

Bituminous

Geomembranes

Teranap 331 TP & 431 TP



2008 edition

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Common provisions

1. Materials handling

Materials handling is to be limited to avoid damaging the base layer by rutting.

For materials coming on pallets, these are to be brought in using a lifting rig at every point of the jobsite (bottom and top of the slope) so as to correctly position the rolls and be able to unroll them manually. Constructing a cradle can facilitate the positioning of the material.

Installing geomembranes 4m wide and wider requires a lifting rig and a gantry crane (see Paragraph 3). The width of the gantry crane will depend on the width of the rolls being handled.

2. Delivery of materials to the jobsite

During loading and unloading operations, make sure to avoid damaging the first turns of the rolls.

For that purpose, geomembrane rolls are to be stored in their original packing, laid flat, parallel, on a plane unobstructed area with sufficient bearing capacity.

The geomembrane rolls will be able to be stored 2 to 3 rolls high.

3. Transversal joints on slopes

In principle, the use of horizontal joints on slopes is prohibited except for dealing with

angles. However, in certain configurations such a connection may turn out to be necessary. In such cases, the agreement of the main contracting firm and of its technical inspection body must be obtained in advance.

In particular, make sure to avoid two welds being lined up on two neighbouring strips (at least 1m between two longitudinal welds).

4. Transversal joints at the bottom

Quadruple overlap joints (points with four thicknesses of geomembrane) are prohibited.

Triple overlap joints are to be avoided; should they be inevitable, special attention is to be paid to them.

1. Description of the products

Teranap 331 TP

Modified SBS elastomeric bitumen geomembrane, non-woven polyester reinforcement, made in full width (SBS = Styrene Butadiene Styrene).

Nominal mechanical and physical characteristics:

- Thickness: 3mm;
- Cold bending characteristics (UEAtc¹ Rules): no cracking at –20°C on mandrels x 20mm;
- Resistance to puncture under concentrated static load (Standard NFP 84 507): > 490N.

Teranap 431 TP

Modified SBS elastomeric bitumen geomembrane, non-woven polyester reinforcement, made in full width.

Nominal mechanical and physical characteristics:

- Thickness: 4mm;
- Cold bending characteristics (UEAtc Rules): no cracking at –20°C on mandrels x 20mm;
- Resistance to puncture under concentrated static load (Standard NFP 84 507): > 490N.

2. Sizing of the geomembrane protection by geotextile

To protect the geomembrane from any puncturing, it is very often necessary to install an anti-puncture geotextile under or upon the geomembrane.

| TERANAP | Depth of liquid or height of product stored | Under the geomembranes | | | |
|---|---|------------------------|-------|-----------------------|------|
| | | 331 TP | | 431 TP | |
| | | Mechanical protection | | Mechanical protection | |
| | | Without | With | Without | With |
| Smooth concrete (HS < 1mm) | H < 3m | No | No | No | No |
| | H < 10m | No | 300 | No | No |
| Trowelled concrete (1.0mm < HS ² < 2.0mm) Macadam | H < 3m | No | No | No | No |
| | H < 10m | 300 | 300 | No | 300 |
| Cement-bound graded aggregate Bituminous-bound graded aggregate | H < 3m | 300 | 300 | No | No |
| | H < 10m | 400 | 400 | 300 | 300 |
| Sand, silt, clay | H < 3m | No | No | No | No |
| | H < 10m | No | No | No | No |
| Topsoil, crusher-run material, crushed materials Dmax = 15mm, rounded materials Dmax = 50mm | H < 3m | No | No | No | No |
| | H < 10m | 300 | 400 | No | 300 |
| Crushed materials Dmax = 31.5mm Rounded materials Dmax = 80mm | H < 3m | 300 | 400 | No | No |
| | H < 10m | 700 | 700 | 300 | 300 |
| Crushed materials Dmax = 50mm | H < 3m | 700 | 700 | 300 | 400 |
| | H < 10m | Study | Study | 700 | 700 |

(1) UEAtc – Union Européenne pour Agrément technique dans la construction (European Union of Technical Agrément in Building).

(2) HS – Hauteur de Sable – Texture Depth (in sand patch test).

| TERANAP | Depth of liquid or height of product stored | On the geomembranes | |
|--|---|---------------------|--------|
| | | 331 TP | 431 TP |
| Smooth concrete (HS < 1mm) | H < 3m | 700 | 400 |
| | H < 10m | 700 | 400 |
| Trowelled concrete (1.0mm < HS < 2.0mm) Macadam | H < 3m | 300 | Kraft |
| | H < 10m | 300 | 300 |
| Cement-bound graded aggregate Bituminous-bound graded aggregate | H < 3m | 400 | 300 |
| | H < 10m | 700 | 400 |
| Sand, silt, clay | H < 3m | No | No |
| | H < 10m | No | No |
| Topsoil, crusher-run materials, crushed materials Dmax = 15mm, rounded materials Dmax = 50mm | H < 3m | 300 | No |
| | H < 10m | 400 | 300 |
| Crushed materials Dmax = 31.5mm Rounded materials Dmax = 80mm | H < 3m | 700 | 400 |
| | H < 10m | Study | 700 |
| Crushed materials Dmax = 50mm | H < 3m | Study | Study |
| | H < 10m | Study | Study |

3. Installation

3.1. General description

The bituminous geomembranes have a distinct surface and a distinct underface (sand surfaced face, film surfaced face):

- the sand surfaced face is an interface;
- the film surfaced face contains a film that is particularly resistant to roots;
- Professional practice concerning the installation of the geomembranes (connecting the strips, slope gradients, etc.) must be followed.

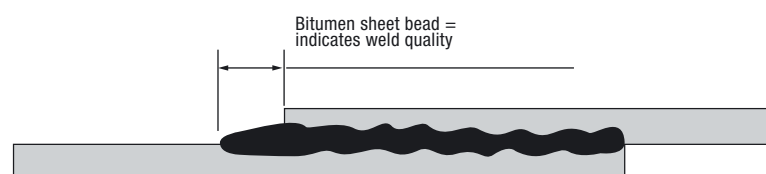
3.2. Welding bituminous geomembranes

The **welding is carried out as the works progress** rolling the upper strip onto the neighbouring strip, permanently maintaining a bitumen bead along the overlap.

Concealed welding is utilised when a weld as the works progress is not possible. The two strips to be assembled are positioned and the weld is executed lifting the upper strip at that location and heating the two strips together before smoothing down.

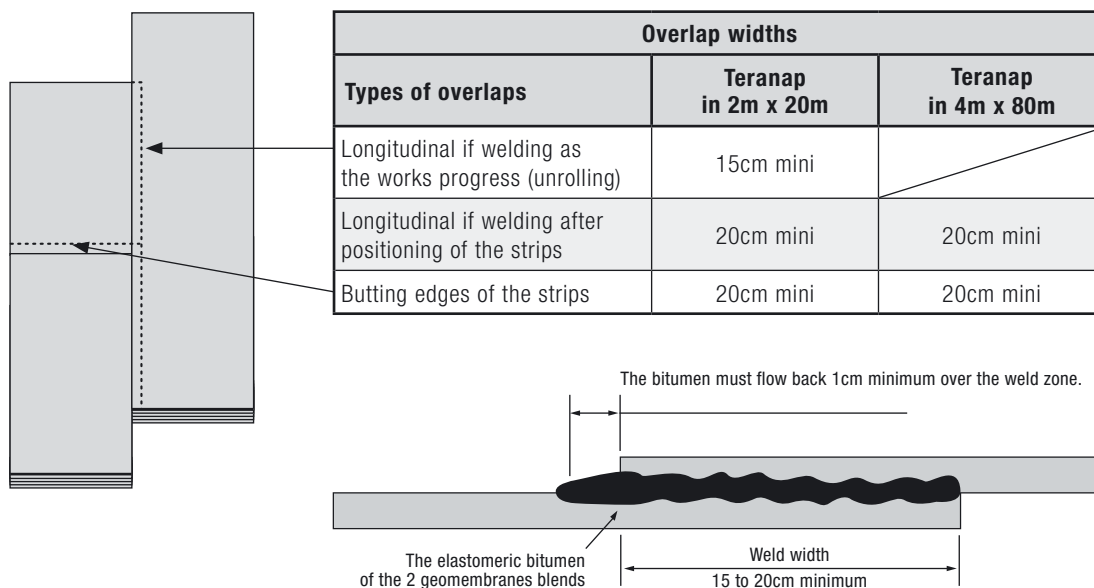


Welding as the work progresses



The part of the strips used to make joints will always be kept clean. For this purpose, the protection paper is to be removed from the weld path just before welding.

After the self-inspection of the weld, the fusion face of the joint is **chamfered** by heating the upper part of the joint and crushing the fusion face with a gauging trowel.



3.3. Protecting the geotextile during welding

In case a heat sensitive material is installed under the geomembrane (for example, an anti-puncture geotextile), arrangements need to be made before welding to avoid damaging this material. A heat shield can be used, for example, a strip of Verecran 100, 50cm wide.

3.4. Specific connection guidelines

Generally, Teranap TP connects to concrete structures in the following way:

- Installation on concrete, a Siplast Primer type bituminous impregnation, applied with brush or roller, 250 to 300g/m²;

- Torched welding of the Teranap TP onto the Siplast Primer after drying;
- Installing a mechanical fixing on the weld.

Nota: it is very easy to weld the sand coated face of the Teranap TP on concrete. This is because the energy provided by the flame serves only to bring the bitumen to fusion and it is not necessary to verify that the underface film has been destroyed. Furthermore, this facilitates the smoothing down.

For long lines of welding on concrete, it is preferable to use membranes 1m wide which are easier to manipulate and are especially designed to have a good bond on concrete:

- In the case of a connection by simple welding without mechanical fixing, use Parafor Ponts or Verinox S;
- In the case of a connection by welding and mechanical fixing, preferably used Parafor Solo S, a non-surfaced product.

To avoid corrosion of the mechanical fixing, protect it by welding a strip of geomembrane on it.

4. Quality Assurance Operations

4.1. Destructive tests

Take a weld test specimen and calculate the ratio of the joint's combined tensile-shear stress resistance according to Standard NFP 84502-1 to the tensile strength of the geomembrane in main areas according to Standard NFP 84-501.

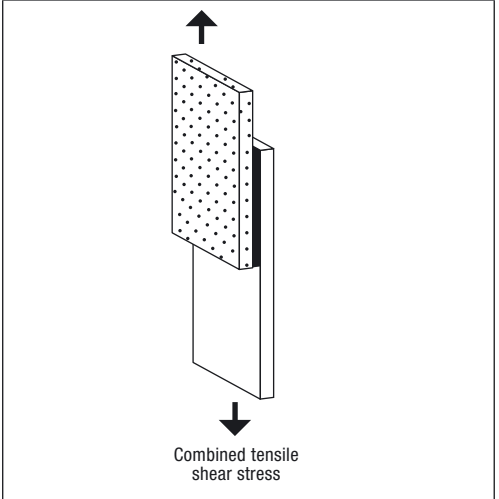
The frequency of this type of test depends on the main contracting firm's specifications.

To the degree possible, the test specimens are taken in zones that are not very sensitive.

Specifications on the welds:

| Bituminous geomembrane |
|---|
| Combined tensile-shear stress 16kN/m or FS \geq 80% |

Under combined tension-shear stress according to NFP 84-502/1



4.2. Non-destructive tests

| TERANAP | Test type | Description |
|--------------|------------------------|--|
| Manual welds | Visual | General appearance of the welds |
| | Guide pin or air lance | Passing a guide pin along the weld. Passing an air lance along the weld (air under 500kPa pressure) |
| | Vacuum bell | Bringing the weld zone to be inspected down to hypobaric pressure (0.2 to 0.3bars) |

5. Complementary products

5.1. Siplast Primer

Fast drying sealing compound, bitumen base, in elastomer modified solution.

This product is intended as a primer for all types of substrate (metal, masonry and wood) before welding a bituminous membrane. It is to be applied in compliance with the application documents accepted by Siplast.

5.2. Connections with Parafor Pont, Parafor Solo S or Verinox S membranes

These materials can be used to build upstand flashings on concrete or steel. They come in widths of 1m.

5.3. Verecran 100 type interposed heat shield

Glass fibre mat 100g/m², used as a heat shield (see Paragraph 3.3.).

5.4. Geofelt type anti-puncture geotextiles

The Geofelts are non-woven geotextiles, made using long rot-resistant fibres, 100% polypropylene, linked together by needling.

5.5. Geoflow and Fonda GTX type drainage geocomposites

Geoflow 44 is a drainage geospacer.

Fonda GTX is a drainage geospacer, consisting of a sheet of polypropylene (PP) with, on one face, embossing with raised octagons, covered with a non-woven polypropylene (geotextile).

6. Maintenance and repairs

In case of degradation (accidents during maintenance, vandalism, etc.) repairs of bituminous membranes are particularly easy since they require only a small amount of equipment (gas bottle and torch) and since the surface to be repaired requires no particular preparation except for cleaning.

Siplast-Icopal's Technical Department is at your disposal in case of doubt concerning the geomembrane's surface state.



12, rue de la Renaissance
92184 Antony Cedex - France
Tel: +33 1 40 96 35 00
Fax: +33 1 46 66 24 85
www.siplast-international.com