VEKAPLAN Sheets

VEKAPLAN

ALWAYS THE IDEAL SOLUTION

PROCESSING GUIDELINES

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VEKAPLAN Sheets

VEKAPLAN
Always the Ideal Solution

QUALITY. TRUST. SAFETY: It is on the basis of these principles that VEKA has become the globally leading manufacturer of plastic profiles for windows and doors with more than 5,600 staff spread across 4 continents. Since as early as 1985 we have been using our PVC competence also for the production of our high-quality VEKAPLAN sheet systems – and we have succeeded in establishing ourselves in this market sector also as a high-quality supplier.

- As the global leader with the highest standards of quality, VEKA has become a guarantee for unconditional quality also with our VEKAPLAN sheet systems.
- Because it is only a product of consistent high quality that enables simple processing complying at the same time with all practical requirements in a reliable manner.
- In order to guarantee that quality, we perform continuous strict controls across the entire production chain.
- From quality controls of supplied raw materials performed in our own laboratories and periodic colour matching through to the final control of extruded sheets and foiling.

VEKAPLAN Sheets

VEKAPLAN
Always the Ideal Solution

Service for your Success

VEKAPLAN stands for comprehensive service offerings and high motivation. We maintain long-lasting business relationships based on partnership and we support our partners in many ways

- E. g. through full technical advice with respect to any matters regarding the use and processing of our sheet systems;
- but also through appealing marketing materials and very strong delivery capabilities.
- As a VEKA partner you benefit from valuable advantages in competition – and we are always prepared to listen to your individual wishes regarding production.

Protecting Resources through Recycling

As a family-run and value-based business we stand by our responsibility for the protection of natural resources and sustainable management.

- This is the reason why the production of our VEKAPLAN sheet systems is particularly resource-efficient based on - among other aspects - an extensive heat recovery.
- In addition, we have built a powerful system for PVC recycling which enables us to recover valuable reusable materials from old products and to reintroduce them into the production of new high-grade products.

Information given in this brochure is based on the long-term experience of our company in the field of the production of semi-finished plastic products.

All VEKAPLAN products are subject to constant quality controls. Some data, however, may vary depending on processing methods and environmental influences.

Quality and Quality Assurance

From raw material controls and preparation and the production of sheets through to testing of the finished product, a strict control program will always ensure the consistently high quality of our products. Using advanced test facilities, our expert staff of our in-house test centre monitor the properties of the VEKAPLAN range of sheets on a continuing basis.

The VEKA Quality Management System has been certified according to the ISO 9001:2008 standard.

Manufacturer and Product Specifications

All manufacturer and product specifications with respect to third-party products are intended as recommendations and assistance only; they do not guarantee the fitness of the products for certain purposes. As a general principle, the respective manufacturer's product information and processing guidelines should be adhered to!

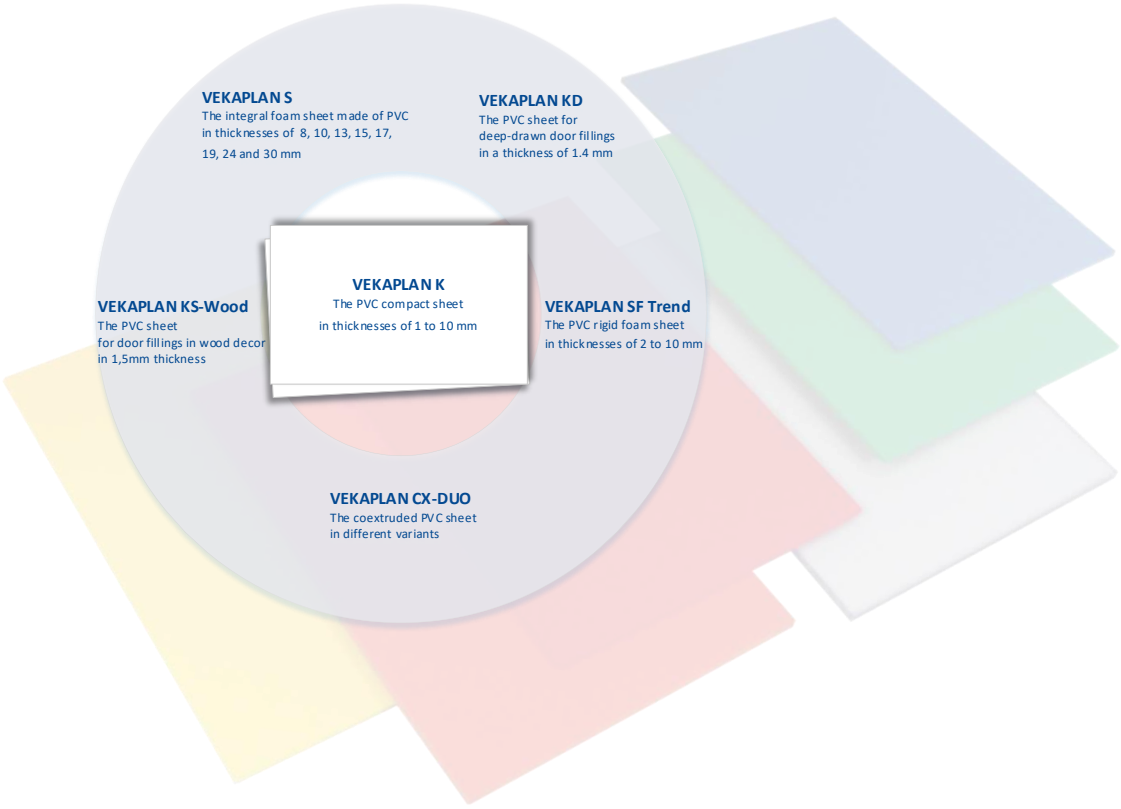
Technical Data and Advice Service

All information and our application-related consultation - orally, in writing and on the basis of our tests - is given to the best of our knowledge. However, for lack of knowledge of the concrete framework conditions, it just serves as non-binding information. The same applies to possible third parties' property rights. Our consultation does not release you from the obligation to verify the information currently provided and to check the suitability of our products with respect to the intended processing methods and purposes. Application, use and processing of our products and of products made on the basis of our application-related advice take place beyond our control options and are therefore not our responsibility.

Should you find no sufficient answers to your questions in this brochure, we recommend that you contact our specialist advisers for more information.

The universal Range of Sheets

For detailed information on our delivery program, please refer to the VEKAPLAN delivery overview.



Product Properties

All VEKAPLAN sheets are made of PVC-U (U = unplasticised) plasticiser-free PVC formulation and are characterised by the following PVC-typical properties:

- Durability
- Weather resistance
- Resistance to humidity
- Good resistance to chemicals
- Strength and form stability
- Impact resistance
- UV resistance (white)
- Variety of applications

Depending on the production method and the recipe structure, each sheet type offers individual advantages making it suitable for the most varied applications.

VEKAPLAN S:

PVC integral foam sheet produced by the Celuka process with smooth compact surfaces. For applications requiring sheets with good stability and low weight.

VEKAPLAN SF Trend:

PVC free-foam sheet for applications requiring low weight sheets and all the opportunities of a creative surface design.

VEKAPLAN K:

This compact PVC sheet of high impact resistance and the most versatile processing methods is used in cases where robust materials are required.

VEKAPLAN KD and VEKAPLAN KS-Wood:

The compact PVC sheets for door filling surfaces with a distinct design, whether in white or various other colours and patterns.

VEKAPLAN CX-DUO:

Depending on a combination of foamed and compact PVC layers, a solution for individual applications that other sheets will not meet.

For detailed information on the technical properties of the individual sheet types please refer to www.vekaplan.de – or contact us directly.

Range of Applications

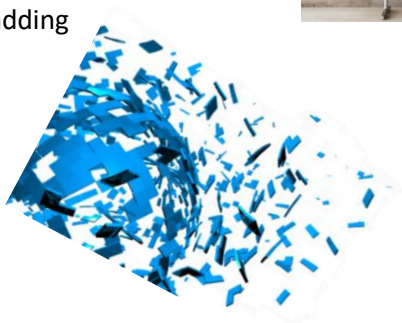
Thanks to their material properties and the variety of processing possibilities, VEKAPLAN sheets can be used for a variety of applications both in indoor and outdoor areas.

Range of Applications

Construction
Attika
Balcony cladding
Balustrade elements
Container construction
Ceiling lining
Interior design and outside architecture
Wet and cleanroom
Frame broadening
Roller shutter box
Sandwich element
Sanitary facilities
Separating walls
Door fillings
Roofing
Wall cladding

Viscom / Advertising
Stage decoration
Digital printing
Display
Shopfitting
Illuminated advertising
Trade fair construction
Signage design
Window dressing
Screen printing

Industry
Ambulance vehicles
Boat and ship building
Caravan industry
Vehicle interior fitting
Machine cover and cladding
Furniture manufacture
Control and meter cabinet
Special vehicle manufacturing



Tolerances

Product	Length	Width	Thickness
VEKAPLAN S	+ 10,0 mm - 0,0 mm	+ 6,0 mm - 0,0 mm	(0,08 + 0,03 x T) mm
VEKAPLAN SF Trend	+ 8,0 mm - 0,0 mm	+ 1,0 mm - 0,0 mm	(0,08 + 0,03 x T) mm
VEKAPLAN K	+ 3,5 mm - 0,0 mm	+ 1,0 mm - 0,0 mm	(0,08 + 0,03 x T) mm
VEKAPLAN KD	+ 4,0 mm - 0,0 mm	+ 4,0 mm - 0,0 mm	(0,08 + 0,03 x T) mm
VEKAPLAN KS- Wood	+ 4,0 mm - 0,0 mm	+ 4,0 mm - 0,0 mm	(0,08 + 0,03 x T) mm
VEKAPLAN CX-DUO	+ 9,0 mm - 0,0 mm	+ 1,0 mm - 0,0 mm	(0,08 + 0,03 x T) mm
Cuttings	0,5 mm	0,5 mm	(0,08 + 0,03 x T) mm

VEKAPLAN sheets are stacked on wooden pallets. To protect them against damage and grime the pallets are provided with labelled cover sheets and then wrapped in film.

Pallets and sheets should be transported in such a way that unnecessary bending is avoided. The same applies to cuttings.

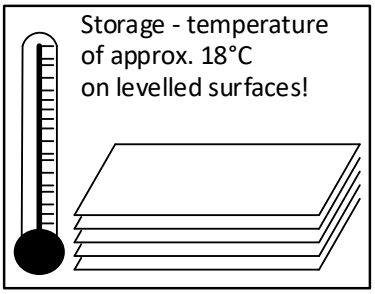
For the upright transport of single sheets, suitable sheet stands or trolleys should be used.

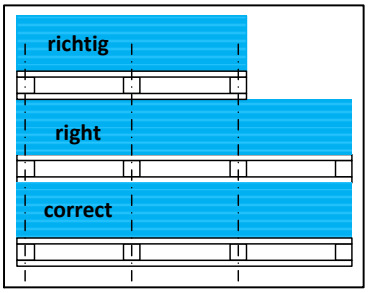
VEKAPLAN sheets should be stored in dry and warm places, stacked on levelled surfaces to avoid bending.

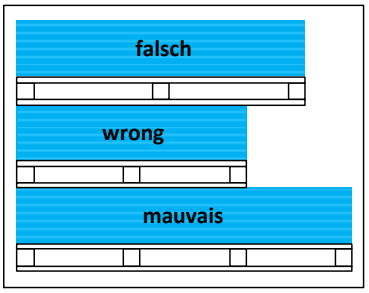
Prior to further processing, it is recommended to condition the sheets at normal climate conditions (23°C / 50 % air humidity).

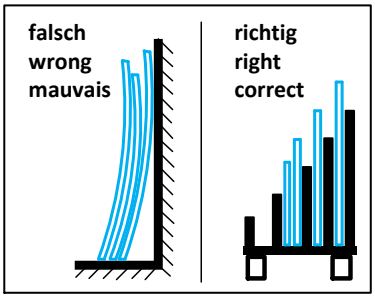
Depending on the sheet type, VEKAPLAN sheets are provided with a protection film on one or both sides. **This protection film should be removed immediately after installation**.

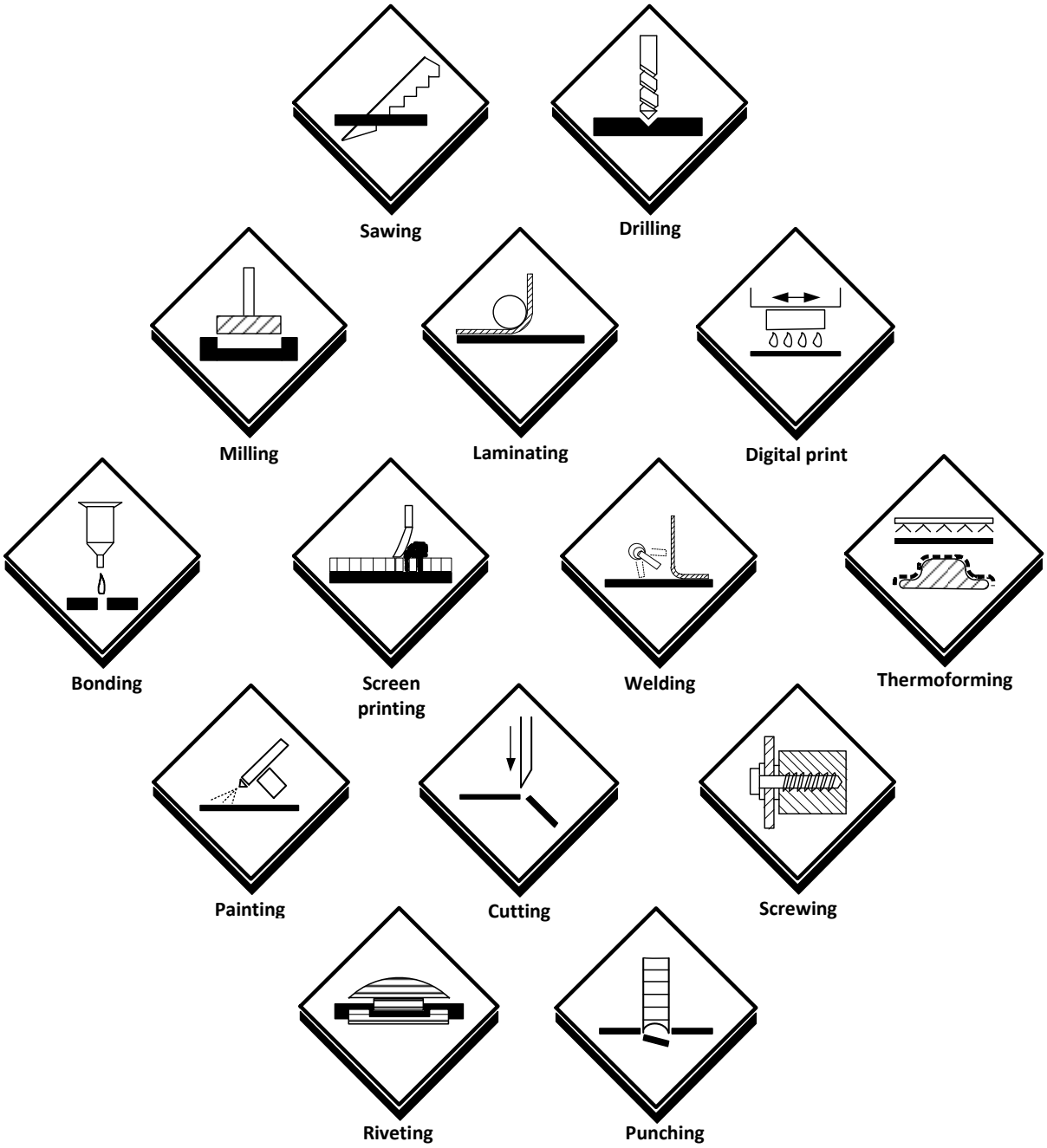
Due to the properties of the protection films (normally storable for max. 6 months) sheets should not be stored over a longer period.

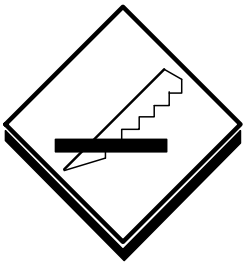




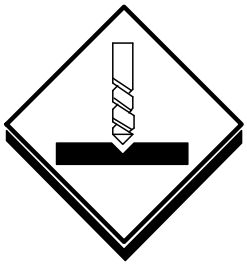




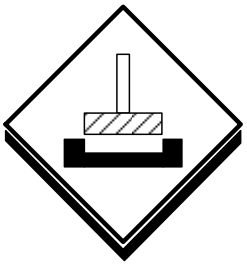

Sawing
Drilling
Milling
Laminating
Digital print
Bonding
Screen printing
Welding
Thermoforming
Painting
Cutting
Screwing
Riveting
Punching



Sawing



Drilling



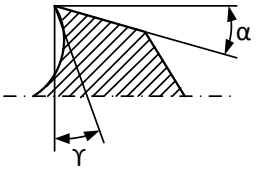
Milling

The machining of VEKAPLAN sheets can be done using common tools which are also used for the processing of wood and metal. Basically, you should work at high cutting speed, minor feed and low chipping depth.

Sawing

Depending on the thickness of the sheet you should use alternately bevelled blades with flat and trapezoidal, carbide tipped blades and a tooth pitch of between 5 and 10 mm. To obtain clean cutting edges, the sheet material - in particular thin sheets of 1 to 3 mm thickness - should be inserted vibration-free.

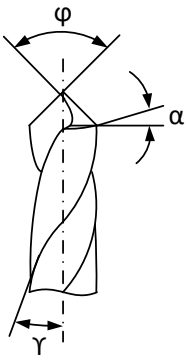
ϒ = Tool orthogonal rake: 5°-10°
α = Relief angle: 10°-20°



Drilling

For drilling you should use common twist drills like they are used for metals, the angle of twist of which should be approx. 30°. For holes exceeding a diameter of 20 mm it is recommended to use a twin cutter (Forstner cutter).

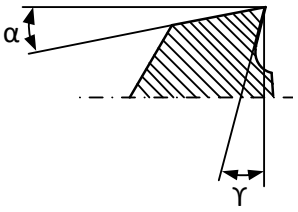
ϒ = Tool orthogonal rake: 3°-5°
α = Relief angle: 8°-10°
φ = Point angle: 80°-110°

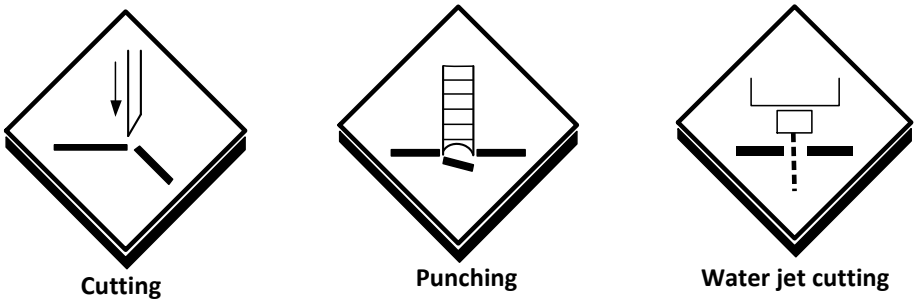


Milling

For milling you should use millers with plastic grinders capable of absorbing or discharging a sufficient chip volume.
The cutting speed as a function of rotational speed, feed and milling diameter should be chosen so that - together with the chip - a sufficient heat dissipation is ensured and that the “fusion“ of chips is avoided.

ϒ = Tool orthogonal rake: 0°-20°
α = Relief angle 5°-25°





Cutting

VEKAPLAN SF, K, KD and CX-DUO sheets of up to 3 mm thickness can also be cut with guillotine shears.

The process could result in a lightly rounded-off cutting edge. The cutting quality depends on the cutting tools (sharp and free of imperfections), the cutting tolerance and also on the temperature of the sheet.

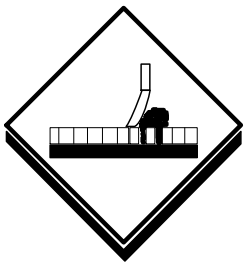
The cutting tolerance should not exceed 0.3 mm while the sheet temperature should be at least 20°C.

Punching

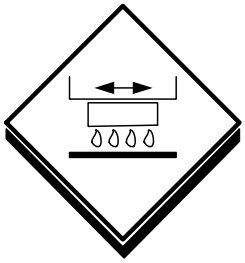
Punching of VEKAPLAN sheets up to a thickness of 3 mm is possible using customary punching machines. Simple contours can be punched out using two-piece punching tools. In the case of more complex contours it is recommended to use so-called band steel cutters (with facet cut on both sides). Best cutting results will be achieved with the sheet warmed up to 30–40 °C.

Water Jet Cutting

As an alternative to punching, and in particular in the case of single-item production, VEKAPLAN sheets can also be processed using the water jet technique. Even very fragile parts that cannot be manufactured by milling or punching due to unavoidable shear forces can be realised by using this cutting technology. In order to achieve an adequate quality of the cut surface, the cutting media and speed should be adapted to the type and thickness of the sheet or be determined through cutting tests, respectively. In certain cases it would be recommendable to agree on the quality of the cut surface in coordination with the customer.



Screen Printing



Digital Printing

Screen Printing

VEKAPLAN S, SF Trend, K and CX-DUO sheets can be screen printed very well with usual PVC-U compatible screen printing colours.

Depending on the application (e. g. indoor or outdoor areas) the suitable paint system can be determined in cooperation with the paint manufacturer (e. g. Diegel, Marabu, Wiederhold, Sericol). Due to the increased temperature absorption during solar radiation it is recommended to abstain from printing of large surfaces with darker colours in outdoor areas.

Digital Direct Printing

For digital direct printing, VEKAPLAN SF Trend rigid foam sheets are used for the most part. But basically, all of the other VEKAPLAN sheet types can also be printed using the digital direct printing technique. Apart from the more usual UV inks, also solvent inks can be used if required (e. g. in the case of subsequent thermoforming).

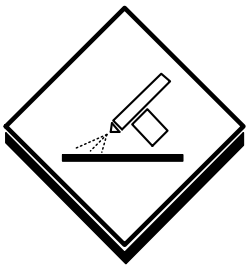
Apart from the sheet itself as the substrate to be printed other factors such as the printing ink, the printing machine, the image composition, the protective foil, static charge and environmental influences such as air humidity and temperature contribute significantly to the printing result. For a faultless printing result, the careful storage and handling of the sheets consistent with the “complex“ printing technique is of the essence. During the cutting and printing processes for instance, clean woollen gloves should always be used!

When handling UV hardening inks, a sufficient UV intensity during drying time must be ensured in order to achieve the required ink adhesion. Examination of the ink adhesion should only be made 24 to 48 hours following printing.

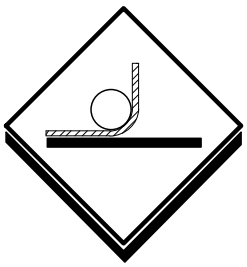
If the UV intensity is too high, the IR radiation emitted at the same time might lead to overheating and consequently to the curling of the sheet material.

Static Charge (influence of protective films)

By nature, synthetic materials are more statically charged than other materials. The removal of the protective films will increase the static charge (charge peak) of the sheets‘ surfaces which can result in an uneven printing image - the so-called “cloud formation“. In order to avoid a possible “cloud formation“ in the printing image, printing machines not yet equipped with discharge bars should be retrofitted accordingly.



Painting



Laminating

Painting

Just like the printing of VEKAPLAN sheets, painting is possible using commercially available PVC-U compatible lacquers and paints. One- or two-component lacquers on the basis of acryl or two-component polyurethane lacquer systems are particularly suitable for painting. As a general rule, we recommend the varnishing on both sides in order to exclude curling of the sheets especially for multi-layer paint systems and for outdoor applications.

Depending on the application (e.g. indoor or outdoor areas), the suitable paint system can be determined in cooperation with the paint manufacturer. As with printing it is recommended to abstain from painting large surfaces with darker colours in outdoor areas due to the increased temperature absorption during solar radiation.

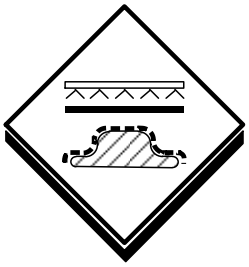
Laminating

You can laminate and design your VEKAPLAN sheets using commercially available self-adhesive films which are suitable for photo lamination and labelling. Ornamental surface lamination is possible using suitable gluing and coating systems also with other materials such as films, paper, textiles, high pressure laminates, etc.

The choice of the adhesive depends on the material combination and on the requirements of your application. Depending on the type of available laminating machines (e. g. presses or roll coating machines) two-component PU adhesives or PUR hot-melt adhesives can be used. As a general rule, it is recommended to choose an adhesive after obtaining application-related advice from the adhesive manufacturer.

Since in most cases materials with different physical properties are connected for lamination, VEKAPLAN sheets should always be laminated on both sides using the same material and the same material thickness (counter-tension) in order to avoid a possible curling of the composite material. As a general rule, preliminary tests should always be carried out before starting actual production!

As in the case of printing and painting, materials should only be laminated in lighter colours for outdoor applications since darker colours might result in an increased temperature absorption and the curling of the composite material.



Thermoforming /Bending / Folding

Thermoforming / Bending/ Folding

Thermoforming of VEKAPLAN K and SF sheets is possible in a thermoelastic stage using the known procedures used for thermoplastic materials.

From bending/folding and hot pressing through to the most varied forms of deep drawing and stretch forming - these different processing methods can all be chosen depending on the design and the required degree of deformation. Depending on the respective method, machines and equipment such as bending and folding benches, circulating air ovens and thermoforming machines as well as suitable forming tools can be used.

Moulded parts made from VEKAPLAN K or SF sheets are generally produced using the stretch forming process (with fixed hold-down devices) with the corresponding reduction of the material thickness.

For application as thermoformed surface layers for entrance door panels, relatively “sharp“ contours (small edge radii) should be obtained. It is for this type of application that VEKAPLAN KD and VEKAPLAN KS Wood Sheets were developed. The special material recipe makes it possible to obtain the required contour definition using these sheets.

For deep drawing/bending, a surface temperature of 180 °C should not be exceeded, since this would result in the discoloration of and thermal damage to the material. In the case of foam sheets (SF Trend & SF), the max. surface temperature must be lower. For overheating would lead to an alteration of surfaces such as excessive roughness or lump formation.

Thermal Forming

For thermal forming the bending radius should be at least two to three times the thickness of the sheet. The heating zone should be at least five times as broad as the sheet thickness!

Cold Bending

“Cold bending“ of VEKAPLAN sheets is possible, too, but should only be used with sufficiently large radii. The ideal bending radius **R** is determined by the sheet thickness.

R = 250mm x sheet thickness in mm !!

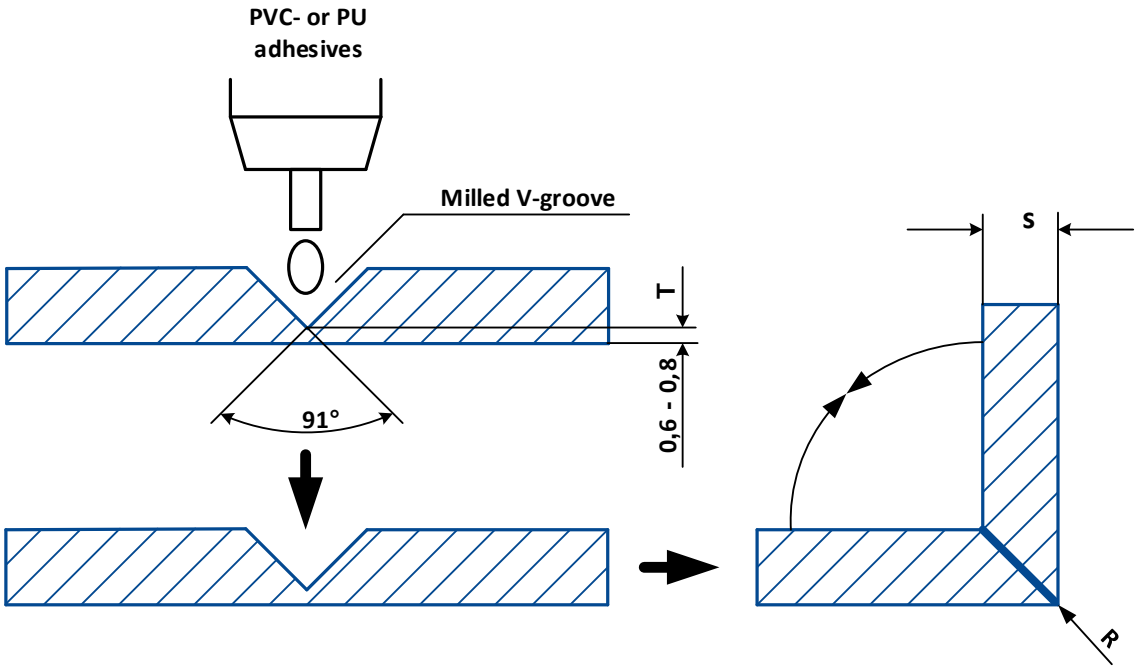
The sheet temperature should be at least 18 °C for this application!!

Edge-Milling Technique

Components having almost “sharp-edged“ or very small edge radii can also be produced “cold-formed“ by using the so-called edge milling technique.

By milling of a v-nut (see sketch 91° angle), the sheet thickness along the bending line is reduced to thickness (T) which thus also determines the edge radius (R). This technique allows folding even thicker sheets at the required angle.

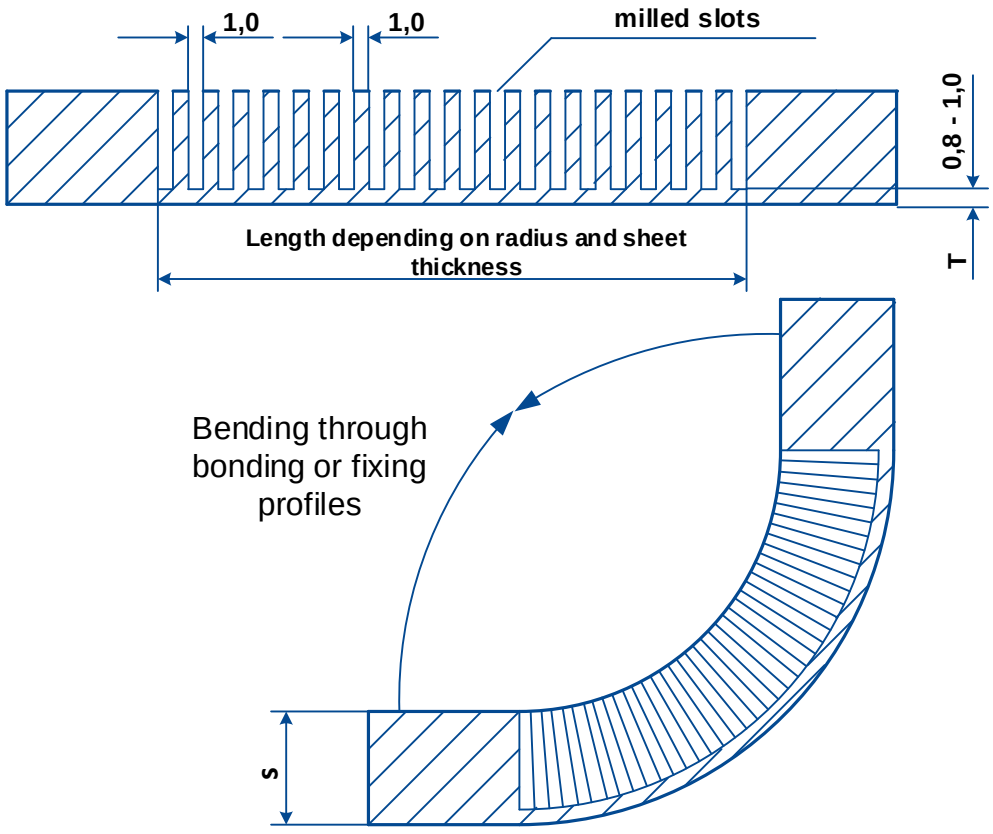
Edge-Milling Technique

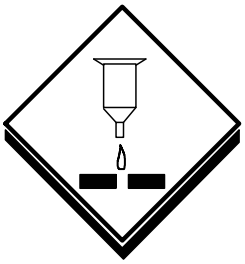


Slit-Bending Technique

Using the so-called slit-bending technique, even thicker sheets can be cold-bent and - in comparison with the traditional “cold bending“ technique even components having relatively small bending radii can be produced.

Slit-Bending Technique





Bonding

Welding

Bonding

In order to obtain durable insoluble firm adhesion between the same or different materials, the bonding technique is becoming more and more important.

When bonding VEKAPLAN PVC sheets among each other, solvent-based adhesives (cold welding), reactive adhesives (e.g. cyancrylate-based adhesives) or polyurethane adhesives are used in most cases.

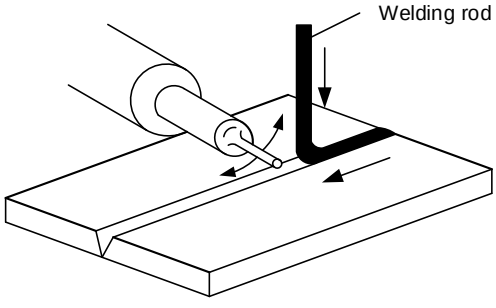
When bonding other materials, suitable glues from several producers are available for almost each application and material combination. Apart from 1- and 2-component polyurethane adhesives, high-grade double sided adhesive tapes are increasingly being used.

Besides the material combination, the required conditions for the respective application (weather resistance, resistance to chemicals etc.) are the most important criteria when it comes to the selection of the appropriate adhesive. It is therefore recommended to always obtain application-technical consultation with respect to aspects of the adhesive and to carry out preliminary tests prior to production as such.

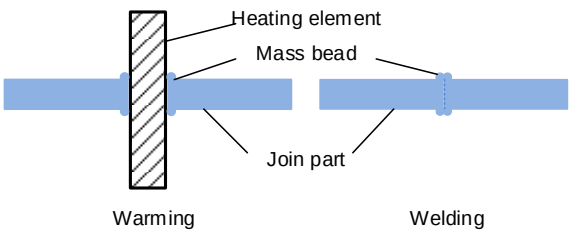
Welding

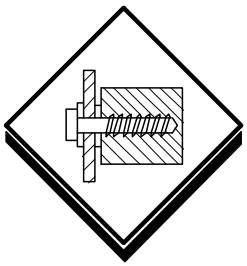
Welding of VEKAPLAN sheets S, SF and K is possible using the so-called hot-gas welding technique with filler metal and through application of the various hot plate welding methods. To obtain ideal welded joints, relevant parameters such as welding temperature, time and pressure should be adapted through test welding to the respective sheet type and sheet thickness. According to the application chosen, commercially available welding devices and welding machines can be used.

Warm gas – fan welding

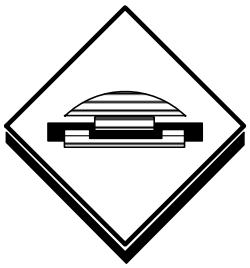


Heated tool butt welding





Screws



Rivets

Screws and Rivets

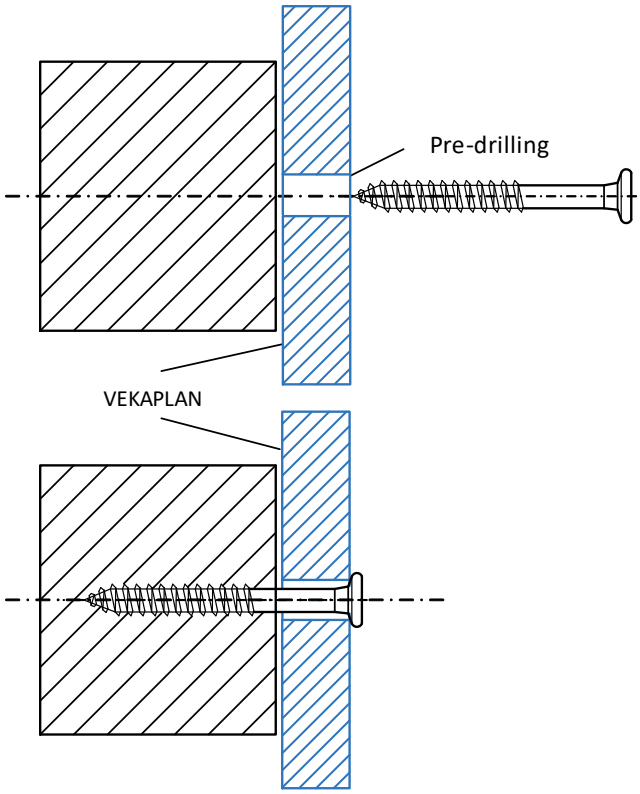
In order to fasten parts and components of VEKAPLAN sheets commercially available screw and rivet types as used for processing wood and metals.

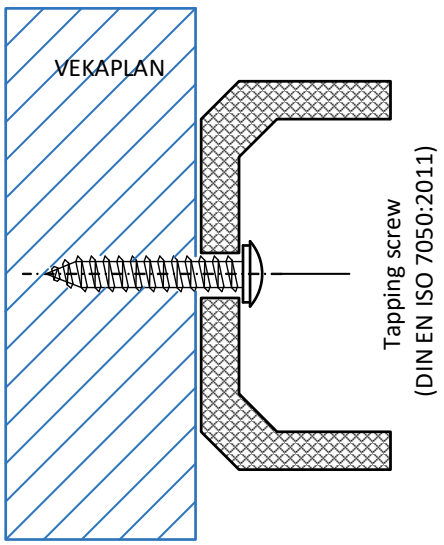
As a rule, it is recommended to pre-drill the sheets in order to avoid the notch impact on the material.

For the screwing of components with VEKAPLAN S and SF foam sheets, so-called tapping screws (DIN EN ISO 7050:2011) should be used.

As a general rule it must be differentiated between indoor and outdoor applications when fixing with screws or rivets!

For more detailed information please refer to chapter “Processing tips for outdoor applications“!





Due to their properties, VEKAPLAN sheets are used for a variety of applications for outdoor use such as displays, claddings, signage, etc. When used for outdoor applications, they are exposed to weather and environmental influences as well as to naturally occurring temperature fluctuations. Such influences should be taken into account with respect to their processing and assembly.

Weather Resistance and UV-Stability

VEKAPLAN sheets are weather and UV-resistant so that no further material-related alteration of properties can occur. White-coloured VEKAPLAN products are colour-fast which means that colour changes (depending on the place of application) do not occur or they occur within a minor tolerance range (grey scale level 3).

As far as their colour fastness is concerned, coloured VEKAPLAN sheets are only restrictedly suitable (max. 4 weeks) for outdoor applications since colour changes (fading) can occur. As a general rule, black sheets should not be used for outdoor applications!

Climate Impact

VEKAPLAN sheets have been used reliably in Northern and Central Europe for several decades now since material recipes were developed for the requirements of the climatic conditions prevailing there. Their use in climatic zones with a substantially higher UV radiation intensity is possible only to a certain extent. Our expert staff will be happy to give you advice in this matter.

Climate conditions in various large European cities:

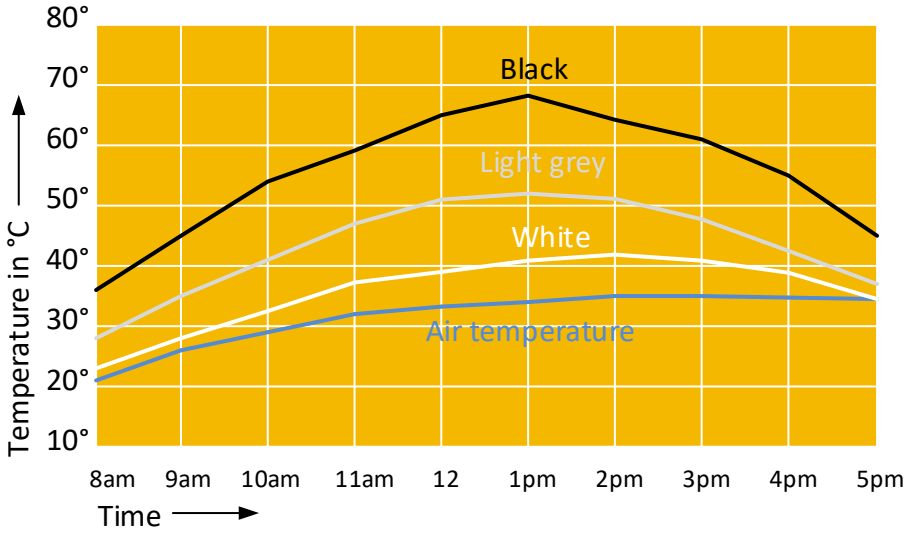
City	Country	Global Radiation [Kly/cm²/Year]
Hamburg	Germany	**80**
Brussels	Belgium	**80**
Paris	France	**90**
Munich	Germany	**100**
Vienna	Austria	**100**
Bordeaux	France	**100**
Venice	Italy	**110**
Marseille	France	**120**
Rome	Italy	**130**
Madrid	Spain	**140**
Lisbon	Portugal	**140**
Athens	Greece	**140**
Ankara	Turkey	**140**
Palermo	Sicily	**140**

Surface Finish

With regard to the design of the surface of sheets for exterior application through printing, film lamination, painting, etc., it has to be taken into account, that dark colours, in comparison to bright colours, cause considerably intense heating of the sheet surface (and sheet) when exposed to sunligt. This can lead to material overheating.

In order to avoid this effect, apart from the lettering, larger surfaces should be designed with bright colours (white, light-grey, yellow, etc.) (see graph).

Temperature profile of plastic sheets in different colours at a maximum air temperature of approximately 35 °C:



Temperature Behaviour

As far as their heat resistance and thermal expansion properties are concerned, the temperature behaviour of VEKAPLAN PVC sheets are those properties which are typical for thermoplastic materials. That means that a subsequent overheating of the sheets must be excluded at an early stage i.e. when cutting or during their assembly by taking appropriate measures (e.g. rear ventilation) and that the specific length variation behaviour must be taken into consideration.

This is why the following information about outdoor installation must be observed under all circumstances!

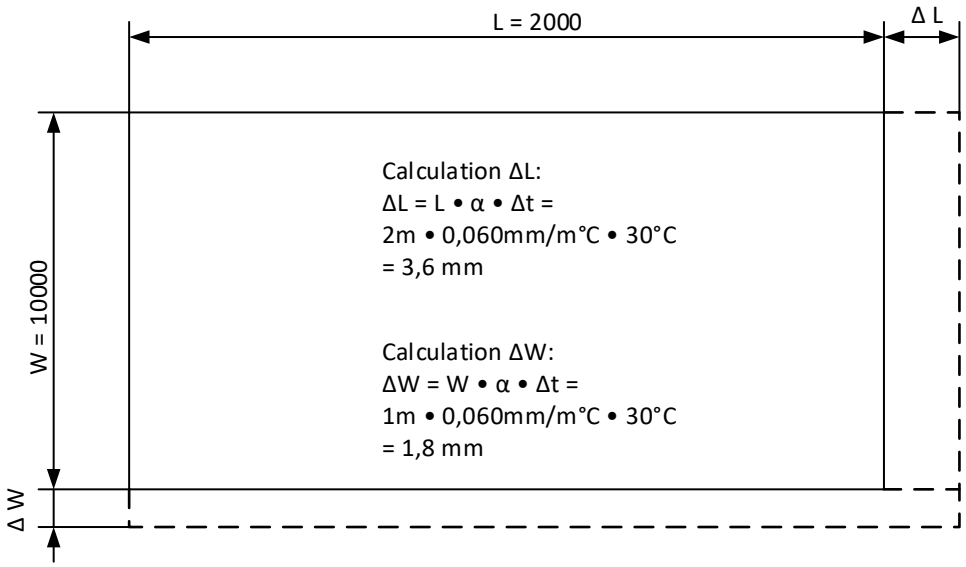
Length Variation Behaviour

The temperature-related length variation behaviour (dilatation) of all materials is determined by the specific linear coefficient of thermal expansion “Alpha“.

Besides the expansion coefficient of sheets, it is the expected maximum temperature variation (depending on colour shade) and the length of the sheets that is decisive for their length variation. Based on such factors the length variation is calculated according to the following formula.

ΔL = L • α • Δt
ΔL = Length variation (mm)
L = Sheet length under normal conditions (m)
Δt = Temperature variation (°C or °K)
α = Heat expansion coefficient (mm/m°C)

Calculation example:
Determination of the length variation ΔL & ΔW of white VEKAPLAN S sheets size 2000 x 1000 x 10 mm
L = 2 m ; W = 1 m
α = 0.060 mm/m °C
Assembly temperature: 15 °C
Min. surface temperature: -15 °C
Max. surface temperature: +45 °C
Temperature variation Δt: 30 °C



The starting situation (starting temperature) for length variation is always the currently prevailing outdoor temperature (assembly temperature).

The minimum outdoor temperature is decisive for sheet shrinkage, which is determined by the climate zone (Germany -15°C on average).

VEKAPLAN expansion coefficients:

VEKAPLAN S / SF / CX-DUO = 0.060 mm/°cm

VEKAPLAN K = 0.070 mm/°cm

Chart detailing the extension of
VEKAPLAN S / SF / CX-DUO -sheets

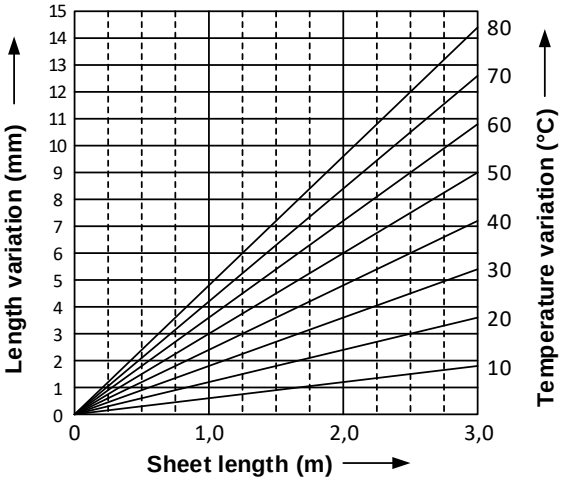
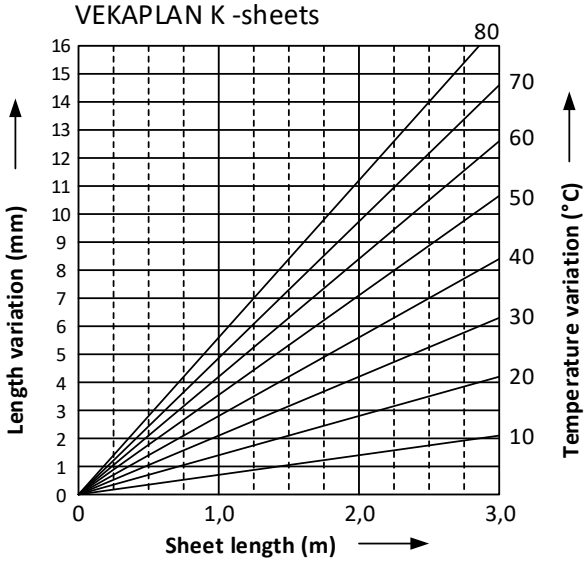


Chart detailing the extension of
VEKAPLAN K -sheets



As a general rule, the expansion-related movement in the case of sheet-like components occurs from the centre of the sheet towards its edge. Fixings at the edge area will inhibit such movement leading necessarily to the formation of dents. In order to avoid that effect, appropriate expansion joints, hole tolerances or slotted holes must be provided in the case of all outdoor fastenings.

Calculation Example: Screw fixing with sufficient hole tolerance

Let us assume you would like to fasten an advertising sign made of 10 mm thick VEKAPLAN S, printed with light colours in the size of 1500 x 1000 mm in an outdoor area to a rear-ventilated substructure using screws.

- The diameter of the shank of the screws to be used is 5 mm.

Determination of the bore diameter on the sheet:

- Max. temperature: 55 °C (printed surface)
- Assembly temperature: 10 °C
- Temperature variation: 45 °C
- Length variation: 5.5 mm (from diagram S sheets) >> 6 mm

Since the length variation from the fixed point (centre) halves towards each side, the following bore diameter results:

- Movement bores: 6 mm/ 2 + 5 mm = 8 mm
- Fixed point bores: 5.5 mm

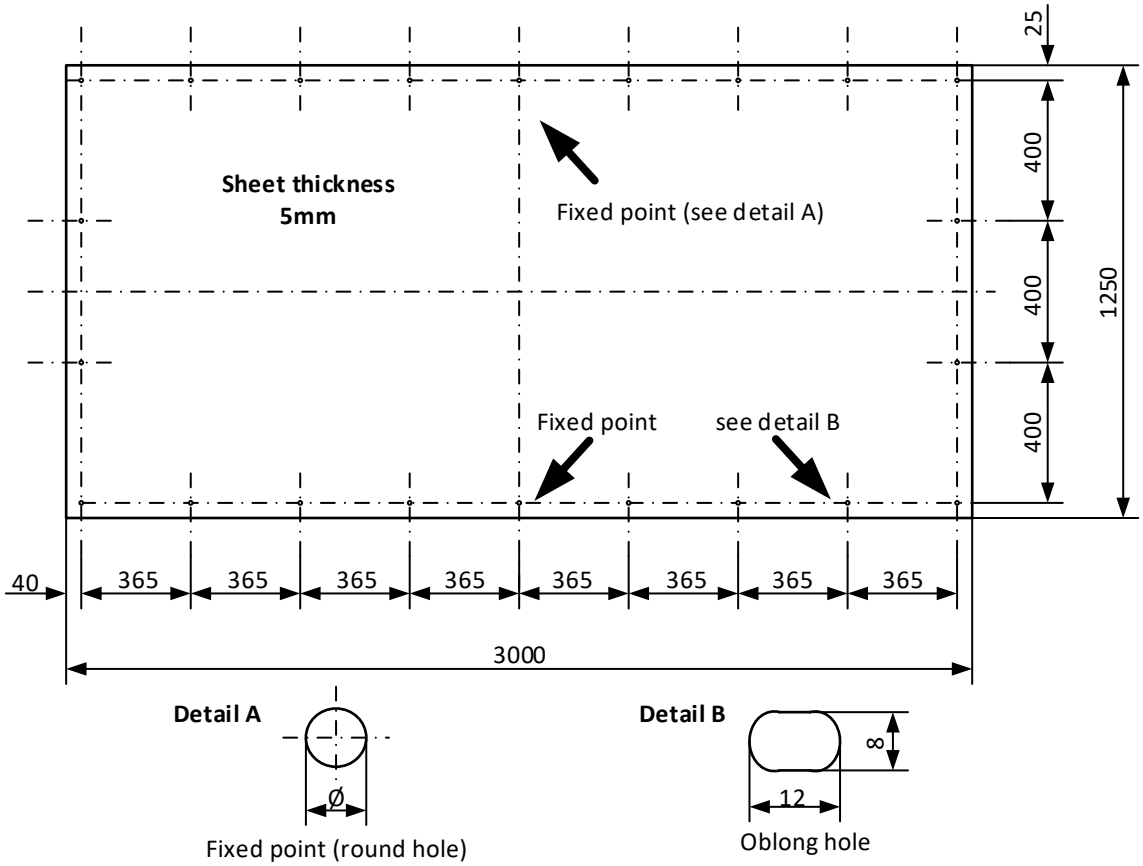
The following applies as a general rule:

- For direct fastening, countersunk screws or rivets should not be used (penetration into the sheet).
- Screws with a conical shank should not be used (penetration into the bore hole).
- Clamping caused by tightening screws too much should be avoided.
- For outdoor application, rivets should always be placed with an attachment gauge.
- Sheets for outdoor use should always be pre-drilled with a sufficiently dimensioned hole tolerance.
- For assembly at closed walls and claddings in the roof area, sufficient rear ventilation (counter-batten) should always be ensured in order to avoid possible heat accumulation.

Apart from temperature variations due to weather conditions, make sure wind loads (pressure and suction) are also taken into consideration for outdoor assembly and fastening. Besides the adapted sheet thicknesses (inherent stability), a sufficient number of fixing points must be provided. In the case of freestanding signs it might be necessary to install an additional substructure or to fasten the sheets in a frame.

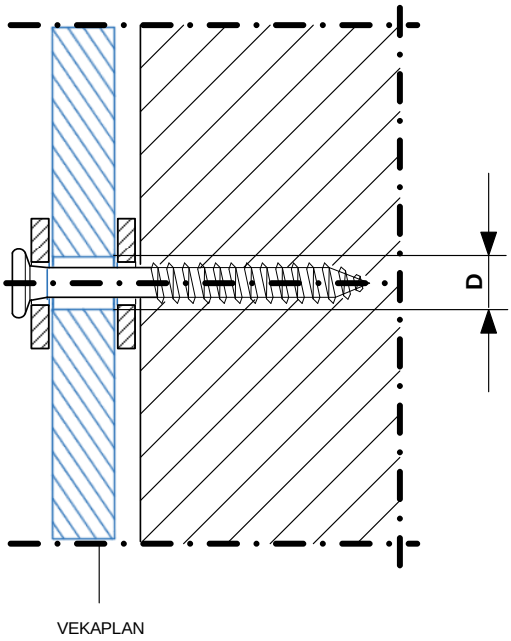
Distance between screw connections depending on sheet thickness:

Sheet thickness (mm)	Distance between screw connections (mm)
2	approx. 150 - 200
3	approx. 200 - 300
4	approx. 350 - 400
5	approx. 400 - 500
6	approx. 500
8	approx. 500
10-30	approx. 500

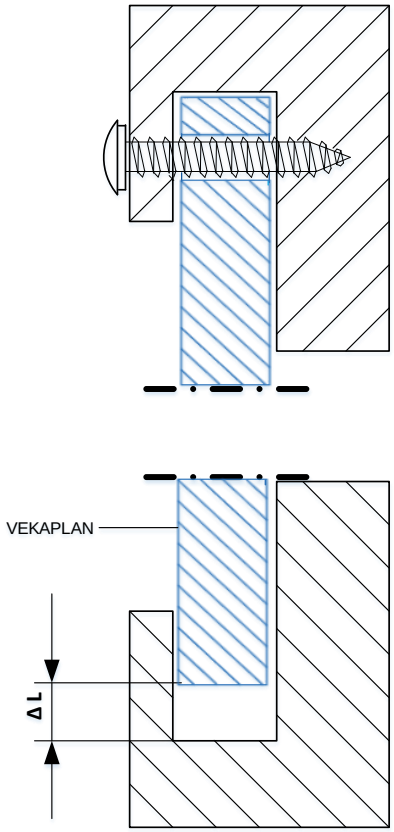


Assembly Examples

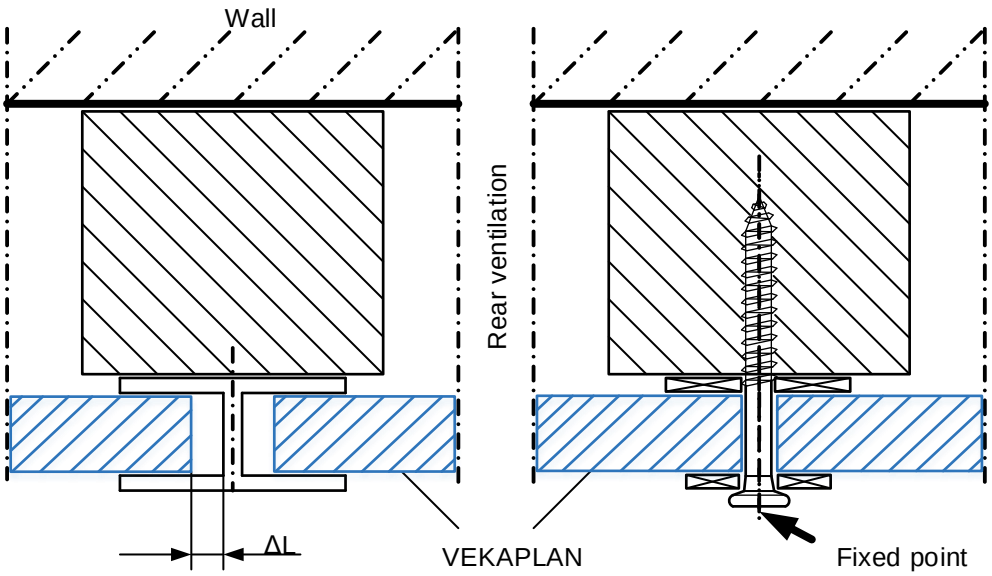
Direct screw connection



Assembly suspended in frame



Assembly, rear ventilation



Generally, PVC sheets do not require special maintenance. However, for a sustained preservation of the visual aesthetic value, regular cleaning is recommended as it is the case with other materials. This applies in particular to outdoor applications.

As a rule, normal soiling can easily be removed using warm water or soapsuds. For washing off and drying, only clean, non-abrasive sponges or cloth should be used.

Do not use cleaning agents with abrasive/scoring agents or detergents containing solvents since this could result in irreparable damage to the surfaces or changing material properties.

For a preparatory cleaning of surfaces, as required for instance before bonding, painting, etc. the use of residue-free cleaning agents such as isopropyl is recommended.

Numerous other cleaning agents such as *“plastic cleaners“* lead to or form - partially intended - invisible surface films which can impair the adhesion of glues, lacquers, etc. at the sheet surface.

Detergents referred to with the general term *“plastic cleaners“* should only be used if their suitability for PVC is explicitly confirmed by the manufacturer.

If in doubt, it is recommended to seek advice from the manufacturer.

VEKAPLAN sheets are made of PVC-U and do not contain any plasticisers.

PVC-U is resistant against saline solutions, numerous diluted, partially even concentrated acids and alkaline solutions as well as against nopolar solvents.

PVC is not resistant against liquid halogens, polar solvents such as ester, chlorinated hydrocarbons, ketones and aromatic hydrocarbons.

The following list of substances and chemicals and information about the behaviour of PVC in contact with the same are based on test results from various PVC manufacturers (suppliers) and originate from various sources from relevant literature.

Note:

This information is given to the best of our knowledge. However, for lack of knowledge of the concrete framework conditions, it just serves as non-binding information.

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50°C	> 50°C
A				
Acetaldehyde	10		++	+
	40		+	O
	techn. pure		O	O
Acetamide	saturated		O	O
Aceton	techn. pure		O	O
Acetophenone			O	O
Acetylene	100		++	+
Acrynitrile			O	O
Aluminium chloride	10		++	++
Anti-freeze agents (motor vehicles)			+	+
Ammoniac	25	aqueous	++	+
	conc.	aqueous	++	+
	100	gas	++	++
Ammonium nitrate		aqueous	++	++
Amyl acetate			O	O
Amyl alcohol			++	O
Aniline			O	O
Apple juice			++	++
Aqua regia			O	O
Asphalt			++	++

Key:
O not resistant **+** conditionally resistant **++** resistant

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50°C	> 50°C
Acids				
Battery acid			++	++
Formic acid	10		++	+
Formic acid	50		++	O
Battery acid	30	aqueous	++	++
Benzoic acid	saturated		++	+
Hydrocyanic acid		aqueous	++	+
Hydrobromic acid	50	aqueous	++	++
Butyric acid			+	O
Chromic acid	10 20		++ +	+ O
Acetic acid	10 50 100		++ ++ +	+ + O
Acetic acid butylester	100		O	O
Acetic acid ethyl ester	100		O	O
Hydrofluoric acid	50		+	O
Lactic acid	10 50		++ ++	++ +
Monochloroacetic acid			O	O
Oleic acid			++	++
Oxalic acid	10	aqueous	++	++
Salicylic acid	saturated		+	O
Nitric acid	up to 25 50		++ +	++ O
Hydrochloric acid	conc.		++	++
Sulphuric acid	up to 25 50 96		++ ++ ++	++ + O
Tartaric acid	saturated	aqueous	++	++
Citric acid	saturated	aqueous	+	+

Key:
O not resistant **+** conditionally resistant **++** resistant

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50 °C	> 50 °C
B				
Barium chloride	saturated		++	O
Benzaldehyde			O	O
Benzene			O	O
Beer			++	++
Bleaching lye	12,5 % Cl		++	+
Brake fluid			++	+
Bromine		liquid	O	O
Butter			++	
C				
Calcium chloride		aqueous	++	+
Calcium hydroxide	conc.		++	++
Chlorine			O	O
Chlorinated water			+	O
Chromium salts			++	++
Carbon dioxide	techn. pure		++	++
Cresol			O	O
Carbon disulphide			O	O
Cyclohexanol			++	+
Cyclohexanone			O	O

Key:
O not resistant **+** conditionally resistant **++** resistant

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50 °C	> 50 °C
D				
Decahydronaphthalene (decalin)			++	+
Dibutyl phthalate			O	O
Dichloroethane	100		O	O
Diesel			++	++
Diethylether (Ether)			O	O
Dimethylformamide			O	O
Detergents			++	+
Dextrin	saturated	.	++	
Dishwashing agents		liquid	++	++
E				
Ethyl acrylate	100		O	O
Ethanol (denaturated)	10	aqueous	++	+
	50		++	+
	96		++	+
Ethylene chloride (Dicloroethane)	100		O	O
Ethylene glycol			++	++
Ethyl ether	techn. pure		O	O
F				
Fluorine		gas	++	+
Fluorides			++	++
Formaldehyde	10	aqueous	++	+
	30		++	+
	40		+	O
Formalin			++	++
Fuel oil			++	++
Fruit juices			++	++

Key:
O not resistant **+** conditionally resistant **++** resistant

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50 °C	> 50 °C
G				
Glucose			++	O
Glycerine	100		++	++
Glycol	100		++	++
H				
Hydrogen peroxide	30		++	
Heptane, n-			++	++
Hexane			++	++
Hydrazine hydrate		aqueous	++	+
I				
Isooctane			++	++
Isopropyl (isopropyl alcohol)			++	+
Isopropyl acetate			O	O
Iron salts		aqueous	++	++
Iodine (iodine tincture)			O	O
Ink			++	++
K				
Kerosene			++	++
Ketones			O	O
L				
Lanoline			++	++
Linseed oil			++	++

Key:
O not resistant **+** conditionally resistant **++** resistant

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50 °C	> 50 °C
M				
Magnesium salts		aqueous	++	++
Magnesium chloride			++	++
Machine oil			++	+
Menthol			+	+
Methylene chloride			O	O
Methyl ethyl ketone			O	O
Mineral oil			++	+
Mercury	100		O	O
Mercury chloride			++	O
Mercury salts		aqueous	++	
N				
Nail varnish			O	O
Nail varnish remover			O	O
Naphthalene	100		O	O
Nitrobenzene	up to 25 100		+ O	+ O
O				
Octane, n-			O	O
Oleum			O	O
Oils, vegetable			++	++
Orange peel oil			O	O
Ozone			++	

Key:
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Substance / Material	Conc. [%]	State	Resistance	
			20 – 50 °C	> 50 °C
P				
Plasticisers			**O**	**O**
Propane	100 100	liquid Gas	**++** **++**	**+**
Propylenglycol			**O**	**O**
Propylene oxide			**O**	**O**
Pyridine	100		**O**	**O**
Petrol			**O**	**O**
Potash		aqueous	**++**	**++**
Potassium chloride		aqueous	**++**	**++**
Potassium iodide		aqueous	**++**	**++**
Potassium hydroxide (caustic potash)	up to 50		**++**	**++**
Potassium permanganate		aqueous	**++**	**O**
S				
Salicylaldehyde			**O**	**O**
Salt water / Sea water			**++**	**++**
Sulphur	100		**++**	**++**
Soap solution	saturated		**++**	**++**
Sulphides			**O**	**O**

Key:
O not resistant **+** conditionally resistant **++** resistant

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50 °C	> 50 °C
S				
Sodium acetate		aqueous	+	O
Sodium carbonate		aqueous	++	++
Sodium chloride		aqueous	++	++
Sodium hydroxide (caustic soda)	up to 30		++	++
Sodium hydroxide (caustic soda)	50		++	+
Sodium hydroxide (caustic soda)	100		++	
Sodium hypochloride	15		++	++
T				
Tar			++	++
Tetrachloroethane	100		O	O
Tetrahydrofuran			O	O
Toluene			O	O
Tomato juice			++	++
Trichlorethylene			O	O
Trikresylphosphate			O	O
Trioctylphosphate			O	O
Toothpastes			++	++

Key:
O not resistant **+** conditionally resistant **++** resistant

Substance / Material	Conc. [%]	State	Resistance	
			20 – 50 °C	> 50 °C
U				
Urea (carbamide)		aqueous	**+**	**O**
V				
Vinyl acetate			**O**	**O**
Vinyl chloride	30		**O**	**O**
W				
Water gas			**++**	
X				
Xylol	100		**O**	**O**

Should you find no sufficient answers to your questions in this brochure, we recommend that you contact our specialist advisers for more information.

Key:
O not resistant **+** conditionally resistant **++** resistant

We will be happy to answer your questions
Your VEKAPLAN Team

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VEKAPLAN Sheets