# Lantor Composites®

## Application Manual


**Learn all the benefits of Lantor Composites® products**

**Improve product performance**
**Increase process efficiency**
**Reduce part weight**

LANTOR nl Composites

# LANTOR APPLICATION MANUAL

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Version 2.0



LANTOR nl Composites

# INTRODUCTION

Lantor B.V., based in Veenendaal in the Netherlands focuses on the development, manufacturing and global marketing of high added value nonwovens for applications in the Cable, Composites, Construction, Packaging and Automotive industries.

The Lantor Composites division offers a comprehensive range of innovative nonwoven solutions for the Composites (Fibre Reinforced Plastics) industry, including:

- Lantor COREMAT core material (bulker) and print-blocker (liner) for hand lay-up and spray-up processes
- Lantor SORIC core material (bulker), infusion medium and print-blocker (liner) for closed mould processes
- Lantor FINISHMAT: synthetic surfacing veils for surface enhancement, chemical and weathering resistance.

Lantor Soric is a polyester nonwoven with a pressure-resistant hexagonal or a random dot-printed cell structure, specifically developed for closed-mould processes. Soric was introduced at the JEC in Paris in 2002, and as such is a relatively new product to the industry.

The purpose of this Application Manual is to provide information on the properties, applications, benefits and processing of Lantor Products - Coremat, Soric and Finishmat.

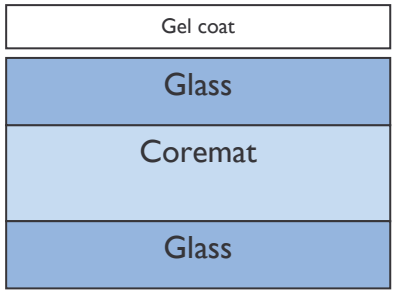
Figure 1: MAN Truck, Infused with Finishmat D7760


Figure 2: Bénéteau (FR) Soric SF and Soric TF

# 1. COREMAT

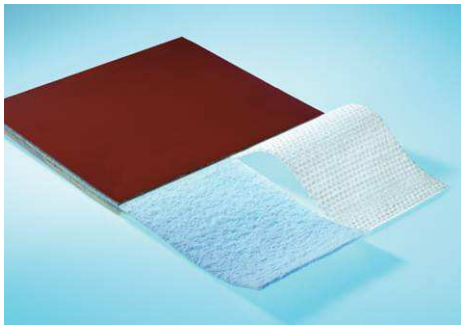
Coremat is a polyester nonwoven that contains microspheres. Coremat is used as a thin core (bulker mat) or print blocker in fiber reinforced laminates, manufactured in Hand Lay-up or Spray-up processes.
Coremat should always be fully impregnated with resin. The microspheres in Coremat prevent excessive resin up-take. The most important reasons to use Coremat are:

- Labour saving: Impregnating one layer of Coremat takes the same time as impregnating one layer of glass. However, Coremat builds up 1 to 10 mm (0.04-0.39 inch) in one layer, where with glass this will take multiple layers.
- Weight saving: Coremat has a density of 610 kg/m$^3$ (38 lb/ft$^2$). Impregnated chopped strand mat has a density of 1.500 kg/m$^3$ (94 lb/ft$^3$). This is a weight saving of 60%.
- Coremat saves resin and glass. Coremat can replace glass layers; it absorbs less resin than glass per mm thickness. 1 mm CSM uses 1 kg (2.2 lb) of resin, 1 mm Coremat uses 0.6 kg (1,32 lb) of resin.



## 1.1 **COREMAT PRODUCT RANGE**

The Coremat product range consists of two types; Coremat Xi and Coremat XM.
Coremat Xi is the standard Coremat product and has a colour change resin indicator. Coremat XM has hexagonal cells and excellent processing properties.



**Coremat Xi**
Coremat Xi is the world standard for bulker mats. The Coremat resin consumption is about 600 grams (21.2 oz) per mm thickness. It contains a colour change resin indicator which confirms that resin has been applied to the Coremat, however it does not show whether the Coremat has been fully saturated.
Coremat Xi is very soft and pliable when it is wet and therefore very suitable for complex shapes.

**Coremat XM**
Coremat XM has a low resin take up: 500 gram (17.6 oz) of resin per mm thickness. It is therefore suitable for weight critical applications. The hexagonal cell pattern results in a very consistent thickness in the product. Coremat XM has a higher wet tensile strength than Coremat Xi; it is often used in applications where mats are pre-wetted outside the mould.
Generally customers choose Coremat XM, because of its smoothness, ease of working, and resin savings.

**Thickness range**
Coremat Xi is available in thicknesses of 1, 2, 3, 4 and 5 mm.
And Coremat XM in thicknesses of 2, 3, 4 and 10 mm.

**Width**
Standard Coremat Xi and XM are available in 1 meter (39 inch) width.
Greater widths may be available upon request.

## 1.2 **COREMAT KEY BENEFITS**

**Coremat saves labour**
One layer of Coremat builds up thickness quickly, one layer of Coremat is 1 to10 mm (0.04-0.39 inch) thick. It will take multiple layers of glass fiber to achieve these greater thicknesses. With Coremat it requires only one layer.

**Coremat saves weight**
Coremat as a core material is used in the centre of a laminate. Coremat can replace solid glass layers which are much heavier than Coremat. For example:

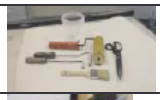
- 2 mm Coremat weighs 1.2 kg/$m^2$ (3.9 oz/$ft^2$)
- 2 mm impregnated CSM weighs 3 kg/$m^2$ (9.9 oz/$ft^2$)
- This means a weight saving of 60%.

**Coremat saves resin and glass**
Coremat uses less resin than CSM: 1 mm (0.039 inch) of Coremat uses 0.6 kg/$m^2$ (2.0 oz/$ft^2$) while 1 mm (0,039 inch) of CSM uses 1 kg/$m^2$ (3.31 oz/$ft^2$). Coremat generally replaces glass layers. However Coremat should always be used between glass layers.

**Coremat is an excellent print blocker**
Coremat can be used to block "print through" of glass reinforcements and cores, especially when using dark gelcoat surface finishes. Coremat is most often applied against the "skin" coat to create a superior surface finish on hull sides.

## 1.3 **HOW TO USE COREMAT**

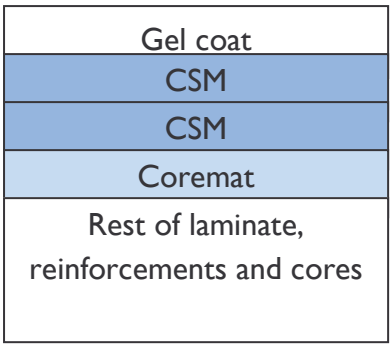
### PRACTICAL TIPS FOR USING COREMAT

| | |
|---|---|
| Normal laminating tools are suitable to apply Coremat |  |
| Coremat can be pattern cut to fit exactly, using a trim knife or hand scissors. |  |
| Gel coated mould |  |
| Apply first layer of resin in the mould |  |
| Apply layer(s) of glass mat "skin coat" |  |
| When the skin coat cures, apply Coremat in the mould. Coremat Xi should be impregnated in the mould. Apply resin to the skin coat first, then install the Coremat, working the resin through the Coremat with a metal roller, while applying more resin to the top. Wet the backside of Coremat Xi 4 and 5 mm separately by folding the Coremat back on to itself in order to ensure complete saturation. Coremat XM can be wetted outside the mould than the saturated Coremat placed in the mould and rolled. |  |
| Apply resin to the Coremat in the mould. You can not apply too much resin. The subsequent glass layers will absorb superfluous resin |  |
| Coremat Xi is very conformable when it is wet, it will conform to corners and edges easily. However, do not roll Coremat Xi aggressively. |  |
| Always check impregnation. A small puddle of resin should form in front of the roller when a light pressure is applied. Resin consumption is ± 600 g/m$^2$ (2.0 oz/ft$^2$) per mm thickness for Xi and ± 500 g/m$^2$ (1.65 oz/ft$^2$) per mm for XM |  |
| Coremat Xi can easily be butt-jointed. You can easily close a small gap between the mats by rolling the edges to each other. However, do not roll Coremat Xi too aggressively. |  |
| Apply layer(s) of glass fiber on top of Coremat), using any excess resin to back wet the glass layers. |  |
| Ready | |

**Coremat as a Thin Core**

Coremat when used as a thin core, as opposed to a "print blocker" is generally used in the centre of a laminate. The thickness of the Coremat ideally has to be about 50% of the total laminate thickness. It's important to always use Coremat with one or more glass skins on either side. Take note that Coremat should be used to increase the stiffness of laminates by increasing laminate thickness, not to strengthen the laminate.

**Coremat as a Print Barrier**
Coremat is also applied as a print blocker (liner). Coremat can block print through of reinforcements and cores. When used as a print blocker Coremat should never be placed directly against the gel coat. Always use a one or two layers of CSM "skin coat" between the gel coat and the Coremat.




**Using Multiple Layers of Coremat**
Coremat can be used in multiple layers in order to build even greater thickness. Points of attention when using Coremat in multiple layers, are:

- The total thickness of the Coremat should be in the range of 50% of the laminate thickness. So if the final laminate is 14 mm (0.55 inch), the Coremat should be no more than 7 mm (0.28 inch) thick.
- Coremat can be used wet-on-wet. However, beware of excessive exotherm build-up. Multiple layers of Coremat contain a volume of resin which cures at the same moment. The peak temperature due to the exothermic reaction may exceed the allowable temperature for Coremat, 145 °C (293 °F). This can be prevented by waiting for the previous layer of Coremat to cure before applying the next one.
- When a layer of Coremat has cured it should be lightly sanded to knock off any high points before the next layer is applied. To avoid sanding, a light CSM layer can be added before curing. When cured, another layer of CSM or Coremat can than be applied directly.

**Impregnation Outside the Mould**
Impregnation of the Coremat outside the mould is often more convenient than inside the mould. This is often the case when small pieces are involved or when vertical faces have to be impregnated. However, it is important to remember that the binder in Coremat Xi dissolves quickly in styrene. This makes Coremat Xi extremely pliable when it is wet, but it makes it harder to lift a piece when it is wetted.
If impregnation of the Coremat outside the mould is a requirement, then Coremat XM may be the better option. Coremat XM is also conformable because of its hexagonal cell pattern. It is not totally reliant on the styrene dissolving the binders for conformability, and therefore has higher "wet strength, and is thus more suitable for wetting outside the mould.

**Coremat Saves Resin**
Coremat impregnates quickly and easily. The microsphere content of Coremat prevents excessive resin uptake. Superfluous resin will be absorbed by the next layer of glass.
One layer of Coremat not only builds thickness faster than multiple layers of glass fiber, but the overall use of resin is less. For instance, 3 mm of Coremat needs 1.8 kg/m$^2$ (6.0 oz/ft$^2$) of resin. 3 mm of CSM needs 3 kg/m$^2$ (9.9 oz/ft$^2$) of resin, or over 50% more.
Although it is not possible to use too much resin on Coremat, it is possible to not use enough. When too little resin is applied, the Coremat may absorb resin from the glass layers. This may cause "dry spots" n the reinforcements. These lower than optimum "glass to resin ratios" can have a negative effect on the mechanical properties of the laminate.

**Applying Resin**
Resin can be applied by hand, but is better applied with spray equipment. Use a metal or short nap roller (instead of a brush) to spread the resin and force it into the Coremat. Do not use vertical pressure. The impregnation of Coremat is very good, when resin is applied to the surface, the Coremat will absorb it by itself. For this reason, there is no need to roll Coremat Xi aggressively.

**"Impregnation Check"**
A small puddle of resin should form in front of the roller when the roller is lightly applied to the Coremat surface. Another way is the "proof of thumb". Press your thumb with a light pressure on the Coremat layer. When resin forms a puddle around your thumb, enough resin has been impregnated.

**Overlapping Coremat**
It is better to use butt-joints between pieces of Coremat. A small gap between may be closed by rolling the edges together. Lapping Coremat layers should be avoided because:

- Coremat is relatively thick. Two layers of 2 mm when overlapped are 4 mm thick. 5 MM becomes 10 MM.
- An overlap thus creates an increased mass of resin, which may cause print through in the surface as it cures, shrinks, and exotherms.

**Vertical Lamination**
Most hull moulds rotate to allow easy application of the laminate on near horizontal surfaces. However, for vertical surfaces which cannot be rotated to the near horizontal, laminating Coremat needs a slightly different procedure. Laminate the glass mat as usual. Impregnate Coremat on one side on a horizontal table to ensure full impregnation. Again, Coremat XM may be more appropriate for this application than Coremat Xi. Always use a thixotropic resin. Work top down applying the Coremat against the glass. Try to fix the Coremat at the top and roll downwards. Continue the lamination process on the other side.

## 1.4 COREMAT TECHNICAL INFORMATION

### Approvals
Lantor Coremat has the following approvals:
- Type Approval: Lloyds Register of Shipping, MATS/2828/1
- Certificate of Design Assessment: American Bureau of Shipping, 04-LD389636-PDA
- Lantor B.V. is certified ISO9001:2000 and ISO14001:2004

### Acoustic Properties
Coremat has a positive effect on the damping of sound. The microspheres in Coremat strongly improve sound damping properties.

### Chemical resistance
The chemical resistance for Coremat has been tested for several chemicals. The laminate build up was:
- CSM 225 g/m$^2$ (0.75 oz/ft$^2$)
- CSM 450 g/m$^2$ (1.5 oz/ft$^2$)
- Coremat Xi 3 mm
- CSM 450 g/m$^2$ (1.5 oz/ft$^2$)

Resin: Bisphenolic acid Synolite 371-54-0000 DSM

| Tested chemical | Tested temperature | Exposure time | Conclusion |
|---|---|---|---|
| Distilled water | 80 °C (176 °F) | 60 days | Resistant |
| Hydrochloric acid 37% | 80 °C (176 °F) | 60 days | Not resistant |
| Sodium Carbonate 25% | 70 °C (158 °F) | 60 days | Resistant |
| Sodium hypochlorite 25% | 80 °C (176 °F) | 60 days | Not resistant |
| Acetic acid 50% | 80 °C (176 °F) | 60 days | Resistant |
| Sulphuric acid 5% | 80 °C (176 °F) | 60 days | Resistant |
| Oxalic acid 15% | 50 °C (122 °F) | 60 days | Resistant |

### Calculation Service
Lantor B.V. provides a calculation service. We can advise you on an alternative laminate build with Coremat or Soric. For costumers in the USA and Canada we refer to Alcan Baltek in the USA. They have similar services for the North American region.

*Example of re-design with Coremat.*
When re-designing an existing (all glass) laminate to incorporate Coremat, a number of parameters need to be considered. Lantor Calculation Service can offer important insights in the consequences of various design decisions. As shown in the following example.

*Tank Cover*
A Lantor proposal to modify the current lay-up from tank covers. The use of Coremat leads to a 15% weight saving, and an improvement of the flexural stiffness of the product. As only 5 in stead of 6 layers have to be laminated, there will be a labour saving too.

| ORIGINAL Tank Cover | PROPOSAL With Coremat |
|---|---|
| Gel coat | Gel coat |
| CSM 600 g/m² (2 oz/ft$^2$) | CSM 450 g/m² (1.5 oz/ft2) |
| CSM 600 g/m² (2 oz/ft$^2$) | CSM 600 g/m² (2 oz/ft2) |
| WR 520 g/m² (1.7 oz/ft$^2$) | Coremat Xi 3mm |
| CSM 600 g/m² (2 oz/ft$^2$) | CSM 800 g/m² (2.6 oz/ft2) |
| CSM 520 g/m² (1.7 oz/ft$^2$) | CSM 450 g/m² (1.5 oz/ft2) |
| CSM 600 g/m² (2 oz/ft$^2$) | |

| | | Original tank cover | Coremat tank cover | Difference % |
|---|---|---|---|---|
| Thickness | mm<br>inch | 6.88<br>0.27 | 7.48<br>0.29 | + 8.8 % |
| Weight | kg/m$^2$<br>oz/ft$^2$ | 10.1<br>33.4 | 8.5<br>28.1 | - 15.5 % |
| Density | kg/m3<br>lb/ft$^3$ | 1.47<br>0.09 | 1.14<br>0.07 | -22% |
| Flexural modulus | MPa<br>Psi | 6793<br>985,000 | 6746<br>978,000 | Equal |
| Flexural stiffness | MPa<br>Psi | 184.1<br>26,700 | 235.4<br>34,100 | + 27.9 |
| Bending moment (gel coat loaded) | Nmm<br>ft-lb | 1497<br>1.10 | 1858<br>1.37 | + 24.1 |
| Flexural strength gel coat loaded) | MPa<br>Psi | 190.0<br>27,550 | 199.2<br>28,900 | Equal |
| Bending moment (topcoat loaded) | Nmm<br>ft-lb | 1396<br>1.03 | 1564<br>1.15 | + 12.1 |
| Flexural strength (topcoat loaded) | MPa<br>Psi | 177.1<br>25,700 | 167.6<br>24,300 | Equal |
| Numbers of layers | | 6 | 5 | -17% |

**Compatibility with Resins**
Coremat is compatible with all commonly used resin types; Polyester, Vinylester, Epoxy and Phenolic.
Coremat Xi though, only changes colour with polyester and vinylester resin.

The binder used in Xi and XM dissolves in polyester and vinylester, this means less conformability, especially with Xi, in other types of resin may occur
Some catalyst systems can cause brown colouring of the Coremat. When this occurs, Lantor advises the use of a different catalyst system.

**Density**

| **Product code** | | **Xi 1** | **Xi 2** | **Xi 3** | **Xi 4** | **Xi 5** |
|---|---|---|---|---|---|---|
| Coremat Xi dry weight | g/m$^2$<br>oz/ft$^2$ | 46<br>0.14 | 62<br>0.20 | 88<br>0.29 | 114<br>0.37 | 125<br>0.41 |
| Resin uptake | kg/m$^2$<br>oz/ft$^2$ | 0.8<br>2.64 | 1.2<br>3.97 | 1.8<br>5.95 | 2.4<br>7.94 | 3.0<br>9.93 |
| Xi density impregnated | kg/m$^3$<br>oz/ft$^3$ | 630<br>39.0 | 630<br>39.0 | 630<br>39.0 | 630<br>39.0 | 630<br>39.0 |

| **Product code** | | **XM 2** | **XM 3** | **XM 4** | **XM 10** |
|---|---|---|---|---|---|
| Coremat XM dry weight | g/m$^2$<br>oz/ft$^2$ | 96<br>0.31 | 128<br>0.42 | 163<br>0.54 | 335<br>1.10 |
| Resin uptake | kg/m$^2$<br>oz/ft$^2$ | 1<br>3.31 | 1.5<br>4.96 | 2<br>6.62 | 6.5<br>21.51 |
| XM density impregnated | kg/m$^3$<br>oz/ft$^3$ | 540<br>33.5 | 540<br>33.5 | 540<br>33.5 | 680<br>42.1 |

**Fire resistance**
The fire resistance of Coremat can not be evaluated separate from the laminate. The properties of the resin have a major influence on the fire properties of the laminate.
Coremat has been evaluated according to British Standard BS476 (building products) and DIN5510 (Railway carriages).

Results BS476: Fire Propagation test
The laminate build up was:

- CSM 450 g/m$^2$ (1.5 oz/ft$^2$)
- Coremat 2 mm
- CSM 450 g/m$^2$ (1.5 oz/ft$^2$)

Polyester resin

The laminate was classified with a fire propagation index of 7.94. For comparison see the table below: The lower the value, the better the fire properties.

| **Material** | **Treatment** | **Thickness** | **Fire propagation index** |
|---|---|---|---|
| CSM laminate with gel coat | | 3.6 mm | 22.9 |
| CSM laminate | Flame retardant additive | 3 mm | 11.1 |
| Polyurethane foam | Flame retardant grade | 13 mm | 28.6 |
| PVC | | 3 mm | 16.8 |
| Steel sheet | PVC coating 0.3 mm | 3 mm | 5.5 |
| Plasterboard | Emulsion painted | 13 mm | 9.0 |

**Results B476: Flame spread over surface**
The laminate build up was:

- CSM 450 g/m$^2$ (1.5 oz/ft$^2$)
- Coremat 2 mm
- CSM 450 g/m$^2$ (1.5 oz/ft$^2$)

Polyester resin
The laminate was classified as Class One. The classification ranges from zero to four in which zero is best.

**Results DIN5510:**
The laminate build up was:

- OLDOPAL-gel coat S250 SV
- 2 layers CSM 450 g/m$^2$ (1.5 oz/ft$^2$)
- Coremat 5 mm
- 2 layers CSM 450 g/m$^2$ (1.5 oz/ft$^2$)

Resin OLDOPAL S453 TV-01

The laminate was classified as follows:

- Flammability class: S4
- Smoke development class: SR 2
- Dripping class: ST2

This classification meant the material could be applied in the interior of a railway carriage.

**Impact resistance**
Coremat is always used in combination with fiber reinforcements. The effect of Coremat can be seen when laminates with and without Coremat are compared.
Lantor tests impact resistance of Coremat by means of a "drop weight" test. A laminate is laid on a frame and a standardized weight is dropped through a plastic tube from a height of one or two meters. The mechanical properties of the laminate are tested before and after the impact.
The laminate skin bond is excellent with Coremat. This means that impact will normally show as a dent or as crack in the laminate, but not as delaminating between Coremat and the skins.
When Coremat replaces glass layers the impact resistance is reduced. Generally Lantor advises to use not more than 40% Coremat by volume, in laminates that require impact resistance.

**Mechanical properties**
The mechanical properties of laminated Coremat are directly dependant on the physical properties of the resin used to saturate the Coremat. Typical properties of Xi impregnated with unsaturated polyester resin

| Mechanical property | | Value | Test method |
|---|---|---|---|
| Flexural strength | MPa<br>Psi | 11<br>1,595 | ASTM D790 |
| Flexural modulus | MPa<br>Psi | 1100<br>159,500 | ASTM D790 |
| Tensile strength across layers | MPa<br>Psi | 4<br>580 | ASTM C297 |
| Compression strength<br>(10% strain) | MPa<br>Psi | 10<br>1,450 | ISO 844 |
| Shear strength | MPa<br>Psi | 5<br>725 | ASTM C273 |
| Shear modulus | MPa<br>Psi | 35<br>5.075 | ASTM C273 |

The mechanical properties of laminated Coremat are directly dependant on the physical properties of the resin used to saturate the Coremat. Typical properties of XM impregnated with unsaturated polyester resin

| Mechanical property | | Value | Test method |
|---|---|---|---|
| Flexural strength | MPa<br>Psi | 8,5<br>1,233 | ASTM D790 |
| Flexural modulus | MPa<br>Psi | 1250<br>181,250 | ASTM D790 |
| Tensile strength across layers | MPa<br>Psi | 4<br>580 | ASTM C297 |
| Compression strength<br>(10% strain) | MPa<br>Psi | 10<br>1,450 | ISO 844 |
| Shear strength | MPa<br>Psi | 3<br>435 | ASTM C273 |
| Shear modulus | MPa<br>Psi | 25<br>3,625 | ASTM C273 |

**Screw holding capacity**
Screw connections are a widespread and simple method to mechanically bond materials. Coremat holds screws quite well. Because Coremat is rot free, water will not affect the mechanical bond of a screw connection.
The screw holding capacity can be calculated by measuring the force which is needed to pull a screw out of a panel. Standard NEN3217 describes the test.
The screw holding capacity of different materials is given in the table below.

| Material | | Screw holding capacity |
|---|---|---|
| CSM 30% glass content, UP resin | MPa<br>Psi | 35.0<br>5,075 |
| CSM 20% glass content, UP resin | MPa<br>Psi | 22.5<br>3,263 |
| Plywood | MPa<br>Psi | 6.5<br>943 |
| PVC foam | MPa/Psi | 0 |
| PUR foam | MPa/Psi | 0 |
| Balsawood | MPa/Psi | 0 |
| Coremat Xi, impregnated with UP resin | MPa<br>Psi | 5.0<br>725 |

| | | |
|---|---|---|
| Coremat XM 10 mm, impregnated with UP resin | MPa<br>Psi | 4.5<br>653 |
| Coremat XM 10, after one month immersion in distilled water | MPa<br>Psi | 4.7<br>682 |

**Temperature Resistance**
Lantor Coremat is resistant to temperatures up to 90 °C (194 °F) for long time exposure. For short-time exposure it is resistant up to about 145 °C (293 °F). However, as the mechanical properties of a saturated Coremat laminate are dependent on the resin use, so is the temperature resistance.

**Thermal Properties**
The thermal conductivity of Coremat is expressed in the thermal conductivity coefficient. The value for Coremat is 0.1 W/mK. A solid glass laminate has a thermal conductivity of 0.12 W/mK. Coremat has a better heat insulation than a solid glass laminate because of the microspheres in Coremat, which act like insulating air bubbles.

**Water Absorption**
Since Coremat is widely used in Marine applications, the amount of water absorption is an important consideration. Coremat is a fully synthetic product which does not absorb water and is impervious to decay.

The standard for testing water absorption is ASTM D543
The following laminate is impregnated with general purpose polyester resin (orthophtalic).

- CSM 225 g/m$^2$ (0,75 oz/ft$^2$)
- Coremat XM 4 mm
- CSM 225 g/m$^2$ (0,75 oz/ft$^2$)

Sample size: 250 x 25 mm (cut from a large laminate, this means that Coremat at the edge of the laminate is directly in contact with water). Immersion time was one week. Immersion liquid was demineralised water, immersion temperatures were 23°C, 50 °C and 70 °C (73°F, 122°F and 158°F).

| | 23°C (73 °F) | 50 °C (122 °F) | 70 °C (158 °F) |
|---|---|---|---|
| Weight increase | 0.8% | 2.1% | 3.6% |

## 1.5 **COREMAT COMPETITION**

The composition of Coremat is a carefully calculated balance between ease of processing, cost, and mechanical properties. No other product offers the same combination of excellent drapeability, conformability, high resin savings, and good mechanical properties, all at such low prices. Coremat is an optimally balanced product between light weight, high properties, and low cost.

Numerous comparison tests with competitive materials have confirmed that Coremat is the best balanced product on the market today. For specific competition info contact Lantor BV. Costumers in North America are referred to Alcan Baltek in the USA.

## 1.6 **APPLICATIONS OF COREMAT**

Coremat is incorporated into a wide range of products, from bath tubs and boat hulls to tail wings of model aircraft Coremat is used to stiffen laminates without adding weight. The following overview gives some idea of the broad possibilities of Coremat.

| **Product** |
|---|
| **Marine** |
| Print barrier in hull sides |
| Core material in decks |
| Core material in hulls |
| **Leisure** |
| Swimming pools |
| Kayaks |
| Water slides |
| **Transportation** |
| Bus panels |
| Train panels |
| Train toilet units |
| After market car parts |
| Special car body parts |
| Truck panels |
| **Construction** |
| Bath tubs |
| FRP shelters |
| Cladding panels |
| Advertisement panels and signs |
| **Industrial** |
| Mould making |
| Nacelles of wind turbines |
| Tank building |

## 1.7 **CASE HISTORIES LANTOR COREMAT**

### A. SWIMMING POOL, SUNDANCE POOLS

**Product**
Sundance Pools produces high quality swimming pools primarily for residential use. Sundance Pools do not use reinforcing webs for stiffness, which means they can be nested for transportation and storage after fabrication. The pools also have contoured corners that make them easier to clean and nicer looking.

**Why Coremat?**
By using Coremat as a thin core in the laminate, enough stiffness is added that there is no need for reinforcing frames. This has several advantages:

- No print through of the frame
- Nesting of pools for transport is easier
- Pools can easier absorb ground movement with no localized distortion.

This additional stiffness could have been achieved with the addition of more glass laminate, but this would have increased and increased weight and cost.

**Why Coremat XM 2mm?**
Coremat XM 2 mm is a very even product and therefore ideal for applications where surface quality is important. The high microsphere content and low resin absorption results in a very low shrinkage, which is again very important for a high quality surface finish.
Coremat XM 2 mm conforms very well into the contoured corners, which makes impregnation of XM easy and it prevents resin rich corners and resulting shrinkage.

**Laminate build up**

- Isophtalic gel coat
- 2 layers of CSM
- Coremat XM 2 mm
- 2 layers of CSM

B. MACHINE COVER FOR PRECISION MEASUREMENT EQUIPMENT

**Product**
Leitz Messtechnik-Wetzlar produces high-precision measurement equipment often used in the automotive industry. Leitz Messtechnik-Wetzlar is a world leader in this type of equipment. The equipment covers are made of glass fiber composite. The primary requirements of these composite covers are adequate stiffness and an excellent surface finish as befits a quality piece of equipment.

**Why Coremat?**
The use of Coremat Xi3 achieves both these requirements. Coremat, acting as a thin core, builds up thickness quickly. This saves labour, glass and resin. Coremat also acts as a print blocker, greatly improving the cosmetics of the finished part. The use of Coremat also reduces the weight of the panel as compared to the all glass version, making the panels much easier to install.

**Why Coremat Xi 3 mm?**
The 3 mm Coremat Xi proved to be the optimum thickness to achieve the required stiffness needed for the covers. Coremat Xi also adapted easily to the complex shape of the part. Coremat XM3 achieved both the required stiffness and the improved appearance of these laminated parts.

**Laminate build up**
- Gel coat blue or white
- Glass layers
- Coremat Xi 3 mm
- Glass layers

C. NACELLE COVER DEWIND


**Product**
The nacelle cover houses the turbine of a wind turbine. It has to be weatherproof and have a lifespan of more than 10 years. Composites are a logical choice for these materials. Because of the size of the covers they are usually produced with open moulding.
The DEWIND nacelle cover is a steel frame covered with composite skins. This creates a lightweight and durable construction.

**Why Coremat?**
The span over the supporting frame is such that the panels need several millimetres wall thickness to achieve the required stiffness. Coremat builds up this thickness quickly, saving both labour and time. The use of Coremat instead of solid glass saves weight.
Coremat also reduces print through of steel frames. Coremat also acts as an insulating heat barrier. Coremat achieves all this without creating additional laps in the laminate resulting in an exceptionally consistent laminate thickness.

**Why Coremat Xi 2 mm?**
Coremat Xi 2 mm achieved both the stiffness required and prevented printing of the frames and the woven roving in the laminate. Xi2 impregnates well, and conforms easily. The Xi 2 replaced two layers of chopped strand mat, reducing the weight of the nacelle cover.

**Laminate build up**
- Gel coat
- CSM
- Coremat Xi 2 mm
- WR
- CSM

# 2. **SORIC**

Soric is a polyester nonwoven material with a compression resistant hexagonal (XF, SF) or random dot-printed (TF) cell structure. These pressure-resistant cells, which are separated by channels, contain synthetic micro-spheres. The cells do not absorb resin and therefore limit the total resin up-take. Since these cells are pressure resistant, they create thickness in the laminate even when pressure is applied by vacuum bag. The channels facilitate resin flow and form a pattern of cured resin with good mechanical properties and excellent bonding to the outer skins. Because of these unique properties and characteristics, Soric can be used as:

- Thin core (bulker), adding stiffness, while reducing weight
- Inter-laminar resin flow medium, eliminating the need for other (disposable) flow media
- Print blocker (liner), that meets the most demanding cosmetic and finish requirements.

Figure 3 shows a close up of Soric XF. Figure 4 shows in a diagram how the channels in Soric are filled while transmitting resin during the infusion process.

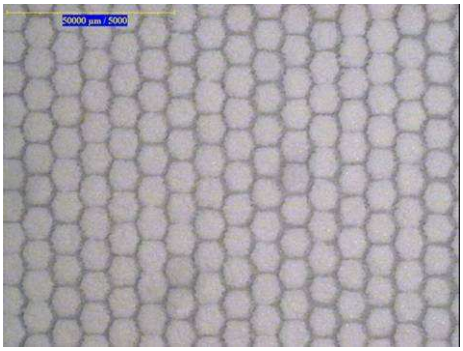


Figure 3: Close-up of Soric XF

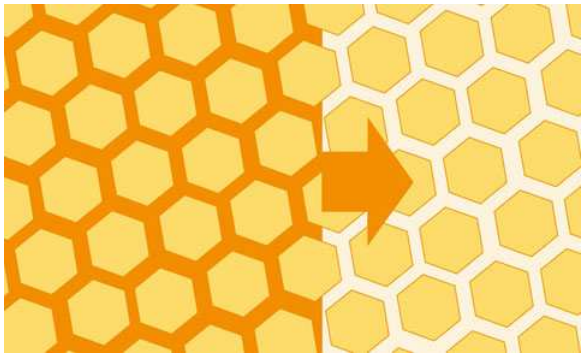


Figure 4: Resin front in Soric XF

## 2.1 SORIC PRODUCT RANGE

Soric is available in three distinctive grades:

- Soric XF (large hexagonal cells) maximises weight reduction in structural core applications. Soric XF offers the fastest resin flow for the lowest resin consumption, and is therefore ideal for thicker laminates.
- Soric SF (small hexagonal cells) is the general purpose grade, balancing resin flow and surface quality. Soric SF is therefore especially suitable for thinner laminates.
- Soric TF (random dot-print) is the ideal product for the most demanding cosmetic and surface finish requirements. Soric TF can be used as a core, but is most often used as a print blocker for infused laminates.

| **Grade** | **Typical use** | **Thickness in mm *** | **Relative Resin flow** | **Resin take-up kg/m$^2$/mm **** | **Relative Surface Quality** |
|---|---|---|---|---|---|
| Soric XF | Structural cores | 2,3,4,6 | Fastest | 0.5 | Reasonable |
| Soric SF | Thinner laminates | 2,3 | Medium | 0.55 | Good |
| Soric TF | Cosmetics and finish | 2 | Slowest | 0.65 | Excellent |

* Soric layers can be combined to achieve other desired thicknesses

** Resin uptake after impregnation taking the thickness loss into account. Therefore the dimension of kg/m$^2$/mm

## 2.2 SORIC KEY BENEFITS

In infused laminates, the use of Soric greatly improves overall product performance and process efficiency. By acting as both a thin core and print barrier, as well as an integral infusion medium, substantial savings in time are achieved with a substantial reduction in "disposables".
Obviously, such benefits far exceed the cost of Soric. As such, Soric provides the industry with an excellent return on investment!

**Soric reduces part weight**
Weight reduction is a key issue in many industries, and the marine industry is no exception. With similar engines, reduced weight achieved by the use of Soric will increase boat speed, reduce fuel consumption, and improve, comfort and safety. Alternatively, to achieve the same speed, smaller engines may be used. With Soric, laminate weight reductions of up to 35% have been observed. Heavy inner layers of glass absorbing significant amounts of resin can be replaced by Soric.

**Soric creates stiffness without adding weight**
Stiffness in a laminate is almost always the driving criteria. Soric in an infused laminate increases thickness in exactly the same way that Coremat does in a hand laid laminate. (Coremat cannot be used in an infused laminate because it compresses under the pressure of the vacuum bag and will not become saturated with resin). In order to create stiffness in the laminate without adding weight, Soric is a much more sensible alternative than adding layers of glass:

- 2 mm CFM infused, weighs 2.7 kg/m2 (9.0 oz/ft$^2$)
- 2 mm CSM infused, weighs 4.7 kg/m$^2$ (15.6 oz/ft$^2$)
- 2 mm Soric infused, weighs 1.2 kg/m$^2$ (4.0 oz/ft$^2$)

**Soric compensates for thickness loss**
One of the problems of vacuum infusion is that reinforcements are compressed. For example, whereas one layer of CSM 450 g/m$^2$ (1.5 oz/ft$^2$) in hand lay-up creates 1 mm thickness, the same layer in vacuum infusion creates only 0.5 mm thickness. When the laminate is only 50% of its original thickness, it will only have 12.5% of its original stiffness. Since Soric hardly compresses under the typical pressures used in vacuum infusion and RTM Light, it is the ideal material to compensate for thickness loss.

**Predictable and constant thickness**
Because of the pressure resistance of Soric, laminate thickness is predictable and constant, which contributes to the overall quality of the part.

**Soric facilitates fast and accurate resin flow**
In closed mould processes, it is essential to have a medium that facilitates resin flow. This could be a surface medium, a core material, a special type of glass, or Soric.
When used for this purpose, Soric offers significant benefits:
Because of the pressure-resistant cell structure, Soric provides excellent flow properties, even when using heavy fabrics like multi-axials and Continuous Filament Mat.
Soric's fast and accurate resin flow directly contributes to the mould turnaround time and therefore to production efficiency.
Soric is an inter-laminar flow medium and as such is an integral part of the laminate. This means that no add-on surface flow media need to be applied, thus reducing labour, or disposed of, reducing chemical waste.
As shown in Figure 5, Soric also provides a more even resin front than surface flow media.

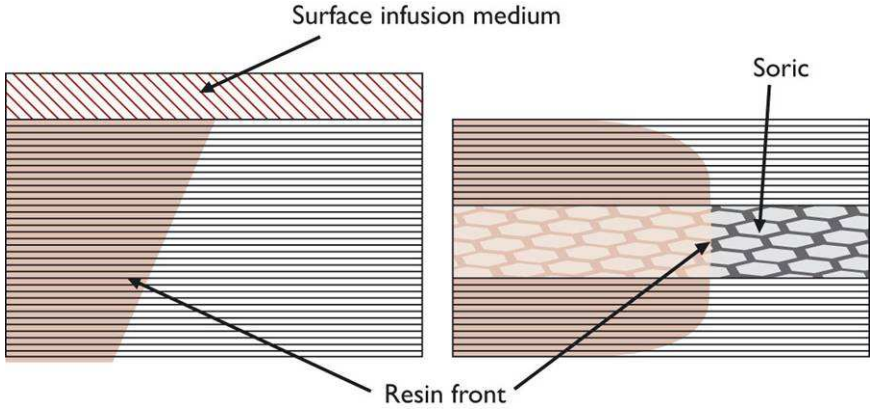



**Figure 5: Resin front distribution in surface medium infusion and Soric infusion**

**Soric is easy to process**

Because of its conformability, Soric can be used in the most complex moulds or structures. Soric is easy to cut with a normal pair of scissors or a knife.

## 2.3 USING SORIC

Soric can be applied in various types of closed mould processes. The most common are:

- Vacuum Infusion
- Vacuum bagging
- RTM light/VARTM
- RTM heavy/Matched Metal Moulding
- Pre-pregs

The function of Soric is the same for all processes; bulking up the laminate without adding weight. In vacuum bagging (Although unusual, Soric can also be wet out by hand) and vacuum infusion the pressure resistance of Soric is an important benefit. The vacuum pressure compresses other materials under the bag. Soric keeps its thickness and creates the stiffness of the laminate.
In RTM light and RTM heavy the function is to replace more open materials like continuous filament mat and combination mats (e.g. Rovicore). The advantage of Soric to these materials is the low resin uptake, resulting in lighter parts.

**Fibre reinforcements**
Soric's unique resin flow properties allow it to be used with all available fibre reinforcements types (Glass, Carbon, Aramid, etc.), and weaves (Mat, Woven roving, Continuous Filament Mat, Multi-Axial, etc.). Soric should never be used directly against the gel coat. When not using a skin coat, preferably one or more layers of CSM/Stitch mat (or CFM), amounting to 900 g/$m^2$ (3 oz/ $ft^2$), should first be placed against the gel coat. Soric can be applied directly against the skin coat though. It exhibits excellent bonding with glass (fibres, mats, fabrics). Applying a glass mat in between Soric and Balsa will provide excellent bonding of these materials. SORIC and Foam can be used directly against each other.

**Placement in the tool**
No special tools are needed for tailoring Soric. Standard scissors or knives will suffice. When placing the dry laminate package in the tool, Soric can easily be positioned using a spray adhesive or tape. In order to prevent unwanted resin-runner phenomena (race tracking), special attention should be paid to proper placement in areas (corners) with sharp angles. Soric XF is less conformable than SF and TF because of its cell size. When Soric is overlapped, it will create a thick spot in the laminate, especially as Soric compresses so little under the pressure of the bag. This means that an overlap of 2 layers of 2 mm will create a thickness of about 4 mm. Like Coremat, Soric should be but-jointed. Keep the joint in place using a spray adhesive or tape. Soric can be used in double layers to create larger thicknesses – for example, 2 layers of 4 mm to create an 8 mm core. It is not necessary to place a CSM in between the layers as the adhesion in closed mould processes is generally very good. However, to be absolutely certain of the bonding between the two Soric layers a light glass mat placed between the two layers will certainly do no harm.

**Negligible visual differences**

The honeycomb pattern on Soric is not symmetrical. A difference between (production) machine direction and cross direction can be observed. In addition, there is some visual difference between the top and bottom. These parameters are negligible when designing laminates or when placing Soric in the tool. Evaluation of flow properties, mechanical properties and surface quality of moulded parts has indicated that there are only very minor differences.

Figure 10: Malmsten Boats (S) application of Soric in a small hull of a sail boat.

## 2.4 TECHNICAL PROPERTIES OF SORIC

### Acoustic properties
By adding more thickness of lower resin content material, Soric can act as sound barrier, The microspheres create a layer with hollow spheres. Therefore, a Soric laminate has slightly better sound insulating properties than a full glass laminate.

### Compatibility with resins
Soric is compatible with all commonly used types of resins; Polyester, Vinylester, Epoxy and Phenolic.

It is possible to use Soric in combination with filled resins. For an infusion, the resin viscosity lies ideally below 200 cps. For other processes the viscosity might be higher. Soric is used with filled resins to create a better surface quality or to improve fire resistance properties.

### Density
Dry weight is normally given in g/m$^2$ [oz/ft2] and impregnated density in kg/m3 [lb/ft3]

| **Product code** | | **TF2** | **SF2** | **SF3** | **XF2** | **XF3** | **XF4** | **XF5** | **XF6** |
|---|---|---|---|---|---|---|---|---|---|
| Soric dry weight | g/m$^2$ | 115 | 130 | 180 | 140 | 190 | 260 | 320 | 360 |
| | oz/ft$^2$ | 0.38 | 0.43 | 0.60 | 0.46 | 0.63 | 0.86 | 1.0 | 1.2 |
| Thickness loss at 0,8 bar | % | <25 | <15 | <15 | <10 | <10 | <10 | <10 | <10 |
| Resin uptake | kg/m$^2$ | 1.0 | 1.0 | 1.3 | 1.0 | 1.4 | 1.9 | 2.4 | 2.8 |
| | oz/ft$^2$ | 3.3 | 3.3 | 4.3 | 3.3 | 4.6 | 6.3 | 8.0 | 9.3 |
| Soric density | kg/m$^3$ | 700 | 700 | 600 | 600 | 600 | 600 | 600 | 600 |
| impregnated | lb/ft$^3$ | 43.7 | 43.7 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 | 37.4 |

### Fire resistance
Lantor has tested the reaction of Soric to fire. The lowest oxygen index for Soric is about 20%. This means that the material can be considered as combustible.
When Soric is used in combination with fire resistant resins, a good level of fire resistance can be reached, because the contribution of Soric to the fire properties of the laminate is low.

A German test house has tested laminates with Soric according to DIN5510. The classification was:

- Flammability: S4
- Smoke development: SR2
- Drip forming: ST2

This means that a laminate which was heated with a flame caught fire after 8 seconds, but after removal of the flame the laminate extinguished within 1 second.

### Laminate calculation service
Lantor B.V. has a laminate calculation service. We can calculate the effect of Soric on the mechanical properties of a laminate. When a customer builds in hand lay-up, Lantor compares the properties of his hand lay-up laminate, with a new laminate in infusion using Soric. It is also possible to compare infusion laminates with each other. Customers in North America are referred to Alcan Baltek in the USA for calculation services.

**Mechanical properties**
Typical properties of Soric impregnated with unsaturated polyester resin are heavily influenced by the amount of resin absorbed and the type of resin used. . The differences between the types are mainly caused by the differences in resin absorption.

| Mechanical property | | TF | SF | XF | Test method |
|---|---|---|---|---|---|
| Flexural strength | MPa<br>Psi | 19<br>2,755 | 16<br>2,320 | 8<br>1,160 | ASTM D790 |
| Flexural modulus | MPa<br>Psi | 1500<br>217,500 | 1000<br>145,000 | 800<br>116,000 | ASTM D790 |
| Tensile strength across layers | MPa<br>Psi | 7<br>1,015 | 6<br>870 | 4<br>580 | ASTM C297 |
| Compression strength<br>(10% strain) | MPa<br>Psi | 4<br>580 | 4<br>580 | 8<br>1,160 | ISO 844 |
| Shear strength | MPa<br>Psi | 7<br>1,015 | 6<br>870 | 3,5<br>508 | ASTM C273 |
| Shear modulus | MPa<br>Psi | 34<br>4,930 | 40<br>5,800 | 35<br>5,075 | ASTM C273 |

**Surface quality.**
To prevent print through and blistering due to osmosis in an infused laminate, Soric TF is used often in combination with Finishmat D7760. The D7760 will create a resin rich layer against the gelcoat that reduces the risk of osmosis and fibre print through. The Soric TF will block the print through of the heavier fabrics and core in the laminate. A typical build-up for this purpose is:

| Gel coat |
|---|
| Finishmat D7760 |
| 2 layers CSM |
| **Soric TF** |
| Reinforcements |
| Core material |
| Reinforcements |

**Temperature resistance**
Lantor Soric has been tested for temperature resistance. The maximum temperature is 170 °C (338 °F).
Lantor BV has also tested a Soric laminate on heat resistance. The laminate was exposed to 80 °C (176 °F) for 2 periods of three hours. Visual inspection did not show any deterioration. However, temperature resistance of the laminate as a whole is also a function of the resin used

**Thermal Insulation**
The thermal insulation of impregnated Soric was measured according to ISO8302. The test was conducted with impregnated XF4 (resin type Synolite 6811-N1). The coefficient of thermal conductivity is 0,064 W/(m.K).

**Water absorption**
Lantor tests water absorption of Soric with samples of Soric which have been impregnated with resin, but do not have glass skins. The sides of these plates are sawn; this means the Soric cells are directly exposed to water.
The results of a 28 day immersion in distilled water at 35 degrees Celsius were:
Soric XF, impregnated, 75 mm x 75 mm, water absorption, 4.5 g (0.16 oz)
Soric SF, impregnated, 75 mm x 75 mm, water absorption, 1.9 g (0.07 oz)
Soric TF, impregnated, 75 mm x 75 mm, water absorption, 1.4 g (0.05 oz)
The mechanical properties of the samples after 28 days of water absorption at 35 °C (95 °F) are at least 65% of the properties before immersion.

## 2.5 APPLICATIONS OF LANTOR SORIC

| **Product** |
|---|
| **Marine Applications** |
| Print barrier in boat hull |
| Core material in boat hull |
| Infusion medium in deck |
| Core material in pre-preg |
| **Leisure** |
| Kayak |
| Fishing ski |
| **Construction** |
| Anti–slip stairs |
| Play ground bench |
| Office chair |
| **Industrial** |
| Water tank in fire fighting vehicle |
| Mould making |
| **Transport** |
| Window panels of train |
| Covers for Caterpillar |
| Front end of sky train |
| Floor of small trailer |
| Bus panels |
| |
| **Processes** |
| Vacuum infusion |
| Pre-pregs |
| RTM light |
| RTM heavy |

## 2.6 CASE HISTORIES

A. BACKMAN SAIL BOATS

Figure 11: Infusion of Backman 21 (UK)


Figure 12: Backman 21 (UK) prototype

**Product**
The Backman 21 is a small and fast sailing boat. It is a trailer-sailor, which means it has to withstand trailer induced impact on the road and launching ramp. The hull is vacuum infused with. Soric XF3. The resin used is an epoxy resin from Nils Malmgren in Sweden. The reinforcements are multi-axial glass fibres with a carbon reinforced keel. Based on the success of the 21, Backman plans to produce a range of boats.

**Why Soric?**
Backman boats utilize Soric XF to achieve fast resin flow without the need of a surface infusion medium. Because Soric has very exact dimensions and a regular flow, it is possible to exactly control the amount of resin used. Soric has been found to be easy to install. It can be tailored easily, and it is easy to apply. Soric in combination with epoxy resins has resulted in excellent shear properties of the laminate. The laminate is very light and robust, which is important for a trailer-sailor.

**Why XF 3 mm?**
Soric XF has the lowest resin consumption in the Soric range. Soric 3 mm has an excellent resin flow and yet a limited resin consumption. The 3 mm gives the hull exactly the right thickness without adding a lot to the weight. Slow-curing epoxy resin prevents print-through of the hexagonal pattern. Without Soric, the skins would have needed to be heavier to achieve the same stiffness, which would have led to a heavier laminate.

**Laminate build up**
- Gel coat
- glass bidirectional 0°-90°,160 g/m$^2$ (0.5 oz/ft$^2$)
- 2 layers glass unidirectional 60°,160 g/m$^2$ (0.5 oz/ft$^2$)
- Soric XF3
- 2 layers glass unidirectional 60°,160 g/m$^2$ (0.5 oz/ft$^2$)

The keel was built up with carbon bi-directionals and uni-directionals to a thickness of 3 mm. To be able to infuse the keel, it was covered with a layer of Soric and a glass layer for protection.

B. ALSTOM ICE-3 INTERIOR PANELS

**Product**
The ICE-3 high speed train contains various composite parts, SMC parts, RTM parts, etc. Alstom has applied Soric in interior panels for the dining car of the train. The panels have been made with an expanding epoxy resin. Alternating layers of reinforcements and resin were applied. The mould was closed and a vacuum was applied. The resin expanded.

**Why Soric?**
The key benefit of Soric in the train panels is weight saving. The panels have a very severe weight restriction. Soric made it possible to produce panels which were within specification. Soric could be used because it also met the required fire properties of the panel. The resin used was a fire resistant resin. Soric supported the distribution of the resin throughout the mould and thus the mould filling. The gaps between the cells enable resin flow in the closed tool.

**Why XF 2 mm?**
XF 2 mm has the lowest resin absorption of the Soric range. For this weight-critical application the choice for XF was natural. The dimensions of the panel had already been designed, when the choice for Soric was made. Soric XF 2 fitted best in the mould.

**Laminate build up**
- Gel coat
- CSM 225 g/m$^2$ (0.75 oz/ft$^2$)
- CFM 450 g/m$^2$ (1.5 oz/ft$^2$)
- Soric XF $^2$ mm
- CFM 450 g/m$^2$ (1.5 oz/ft$^2$)
- CSM 225 g/m$^2$ (0.75 oz/ft$^2$)

Resin used: Büfa Fire Stop expanding epoxy resin

C. SORIC TF OCQUETEAU

**Product**
Ocqueteau is a famous French builder of day cruisers, fishing cruisers and sports cruisers. The yachts have a high quality and performance. To ensure this quality Ocqueteau has moved from hand lay-up to infusion.

**Why Soric?**
In the change from hand lay-up to infusion a very important requirement is to maintain the thickness of the laminates. The vacuum bag compresses the reinforcements which results in a very thin laminate. Soric keeps its thickness under the bag and enabled Ocqueteau to create very stiff laminates without a weight penalty.
The use of Soric allowed rapid resin flow in the infusion process without the need for a separate infusion medium. This saves time and reduces waste.

**What type of Soric?**
Ocqueteau uses two types of Soric:
- Soric TF as a print through barrier
- Soric XF as flow medium and core

Creating a good surface quality in infusion is more difficult than in hand lay-up. The pressure of the reinforcements on the gel coat is greater and the amount of resin curing in one time is larger. Lantor Soric TF is used to prevent print through problems. Soric XF is used to create a resin flow medium in the laminate, which impregnates the reinforcements without use of surface media. XF bulks up the laminate. Keeping thickness in infusion proved to be very difficult without Soric.

**Laminate build up**
- Gel coat
- CSM (Skin coat)
- Soric TF
- Multiaxial
- Soric XF
- Multiaxial

# 3. FINISHMAT

Finishmat is the Lantor range of surfacing veils for the composites industry. Finishmat is used to improve surface quality in a very broad sense of the word. For instance:

- Improved cosmetics
- Better chemical resistance
- Reduced abrasion of moulds

Each Finishmat product has its specific properties which makes its suitable for specific processes and applications.

**Finishmat D7760**

Finishmat D7760 is a needled felt made of polyacrylonitrile fibres. D7760 is applied in RTM processes, like vacuum infusion, RTM light and RTM. It prevents fibre print through from glass fibres. For instance, It is used for truck cabins, which are made with continuous filament mat in RTM, and are painted afterwards.

**Finishmat 6691 range**

Finishmat 6691 is a chemical bond, polyester tissue. 6691 veils are used in filament winding and pultrusion processes. They create a smooth, resin rich layer. This layer serves as a chemical barrier and creates a smooth surface finish.

## 3.1 FINISHMAT D7760

**Key benefits of Finishmat D7760**

- D7760 is applied right against the gelcoat in an infused laminate. It reduces fibre print through and is often used in conjunction with Soric TF applied against the skin coat. The most important benefit of D7760 is that it reduces fibre print through of glass fibres in the surface. This means a better surface quality. If painted, less treatment is necessary. D7760 can be used in combination with a gel coat or as a top layer without a gel coat.
- D7760 is chemical resistant.
- D7760 is heat resistant and can be applied in pre-forming processes.
- The refraction index of the PAN fibres in D7760 is the same as the refraction of polyester resin. This means that the fibres are not visible in the resin.

**Product range**

Finishmat D7760 is a 60 grams mat of polyacrylonitrile. The standard width is 1.10 m, but it is available in other widths on request.

**Processes suitable for D7760**

- Hand Lay-up (Vacuum bagging). Finishmat D7760 can be used in hand lay-up to help prevent fibre print through when Vacuum bagging the laminate.
- Infusion. Finishmat D7760 can be used in infusion processes as a fibre print blocker. One of the problems of infusion is that fibres which are near the gel coat are visible in the surface. Finishmat D7760 solves this kind of print through.
- RTM light. Parts made in RTM light are often resin rich, fibre print through, therefore, is often an issue. Finishmat D7760 can be applied either directly to the mould or on the reinforcement. Finishmat D7760 can also be used together with combination mats, like Rovicore.
- RTM (heavy or matched metal moulding). Finishmat D7760 is used on a wide scale for the production of truck parts. It is used in pre-formed continuous filament mats. The pre-forms are laid in the mould and injected. These parts are generally spray-painted after curing.

**Practical tips using D7760**

D7760 is placed directly against the gel coat, preferably when the gel coat is still a little tacky. It is possible to use a spray adhesive on D7760, but it should be used very lightly.
It is possible to use D7760 without a gel coat. In this case it is the easiest to attach D7760 to the rest of the material, for instance in a pre-forming process or with an adhesive.

It is important that there are no wrinkles or laps in the D7760, since these will cause resin rich spots, which show as shadows in the product. D7760 stretches and conforms easily. It has an elongation of 100% before break.

Finishmat D7760 is a relatively dense product. It will be impregnated in the “Z” direction. There will be hardly any resin flow along the D7760 in the X and Y directions..

When filled resins are used it is important to use particles which are a small as possible. It is best when no more than 30% filler is used.

**Application of Finishmat D7760**
Car bumper for luxury sports car

The bumper is made in RTM with metal moulds. The bumpers are made in two steps:

- A pre-forming step. Several layers of special continuous filament mat and a layer of Finishmat D7760 are heated. The heated materials are pressed in the shape of the final product. This pre-formed product is trimmed on the edges.
- The pre-formed product is put in a metal mould and the resin is injected under pressure. After the injection the parts are prepared for painting and painted.

Why is Finishmat D7760 used? Finishmat reduces fibre print by creating a resin rich layer. This means parts need less preparation before painting, which saves cost. The end product has a much better finish when Finishmat D7760 is applied.

**Technical data Finishmat D7760**

| | | | |
|---|---|---|---|
| Fibre | | polyacrylonitrile | |
| Weight | $g/m^2$<br>$oz/ft^2$ | 60<br>0.2 | |
| Thickness | mm<br>inch | 0.2-0.5<br>0.008-0.02 | depending on processes pressure and gap between the moulds |
| Colour | | White | |
| Binding system | | Needled | |
| Binding agent | | None | |
| Resin compatibility | | Polyester, Vinylester, Epoxy | |
| Elongation at break (%) longitudinal | | > 100 | |
| Impact resistance | | In general the impact resistance of the laminate improves when Finishmat D7760 is used | |
| Resin Absorption | $g/m^2$<br>$oz/ft^2$ | 400<br>1.32 | |
| Standard width | m<br>inch | 1.1<br>43 | |
| Processes | | Vacuum infusion, RTM | |
| Maximum exposure temperature | | 160 °C<br>(320 °F) | |

## 3.2 FINISHMAT 6691 SL AND LL

Finishmat 6691 is a chemical bond veil. This means that the fibres are bond together by means of a binder. The fibres are more or less glued together. The binder system used in 6691 is partially soluble in styrene. This means that the material becomes softer when it is wetted. This makes it easier to shape 6691 into curved products.

**Key benefits of 6691 SL and LL**

- Good chemical resistance 6691 SL and LL are very resin rich. They create environmental and chemical resistance.
- Conformability. The binder in 6691 dissolves partially in styrene; this means the material is very soft and pliable when it is wet. It can be used in complex shapes.

**Product range of 6691 SL and LL**

The Finishmat 6691 range consists of two weights:

- 6691 SL weighs 20 g/m$^2$ (0.066 oz/ft$^2$)
- 6691 LL weighs 40 g/m$^2$ (0.13 oz/ft$^2$)

The standard width of Finishmat is 1 m wide. Wider widths, up to 2 meter (6.6 ft) are available on request. Lantor can slit 6691 into tapes if necessary. The standard roll length is 1000 m (3,280 ft)

**Processes suitable for 6691 SL and LL**

- Hand lay-up. 6691 can be used in hand lay-up to improve the surface quality of the laminates. It is used for a very smooth surface finish. 6691 SL is very conformable and can be used in relatively complex shapes.
- Pultrusion. 6691 is used to create a very smooth surface on pultruded profiles. 6691 is a very regular and flat product. It creates a very good surface quality. Another important advantage of the use of a synthetic veil is that the abrasion of the mould is reduced, as 6691 causes less friction than glass veils.
- Filament winding. 6691 is used in filament winding to create a barrier on the inside or outside of a tank. No glass fibres will stick out of the laminate when 6691 is used.

## Application of 6691 SL

## Pipes production

6691 SL is used in the manufacturing of oil pipes. 6691 SL is used on the inside of the pipe to improve the chemical resistance of the pipes. The material creates a resin rich layer in the pipe. This has the following advantages:

- The resin rich layer creates a chemical barrier
- The smooth finish of the pipe has a positive effect on the flow properties
- 6691 SL prevents glass fibres sticking out the surface, this improves the durability of the pipe
- Synthetic fibres are more resistant against water contact than glass fibres, as they do not contain silane.

## Technical data 6691

| | |
|---|---|
| Fibre | Polyester (PET) |
| Weight | 6691 SL: 20 g/m$^2$ (0.066 oz/ft$^2$)<br>6691 LL: 40 g/m$^2$ (0.13 oz/ft$^2$) |
| Thickness | 6691 SL: 0,30 mm (0.011 inch)<br>6691 LL: 0,45 mm (0.017 inch) |
| Colour | White |
| Binding system | Chemical |
| Binding agent | Acrylic |
| Resin compatibility | Polyester, Vinylester, Epoxy |
| Elongation at break (%) longitudinal | >10% |
| Resin Absorption (g/m$^2$) | 6691 SL: 350 g/m$^2$ (1.15 oz/ft$^2$)<br>6691 LL: 500 g/m$^2$ (1.65 oz/ft$^2$) |
| Standard width | 1 m (3,2 ft) |
| Standard roll length | 1000 m (3,280 ft) |
| Processes | Filament winding, pultrusion, hand lay-up |

# 4. GENERAL

## 4.1 CONTACT INFORMATION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## 4.2 BROCHURES AND SAMPLES

Brochures, Datasheets and Samples are available upon request.