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Introduction

The objective of this document is to provide the installer information of how to install the rubber liner. It includes general instructions for correct design and installation.

The apparent simplicity of a project using EPDM rubber liner sometimes can be deceiving. This manual serves to explain some design and installation techniques.

The simple and reduced projects can be resolved by non-experienced installers.

Annex: Description of all products required for lining process

Necessary tools for installing Giscosa Lining Systems

For larger projects a full TECHNICAL SPECIFICATIONS MANUAL is available from GISCOSA or distributor.

1 Garden Pond Design

1.1. USES OF LINING MATERIALS

This document's content can be applied principally for:

- ornamental lakes
- decorative small ponds

The Giscosa's EPDM rubber membrane giscolene, is also available for bigger projects:

- agricultural / fishing ponds
- fire fighting reservoirs
- sediment ponds/ settlement basins
- hazardous material containment / disposal
- irrigation canals
- enlargement of natural ponds

1.2. GARDEN POND LOCATION

The location for a garden pond must be decided after considering many factors. This will ensure a result lasting for decades.

1.2.1 NATURE OF SOIL

Depending upon the size of pond we intend to install, it may be necessary to carry out a geological study.

It is important to consider mechanical laws in order to ensure the stability of the soil base in the given situation.

This table allows the installer to evaluate the risks regarding soil characteristics:

TYPE OF SOIL	RISKS	SOLUTIONS
COMPRESIBLE SOILS (peat, fine sand…)	• gas emanation • contra-pressures • settlement • excessive compaction after filling pond	• gas drainage • pond base sloped to ensure gas drainage • satisfactory compaction
SOILS CONTAINING ORGANIC MATERIALS (Old ponds from sugar and paper industries)	• fermentation • contra-pressures by pockets of gas under the geomembrane	• gas drainage
SOILS WHERE POSSIBLE INTERNAL ROTTING CAN OCCUR (Embankments with waste demolition, calcareous soils, chalks, plaster…)	• reduction in base level caused by decomposition of soil content • fail caused by an eroding watercourse	• thorough geological cavity study • special compaction or double waterproofing
VOLCANIC SOILS (porous clay, compressible slimes…)	• absorbent capacity • different base structure causing inconsistent conditions - risk of tearing	• intermediate layer • specific drainage • special compaction around base features

1.2.2 AROUND WATER LEVEL: (WATER TABLE)

The level of the ground water within the excavated hole is critical, as if it becomes too high it may cause the installed liner to be forced upward in response to underlying pressure increases and cause displacement of the pond water content.

Constructing a pond with raised sides (part of pond above existing ground level) can alleviate problems caused by rising water table as increased atmospheric pressure (effective weight of water) forces uprising groundwater to “bleed” from under constructed pond, therefore not causing liner displacement within the pond.

Accordingly it is necessary to know the level of the water table (medium and high values).

1.3. BASE LEVEL

1.3.1 GARDEN-POND BOTTOM

We recommend a 2 % slope for:

- Good working of the draining system
- Better settling down of liner
- Easier garden-pond maintenance (emptying, cleaning)

This slope is even more necessary if the garden-pond has a large surface area and suffers different settlings after filling.

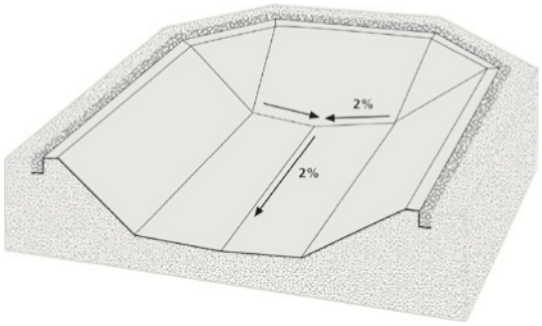


Fig. 1: slopes of the garden-pond bottom

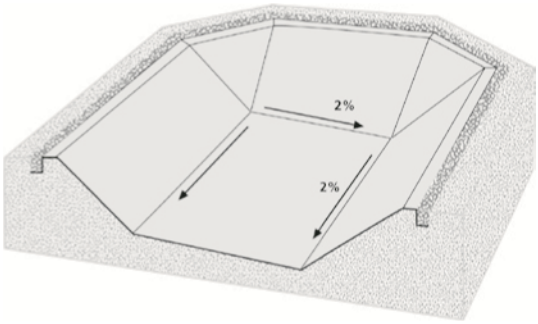


Fig. 2: slopes of the garden-pond bottom

1.3.2 LATERAL SLOPES

When constructing garden ponds there does not tend to be a problem. The ground water level and/or the soil type must however be controlled

SOIL TYPE	SLOPE			
clayey soil	2,5 H / 1 V	(1/2.5)	40%	23º
sandy - clayey soil	2 - 3 H / 1 V	(1/2 – 1/3)	50% - 33.3%	28º - 20º
sandy - clayey soil	2 H / 1 V	(1/2)	50%	28º
new rock (tender)	1,5 H / 1 V	(1/1.5)	66.6%	35º
* illustration:	1 H /1 V	1/1	100%	45º

The slope ridge must be sufficiently wide for the anchoring and other needs of the project

(e.g. fixing edging stones)

1.3.4 MAXIMUM HEIGHT OF WATER FROM GROUND LEVEL

The greater the water height in the pond, the greater the pressure on the bottom and slopes will be. Despite the high tensile strength capacity of the membrane, it's possible that cavities in the ground can provoke a burst. Therefore we recommend a regulation layer with sufficient thickness and/or a geotextile, laid under the lining material.

1.4. PREPARATION OF THE BASE

1.4.1 NATURAL GROUND

The support (surface in contact with the waterproofing membrane) must be smooth and clean, free of aggressive roughness and small cavities.

The preparation of the ground can be made in different ways:

- Remove the stones plants etc., and then smooth the ground and compact it.
- Add a regularization layer, normally sand with controlled granule size, then compact it.

Plants:

In order to avoid possible gas pressure produced by decomposition of the vegetation, which may create contra-pressure on the lining, all the plants must be removed from the bottom of the garden-pond before compacting the soil. We recommend using an environmentally friendly herbicide with long-term effect in zones where the vegetation may grow again, especially near the anchoring. The herbicide must be compatible with the geomembrane.

Compacting:

The support must be well compacted be especially careful when compacting the top of slope.

Geotextiles:

We recommend putting a geotextile layer between the ground and the membrane. It is absolutely necessary on slopes and tops where addition of a regularization layer (e g. sand) is usually difficult.

Depending on the kind of support, the thickness of the geotextil may vary from 200 to 500 g/m2.

1.4.2 NATURAL GROUND

A geotextil layer is absolutely necessary between the membrane and a hard base like concrete, except when the waterproofing membrane is fully adhered to the base.

Over bituminous supports (bituminous mortar, floors stabilized with asphalt emulsions, etc) it is also necessary to use a geotextil of 300 g/m2 as a minimum.

1.4.3 SURFACES AROUND CONCRETE SUPPORT

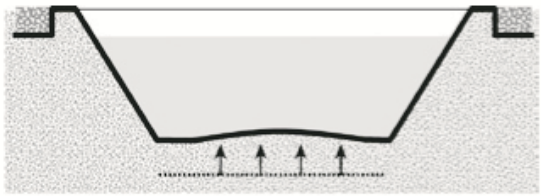
Be especially careful when compacting the soil around this kind of support in order to avoid all possible strain that could tear the membrane.

The geomembrane fixed on the concrete support must be able to absorb all possible settling movements around it. The ground added around the support must be compacted.

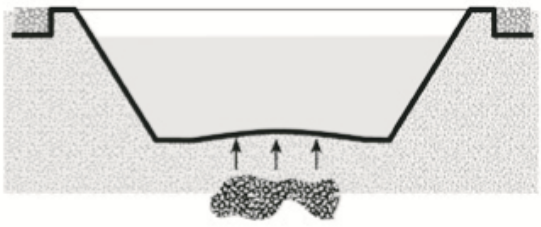
Inspection of the support: Before placing the geomembrane, always assure the stability of the soil in order to evaluate the preventive measures, which must be taken.

Figure 3 illustrates the main reasons of possible contra-pressure below the geomembrane, which can be avoided with water or gas drainage system.

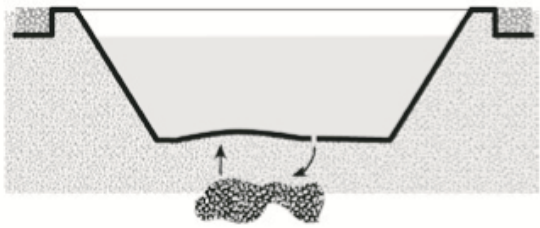
3.1 Existence of a waterproof layer which causes the slope's weakening



3.2 Elevation of the water table

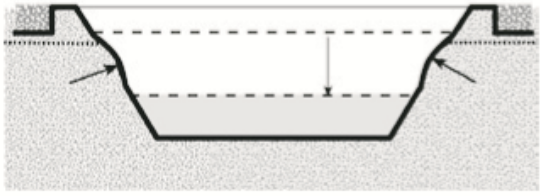


3.3 Decomposition of the organic materials



3.4 Leaks in the membrane and existence of the organic materials

3.5 Water table higher than garden-pond level



3.6 Fast emptying of the garden-pond

Fig. 3: Factors that cause contra-pressure

2 Execution

2.1. DIGGING THE HOLE:

2.1.1 SOIL PREPARATION

Using : - only excavated hole

- earth to form the pond's embankments

- a mixed solution consisting in excavating the pond hole and using the material to form the embankments.

The following table explains the advantages and disadvantages of these three systems:

SYSTEM	ADVANTAGES	DISAVANTAGES
• only excavation	• prevents the soil movement (natural consolidation)	• possible problems with ground water levels
• adding earth	• the drainage is more easy, no problems with the water table	• cost • needs to be compacted
• mix solution	• average of two systems	

All the soils to receive a geomembrane must be CORRECTLY compacted.
The soil may not contain cutting materials with a size bigger than 5 mm.
After the stones and roots have been recollected check that the soil is in a correct state.
If no punching materials compose the bottom, like sand or clay it is possible to install the membrane directly over the soil.

In most occasions it is necessary to furnish a layer with granular material (sand, grit…) and/or install a geotextile, no less than 300 g/m2.

Over the gradient slopes and over the gravel soil (concrete, brickwork…) it is advisable to install a geotextil, with a maximum of 300 g/m2

Anchorage trench

Open an anchorage trench all the way around the outer pond edges. The extracted material, should be deposited at the exterior side of the trench.

This trench must be opened away from the ridge to prevent a possible collapse of created ridge (see paragraph 1 – recommendations)

The transition from the ridge to the slope is realized by a dull bevel with 30 to 50 cm radius, to prevent the membrane from being drawn into the excavated pond when filling is complete.

Consolidate around structures in pond base

In order to avoid different degrees of setting, it is necessary to give special attention to and solid structure in the base that may have puncturing effect on liner. For example, use extra geotextile around structure to dull exposed edges and add extra sand to cushion liner.

2.2 INSTALLING THE LINER

2.2.1 GISCOSA'S GEOMEMBRANE – INFORMATION

GISCOSA' s geomembrane "giscolene" is a synthetic EPDM (Ethylene-Propylene-Diene-Monomer) rubber. All components necessary for laying and joining the geomembrane are manufactured by GISCOSA and Technical Data Sheets are available by request.

The Giscosa EPDM rubber membrane is sold in many sizes and thickness.

Standard width	1,5 m (roll) n x 1,5 m (sheets)
Standard length	20,0 - 30,5 m
Standard thickness	0,75 - 1,0 - 1,2 - 1,5 - 2,0 mm

Each roll is labelled with the brand name, the thickness and the size.

2.2.2 TRANSPORT & STORAGE

Take necessary care not to damage the geomembrane during transport and whilst loading /unloading. The rolls must be stored over an area that is smooth, clean and has no risk of puncturing occurring. The EPDM rubber does not require any special protection from the weather, as it is waterproof, frost proof and UV stabilised.

Any accessories necessary for installation (e.g. joining tape) must be stored away from weathering effects between 10ºC – 15ºC minimum.

2.2.3 PLANNING THE INSTALLATION

The contractor must set up an installation plan according to the execution drawings, this will permit the future possible repairs in the seams between the sheets and around outlet pipes.

2.2.4 MEMBRANE INSTALLATION

Geotextile placement

The geotextiles are placed with 30cm (12") overlap, minimum.

To prevent any wind rise it is necessary to temporary ballast the membrane, with sandbags, old tires…etc, or permanently fix to ground with plastic flat headed pegs. Smaller areas of geotextile can be sprayed with water to make the material heavy.

Membrane placement

Unrolling and unfolding of the rolls according to the installation plan, having in mind possible seaming and anchoring. To ease his displacement we advise to use air from a compressor under the membrane and displace by floating.

After verifying the correct situation of the EPDM rubber sheeting it is necessary to let it settle for 30 – 45 minutes, before finally closing the joints and/or all lining details.

2.2.5 ANCHORING THE GEOMEMBRANE

Normally the anchoring is made by burying the membrane in a trench or by ballasting (e.g. edging stone).

Trench dimensions depend upon the specification required by the project. For most installations, it is advisable to install a temporary ballast in the trench, or around perimeter once liner is laid out.

When all joints, seams and other lining details are finished, it is necessary to fully fill the pond to determinate the final settlement level of the water. Only when liner has fully settled can permanent fixing be applied around edges.

Immediate Anchoring

Not advisable, but sometimes necessary and suitable for only small projects, i.e. cascade and waterfall construction or small tank linings. Ensure that full consideration is given to find settlement of liner before applying permanent fixing. (e.g. cement)

2.2.6 JOINT FIXING

In case several sheets are necessary joints will have to be made. The sheets must be installed with no tension, or wide plies, and with minimum overlap of 15cm (6").

For small garden-ponds it's possible to make the joint seam at the side of the garden-pond, on a flat support.

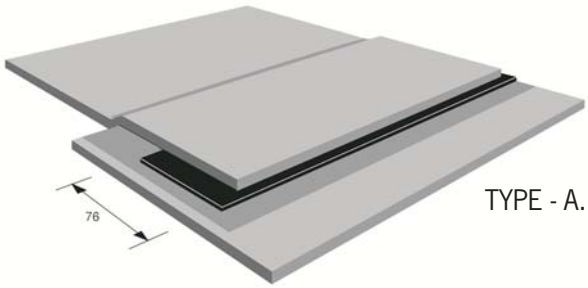
In bigger ponds we suggest to put a stratified wood panel, or an insulating panel, under the membrane along the joint. The panel can be moved along, as the welding moves forward.

DO NOT make a joint when:

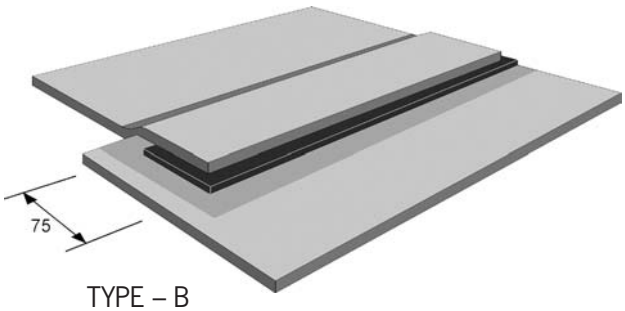
- Snowing
- Raining
- Under water
- In the sludge
- When there is condensation over the membrane

The joint between two adjacent sheets can be made with:

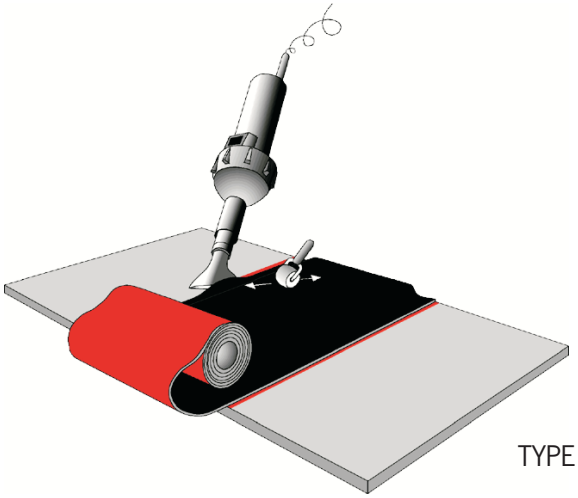
- Junta Rápida de 7,6 - (3" Quick Seam Flashing Tape) : TYPE - A.
- With Splice Adhesive SA-008 and sealed with the Lap sealant LS-009: TYPE – B
- Using the new technology from the Thermo-weldable Tape, called BTS : TYPE C



TYPE - A.



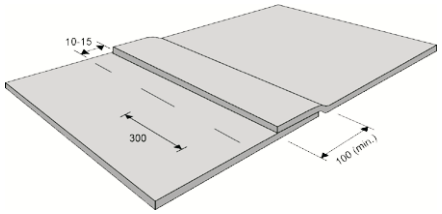
TYPE – B



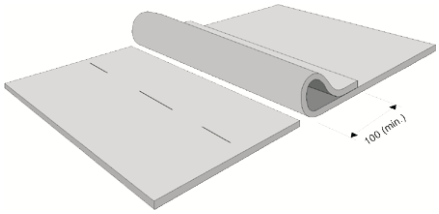
TYPE C

Joints – TYPE A: -Junta Rápida de 12 – 5” Quick Seam Splice Tape.

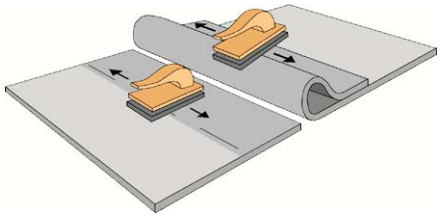
1st sep: Position the membrane



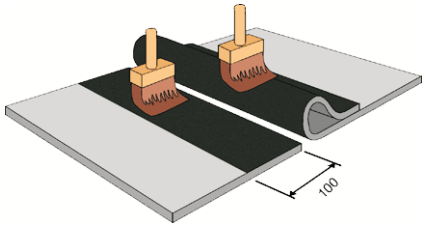
2nd step: Turn the overlap



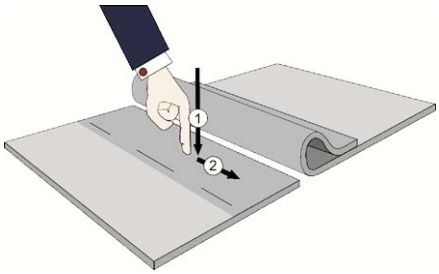
3rd step: Cleaning – if necessary



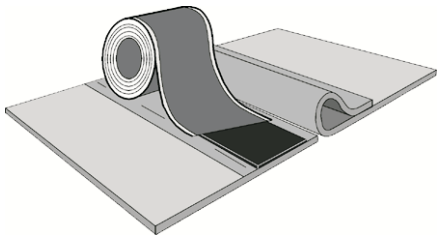
4rh step: Apply the adhesive SA-008



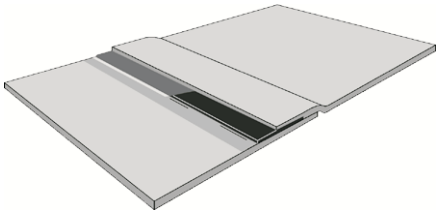
5th step: Test splice adhesive: tacking - pushing



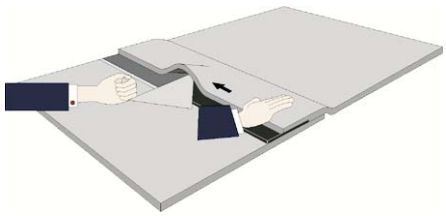
6th step:Install Junta Rápida 7,6 (3” Quick Seam Splice Tape)



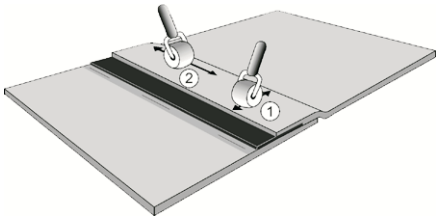
7th step: Check Tape Alignment

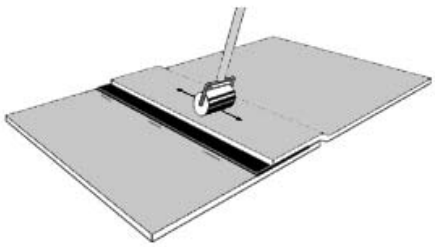


8th step: Remove paper backing



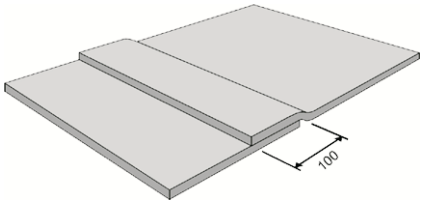
9th step: Roll the Seam



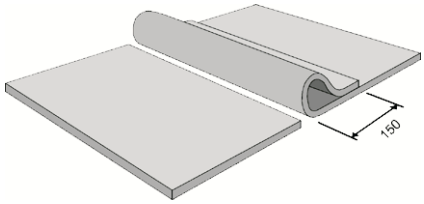


Joints – TYPE B: SPLICE ADHESIVE SA-008

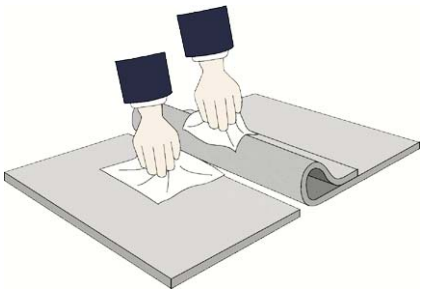
1st sep: Position the membrane



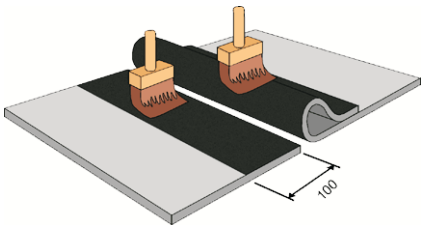
2nd step: Fold membrane back



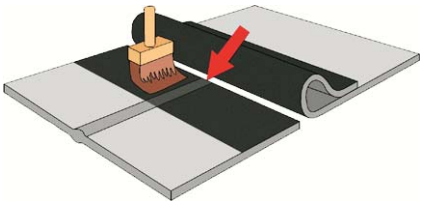
3rd step: Clean splice area



4rh step: Apply the adhesive SA-008

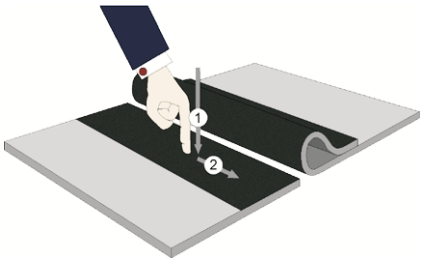


5th step: Provide extra adhesive at cross seams

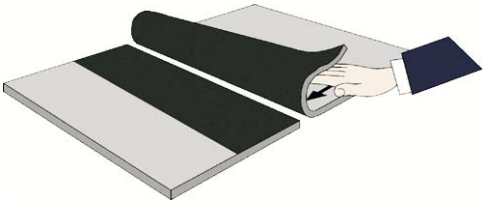


6th step:Test splice adhesive for readiness

Note: conduct both tests in the middle of the seam, not at the edge.

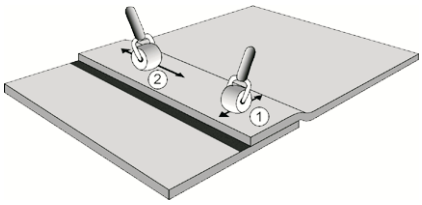


7th step: Close the lap

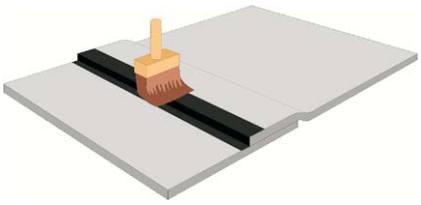


8th step: Assemble the lap

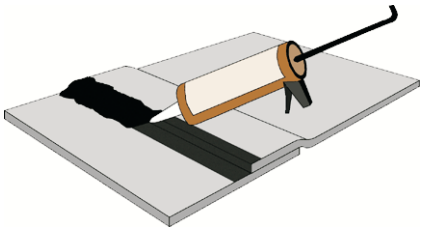
9th step: Roll the assembled lap



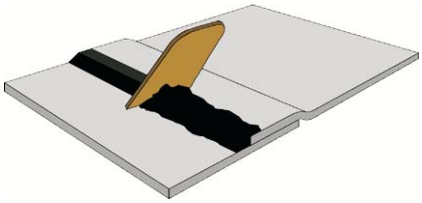
10th step: Prepare the edge



11thstep: Lap Seal with LS-009



12th step: Feather the Lap Sealant



Joints – TYPE C: SPLICING WITH B.T.S. STRIP (Best Thermo Strip)

The hot welding strip (BTS) of GISCOSA is a vulcanised giscolene EPDM strip adhered to a special thermo plastic resin on its backside.
Heating this inferior side the giscolene BTS strip allows it to be jointed to the giscolene membrane. It is available in 10cm wide and 50m long rolls.
Avoid two hot welded seams just in front of each other.

Take special care that the hot air gun does not damage the giscolene EPDM rubber membrane, if it is left on the membrane after using it.

Technical Equipment:

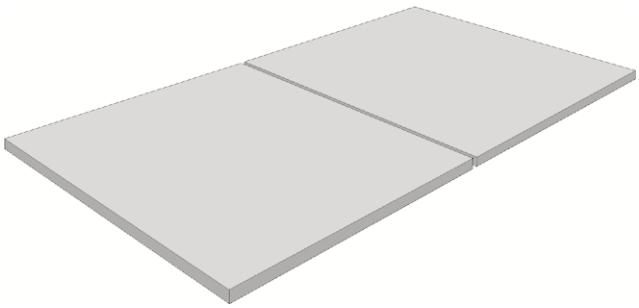
- For the application of giscolene BTS a hot air blower is required.
  Giscosa recommends the use of the Leister Triac, or similar automatic equipment.
- Adjust the temperature of the Leister Triac to 580 ºC - position 9.
- Use a 6cm nozzle for the Leister, which preferably has been bent a bit to the upper side.
- Use a silicone roller for pressing and fixing the strip on the seam.

The following steps show the application of giscolene BTS strip:

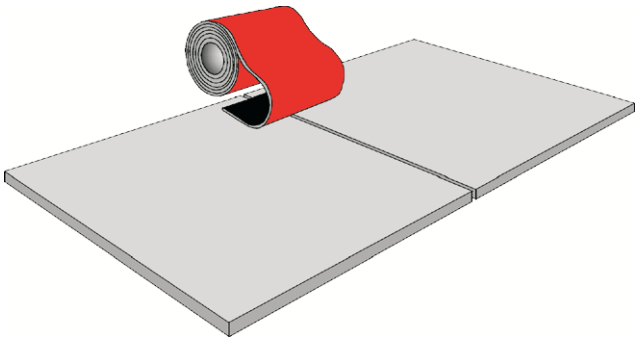
Splicing Precautions :

- Material must be clean, dry, and exempt of dangerous materials, such as: oils, fats, petroleum derivates and other waste or remains, which can damage EPDM rubber products.
- If the membrane has been in contact with open air during a few days (exposed to U.V. light), it has to be roughened with a steel brush before applying the BTS Strip.
- Check the joints after cooling down.
- The nozzle of the hot air must be cleaned with a metal brush.

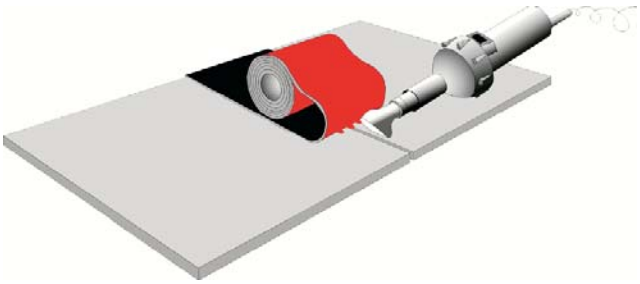
Step 1 : Position the membrane



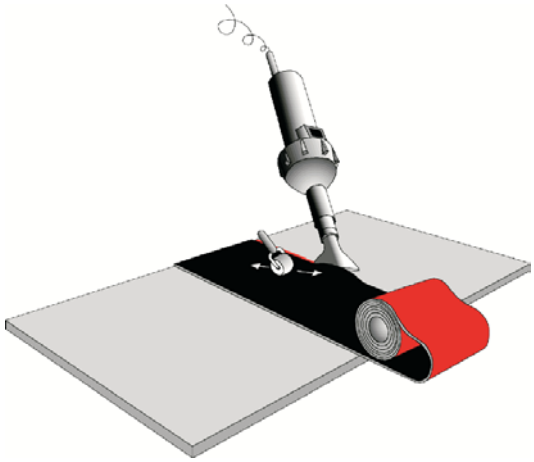
Step 2 : Unroll the BTS Strip



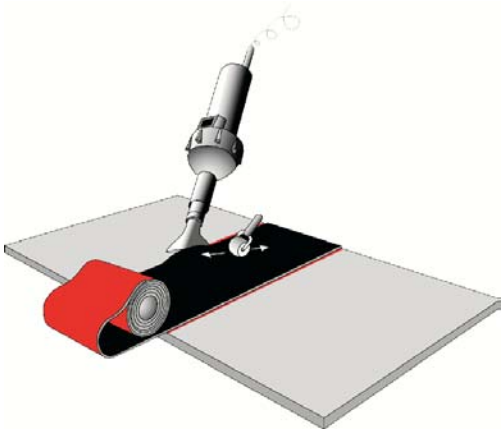
Step 3 : Fix the BTS strip



Step 4 : Weld one side



Step 5 : Weld the other side



2.2.7 MEMBRANE PROTECTION

Depending of the future use of the garden-pond, membrane protection may be required. This protection can be realised with: sand, geotextile, stone, earth or prefabricated decoration.

2.2.8 BUILDING SITE: giscoform installation

The following expose the steps for the correct application of giscoform (EPDM – formflash).

1st. step: **install the giscolene membrane: smooth, no tension.**

2nd step: **clean the membrane zone: degrease with cotton rag and splice wash, if necessary.**

3rd step: **apply the reticulation adhesive SA-008: simultaneously on both sides.**

4th step: **drying the adhesive: it must be completely dry before assembling.**

5th step: **close the lining: apply the giscoform over the membrane.**

6th step: **assemble the lining: press with a rubber roller.**

7th step: **lap sealant: apply the LS-009.**

8th step: **feather the lap sealant: with the plastic spreader.**

2.2 LINING DETAILS

2.3.1 GENERAL:

In all cases where possible, it is recommended NOT TO CUT the giscolene membrane, and re-fold the remaining on top, around edges of pond.

When the membrane is cut, giscoform tape will have to be used to waterproof around the detail.(e.g. bottom drain or side outlet / inlet)

2.3.2 FIXING TO: Concrete, Brick-wall…

- the fixing walls must be clean, smooth, and without roughness
- the wall joint must not permit the water to leak out between the membrane and the wall.

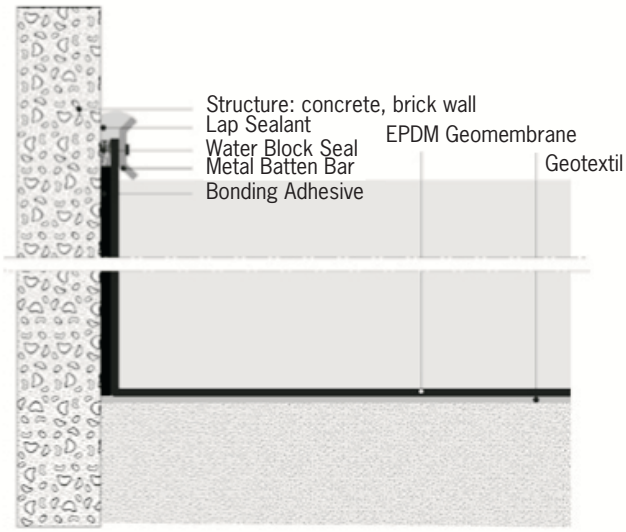


Fig. 4: Fixing to concrete, brick wall

2.3.3 FIXING TO CANALISATIONS:

It is necessary to verify if the ground compactation around the canalisations are sufficient to prevent all possible later settlement.

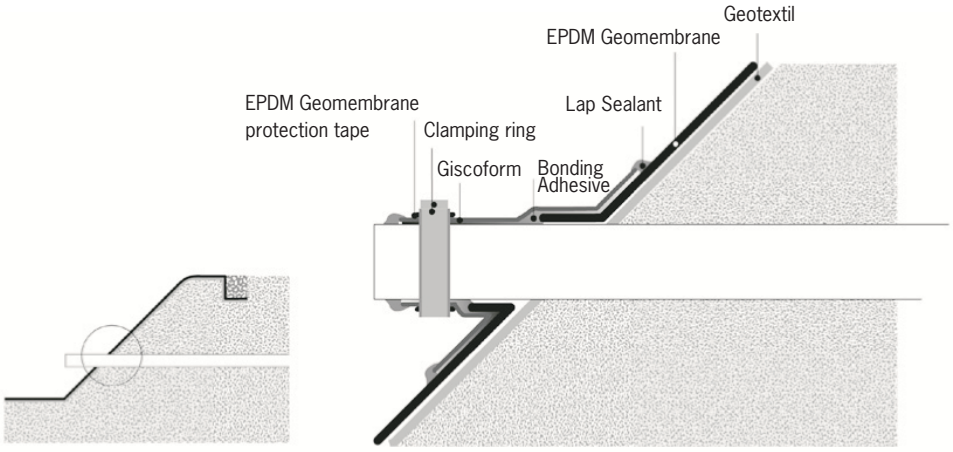


Fig. 5: fixing to canalisations

2.3.4 FIXING TO DRAINS:

The fixation between the giscolene membrane and drain outlet tube can be done by use of a mechanical system, i.e. flanged drain connector.

Between the membrane and the clamping ring seat flanges, it is imperative to include a water block seal cordon.

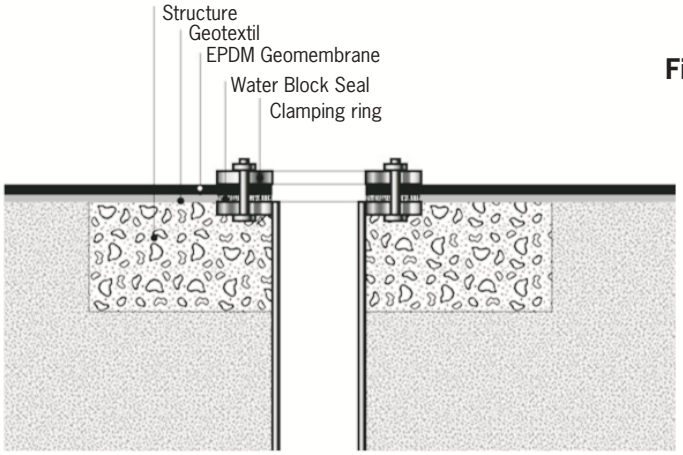


Fig. 6: clamping rings system

Fig. 6.1: drain system with clamping ring

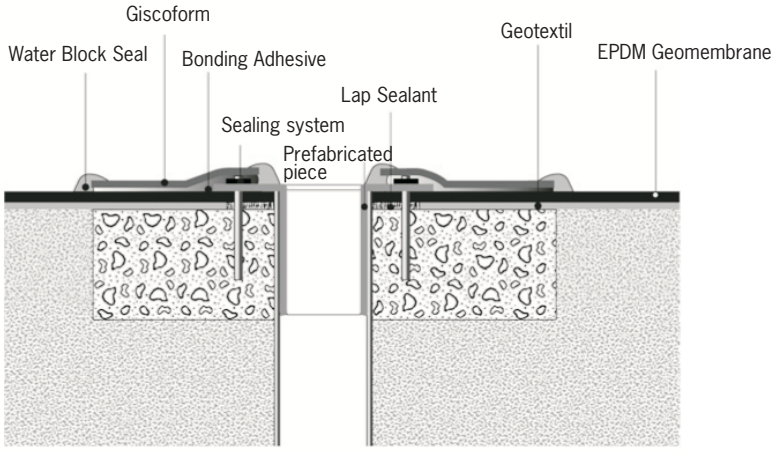


Fig. 6.2: clamping rings system

2.4 LINER REPAIR NOTES

The repair method varies according to if the membrane is new or if it has been in service for many years.

In the first situation, the best method is:

- Each membrane damaged will be repaired with a piece of the same membrane, around 15cm larger on each side, than the damage. The new piece will be adhered to the damaged membrane with reticulation adhesive SA-008.

If it is necessary to clean before the adhesive application, use a cloth with unleaded petrol.

In the second situation, the method is different:

- Firstly clean the damaged zone to remove the accumulated waste, initially, scrubbing with a mop with soap and warm water, rinse with clear water and wait to dry. Next to continue like the first situation,

Finally seal and protect the edges with LS-009.

ANNEX 1: PRODUCT DESCRIPTION

The Giscosa waterproofing systems for garden-pond lining use a complete range of products including the giscolene geomembrane, adhesives, tapes, sealants, cleaning products and prefabricated accessories.

Geomembrane

Giscolene: a geomembrane produced by calendering and vulcanisation, different thickness are available Sheets from: 0,75 - 1,00mm (.030" - .040") thickness are mostly used for pond construction.

Adhesives and tapes

Giscoform: self-vulcanising tape, can be moulded and adjusted to irregular forms like corners, pipes….
Splice Adhesive (SA-008): Reticulation adhesive based on butyl, used for on site joints between géomembranes and/or with giscoform.
JUNTA RÁPIDA de 7,6 – (3" Quick-seam splice tape): butyl tape, self-adhesive double-faced for the joint between the giscolene sheets. To be used together with Primer
B.T.S. –(Best Thermo Strip): EPDM rubber vulcanised tape, at the underside a transparent thermoplastic film is adhered.
Bonding Adhesive (BA-007): Contact adhesive based on neoprene, used for bonding sheets or giscoform to other surfaces (wood, metal, concrete, and others…)
· Primer: To prepare the cured EPDM membrane activating his surface before to receiving the self adhesive tapes. Brush applied.

Sealants

Lap Sealant (LS-009): Filler rubber based for the sealing of joint edges that have previously used splice adhesive

Accessories

Termination Bar: normally is used for attaching and sealing flashing wall terminations.

Materials from other origins include fasteners, bridles, drain pieces, metallic profiles, etc…, can be used with Giscosa approval.

ANNEX 2: TOOLS CHECKLIST

TOOLS CHECKLIST

1. REQUIRED

- Preparation
  - tape measures – 5 and 50 m.
  - scissors
  - chalk liner

- Cleaning
  - adequate cotton cloths
  - cleaning agent

- Joints
  - painters brush - solvent resistant, short hair, 100 mm wide
  - silicon rubber roller 5cm wide
  - caulking gun

2. ADVISABLE

- hot air gun – blow dryer type
- electric extension cable
- RCD adaptor
- paint rollers – solvent resistant, short hair, 225 mm wide
- rubber lip spreader
- pliers
- chalk
- rubber gloves
- tool box
- screwdriver
- 20 l / 5 gal Unleaded petrol