

MANUFACTURER'S OFFICIAL INSTRUCTIONS FOR USE (IFU)

ISSUE NUMBER: 3

18.02.2014



PRODUCT: FLAGON GEO P/AT

Synthetic liner with Signal layer (contrasting colours of upper and lower surfaces) for use as a waterproof liner to tanks, lakes, vestibules designed to hold water intended for human construction.

Synthetic liner with single colour for use as a baffle curtain to tanks, lakes, vestibules designed to hold water intended for human construction.

FEATURES

- Excellent weldability;
- Softness and flexibility;
- High ultimate elongation (dimensional variation of the membrane when subjected to mechanical stress);
- Tensile strength (the membrane can resist tensile stress without tearing);
- Durability;
- Adaptability to irregular substrates;
- Maintains its integrity even in the case of structural movements or soil subsidence;
- Resistance to fluctuating electrical current;
- Suitable for installation in damp conditions;
- Resistance to static puncturing;
- Resistance to dynamic puncturing;
- Chemical resistance;
- Resistance to bacteria and fungi;
- Resistance to micro-organisms;
- Resistance to roots;
- Signal layer surface (bi-colour membrane only)
- Compatibility with special accessories;
- Ease of performing quality tests in the post-application stage (Specifically, checking the welded seams).

Other possible attributes can include:

- Fire resistance;
- Compatibility with drinking water;

CONDITIONS OF USE

To be used to provide a waterproof liner to storage tanks containing water intended for human consumption and flexible baffle curtains installed vertically within a reservoir to assist water movement within the tank

SURFACE PREPARATION

The surface of the tank must be as smooth as possible and free from rust, debris and other irregularities that may puncture the waterproofing layers. Nails or bolts must be covered by suitable means and made flush with the surrounding surface;

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Once the correct preparation of the substrate has been verified, it may be necessary to install a protection geotextile to protect against mechanical damage and abrasion, the weight and properties of the geotextile should be condition specific but generally a minimum 200g/m². The geotextile should be laid in dry conditions with a 200mm overlap at edges and only needs to be secured in curved or slanted applications

PRIMERS

No Primers required

COMPOSITION

The Manufacturing Process

Co-extrusion

The exclusive manufacturing process, designed by Flag for this type of membrane, involves the direct co-extrusion.

The mixture of material components (resins, stabilisers, pigments, etc.) is introduced through hoppers into a cylindrical chamber. Here it is heated up and pressed by worm screws into a co-extrusion head, where the single extruders converge, to produce a material that is a single-layer homogeneous liner, with a glass scrim reinforcement in the centre and different colours on either side.

The membrane thickness is automatically adjusted by electronic equipment that controls the opening of the extrusion head and of the calendar.

The process allows production of a two-colour, single-layer membranes with a signal layer or a single-layer single colour membrane for baffle curtains

The signal layer system is an essential feature and ensures immediate detection of any puncture or tear in the liner by exposing the darker colour underneath.

Produced in UNI EN ISO 9001:2000 and UNI EN ISO 14001 certified plant.

INSTALLATION/APPLICATION

Specific installation method for Waterproof Liner

Installed by operatives approved by Flag S.p.A. Finishing and accessories with elements manufactured and approved by Flag S.p.A.

The membrane is laid with the green signal layer uppermost as this is the water contact side. The connection between the Flagon waterproof membranes is made by thermal welding, this produces a homogeneous lap. The two welding systems that can be used are hot air guns or automatic equipment. These are not mutually exclusive, but can be used together according to the specific requirements and characteristics of each project.

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Hot air manual welding

Hot air welding is generally carried out using a hot air gun.

The layers must be overlapped by and fixed by spot welding. The welding temperature varies according to the layer thickness, the environmental temperature and the nozzle used. The next phase is the pre-weld, carried out parallel to, and behind, the main welding line. The pre-weld should be tested for delamination before the main weld is carried out. The final stage is the main weld, which follows the same procedure.

For detailed information, see our "FLAGON installation procedures".

Welding by automatic equipment

Automatic welding can be performed using hot wedge welders. The heating element is made up of a hot wedge that forms a welded seam in a continuous width of 42mm or a double weld that enables the air gap between the two welding lines to be tested using the pneumatic air pressure and gauge method.

The exact electronic control of speed and temperature is vital to ensure a perfect weld.

Leading edges and overlap details

Where there are more than two thicknesses of liner, e.g. at T joints or cross joints, or in the case of the welded air gap, a special chamfering tool is used to prepare the welding seams by cutting the angle of the leading edge. All sharp edges at the leading edges must be rounded using scissors.

Specific Installation method for Baffle Curtains.

Each baffle curtain requires a top and bottom connection detail which retains the curtains in a vertical position. The top and bottom connection requires holes to be drilled into the reservoir soffit ready to receive a mechanical expanding anchors or resin anchors. The top connection has a stainless steel eyebolt screwed into the anchor which then receives an adjustable strap which is used to tension the curtain once in place, the floor connection can either be repeated as above or secured with a stainless clamp bracket which can set the gap between the underside of the curtain and the floor.

The baffle curtain top and bottom pocket receives a continual PVC-U pipe with end caps – (DWI 56/4/937 Durapipe Grey PVC-U Pipe NGS). The curtains are positioned directly below the area of hanging where the pipes are installed in readiness to be pulled up into a vertical position. Carefully, linear holes are punched into the top and bottom hem which allows connection to the floor and provides a mechanism for the curtain to be raised into position, secured and tensioned using the adjustable straps.

The baffle curtain is fixed to the wall by folding the excess material back around a small vertical UPVC pull out tube which is then fixed back to the wall with stainless steel bar and fixings. The free end requires tensioning using a straining wire which is inserted through a UPVC tube in the small vertical pocket. The straining wire is connected through a top pocket eyebolt and clamped, whilst at the bottom is secured using the same practice but incorporating a stainless steel rigging screw which is turned to set the tension required.

CURING

No curing time necessary.

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PRE-COMMISSIONING STORAGE FOR TRANSIT

Rolls of FLAGON GEO P/AT membrane are packaged in rolls wrapped in polyethylene film. They are delivered to site on pallets. These should be stored in a dry place or, if this is not possible, protected against dampness and exposure to frost and snow using waterproof sheets.

All FLAGON GEO P/AT membranes have a green label identifying the manufacturer's name and address, product identification and batch number, its thickness, length and width.

The standard roll weight is 60 kg for 1,2 mm, 65 kg for 1,5 mm, 78 kg for 1,8 mm and 87 kg for 2,0 mm.

CLEANING AND COMMISSIONING

If required the membrane may be flushed using chlorine and rinsed well using fresh water. The maximum constant chlorine concentration at ambient temperature for Flagon GeoP/AT is 40 mg/l (ppm), though flushing for maximum 1 hour with 500mg/l, followed by an immediate clean water wash can be accepted for disinfection. No other treatment is necessary.

INSPECTION OF INSTALLED MEMBRANE TESTING

Visual Test (signal layer)

The contrasting colours of the upper and lower surfaces of FLAGON GEO P/AT membranes allow the integrity of laid membranes to be checked visually. If, during installation, the waterproof membrane has been in any way damaged or abraded, this will be readily apparent as the darker inner layer of the membrane will be exposed. This can then be easily repaired by welding a piece of the same material over the damaged area.

Weld testing

The integrity of welds can be checked by mechanical, pneumatic or destructive testing. These tests can be recorded in the site Journal, if required by the Building Supervisor.

Destructive testing

This test is performed before commencement of each day's installation.

A destructive tensile test is carried out by peel testing a sample of the weld. To do this, cut a 1 cm wide section of the previously welded membrane. Apply pressure to the weld by pulling on the two ends of the sheet. The membrane must fail outside the welding seam. This control must always be carried out each day on a sample weld before the installation of the waterproof membrane commences.

Note: The test, although manually performed on site, is based on the provisions set forth by the UEAtc Directive.

Mechanical test (weld made by manual hot air gun)

Manually welded seams are inspected using a Flag Welding Tester (seam probe) and can also be checked using a vacuum testing unit.

The mechanical test is carried out by passing the rounded tip of the welding tester along the welded seam, exerting an adequate pressure to identify any weak or insufficiently adhered spots. This operation is absolutely necessary to check the integrity of the weld and should be performed when the material is cold. If any gaps or insufficiently welded seams are found, clean and re-weld as necessary or weld over the seam with a minimum 120 mm wide strip of the same product.

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Pneumatic test (weld made by automatic equipment – double seam weld)

This method ensures an absolutely objective check of the welding seams.

The double seam enables the sealed lap to be tested for water and air tightness and mechanical strength by the injection of compressed air. The laps are typically tested with a pressure of 2.0 bar which must be held for a period of approximately 10 minutes. The pressure drop must not be greater than 10%.

GENERAL SAFE HANDLING PRECAUTIONS

Following is a list of the hazards inherent in the lining of the water storage tank and the precautions by which should be taken to minimise the risks.

Manual Handling Electricity – power tools, etc.	Safety Training Servicing and Portable Appliance Testing. Only 110V equipment will be used.
Flying particles – drills, jigsaws, grinding.	Eye Protection, pre-drilled components where possible
Hot air welding - Burns Work at height Collision with protrusions, etc. Cuts to hands with sharp/jagged edges Falling objects	Gloves. Suitable steps/access. Head protection. Gloves. Foot protection, head protection, prevent public access.
Confined Space	Access hatch to remain open at all times to ensure natural ventilation. One engineer to remain as lookout in the hatch area.

Overalls, hard hats, safety boots, confined space harness, goggles and gloves should be worn at all times.

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REPAIR AND PATCH

Should accidental damage occur after installation, repairs are simple. Cut a patch of FLAGON GEO P/AT to completely cover the cut and round the corners with scissors. Trace the circumference of the patch onto the surface. Scrape the surface of the waterproof membrane. Clean the surface of the membrane with a new cloth. Spot-weld, pre-weld and weld the patch in place.

DISPOSAL OF EXCESS MATERIAL

THE DISPOSAL OF FLAGON GEO P/AT

As with other plastic products waste is disposed by:

- 1. Monitored landfills**
- 2. Incineration**
- 3. Recycling**

1. Monitored landfills

Disposal in landfills, in compliance with local laws, avoids ecological problems because the raw materials and additives used are inert and perfectly stable. Micro-organisms in the ground do not attack polymers. But this is not the most ecological way to process FLAGON GEO P/AT membrane at the end of its life because the remaining energy in the sheet is not recycled.

2. Incineration

In compliance with local laws, combustion of FLAGON GEO P/AT membranes in a modern incinerator doesn't cause any environmental problems. During the pyrolysis process, non-polluting gases are produced in the atmosphere.

The inorganic part undergoes an oxidising process that, after proper neutralisation, can be stocked in a waste dump without damage to the environment. The polymeric material is a source of useful energy when incinerated. The neutral nature of the combustion fumes and the solid waste resulting from pyrolysis means the process is absolutely safe, in terms of both incinerator procedures and surrounding areas.

When FLAGON GEO P/AT membranes are dirty or polluted by external agents, disposal by incineration is particularly relevant.

3. Recycling

TPO membranes, like other kinds of synthetic sheets, can be recycled at the end of their life. Mechanical recycling has no environmental impact. While the manufacturing process itself creates some unavoidable waste, this can be recycled and used to replace new raw materials, thereby helping to save energy. At the end of their life, FLAGON GEO P/AT membranes can easily be recycled thus justifying any costs incurred for collection, treatment and energy expenditure. In terms of pollution, recycling is comparable to the original manufacturing process. On this point Flag has already carried out manufacturing tests to produce surfaces that have an additional function, such as separation or protection layers, because the normal ageing process of the polymeric matrix and the unavoidable residues present after FLAGON GEO P/AT liners' cleaning process make them unsuitable for the production of new FLAGON GEO P/AT liners.

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