN/m                |
| Tear resistance, minimum average                         | D1004              | 100 N                   | 150 N                   |
| Index puncture resistance, minimum average               | D4833              | 250 N                   | 370 N                   |
| Axi-symmetric break strain, minimum                      | D5617              | 30%                     | 30%                     |
| Carbon black content                                     | D4218 <sup>1</sup> | 2.0-3.0%                | 2.0-3.0%                |
| Carbon black dispersion                                  | D5596              | See note 2              | See note 2              |
| Initial Standard OIT - OR next row                       | D8117              | ≥100 min                | ≥100 min                |
| Initial high-pressure OIT (HP-OIT)                       | D5885              | ≥400 min                | ≥400 min                |
| Retained Standard OIT, 90 days at 85°C - OR next row     | D5721 / D8117      | ≥35%                    | ≥35%                    |
| Retained HP-OIT, 90 days at 85°C                         | D5721 / D5885      | ≥60%                    | ≥60%                    |
| Retained HP-OIT, 1,600 hours UV                          | D7238 / D5885      | ≥35%                    | ≥35%                    |

1. D1603 or D6370 may substitute with an appropriate correlation. 2. Ten dispersion views: nine in Categories 1 or 2; one permitted in Category 3. Evaluate near-spherical agglomerates.

Average thickness must meet nominal: the individual-reading limit does not allow a roll to average 10% thin. Tensile values use five specimens per direction; break elongation uses a 50 mm gauge length and 50 mm/min test rate.

OIT = oxidative induction time. Either initial OIT method is permitted; initial OIT alone is not the full durability requirement. UV retention is relative to initial HP-OIT; Standard OIT is not recommended for the UV endpoint. UV cycle: 20 h at 75°C then 4 h condensation at 60°C.

Resin basis: virgin resin with no post-consumer resin; up to 10% approved manufacturing rework from the same or a compatible formulation. Confirm the finished membrane and all applicable GM17 requirements, not raw resin properties alone.

Basis: GRI-GM17, Revision 14 (17 March 2021), smooth LLDPE Table 1(b). Confirm all applicable notes and MQC frequencies.

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# Joints and qualification

Maintain the bentonite overlap and qualify any membrane weld.

## Direct GCL contact first

Provide at least 300 mm direct GCL-to-GCL overlap, or more where the approved detail requires. Fold back purpose-made releasable or unbonded laminate edges so no film separates the GCL contact faces. Do not force-peel a bonded laminate. Treated longitudinal GCL edges are self-sealing under hydration and confinement.

Restore the laminate above the completed GCL contact. Thin film overlaps remain loose and are compressed under approved confinement soils. A loose polymer lap is not a tested membrane seam. Treat cut edges, roll ends, repairs and penetrations using the approved matching materials.

## Welded option: qualified LLDPE $\geq 1.0$ mm only

The proposed welded detail excludes HDPE laminates. Verify the actual processed LLDPE formulation and traceable GM17 OIT and ageing evidence before accepting the option. Raw resin data alone are insufficient. OIT evidence supports formulation durability; it does not prove weldability or service life.

Use clean, homogeneous, accessible LLDPE flaps free of bentonite, fibres and adhesive. Confirm film thickness, heat effects on the adjacent GCL, lamination bond, compatible extrusion rod where used, and the approved seam geometry. Qualify the procedure with trial welds and destructive peel/shear tests, followed by specified seam integrity testing.

## Seam acceptance basis for suitable membrane flaps

| GRI-GM19a LLDPE criterion         | 1.0 mm             | 1.5 mm             |
|-----------------------------------|--------------------|--------------------|
| Wedge or extrusion shear strength | $\geq 263$ N/25 mm | $\geq 394$ N/25 mm |
| Wedge peel strength               | $\geq 219$ N/25 mm | $\geq 328$ N/25 mm |
| Extrusion peel strength           | $\geq 190$ N/25 mm | $\geq 290$ N/25 mm |
| Laboratory shear elongation       | $\geq 50\%$        | $\geq 50\%$        |
| Peel separation                   | $\leq 25\%$        | $\leq 25\%$        |

GM19a applies to homogeneous nonreinforced membrane seams, not the fabric-reinforced GCL assembly or its bentonite seal. All five specimens must satisfy the applicable acceptance and failure-locus requirements. Field testing omits elongation measurement. Agree ASTM D6392 testing, frequencies and integrity checks in the project CQA procedure.

## Ordering and installation controls

Common rolls are 5 m  $\times$  30 m (150 m<sup>2</sup> gross); custom sizes and plastic or steel cores are available subject to the selected build. Confirm mass, core bore, winding radius and lifting method. Cover grading, chemistry, internal and interface shear, penetrations and confinement must be designed for the complete assembly.

Before supply: approve the construction schedule, processed membrane/formulation evidence, lamination and winding trial, bond/peel data, hydraulic and mechanical results, factory edge detail, welding procedure and batch quality records.

Seam basis: GRI-GM19a, Revision 10 (18 March 2021).

Installation details: Kontain GCL Installation Guide