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A Low&Bonar solution

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TEXTILES TO TRANSFORM

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MEHLER TEXNOLOGIES
A Low&Bonar solution

Technical Guideline to Permanent Tensile Structures

2nd Edition

TEXTILES TO TRANSFORM

Content

The following information is intended as a basic guide for architects and engineers to assist in concept design and in specifying materials, in order to get enough preliminary background for planning activities.

Our intention is to support architects, engineers and generally all those who approach the technical and commercial aspects of membrane structures solutions.

Brief introduction to the tensile art of construction

Example of primordial tent construction using animal skin.

Tensile architecture is probably one of the oldest methods used to provide protection from adverse climatic conditions and against predator attack. The humble ‘conic’ tent is the simplest form of tensile structure, and excelled where two conditions prevailed: a shortage of building material and a need for mobility. Evidence has been found which confirms that humans have been making tents for at least 15,000 years, initially using animal skins, and only 3000 years later, incorporating woven fabrics. One of the first applications of tensile technology came at the very beginning by transferring sailing principles. The spectators at Roman amphitheatres (e.g. the Coliseum) were protected against the sun by retractable sheets of fabrics roofs, supported by timber masts and cotton fibre ropes as operated by sailors. Differing forms depended on different materials available at the time – for example the American Indian Tepee, the Bedouin tents or the Mongolian Yurt. These forms have developed over time, using more advanced materials and construction methods into larger and more diverse structures such as the Canada Golf Dome in Beijing, China.

Modern fabric materials in modern architecture can shape space, enabling architects to sculpt 3-dimensional areas in a manner that is not possible with any other type of material. This kind of architecture is offering much more: the designer is able to play with light and use this for natural illumination of the space, softening it, fusing it, sharpening it or shaping it. This creates mood and ambience to reflect architectural intent, resulting in an energy saving covering system, by approaching the elementary need of being in touch with nature. The dynamic shape and form of membranes allow new possibilities to become reality.

In no other sector of architecture do form and load distribution depend on each other as greatly as they do in membrane construction. Hence, these represent the perfect marriage between architecture and engineering.

As in nature, the course of forces that are shown in the form and shape can fascinate not only architects and engineers, but also the wider public as well, especially those who can appreciate the equilibrium between aesthetics and functionality.

Example of modern tensile architecture

About Mehler Texnologies

The Company

Mehler Texnologies is the traditional German brand for coated textiles. Mehler’s membranes were used right from the start of Textile Architecture’s reinvention in mid-20th century. The company’s origins reach back to 1837 when Valentin Mehler opened his weaving mill in Fulda. The architectural membranes can be manufactured into stadium roofs, textile façades, sun protection, tents and XXL printed building surfaces. Altogether Mehler produces around 50 million square meters of technical textiles per year.

Ongoing research and development improve existing composite materials and discover new areas of applications. The state-of-the-art machinery ensures the high and consistent quality of our products.

Our Textile Architecture materials are woven and coated in Fulda, in the middle of Germany. Sales companies in Italy, France, Great Britain, Poland, Dubai, India, Latvia, Romania, Turkey and the USA, as well as sales partners in other European countries, Asia and Australia, serve customers in more than 80 countries.

Our capabilities at a glance:

50 million sqm coated technical textiles, approx. 650 employees worldwide.
3 production facilities for coated technical textiles.
18 sales companies, sales offices and sales partners around the world.
Our goal, is to serve the specialized customer. Mehler Texnologies is your specialist for coated fabrics and technical textile materials.

Mehler Texnologies – always „one of the first“

1944
Start manufacturing of PVC-coated fabrics

1954
Technical coating of Polyester base fabric

1969
Lacquering of tarpaulins by means of acryl top coat

1993
First coating based on Polyolefine (PVC-free). Environmental recycling concept standards introduced

1994
First weldable PVDF-lacquer VALMEX® MEHATOP F comes into production

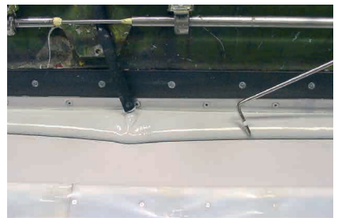
2004
Designed and produced new revolutionary lightweight banner material for digital printing (AIRTEX® GT and AIRTEX® magic)

2006
First coating of polyester base fabric with temperature and chemical resistant Fluor-synthetic base THV

2008
Mehler Texnologies joined Low & Bonar Group

2014
Developing membranes with better self-cleaning effect

Weaving loom (high speed)



Spread the coating

Precision coating plant

Manufacturing of coated fabrics is committed to highest quality standards.

Biaxial strenght test

Tear strength test

The Fabric – Materials properties

A coated structural fabric usually consists of a woven base cloth stabilized and protected by a coating on both sides. The base cloth consists of warp threads running the length of the roll and weft threads running across the width. A mesh fabric is a coated cloth with spacing between the thread bundles.

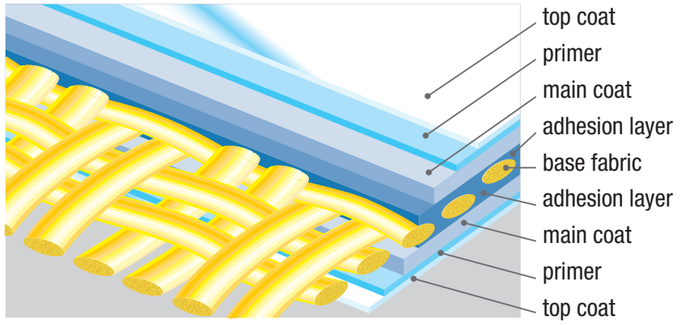
Sometimes mesh fabric can also refer to a woven shade cloth where pre-coated threads are woven into cloth.

For the engineering of tension structures, the most common choices are PVC coated Polyester cloth materials. High quality low-wick treated PVC-Polyester fabrics generally have a structural lifespan in excess of 20 years. On ordinary materials the plasticizers in the PVC migrate towards the surface over a period of time making the surface harder to clean.

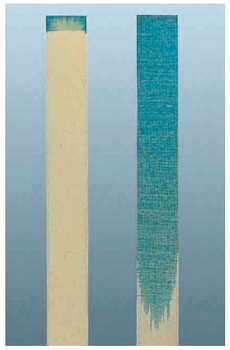
The PVC coating contains additives that include UV stabilisers, fire retardants, colouring and fungicidal agents. Mehler Texnologies quality materials under the brand name VALMEX® MEHATOP are a choice of protective PVDF (Fluorinated Polymer) lacquers that enhance the cleanability of the PVC membrane. To improve this and maintain translucency, Mehler Texnologies is offering a range of products including PVDF lacquer on both material sides, perfectly weldable. The choice of a suitable material is dictated by many characteristics, ranging from technical and mechanical properties to the aesthetical appearance, coming from physical material properties.

The textile industry is constantly improving the existing materials. Low & Bonar as a pioneer fabric producer is continuously increasing and perfecting those materials in each aspect.

There is a wide range of products which are very suitable for particular uses, depending on the specific project needs and the particular defined use (ex. façade shadowing or roof covering, etc.). Regardless of the fact that each material can be used for textile roofing we suggest our customer contact the specialized industry and proceed to this choice after particular analysis of all project characteristics, in order to assure the best possible decision taking into account the aesthetics, the mechanical/static load properties and the economical aspect of the project.



Typical section of Mehler Texnologies coated PVC-Polyester fabric



Low-wick base fabric generate a barrier to infiltration of liquids assuring the original membrane properties.

Non low-wick base fabric absorbs liquids and degenerate the membrane properties.

Comparison between low-wick and non low-wick base fabric

Materials types

In the architectural segment, membranes of Mehler Texnologies are multilayered composite materials with special densely woven low-wick yarns in base fabric. The double thread woven fabric, commonly described as “Panama” weave, varies depending on the mechanical resistance requested by the customers. The different membrane materials are graded by weight and strength, and an overview of the standard types of materials is listed below.

Mehler Texnologies materials are basically ”pre-stressed” with different force grades in both directions. The warp direction (length of the material roll) has less stretch to stabilize the elongation in this sense. The weft direction (the width side of the material roll) has more stretch in order to absorb the orthogonal tension more readily during the distensile installation process* (see graphic below).

Professionals like to maneuver the compensation ratio of the fabric material during the patterning process in order to generate ad-hoc geometries and unique smooth surfaces. This process is generally considered “top secret” to most of them and is also the core of the well qualified textile architecture engineer or specialized manufacturer.

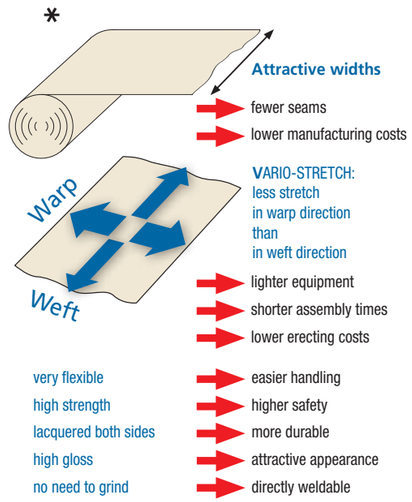
This requires a certain kind of technical information generated by computer analysis, simulation and testing processes, generated case by case for each project.

Mehler Texnologies can provide to the customer biaxial results for each produced batch of material. The tests are executed on client request to external accredited laboratories based on MSAJ/M-02-95 procedure.

Overview of Mehler Texnologies architecture PVDF-coated material types

VALMEX®	FR 700 Type I	FR 900 Type II	FR 1000 Type III	FR 1400 Type IV	FR 1600 Type V
Art.	7205	7211	7269	7270	7274
Finish	PVDF-lacquer on both sides, protected against microbal and fungal attack, UV-protected, low-wick				
Total weight	700 g/m²	900 g/m²	1050 g/m²	1350 g/m²	1550 g/m²
Tensile strength Warp/Weft DIN EN ISO 1421/V1	60/60 kN/m 3000/3000 N/50 mm	84/80 kN/m 4200/4000 N/50 mm	120/110 kN/m 6000/5500 N/50 mm	150/130 kN/m 7500/6500 N/50 mm	200/180 kN/m 10000/9000 N/50 mm
Tear strength Warp/Weft DIN 53363	300/300 N	500/450 N	900/800 N	1200/1200 N	2000/2000 N
Light transmittance (approx.)	6 %	5 %	4 %	3 %	2 %
Flame retardancy	BS 7837 California T 19 DIN 4102: B1	BS 7837 California T 19 DIN 4102: B1	BS 7837 California T 19 DIN 4102: B1	BS 7837 California T 19 DIN 4102: B1	BS 7837 DIN 4102: B1
Most common width	250 cm	250 cm	250 cm	250 cm	250 cm
Welding	weldable without grinding and with common welding equipment				

Higher strengths on request, program changes reserved.
All technical data stated are based on laboratory tests at average results and are provided as a source of information and do not constitute a warranty. Applications suggested here do not release customer from testing material for its intended application. Colours are subject to slight variations. Always check the validity of fire certificate. Manufactured by quality standards ISO 9001.



Example of asymmetrical curvature shapes with symmetrical primary structure, only generable by using VARIO-STRETCH fabric, properly compensated.

Advantages of weldable PVDF coated fabrics

Mehler Texnologies, a pioneer in PVC-PES coatings, introduced more than 14 years ago weldable PVDF coated membrane. In our opinion, the textile industry should provide products to the market which can perform without the need to be modified, ground or manipulated by the fabricator. The industry should assume in full the material properties responsibility, not delegate this to additional substances, to manipulations of the surface, to the uncontrolled machines operation capability or simply to human factor.
It is wrongly assumed that the weldability of PVDF coated material is given by the percentage of PVDF included into the top coat.

Mehler Texnologies PVDF coated fabrics, incorporates a primer between the top coating lacquer and the PVC coating, completing 5 components in the building up of the product (s. schematic picture at page 5). Other manufacturers show 3 to maximum 4 components (base fabric, adhesion layer (some), coating, lacquer).

This is the reason why our fabric is weldable, easy to manufacture and stable (non-peeling). A properties comparison with non-weldable PVDF coated materials follows.

Other material producers have recently offered a weldable version as well as a non-weldable PVDF. The performance of these weldable PVDF lacquers are affected by the thickness of the lacquer, which for tensile architecture where the absolute concept of “less (weight, mass, emissions, etc.) is more”, increasing of the lacquer layer would be full in contradiction. The substrate of lacquering instead has to be thin as possible to perform as protective sheet to the coating surface, be flexible enough (image 3) to avoid stiffness of the material and at the same time be stable, avoiding the so call “peeling effect”(image 1), the release of the lacquer from the coating surface (image 2).

Many years ago the construction industry in general, from construction to automotive, was using thicker, heavy and in general oversized materials for different uses. With huge investments and precise objectives this no longer applies, helping, and in many case improving, materials performances in end use products like those actually used in buildings and cars. So, effective membrane materials have to perform with less efforts and environmental impact; membrane materials lacquering is not a matter of quantity, but more about absolute quality.

Image 1: “peeling effect” due to exaggerate lacquer thickness and bad adhesion.

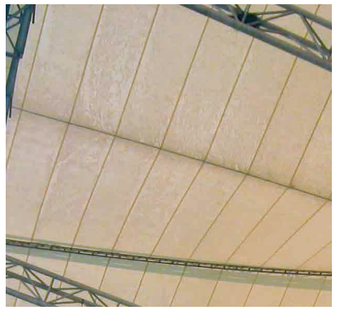


Image 2: Lacquer adhesion problems in translucency. Where lacquer is not performing the coating is directly exposed to soiling and UV attack.

Image 3: Effect of stiffer surface due to thick lacquers. In some circumstances the lacquer substrate can generate deep cracks to the PVC coating.

Comparison PVC/PES-fabrics with weldable/ non-weldable PVDF coating

Comparison PVC/PES-Fabrics with weldable/ non-weldable PVDF coating		
Product Specification	**PVC/PES-PVDF weldable**	**PVC/PES-PVDF non weldable**
MATERIAL PROPERTIES		
Basic fabric	PES (Polyester)	PES (Polyester)
Type of coating	PVC (Polyvinylchlorid)	PVC (Polyvinylchloride)
Top-coating variation	Primer +blended PVDF (polyvinylidene floride) (Mehatop F)	Variable concentrated mixture of PVDF (polyvinylidene floride) with other amalgamating lacquers compounds
Total weight	approx. 650 to 1550 [g/m²]	approx. 750 to 1500 [g/m²]
Tensile strength warp	approx. 2500 to 9800 [N/5 cm]	approx. 3000 to 9800 [N/5 cm]
Tensile strength in fill	approx. 3000 to 8300 [N/5 cm]	approx. 3500 to 6500 [N/5 cm]
Material roll width	250 cm (Standard)	approx. 180 cm (Standard)
Thickness	up to 1,2 mm	up to 1,2 mm
Translucence	up to 15 %	up to 15 %
Flammability	Flame retardant according to DIN 4102, B1 as well as other classes	Flame retardant according to DIN 4102, B1 as well as other classes
Colour	standard white, extensive colour choice , no bleaching	standard white, extensive colour choice , no bleaching
Manufacturing, Handling, Installation		
Manufacture devices preparation	Standard HF machine function tests	Standard HF machine function tests. Grinding machine: adjustment of the grinding parameters and replacement of grinding strip based on request. Preparing of grinding work area.
Weldability	Standard HF weldable without grinding the surface top coating. Welding seams strength and resistance are constant.	Top coat lacquer needs to be ground with abrasive machines. Risk of damaging the basic fabric/ reducing depth of the PVC coating or insufficient removing of the top coat lacquer when parameters or abrasive strip properties are changed. High risk of inconsistent welding seams, strength and resistance.
Foldability	Standard comparable to PVC Acrylic coated materials. Based on Crack resistance test DIN 53359 A+B “No crack @ 100.000 tours	Not defined. Depending on the thickness of the lacquer may result to be difficult to high difficult, due to stiffer surface conformation. Risk of abrasion on doubled folded areas and crack of the whole coating compound higher.
Manufacturing facility special resources	None	Large area for folding operation is necessary. Grinding space to be isolated and separated from manufacturing space. Grinding particle pollution contaminate working atmosphere. Patterns and pattern seams collect additional dirt.
Human resource special resources	None	Persons using grinding machine or working in the near proximity need to wear minuscule particle masks and protective glasses.
Seams and/or welding areas preparation	None	Grinding seam lines to be sketched on and along the material surface. Membrane reinforcement area (cone top, corners, etc.) needs to be ground by hand or using off-axis grinding machines.
On site welding, repairs and preparation	Standard skill required: direct welding to carry out by means of hot air welding machines	Special skill required: welding areas are to be ground off by means of off-axis grinding machines. Especially in case of close flaps welding it may require additional working time and additional human safe harness equipment. Higher risk of main membrane damage. Higher risk of insufficient welding resistance performance. Higher risk of additional dirt collecting into the welding areas. Direct welding to carry out by means of hot air welding machines
General		
Cost evaluative (material/ processes)	Low. Add factors, well foldable, easy welding and short installation.	Higher. Add factors, complicate by handling, quietly stiff, difficult manufacture process and long term installation process in case of site welding (close flaps, site joints, etc.).
Recycling	Full recycling possible	Full recycling possible
Expected lifetime	> 25 years	> 25 years
Self- cleaning effect	Good, where necessary during normal maintenance cleanable with standard non-solvent cleaning agents	Very good, where necessary during normal maintenance cleanable with standard non-solvent cleaning agents
Warranties	Standard ≥ 10 years, can vary depending on project requirements	Standard ≥ 10 years, can vary depends from project requirements
Application field	Standard systems, temporary and permanent constructions, mobile and foldable constructions	Standard systems, temporary and permanent constructions

General performances

Wind

A frequently asked question is if membrane structures are suitable for permanent installation on windy sites. The answer is usually „yes, as long as the project is properly engineered". Today it is possible to generate computer analysis of the different load cases which show that the wind load is the major load case in any scenario. The detailing of the fittings and surrounding structure play an important role and needs to take into account the maximum deflections of the membrane. Under extreme circumstances the engineering and material choice has to be carried out with particular attention.

Designing for permanent load cases (downloads are e. g. snow and sand, uploads are generated by wind suction) requires extreme care as there is a greater risk of form finding mistakes such as e.g. water pounding or sand build up (which can cause permanent uncontrolled stretching of the structure). In these circumstances, the fabric forms generally need to be steeper, spans smaller, curvature greater and sometimes, intermediate cables needs to be introduced as fabric support.

Fire

The fire performance of a membrane material depends on the base fabric and coating type. All membrane materials will melt under higher temperatures, even if at different grades.
VALMEX® FR is difficult to ignite and passes many national fire tests. The speed of this process depends on the type of coating, the temperature reached into the covered space in fire situations and the pretension in the membrane. The effect in a fire situation is beneficial for the persons due to the fact that melted areas generate self-venting opening through a failed seam in the membrane surface and consequently a natural smoke reservoir (which may allow sufficient time for escape, when sufficiently hot) will occur. There is no risk of burning droplets or fire propagation on the material surface. Additionally, the reduced mass avoids high weights falling down. Designers should consider smoke and collateral effects generated by the material used.

The fire performances of materials are classified based on their performances in case of fire dictated by the material behaviour of the project requirements. As well know, PVC will melt with non-drops consequences at lower temperature than PTFE material. This means that in case flames reach the material surface or the internal temperature reached above approx.100° C, PVC membranes help in exhausting smoke quickly and reducing overburning effects. PTFE on glass will melt at approx. 300°C. In this case, all smoke and gases generated below the surface will be captured within the building which is a big health threat to the people, destroying a large part of static construction materials. When the temperature reaches the PTFE melting point, welded seams will open suddenly and give way to a flash-point situation, with the conditions existing for the possibility of an explosion due to the emission of oxygen (as example, material rips, melting point or by opening a door). In case of fire PES/PVC melts where the flame reaches the membrane and lets the smoke escape. As a consequence there is no flash-point situation to fear about.

In general, fire rating classifications are only defining the material performances (burning resistance, smoke generation, droplet, ecc.) once exposed to fire sources. Is task of the user (architects, planner or special-ist) in evaluate and integrate those performances into the entire design concept, taking in account what would be better and safer for people and support construction materials, and not for the material itself.

For high point structures critical steelwork should be supported by means of safety cables so that partial failure of a damaged membrane roof will not cause collapse of the suspended structure.

DIN · TÜV CERT · FIRE LABS Prüfstelle für das Brandverhalten von Baustoffen · OFFICE OF STATE FIRE MARSHAL · CSTB le futur en construction DEPARTEMENT SECURITE STRUCTURES ET FEU Réaction au feu · BTTG FIRE TECHNOLOGY SERVICES · DEKRA

Mehler Texnologies fabrics easily pass the majority of quality tests at several institutes and independent testing laboratories in accordance with major worldwide testing mandates.

General performances

Sun, humidity and pollution

Mehler Texnologies structural fabrics incorporate UV stabilisers that protect colour and base cloth, slowing the rate of degradation.

In areas of high humidity, regular cleaning will reduce the risk of mould growth on the surface of the fabric that may cause permanent staining. Regular hosing down or effective ventilation prevents mould build up in the majority of cases.

Wind, rain and running water carry small quantities of dust and other polluting agents which are deposited on the surface of the membrane.
Generally rain, given that it is regular, should remove most of these particles from the surface of the membrane.
The progressive accumulation of small quantities of the particles will still occur. When it gets to the stage that the majority of the particles remain on the surface and are easy to perceive then the surface is considered dirty. PVDF coating helps to impede soiling and facilitates cleaning.

Thermal insulation

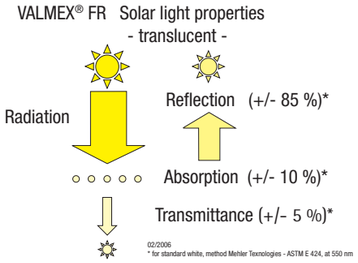
A single layer of VALMEX® FR 1000 membrane with a of 1050 g/m² has a U-value of approx. 5.7 W/m²K (DIN 52611). In this respect it is very similar to glass. A twin skin with a 200 mm air gap will give an approximate U-value of 2.7 W/m²K.

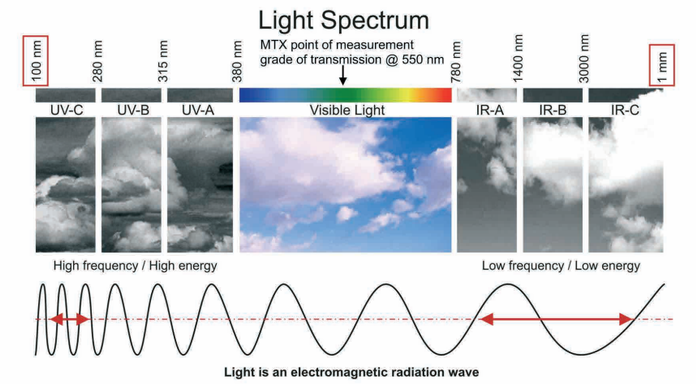
It is possible to get lower U-values than this by using additional material layers to the fabric system. However, this needs to be designed for as it will affect the performance of the entire enclosed space and also will reduce the light transmittance levels.

In certain environment conditions, high reflectance top coating or UV blocking materials can be of interest. This can be a solution for example in case of open air cinemas or circus tents, where the light transmittance would disturb other lighting effects.

Lighting

Natural lighting is now a firmly established concept in architecture, as governmental institutions encourage energy saving processes. The most common PVC-PES fabrics available have visible light transmission of between 5 and 16% (depending on wavelength). However, predicting actual light levels beneath a membrane requires specialist advice. Factors such as the angle of the sun during the seasons, reflectance from surrounding structures and internal finishes will all affect the light levels. UV light transmission lost through membrane materials is usually less than 10%.





Mehler Texnologies materials grade of transmission is measured at 550nm, for humans the centre of the light spectrum visible part.

	Colour	A	B	C	D	E
Solar transmission (at 550 nm)	approx	5%	0%	0.5%	0%	12%
Solar reflection (at 550 nm)	approx	85%	85%	70%	40%	85%
Solar absorbtion (at 550 nm)	approx	10%	15%	30%	60%	3%
UV-transmission	(<380 nm)	0%	0%	0%	0%	0%

A = translucent, standard white
B = opaque white
C = colour 141 pearlwhite
D = colour 852 sandstone
E = highly translucent, white 919/008

Thermal conductivity:
approx 0,18 Watt/(meter x Kelvin)

Heat transfer co-efficient:
approx 5,7 Watt/(sqm x Kelvin)

Special materials application – Façades

Our VALMEX® façade product range inspires architects to follow their sense of design and build the façades of their imagination. This Hi-Tech fabric for building or renewing façades is characterized by numerous functions which can deliver the freedom of design without worrying about the Material. Hard and sharp edges on the one hand smooth sculptural curvatures on the other: VALMEX® façade offers numerous design options.
Highlight your building towards the landscape or take the chance to unify it with the panorama; everything is possible with Mehler Texnologies printable façades.

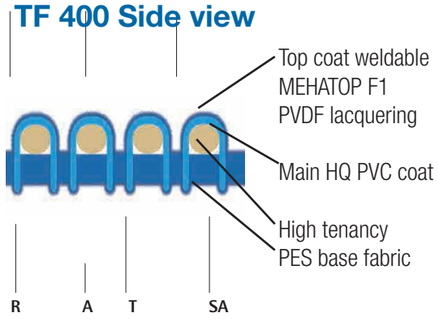
VALMEX® façade membranes are made for long lasting cladding applications. It is stronger, lighter and more flexible than any other products of its kind.

Resistance, durability and permeability have been the main target characteristics throughout the development.

VALMEX® façade product range is adaptable and always an efficient and attractive way to protect any kind of building with a sustainable façade. This is based on the hi-tech composition of well-chosen raw mate-rials. An extremely tight high-tenacity PES base fabric, protected by the unique and well accepted MEHATOP F1 weldable PVDF top lacquering system, results in technical perfection and the first choice material for any long lasting cladding application.

VALMEX® façade membranes have been engineered to provide solar protection for large and permanent façades and also provides see-through properties and protection against rain water.

TF 400 Side view



VALMEX®			TF 300	TF 400	TF 500	TF 600
Product No.			**7283 5246**	**7280 5246**	**7285 5246**	**7286 5246**
Material composition						
Finish	Multi-composed lacquering with highly concentrated PVDF mixture on both sides, weldable without grinding, protected against microbal and fungal attack, UV-protected					
	Measurement methods/ Classifications	**Unit**				
Base fabric	DIN ISO 2076		Polyester	Polyester	Polyester	Polyester
Yarn count	DIN ISO 2060	dtex	1100	3300 / 2200	1670 / 8800	2200 / 2200
Low-wick yarn treatment	Methylenblue liquid method	mm	<5	<5	<5	<5
Total weight	EN ISO 2286-2	g/m²	700	420	500	1050
Fabric thickness		mm	0.94	0.77	1.25	1.46
Fabric openess	PA 12.03	%	approx. 18 %	approx. 34 %	approx.50 %	approx. 24%
Mechanical properties						
Tensile strength (warp/weft)	DIN EN ISO 1421/V1	N/50 mm	4200 / 3000	4000 / 3000	4000 / 3200	6000 / 5500
Tear strength (warp/weft)	DIN 53363	N	800 / 650	800 / 550	1100 / 800	1800 / 1800
Elongation at break (warp/weft)	DIN EN ISO 1421/V1	%	22 / 23	25 / 26	22 /32	25 / 26
Physical properties						
Adhesion	PA 09.03 (intern)	N/cm	20	20	approx. 15	20
Light fastness	DIN EN ISO 105 B02		>6	>6	>6	>6
Seam strength	DIN 53354	N/50 mm	1400	1400	1200	4000
Air permeability	EN ISO 9237	l/m²*sec	2243	6195	>7040	3560
Cold resistance	DIN EN 1876-1	°C	-20	-20	-20	-20
Heat resistance	PA 07.04	°C	+70	+70	+70	+70
Fire resistance	Classification		DIN 4102: B1	DIN 4102: B1 BS 7837 EN 13501-1: B-s2-d0 NFP 92507:M1 VKF Richtlinie 5.2 California T19 NFPA 701 ASTM E84: Class A	flame retardant	DIN 4102: B1 BS 7837 NFPA 701 ASTM E84: Class A
Standard roll width		cm	320	320	320	320

Environment and sustainability

Mehler Texnologies and our label for Environment Engagement

Mehler Texnologies believes that the preservation of the environment is much more than “waste management” as may be the case of the sole recycling tasks. All activities have been bundled under one all-embracing label.

MEHLER eco-care

Low & Bonar as one of the largest coaters in the world, producing more than 50 Mil.m² fabric products per year, is operating on a vast scale of activities, and has taken prevention activities on raw materials, the whole production process, and lastly taking care of the finished waste.
Beside our own policy, and following the EU regulation on use of chemicals, Low & Bonar has for many years supported various EU-based associations pro-actively, contributing in reduced emissions, thus helping to preserve the environment.
Our commitment to the environment starts with the raw materials selection. To do this, Mehler Texnologies is selecting all chemical compounds based on the **REACH** regulation.

Low & Bonar applies REACH:

Mehler Texnologies products contain chemicals which are following the REACH regulation, as far as it is traceable for Low & Bonar. We are always catching up on the releases of the European Commission and facing the challenges to change our compositions in compliance with the latest REACH regulation.

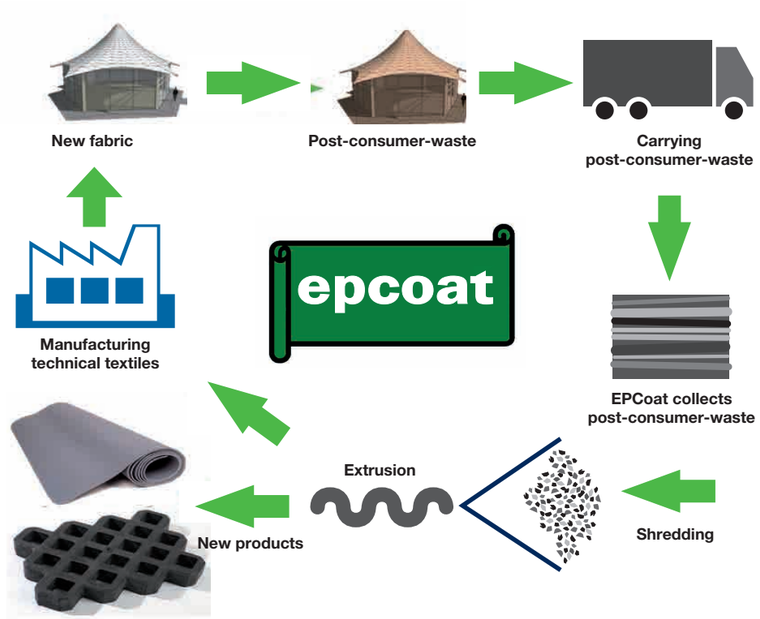
The production process is strongly conrtolled and all machinery has been optimized to reduce energy along the coating process; additionally, some years ago Low & Bonar invested millions of Euros to reduce the emissions of CO_2, in line with the EU environment protection requirements. As a consequence of the optimization processes, Low & Bonar is reutilizing production waste (like coating paste and postproduction fabric waste) to produce a so called E-Membrane, designated to be used as a low-quality product for several use from soil impermeability to temporary coverings.

vinyl plus COMMITTED TO SUSTAINABLE DEVELOPMENT

Mehler Texnologies is additionally one of the active partners of Vinyl plus (http://www.vinylplus.org), an organization putting into practice the commitment of the European PVC industry to Sustainable Development. Thanks to coordinated activities at all supply-chain steps and in cooperation with specialized partners, we are effectively contributing to an increase in the re-utilisation of tons of PVC components, to generate re-built products via the EPCoat system.

The membrane materials recycled via EPCoat system are mechanically shredded and transformed into common use industrial products. This differs from other systems, as this can be applied as a reliable large scale method, and in most cases locally, so there is no pollution produced during transportation of the materials. Also this does not use “additional solvents” to separate the components. In our opinion it doesn’t make sense to use chemicals to generate low quality solvent contaminated chemical compounds which cannot be used for producing high quality fabrics. This is part of our way of understanding “sustainability”.

Those, and future activities, comprise the ”MEHLER eco-care” statement.

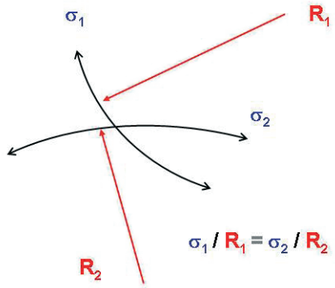


Design

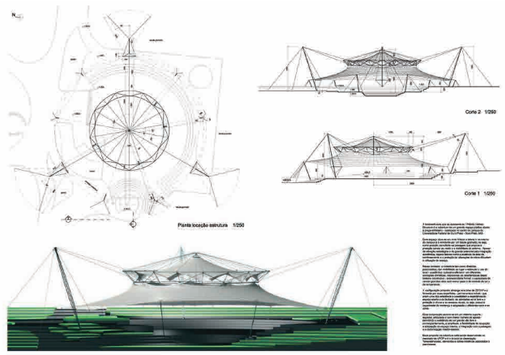
Membrane constructions can be subject to tensile stress only due to the low compressive and bending rigidity of their surfaces. However, plane surfaces react sensitively to deformation by external loads. They tend to flutter and to create snow and water-traps, which in extreme cases can lead to failure of the construction. The stabilization of plane areas would require uneconomic high pre-stressing. Consequently, design and draft follow completely different principles than other supporting structures, which are mainly bending or compressive stressed. In particular the difference is that the process of design of mainly tensile stressed membrane constructions mostly develops self regulation.

This means, that either the form of the membranes approaches the form of so called “minimum surfaces”, (following physical principles under the condition of similar surface stresses within defined continuous edge elements), or it is influenced by changing the boundary conditions, or by inserting additional supporting elements (which can be linear, plane or supported at certain points) respectively by different surface stress preconditions. This allows creating either “anticlastic” saddle shape surfaces or generating “synclastic” surfaces when using pneumatic internal pressure like a balloon. Supporting media for producing internal pressure can be air, gas, water or other liquids but also granulated materials.

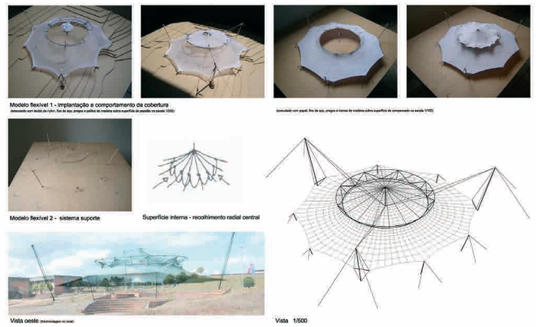
A completely free invented design form therefore must be compelled with the help of additional compression and/or bending-stressed carrying elements and at partly inadequately high pre-loading and/or construction expenditure.



Geometry and forces defined independently of the materials used.



1/3 I PRÊMIO VALMEX STRUCTURE 2007



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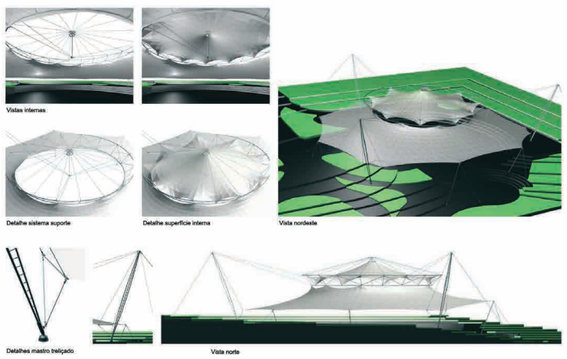


3/3 I PRÊMIO VALMEX STRUCTURE 2007

Examples of design by construction, rendering and model making:
First price of
VALMEX® Structure Award 2007
by Architect Sra. Eliana Ferreira Nunes
from Brazil.

Design

Design process

The stress demands put on the membrane surface will determine the construction and the patterning of the edges, tension elements and anchors. Determination of the form, (the cutting patterns as well as the preconditions for the load-sensitive demands of the surfaces as a basis of the static-dynamic computations) was determined a few decades ago in order to simulate a full scale representation of a natural structure. Today‘s engineering achievements make use of proven computer generated methods for the accurate construction unit dimensioning and automated cutting.

The structural analysis must be completely integrated into the architectural design. The geometry of the membrane is established through a „shape generation“ (form finding) technique in order to ensure static equilibrium of the system. Stress analysis must incorporate „large deformation“ techniques in order to produce accurate results.

The geometry of a tensioned membrane system cannot be precisely defined before analysis. First, a shape generation technique must be used to establish the natural “equilibrium shape”.

The equilibrium shape is the geometric configuration which induces in static equilibrium with its own internal prestress forces.

After arriving at a stable configuration, the structure is analyzed under various load cases using large deflection finite-element method analysis software.

These programs permit the inclusion of tension only membrane elements, as well as cables, struts and beam elements in a three-dimensional computer model resulting in rapid, accurate member analysis and sizing. Each batch of fabric is tested in biaxial (both direction) mode, to measure the stretch in both thread directions at load ratios derived from the form generation computer model. These figures are then used as “compensation percentages” that are factored into the patterning software. The fabric is deliberately manufactured undersize so that when installed to its final dimensions it tensions out correctly.

Mehler Texnologies vario-stretched materials properties have been perfected to meet the engineers’ requirement in equilibrate and be reactive to force distortions generated by orthogonal loads reaction.

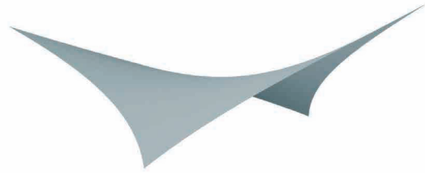


Figure 1: hyperbolic paraboloid

Figure 2: the conical form

Figure 3: the arch supported or barrel form

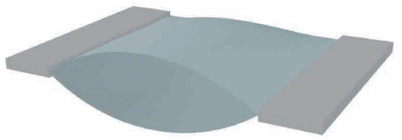
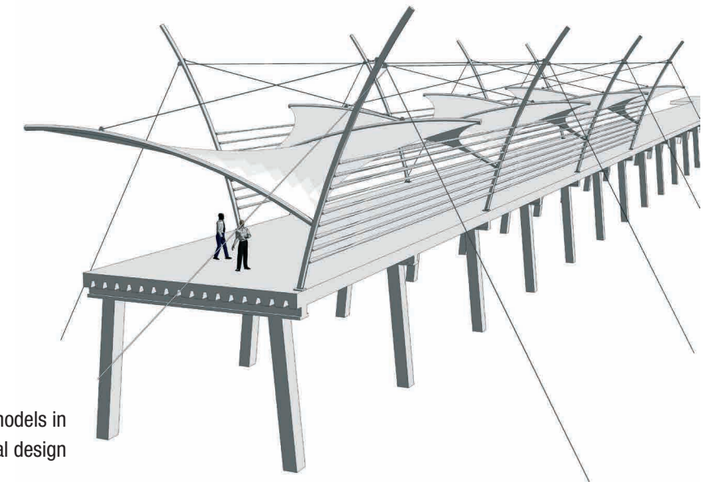


Figure 4: filled synclastic form



Integration of 3-D models in architectural design

Form finding and pretensioning

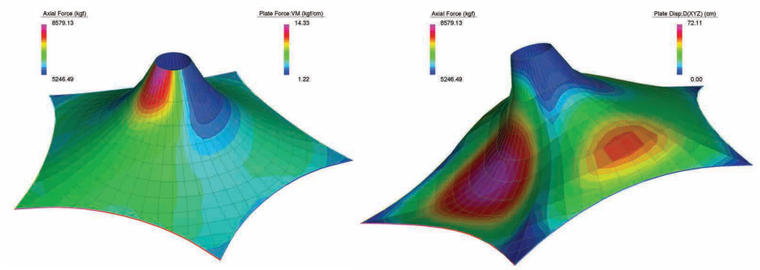
Permanent tensile membrane structures are designed to resist the same basic loading criteria as conventional buildings. Imposed minimum live loads and wind pressures are derived from the requirements of the local building code or the model code having jurisdiction.

This architecture needs a symbiosis of live forces in each situation. The force generating those forms is the tension transmitted and governed by the material. Pretension is defined as the tensile forces in the fabric after erection but prior to external loads being applied.

The ratio of pre-stress in the principle curvature directions, which dictates the shape, is initially established in the computer form generation process. The absolute values of pre-stress are calculated to be sufficient to keep all parts of the membrane in tension under any design load case. Imposed loads are resisted by redis-tribution of the stresses within the membrane system. If this results in any area going into compression then creases will appear and in critical cases generate form distortions until structure collapse.

Similarly, if the pretension is not properly distributed or not high enough then substantial movement of the structure could occur with consequent destabilization of the whole tensile structure.

Proper material compensation and fine-tuning application of the bi-axial values (as well as material high quality mechanical properties) are here highly demanded. Those factors when properly evaluated are avoiding “relaxing” of the membrane surface and consequent re-tensioning needs. Mehler Texnologies materials are commonly performing in the time (s. FAQ section this guideline, at point 3. What consideration should we allow for the membrane material service life?), with proven and excellent values.



Computerized load analysis on the membrane material in warp direction.

Higher stress concentration in weft direction. Note the different loads distribution on both directions of the membrane surface.

Detailing

Once analyzed form and material properties will be necessary to carry out a preliminary statistical analysis.

As part of the preliminary design process a provisional load analysis derived from a computer model will give typical load directions and figures of the design loads to be transferred to the supporting structure. By describing the supporting structure, the type of connections and all accessory parts like the perimetral links, anchor plates and corner devices are to be dimensioned properly.

The boundary of the membrane usually falls into one of two categories: curved and scalloped edges.

These generally consist of a cable sitting in a pocket at the edge of the membrane. In some structures, webb-ing belts can be added parallel to the edge to take out the shear loads.

Membrane edges can also be linearly fixed. Usually there is a rope edge also called “keder” formed by sealing a flexible PVC rod in a small pocket. This can then be trapped behind an aluminium clamp plate bolted directly onto the structural steel work or slid into an aluminium track extrusion.

A properly designed fabric structure should take account of these elements as well as all other particulars to minimise membrane material waste.

Use of complicated devices and non-standardized forms will seriously affect the design and the commercial aspect of the project.

Example of corner fitting plate device

Manufacture

The fabrication of the membrane fabrics is a specialist activity and requires experienced personnel, special materials and facilities adapted for the works. Experienced manufacturers secure a QA manager to oversee the quality aspect of the fabrication and conduct the final inspection and acceptance of the finished membrane.

The cutting patterns are generated using 3D computer models of the structure and taking into account the required compensations for the individual production weave batches of membrane material and the edge corrections for welding seams and edge details. These electronic cutting patterns are then transferred by a computer into a controlled cutter/plotter.

The joining or assembly process of the single membrane area (patterns) for the PVC-coated fabrics is normally per high frequency induction. To this end the main tools for fabrication are purpose built welding machines. Periodical measurement of the main parameters, like the output temperature or the executed pressure level of the machines will be carried out by common external gauges. The hand-held welding process by means of hot-gun tools are used to do the detail work at corner etc.

The production itself can be sub-divided into four phases: delivery and quality inspection of the material, cutting, welding and packing.

In case of non weldable top coat lacquer, this needs to be ground with abrasive machines. Risk of damage to the base fabric/ reduces the depth of the PVC coating or insufficient removing of the top coat lacquer when parameters or abrasive strip properties change needs to be minimized by paying particular attention. High risk of inconsistent welding seams strength and resistance can occur. Persons using grinding machine or working in close proximity need to wear minuscule particle masks and protective glasses. The work area designated to grind needs to be isolated from the rest of the facility.

During the production process, records are made of all the work steps to guarantee state-of-the-art workmanship. The manufacture process of fabric membranes does not bear any significant environmental risks. All waste materials are disposed of in accordance to governmental regulations.

High frequency welding process

Welding is effected by conducting electrical energy in the form of a radio frequency field to the two surfaces that are to be joined together. This stimulates the molecules in the material to move at a speed of approx. 25 million times a second. The friction that arises between the molecules generates the heat that is required to fuse together the material. A weld seam is thereby created which has the similar strength as the surrounding material.

The electrical field is conducted to the material through a metal tool, an electrode. Welding performances need to be tested at each machine adjustment, new start or malfunction. Normally, the welded seam resistance should be at least 70% of the material resistance.

High frequency welding

Cutting the patterns

Final check

Installation

The installation of the fabric systems is a highly specialized area of work requiring experienced personnel and special access equipment. However the tools and other equipment are standard items used in conventional construction rigging.

Most of the roofing materials, i.e. membrane fabric, cables, etc. are relatively lightweight, but access has to be provided for most of the construction area.

One of the biggest advantages of membrane structure is the easy, clean and quick installation and adjustment process. Because of its lightweight no heavy hoisting equipment is required to get it in place and specialist riggers can install them in most cases practically by hand.

The main functions of the installation of the fabric roof are verifying the tolerances of the main structure, installment of the temporary works, securing of the primary structures, and the quality and safety control process of the installation.

The installation of tensile systems requires reasonably clement weather conditions. The lightweight of the fabric materials, coupled with the large areas of exposure, means that work can only precede at wind speeds of less than 5 m/s. At higher wind speeds certain lifting operations must be suspended. Installation should be stopped at temperatures below 10 °Celsius. Working at heights is a high-risk activity. All personnel shall be familiar with a safety induction course and be briefed on safe working procedures and requirements. All men working at height should have a full safety harness with two safety lines, one of which must always be attached to the fixed life lines. When working at heights operatives must always be secured with a fall stop device. All lifting equipment shall be prechecked and sufficient for

the loads to be raised. Areas below open-height working shall be cordoned off and warning signs should be placed advising of the danger of falling objects. The crane(s) and other lifting equipment shall only be operated by trained personnel. Crane lifts shall be controlled by the crane operator and rigger / banksman shall be present at all lifts. Safety procedures at the start of each shift shall include a ‘buddy-system’ check of all PPE for each worker at height.

Installation phase for a high point shaped membrane roof. This process requires to be integrated into planning phase and must be carefully synchronized in the whole installation concept. Therefore only in tensile structures it is possible to cover 2000 m² surface within 5 full days installation time.

Maintenance

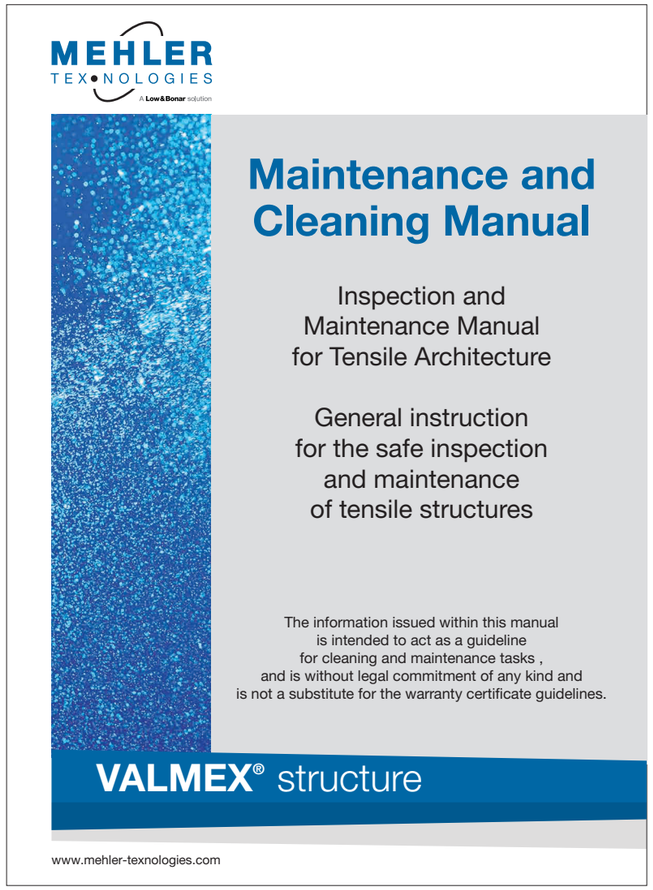
The Mehler Texnologies membrane material is weather resistant and should provide many years of trouble free service life.
However, the fabric can be cut or torn, and damaged by a sharp impact; it can be crushed if subjected to high localised ‘pinching’ loads, caused by bad design or by inappropriate clamping devices. Care must therefore be taken in handling the material at any process stage and while walking on it, to protect against accidental damage. Inspectors and workmen working on this roof must wear clean, soft, white-soled shoes. Care must be taken not to drag any tools or equipment across the surface which may lead to premature deterioration of the roof material.

On structures of this type, the membrane is a structural part of the roof system, and not just a protective cover. It is mechanically pretensioned to provide a stable roof system capable of withstanding the design conditions of wind, sand, weather etc. However, if damaged, redistribution of load can result in a concentration of stress that could cause a propagation of tears. Minor problems can become major if neglected. In order to assure proper service life, it is essential that good operation and maintenance practices are adopted and strictly adhered to.

A continuing awareness of the condition of the membrane is essential. Throughout the life of the structure there shall be visual inspections conducted to spot any obvious damage or deficiencies. If any are found they shall be further investigated and action taken to repair or correct as deemed necessary. Emergency repairs to the membrane material shall be carried out by persons experienced in working with this. One of the great advantages of the VALMEX® MEHATOP® FR materials is that even if PVDF coated, they are perfectly weldable without grinding of the surface, even on site, by means of hot-air gun tools.

Depending on the project location (and the maintenance dedicated to the membrane covering) small quantities of dust and other polluting agents could deposits itself on the surface, degenerating the natural beauty. Generally rain removes most of these particles but when it gets to the stage that the majority of the particles remain on the surface and are easy to perceive then the surface is considered dirty.

Like any building materials, fabric structures look and in some circumstances perform better when regularly cleaned. Following the instruction of our maintenance manual will help preserve the aesthetical characteristics of your project. Please refer to this additional document for more particular indications.



Condensation

In some climatic conditions, internal condensation is likely to occur with roofs covering a sealed heated space. Appropriate design of roof gradients and edge detailing can minimise any problems. Ventilation can obviously reduce the risk but if more control is required then it is often necessary toincorporate a second layer. Controlling the airflow in the air gap between two fabric layers is recommended to get the best environmental control. A sealed air gap is best in winter for insulation and a good airflow in the summer will help cooling.

The design of roofs (particularly in conic forms) can make use of a “passive stack effect” where natural airflow along the surface of the fabric is enhanced. This may be artificially reproduced by fans or louvers, to achieve the required performance and to reduce the risk of fungal attack.

Therefore, in addition to the inherent protective additives in the material, it is of high importance that for the design itself, adequate gradients and edge detailing are considered to optimize the natural ventilation and minimise any problems. Ventilation, in natural or artificial way, can obviously reduce the risk but based on our experience, this is not the only aspect to take in account.

In case of pneumatical structures (it is not a matter which material will be used) more control is required and then it is often necessary to incorporate a dryer between the air blowing and the internal skin chambers. The dryers prevent the temperature difference (outside/inside) that can generate water condensation in between the layers, even if there is a permanent air blowing occurring. To reduce the risk of fungal attack, periodical cleaning of the surface by use of simply clear water is required. Experienced designer’s use high point structures to allow the natural “negative thermal buoyancy” generated by the roof form to grant permanent air flow and at same time excess of “vitiated” air evacuation.

Long exposed surfaces, especially when not maintained, are more exposed to fungal accumulation and consequently to aesthetical (and in extreme cases physical) deteriorating of the material properties.

In general the designer takes care of this on permanent structures; there the problem can appear where ventilation of the inner surface is insufficient or there are “static areas” where differences in outside/inside temperature which generate condensation are not exposed to adequate ventilation. Also, is possible that during installation there may be damages to the lacquer (ex. by sliding the membrane on the floor or simply carrying the material over a cable fitting, etc.) which generates an opening on the coating, exposing the material to UV and water penetration.

The problem becomes significant on temporary structures, where it is necessary to erect and dismantle several times, and in most cases, quickly stored for the next event. There the risk of damage to the lacquers, coupled with humid material, can cause serious problems. Moisture can not only come from rain, but also from condensation (water forming itself when fabric has been folded and packed, without any protection (as the membrane folded generates multilayered, almost “sealed” substrates) and stored in sun/shadowing areas or in humid spaces. This is also the problem of some retractable roofs, in particular where dust and water remains accumulated and where ventilation is insufficient.

Example of moulding for wrongly stored temporary structures. It is clearly to see that mould has formed at the internal part of the folded material, probably due to the fact that the material was stored wet or that the storage place was not adequately dry.

Fabric under fungal attack. Micro organisms have already invaded the coating with possible deteriorating of the original material characteristics.

Frequently Asked Questions

1. Advantages of lightweight, more extensively defined, sustainable architecture.

Other than the obvious aesthetical aspect (most tensile structures acquire landmark status much easier than conventional buildings), there are numerous arguments supporting the reasons which have consistently attracted many architects to investigate the field of tensile architecture and therefore get involved in projects that incorporate tensile structure which we have witnessed for more than 40 years.

The use of this type of architecture generally assists in the drastic reduction of the transformation of raw materials and their utilization, therefore directly contributing in the reduction of environmental impact.

Tensile Structures use natural light thus providing translucency, which results in a reduction of artificial illumination, which allows for natural protection against the elements and ventilation, when engineered properly.

Tensile structures perform under tension instead of compression and bending as we find evident in most traditional structures. Furthermore, tensile structures are flexible when compared to traditional building structures which are generally rigid. The aforementioned factors result in tensile structures to be pre-manufactured and forwarded in smaller containers to site, rapid execution with regards to installation, and the majority of material that was used to be recycled.

Low & Bonar is participating actively in Vinyl plus, the self-commitment EU association coordinating and financing processes optimization and recycling activities for the PVC-Industry sector. Our point of view regarding active contribution to preserve our environment is beginning with the strength selection of the chemical compounds as per REACH (Registration, Evaluation and Authorisation of Chemicals) regulation coming through CO_2 emission reducing investments, recycling process of internal materials rests as well as produced fabrics, to packaging and transportation management tasks.

One of the most evident advantages of using lightweight structures is covering a long span as a suspended roof system capacity, which again has the benefits of reducing the material mass used, lowering costs, reducing delivery time and energy savings.

This kind of structures can be easily integrated into regular buildings and in many forms of construction, from roof to façade and from ceiling to divisors, improving the physical, the aesthetics and cost effective properties of your project.

2. Interesting, let us talk about lightweight structures, what is that?

Tensile structures are called this because all forces are distributed and they are also commonly lightweight structures and are characterized by mass in relation to the forces working within these structures.

Let’s consider a practical example: the weight of 1 square meter of a 7mm float glass for roof construction is approximately 20 kg/m^2, instead of approximately 1 kg/m^2 for a type III membrane material, and this without taking into account the enormous substructure required involving traditional construction materials.

This type of architecture is categorized by smooth and harmonious forms working as tensile (or tension) structures that can be mechanical or pneumatically supported.

Commonly, these forms of construction reject the “angular” idea of enclosed space therefore highlighting the beautiful, essential and modern curved design style to a much greater extent.

The design process is similar to conventional buildings which are due to the relatively low level of “know how” to the wide spectrum of a non-specialized designer, it requires follow up measures at the very beginning of the whole project design stage. It is important to carry out for example preliminary analysis to define the living loads acting on the foundations. In other words, this means that the design of the tensile structures should start immediately with the conceptual design carried out by the design architects under the supervision of membrane specialists. Mehler Texnologies high quality PVC-Polyester fabrics have been used by pioneers in this field and due to permanent innovation been optimized for several uses and diverse customer requirements.

3. What consideration should we allow for the membrane material service life?

Properly designed permanent construction can yield above 20 year lifespan, which is highly dependant on the design, the quality of material used, what the building is used for, the maintenance grade applied dur-ing the project life and the environmental conditions of the location of the installed project.

Permanent structures will obviously last longer than non-permanent structures and the longevity of non-permanent structures is predominantly dependant on the maintenance, the utilization intensity, and the erection and dismantling methods.

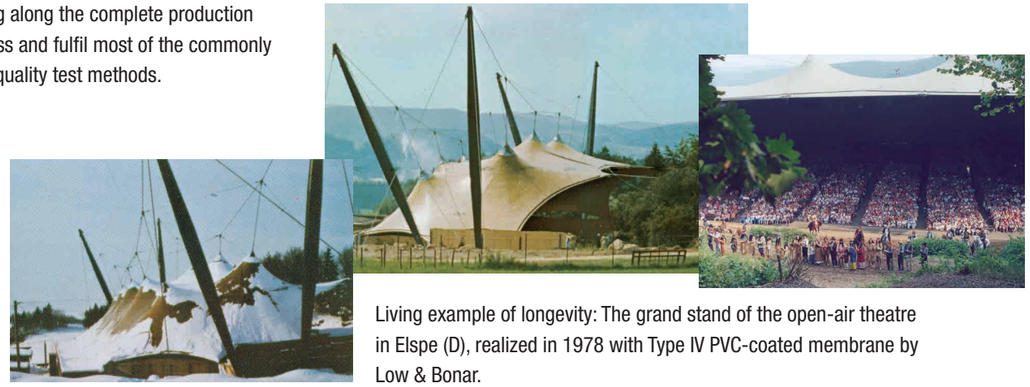
Our materials undergo intense internal testing along the complete production process and fulfil most of the commonly used quality test methods.

A great example of longevity would be the Grand Stand Open-air Theatre in Elspe, Germany. Completed in 1978, this structure is one of the most advanced and spectacular tensile structures to this day, delight-ing visitors with its imposing steel members sustaining the membrane roof and suspending it over 2.000 m^2 space. The project, designed by the engineering company Naumann & Dollansky, has protected approx. 4,500 persons daily from possible adverse conditions during the daily programmed shows since then. The 25m higher masts are suspending the membrane roof so that a 100 m area could remain free of any obstacle.

The structure, due to permanent exposure to typical German climatic condition and in particular higher wind and snow loads, is actually one of the most evident examples of properties longevity for our materials.

The material used is a Mehler Texnologies Type IV PVC-PES coated fabric. The residual mechanical resistance (tensile strength) when measured in year 2007 was 95 % of the initial value. This has to be con-sidered an excellent performance due to several preconditions, good performing engineering, quality membrane material, execution and maintenance tasks.

Up to date, there is no request to replace the fabric. The membrane covering remains a safe and attractive eye-catch structure for all who are visiting the park.



Living example of longevity: The grand stand of the open-air theatre in Elspe (D), realized in 1978 with Type IV PVC-coated membrane by Low & Bonar.

4. Amazing, but… how can you ensure that your materials are resistant to external agents?

Mehler Texnologies materials for architecture are designed to resist environmental factors and general external agent influences. Projects located in areas which have extremely high UV exposure require materials with high UV stabilization substances.

The UV stabilization substances absorb the UV rays and protect the colour pigments against bleaching. It is true that after a period of time, depending on the UV intensity grade, the plasticizer components start to migrate, which results in the PVC coating becoming stiffer. This results in change of colour intensity under certain circumstances and this helps us to recognize projects whereby regular maintenance was not carried out. The special surface lacquering system “MEHATOP F” provides additional protection against infestation by fungus and micro organisms. Our architecture materials are generally guaranteed for 10 years from production date which is dependant on the project characteristics, the end use design, the material type and the guarantee is extendable to longer period of time which is dependant on other circumstances of the project.

5. Are our materials available in different colours?

Technical textiles are available in a wide range of colours upon request. Tensile roofs are realized in white most commonly so to increase the maximum grade of natural light transmission.

Theoretically, all colours can be generated taking into consideration that an entire batch has to run through a coating machine. It is easily understandable that the production of colour pigment additives and cleaning of machinery is a process that requires a substantial amount of time with the involvement of a multitude of resources; we therefore provide support to our customers by making hand samples available of the coated fabric produced in our laboratory. We will produce the requested colour additives and be ready for the coating procedure only after the client has provided us with approval of the hand samples so to ensure superior results post production. We currently have many standard colours in production with some in a metallic finish. Particular requests are carefully analyzed so that we can adequately advise the client of any added costs and delivery time.

It is important to note that our products are highly UV stable. If we use a scale of 7, our product line VALMEX® will achieve a grading of 6. This explicitly means that the colour fastness of our products is to be considered very good to excellent.

6. How much natural light transmission is necessary and how much are our products allowing?

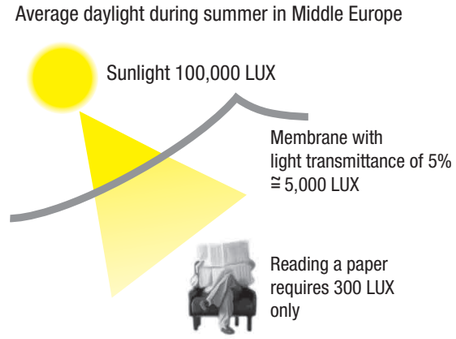
Using natural resources in buildings for purposes of functionality are considered “intelligent architecture” items. The reason for this is to fully understand the needs in energy, and therefore environment, saving. For normal use, a space with a general, diffuse light transmission of 5% is appropriate to carry out living and working tasks (e.g. reading a newspaper).

Lower transmission grade fabrics may require to be artificially illuminated or in comparison, spaces with too much light (UV) transmission can be found to be unpleasant by the public. The grade of natural transmission has to be carefully analyzed “case by case” as this can have dramatic consequences to the final results and depends very much on the intended application of such a building. For example, a sport complex company was planning to install tennis court coverings a few years ago.

The architects preferred to integrate arch supported tensile coverings into the surrounding area with a light green tone. The covering looked very good due to the aesthetical appearance but this led to the tennis player becoming disturbed with the green shadowing on the tennis court.

In reality, anyone can feel uncomfortable underneath a highly transparent covering when the sun is shining. The quantity of natural light and the high UV transmission causes this space to become very warm and consequently may disrupt common tasks that may have to be carried out by people while in the confines of this construction.

Our products allow for different grades of transmission from 2% to 15% (HFT pigmented), also depending on the strength of the material, the thickness of the coating and the colour of the coating. It is important to note that our material translucency is standard measured at 550 nanometers of light spectrum intensity (daylight intensity, that is very close to the frequency to which the human eye is most sensitive). This is the range where we detect light intensity changes; some other material producers use higher light intensity references to increase their values. For particular uses (for example, a circus tent) completely block-out material may be most suitable, which are practically not permeable to the external light and can be produced in combined and different (external/ internal) colours. Please consult www.mehgies.com or contact us for a more detailed indication of the properties with regards to our material.



7. How does the material perform in case of fire?

VALMEX® material range has been approved by the German Institute for Construction and the normative for material classes DIN 4102 as B1 and is therefore graded as flame retardant and self extinguished classification. There are several fire performance standards worldwide whereby our materials are also compliant; individual country valid certification is available upon request. Our material has a very low mass ratio due to it being only a few millimeters thick in comparison to other construction materials. An additional advantage of using our materials for tensile architecture is that there is a very low danger of falling substructure components when compared to traditional construction methods should we take practical examples into consideration.

Furthermore, the material surface will melt open natural smoke vents which help ventilate the construction with regards to smoke generated by burning material below.

8. Material maintenance and cleaning, is this an argument?

Due to low adhesion of dirt on the material surface which is increased even further with fluorpolymer top coated product line, the pollution that may occur will predominantly be removed by rain. Depending on the design in comparison to conventional covering materials, the maintenance required by membrane is considered very low. Regular inspections would initially locate damages caused by sharp objects which can be repaired on site eventually and can be executed usually when normal cleaning occurs. The cleaning intervals may vary from the type of material and the project location. The maintenance program should be evaluated at the very beginning of design as this may require additional safety equipment.

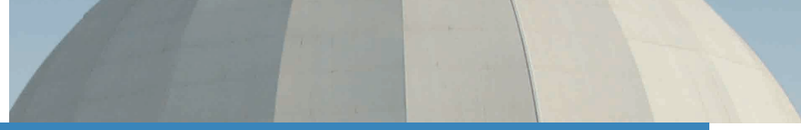
No aggressive or polluting detergents must be used when the material surface is cleaned. We recommend specialized products such as UNGAPON®, a solvent free and non alkaline detergent produced by the company Max Bail which is located in Germany.

The surface must be rinsed off by tempered and clear water; the detergent can be sprayed or applied by clean cloths and then simply wash away by water after a few minutes. Please follow cleaning instructions as specified by the detergent company regarding dilution and environment protection.

9. What kind of guarantee does Mehler Texnologies offer?

In standard form, we provide 10 year warranty time on our products (MEHATOP® F, PVDF lacquered). This warranty covers any abnormal deterioration which causes the fabric to become unsuitable for weather protection, including abnormal deterioration in tensile strength, fire retardancy and waterproofness. We warrant that the material is in accordance with the released data sheet, that the tensile strength of the product will not reduce more than 3% per year on an average base and that the material will remain water-proof (if not damaged) and flame retardant.

The project warranty certificate will be issued on the basis of the information provided by the customer at the time of the order process. This includes approved information in general on the project scope and use, on the design, on the statistical analysis, the engineering details, and the manufacture and installation process and not at least on the maintenance program. The aforementioned information is then evaluated by our technicians and if all information provided is satisfactory, this can lead to a longer guarantee being issued.



Frequently Asked Questions

10. Fine, all above is clear, but…how much does it cost?

The costs of the membrane material vary due to the several types, strength, coating and finishing properties. However, compared to other tensile building materials, PVC-PES membrane is effectively the most appropriate choice under the performance/costs optic. Furthermore, due to the easy and widely used high frequency (HF) welding technique, the high grade of flexibility and the extremely rapid production time, PVC-PES material makes the project increase cost effectiveness.

Mehler Texnologies materials has been tried and tested within the most reliable and specialized membrane manufacturing industries for many decades, optimizing the material performances during the projects manufacture process. Reliable properties like easy handling, easy welding and easy installation due to the variable stretch ratio assists our clients in reducing unnecessary costs and execution time.

The cost of installing customised tensile structures depends greatly not from the difference between the PVC-PES material choices, but much more by other kinds of material choices.

Other factors playing a crucial rule in defining the project costs are: the project size, the design form and its complexity, the statistical requirements, the structural support types, cables, quality of fittings with regards to the accessories materials and connections, the manufacturing and installation method required and finally the local soil and weather conditions.

This evaluation at the beginning of the project where the majority of the information has only been analyzed superficially is the very challenge for reliable cost estimation, due to its customised nature adding to the difficulty of estimation. This is another example whereby tensile structures differ from standard constructions when compared. Each realized project is a unique adhoc design solution; each detail can vary from manufacturer to manufacturer, statistical and quality requests are different between various countries and finally the experience in this field of all partners involved during execution can play a crucial role regarding the costs evaluation and the actual project costs.

Therefore, once all of the aforementioned is established, it is obvious that the estimation of tensile structure should be undertaken by professionals which must be carefully taken into account at the beginning of the design stage.

The costs of the membrane material, in the case of PVC-PVDF fabric, arise between 5% and 15% of the total project amount, depending from material type. As consequence, should be not there where cost needs to be saved on material quality charge.

A PVC-PVDF membrane covering price can range as purely demonstrative value between Euro 100/m² to Euro 300/m² and as seen this vary according to design, type of fabric, type and range of structural support, project location and difficulty grade during the installation task, without to consider wastage factors, transportation duties and taxes. Material wastage and labour costs on conic forms as example are much higher than on other typical designs.

In comparison and even considering this as indicative, a PTFE-coated membrane covering of same kind could arises the whole costs of 30% to 50%, not only due to the considerable price difference between the materials but much more because of the complication during manufacturing and the quietly difficult installation methods.

Air supported structures (pneumatically supported) require continuous air support even if only to replace the eventual leakage, and as a result have higher operating energy costs than tensile structures.

These values are to be understood as purely demonstrative and do not exclude deeper investigation of costs generation on the project you are planning to realise. The examples of cost above are related to a 4000m² large single layer high point shaped tensile structure, realized in Europe during mild weather conditions, without foundation and any other civil construction.

Frequently Asked Questions

11. OK. Last but not at least: when PVC-PES membrane – why Mehler Texnologies?

We offer our clients all our knowledge and experience in this field. Mehler Texnologies is a well-accepted pioneering Company in production of Polyester-PVC coated fabrics and holds long term experience and good relationships with most accredited professionals all around the world.

- For over 60 years, Mehler Texnologies has continually developed innovative quality products making us a reference for the whole industry.
- Our organisation pro-actively preserves our environment. Our products strictly follow the European rules and can be recycled into different products.
- We offer our high quality materials in various grades and finishes.
- Our weldable PVDF top coated material (MEHATOP® F line) has more than 14 years proven in the market.
- We deliver in attractive widths of up to 5 metres (standard 2.5m).
- To reduce CO_2 emission we operate warehouses around the Globe, to deliver promptly throughout the year.
- We produce 50 million square meters/year of high-quality fabric products at our 3 facilities in EU.

12. Any other questions?

Then please, do not hesitate in contact our specialists at info-de@mehler-texnologies.com

Note:
This information has been provided with the intent to help understand the applications of our material and cannot be considered binding for any personal evaluation or reference. Low & Bonar GmbH retains the right to change, replace or modify this information at any time without prior notice.

Mehler Texnologies – Technical Textiles Worldwide

Mehler Texnologies has sales companies and sales offices all over the world. If you are interested in contacting us, you can reach us at info-de@mehler-texnologies.com

Additional information on www.mehler-texnologies.com

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