



# **Firestone EPDM Geomembrane**

## **Project Specifications**

# **General specifications for lining of a water retention reservoir using EPDM Geomembrane**

## **1. Inspection of excavation work and preparation of support**

Before installing the liner, the contractor must visit the project site to check whether the excavation and preparation of the support have been correctly performed. This inspection should involve the general contractor, the ground working contractor(s) and the lining contractor. In no case, the lining contractor can be held responsible for ground stability.

The lining contractor will, in the presence of the general contractor, check:

- the correct finish of the supporting face of side slopes and bottom of the reservoir, aiming to avoid any presence of stones and rocks, plant or mineral protruding elements which could risk puncturing the EPDM Geomembrane;
- the compaction of the soil: insufficiently compacted clay or other supporting surfaces which could cause settling or result in lack of stability of the embankments;
- the absence of water or water inflow on the bottom and side slopes;
- the absence of organic matter susceptible of producing biogas due to fermentation

In addition, the following will be examined:

- the geometry of the project (fall of 2%, side slopes less than 45°, minimum crest width of 4m and minimum 6 m if some operating vehicles should circulate);
- the conformity of singular points onto which the EPDM Geomembrane will have to be connected (concrete structure, pipes, etc.). It is essential that e.g. the concrete can « hold » the mechanical anchoring of the geomembrane;
- the anchor trench will be no closer than 1m from the side slopes and must be sized taking into account the length of the geomembrane between 2 anchor points, the distance between a clamping point and the water level, the length of the embankment, the wind speed and the exposure to such winds;
- the presence of a water and a gas drainage network and corresponding evacuation vents as per the guidelines of the designer.
- all these checkpoints will be included in a document enclosed to the work report.

## **2. Panel layout**

Following acceptance of the support, the panel layout will be adapted to the final shape of the pond based on the as-built drawing provided by the ground working contractor. The aim should be to minimise the number of details and to facilitate at the bottom of the pond, the unrolling of the geomembrane in the direction of greater dimension to minimize the number and length of seams. The panel layout will limit the EPDM Geomembrane loss percentage. The position of the sheet splices will be clearly indicated.

## **3. Provide a warehousing and storage area**

The lining contractor will have to have at its disposal or will have to provide storage and warehousing area (specifically prepared for this purpose and type-approved) for products delivered to the site. The products need to be sheltered from damage but accessible at all times. Access is such so as to be able to handle all materials as per the manufacturer's requirements, at any time including during unloading, in order to avoid any deterioration or damage.

## **4. Reception of materials on site**

The lining contractor will have to be present on site when unloading the materials so as to ensure the correctness of the delivery and to monitor the unloading and storage of all materials.

## **5. Composition of the lining system**

The lining system is presented below.

**5.1 Supply and installation (including anchoring), of a puncture resistant geotextile. The characteristics of the geotextile will be adjusted, depending on the state of the supporting surfaces (stony ground, rock, etc). The minimum characteristics of the geotextile, given below, are merely an indication:**

- Needled, non-woven, short fibre, 100 % polypropylene
- Surface weight (EN 965)  $\geq 300\text{g/m}^2$
- Tensile strength (ISO 10319)  $\geq 20\text{ kN/m}$  (production direction and crossways)
- Puncture resistance (EN ISO 12236)  $\geq 2\text{ kN}$

**5.2 Supply and installation (including anchoring), of an EPDM Geomembrane, assembled before vulcanisation, with the following characteristics:**

- Thickness: 1.1 mm
- Colour: black
- Tensile strength (ISO R 527):  $9\text{ N/mm}^2$
- Water Permeability (EN 14150) :  $< 4 \times 10^{-6}\text{ m}^3/\text{m}^2\text{ j}$
- Durability (EN 12224): 25 years
- Static puncture resistance (EN ISO 12236): 0.7 kN

## **6. Installation of materials**

The installation of geotextile and EPDM Geomembrane will have to be carried out by an approved contractor.

### **6.1 Anchoring of the geomembrane and drainage geocomposite**

The anchoring of the EPDM Geomembrane and drainage geocomposite must be sized taking into account the length of the geomembrane between 2 anchor points, the distance between a clamping point and the water level, the length of the embankment, the wind speed and the exposure to such winds, by conduit or flat by weighting. The anchoring can be done in trench or using ballast.

### **6.2 Gas and water drainage**

The drainage requirements will be the subject of a study by the general contractor to define the type of gas and water drainage system.

### **6.3 Installation of the geotextile**

The puncture resistant geotextile will be unrolled starting from the trench down the embankment and will be installed with sufficient overlap. At embankment level, joints are made parallel to the slope.

The geotextile will either be thermo-bonded (with an overlap of 30 cm), or sewn together in such a way as to avoid any movement of the EPDM Geomembrane while setting in place. If necessary, it is advisable to put temporary ballast on the geotextile, to ensure it stays in place until the installation of the EPDM Geomembrane.

### **6.4 Installation of EPDM Geomembrane**

The rolls are unwound and unfolded according to the layout plan. Installation commences with the covering of the embankments. The EPDM Geomembrane panels are unrolled from the trench down the embankment after the EPDM Geomembrane has been temporarily fixed to avoid it slipping down. Ensure that no pebbles or sharp objects are entrapped under the EPDM Geomembrane, whilst the sheets are being unrolled.

While installing the sheets, severe folds in the geotextile and damage of the supporting face must be avoided to enable the EPDM Geomembrane to be manoeuvred correctly. To facilitate putting the geomembrane in place, it is recommended that the geomembrane be lifted/fluttered at the perimeter allowing air to play underneath, thus moving the geomembrane on an air cushion. Excess geomembrane must be left at the base of the side

slope so as to carry out any connections with adjacent panels on the bottom of the reservoir (these connections must be located a minimum distance of 1 m from the base of the embankment). At embankment level, perpendicular seams to the slope are prohibited.

Leave the EPDM Geomembranes to relax 30 to 45 minutes before splicing or execute details.

Some means of ballasting is required to prevent the wind to lift the EPDM Geomembrane.

### **6.5 Seaming of EPDM Geomembrane**

**Seaming:** splicing of adjoining panels should be performed immediately after the relaxation of the EPDM Geomembrane. Should the EPDM Geomembrane be very dirty cleaning with soapy water followed by rinsing with clear water is required. The splicing of the EPDM Geomembranes will be done using EPDM/butyl auto-adhesive strips in accordance with the manufacturer's specifications. Beforehand, the surface of the EPDM Geomembrane is prepared using a primer.

**Repairs:** the geomembrane is cleaned before repairing. Small damages (pinholes & small punctures) are repaired with a non-vulcanised EPDM strip, laminated onto an auto-adhesive tape. Bigger damages (cuts & punctures) are repaired with a piece of geomembrane.

**Details:** Details are executed in accordance with the manufacturer's specifications by means of non-vulcanised EPDM strips, laminated onto an auto-adhesive tape.

Recommended temperature range for assembling EPDM Geomembranes and waterproofing of details is between 5°C and 30°C. Carrying out any splicing or detail work under the following meteorological conditions is in contradiction with code of good practice: rain, snow, heavy winds, fog.

### **6.6 Quality Control**

The company will carry out or will have carried out a non-destructive control of splicing performed on site (visual control and/or vacuum chamber) upon completion of the installation.

- **Non-destructive testing**
  - Visual control (tape needs to extend for approximately 5 to 15 mm past the seam edge, QuickPrime Plus needs to be visible on bottom sheet exceeding the Tape over its entire length, continuous trace of QuickPrime visible on the top sheet at approximately 150 – 200 mm of the edge of the top sheet, no fish-mouths or wrinkles within the tape, no air bubbles within the seam with a diameter  $\varnothing > 15$  mm)
  - Vacuum chamber
  - Air lance method
- **Destructive testing**
  - Shear testing: min. 4kN/m
  - Peel testing: min. 0.8 kN/m

## **7. Safety**

All necessary measures should be taken to avoid people, animals or objects falling into the reservoir: installation of a perimeter fence, access ramps for operating vehicles. An emergency escape ladder will be installed for workers and one for animals and/or rodents.

## **8. Operation**

Upon signing off on the project, the main contractor will inform the owner about the limitations, care and maintenance requirements of the EPDM Geomembrane reservoir.