AESTHETIC, HYGIENIC WALL PROTECTION

WITH LEXAN™ CLINIWALL™ SHEET

LEXAN™ SHEET

POLYVANTIS

CONTENT

KEY FACTORS TO CONSIDER FOR INTERIOR WALL CLADDING

As a designer, or a manager in material management or maintenance of public facilities such as hospitals, schools, kindergardens or sport venues, you are likely to be focused on:

REGULATORY REQUIREMENTS

Fire safety and smoke release requirements, based on European standard EN 13501-1 fire regulations for building and construction materials classified as **B-s1,d0**.

INFECTION PREVENTION AND CONTROL

- Regulatory and hygienic standards
- Available with anti-bacterial additives
- Resistant against repetitive cleaning

COMFORT & AESTHETICS

Material which can be shaped according to the building design:

- Can be cold curved during installation
- Can be cold and hot-line bended, without the need for profiles
- Can be printed with standard printing processes

DURABILITY, EASE OF SURFACE CLEANING & MAINTENANCE

Materials with a minimal need for maintenance that offer:

- Impact and wear resistance
- Resistant to staining, e.g. urine and blood
- Easy to clean
- Resistance to corrosion, decomposing or delamination

EASY & FAST INSTALLATION

- Up to 35-40m² per day
- Thermoformable

SMOKE TOXICITY OF PVC VERSUS PC

Comparative testing results have shown that PVC sheet has more than 20 times higher toxicity levels in comparison to LEXAN CLINIWALL Sheet (see page 30)

LEXAN™ CLINIWALL™ SHEET FOR INTERIOR WALL CLADDING

LEXAN™ CLINIWALL™ sheet is an opaque, low-gloss LEXAN™ based resin solid sheet, which delivers high impact- and wear resistance, and it can help provide long awaited solutions to customer's needs for materials that can meet European fire regulations for building materials and their sanitation requirements while helping to save significant maintenance costs, resulting in reduced operation costs.

LEXAN CLINIWALL sheet complies with the Restriction of Hazardous Substances (RoHS) directive due to its non-chlorinated and non-brominated flame resistant technology.
The material has the stringest fire and smoke standards:

- PVC free
- b-s1-d0 rating according to European EN13501-1 standard
- ASTM E84 Class A rating
- Halogen free version available
- LEED certified
- BREEAM certified
- Complies to European VOC regulation (Volatile Organic Compounds) for indoor air comfort (A+ level)

Compared to high-pressure laminates, ceramics and steel, LEXAN CLINIWALL sheet can significantly lower system costs through consolidation of parts to streamline production, and avoidance of secondary operations such as painting and coating, machining and polishing, and lower shipping costs due to its light weight.

LEXAN CLINIWALL sheet provides an excellent low-gloss surface finish for the wall, eliminating the need for painting. Its characteristics also help prevent chipping of the surface if impact occurs.

COMPARED TO CURRENTLY USED PVC SHEET LEXAN CLINIWALL SHEET SHOWS

- Better mechanical and thermal properties
- Approximately 20% lower density
- Significant lower smoke toxicity

GOLD AWARD BY PMMT FRIENDLY MATERIALS®

Identified as healthiest building material that use non-toxic materials

POTENTIAL BENEFITS

ENVIRONMENT
non-chlorinated and
non-brominated opaque sheet

ANTI-BACTERIAL PROPERTIES
for specific grades

EXCELLENT RESISTANCE
to chemicals, including staining
of blood and urine

EASY TO CLEAN AND DISINFECT
withstands repeated cleaning with
common cleaning agents

HIGH IMPACT STRENGTH AND WEAR RESISTANCE
virtually unbreakable
and maskings scratches

EASY TO FORM AND INSTALL
even for existing buildings

FIRE SAFETY AND EXCELLENT SMOKE PERFORMANCE
B-s1-d0 rating according to
European EN 13501-1 standard
PVC free, ASTM E84 Class A rating

DURABILITY
10 year written limited warranty,
100% recyclable.
Over 30 years life expectancy

TYPICAL INTERIOR CLADDING APPLICATIONS

PUBLIC FACILITIES

- Schools
- Kindergardens
- Restrooms
- Airports
- Bus stops and train stations
- Sports centers

HEALTHCARE FACILITIES

- Hospitals
- Clinics
- Homes for the elderly
- Primary care centers
- Sterile rooms
- Laboratories

INDUSTRIAL FACILITIES

- Pharmaceutical factories
- Industrial kitchens
- Storage/refrigeration rooms
- Storage areas
- Refrigeration facilities

Cadix Hospital, Antwerp - Belgium

Rijnstate Hospital, Arnhem - The Netherlands

Dialysis Center - Pakistan

Industrial kitchens

Hospital in Murcia, Spain

TECHNICAL DATA

LEXAN™ CLINIWALL™ sheet is a non-chlorinated and non-brominated, fire resistant, opaque sheet which delivers high impact and wear resistance. In addition to excellent stain, blood and urine resistance, it offers ease of processing and installation for internal wall cladding applications.

Table 1: Typical property values*

PROPERTY	TEST METHOD	UNITS	VALUE
PHYSICAL			
Density	ISO 1183	g/cm³	1.2
MECHANICAL			
Yield stress 50 mm/min	ISO 527	MPa	>60
Yield strain 50 mm/min	ISO 527	%	6
Nominal strain at break 50 mm/min	ISO 527	%	>100
Tensile modulus 1 mm/min	ISO 527	MPa	2300
IMPACT			
Izod impact, unnotched 23°C, 3.0 mm	ISO 180/1U	kJ/m²	NB
Izod impact, notched 23°C, 3.0 mm	ISO 180/1A	kJ/m²	70
THERMAL			
Vicat softening temperature, B/120	ISO 306	°C	145
OPTICAL			
Light transmission 3 mm	ASTM-D1003	%	n/a
FIRE RATINGS			
Building & Construction			
Europe	EN13501-1	-	B-s1,d0

** These property values have been derived from LEXAN™ resin data for the material used to produce this sheet product. Variations within normal tolerances are possible for various colors. These typical values are not intended for specification purposes. If minimum certifiable properties are required please contact your local POLYVANTIS representative. All values are measured at least after 48 hours storage at 23°C/50% relative humidity. All samples are prepared according ISO 294.*

ANTIBACTERIAL SHIELD

POLYVANTIS' LEXAN CLINIWALL sheet offers a specific grade with antibacterial additives: AC6206 featuring a pioneering thermoplastics material technology for interior wall cladding applications for public facilities and hospitals that requires a high level of sanitation.

LEXAN CLINIWALL AC6200 sheet was tested at independent test houses against ISO 22196 – "Measurement of Antimicrobial Activity on Plastics / Non-Porous Surfaces" – the industry standard for measuring Antimicrobial activity on Plastics. The silver-ion additive activity was confirmed by this testing and showed a significant reduction in the growth of microorganisms on the sheet surface.

EXCELLENT STAIN RESISTANCE

LEXAN CLINIWALL sheet can be cleaned quickly and effectively, looking as good as new after cleaning, as seen in tests made on blood, iodine, rubber gasket marks and other usual stains that you can come across in hospitals and other public facilities.

LEXAN CLINIWALL sheet has been tested* for blood and urine stains. No obvious staining was observed with the naked eye on LEXAN CLINIWALL sheet with either blood or urine after 24 hours and 48 hours incubation at 37°C. Additionally, LEXAN CLINIWALL sheet was subjected to iodine and black rubber gasket staining tests. Iodine stains were made with Betadine and the marks of black rubber gasket impacts were made with a black rubber. Each sheet sample was marked with a different stain and then stored in an oven at 37°C for 24 hours and 48 hours. After the storage time, both stain spots on the sheets were cleaned by hand, using hot water and a paper towel. The test showed that no stains were observed with the naked eye on any of the sheet samples.

FIRE SAFETY

The European standard EN 13501-1 provides a number of performance criteria to measure the fire characteristics of building products. These cover spread of flame and contribution to fire as well the generation of smoke and the production of burning droplets. Combustible building materials with a very limited contribution to fire are classified as class B. 's' indicates smoke emission level during combustion, values range from 1 (absent/weak) to 3 (high). 'd' indicates production of flaming droplets during combustion, values range from 0 (absent) to 2 (high). LEXAN™ CLINIWALL™ sheet complies with the European fire test standard EN 13501-1 for wall linings with B-s1,d0 classification based on tests done by an independent agent.

EXCELLENT CHEMICAL RESISTANCE

LEXAN CLINIWALL sheet has been independently tested* for chemical resistance against Isopropanol (rubbing alcohol) which is a common disinfectant. LEXAN CLINIWALL sheet samples of tensile bars were stored under 0 and 1.0% strain in contact with Isopropanol for 7 days at 23°C. After 7 days their appearance was checked and their tensile properties were measured. The test samples that were observed with the naked eye, showed no visual defect on their surface after this 7 days exposure.

POLYVANTIS' product was also tested* for its chemical resistance towards common hospital cleaning agents. LEXAN CLINIWALL sheet test samples were evaluated under different strain levels at 23°C for one week. After 7 days the appearance was checked and tensile properties are measured. Test results showed that, except for acetone, nearly all substances (see Table 2 for the list of referred cleaning substances) are compatible with the LEXAN CLINIWALL Sheet.

Please note, depending on the cleaning agent, repeated cleaning may have an effect on the mechanical performance of the sheet product. Please contact POLYVANTIS for additional information.

Table 2: Europe EN 13501 classification table

A	Non-combustible materials	Concrete, steel
B	Very limited contribution to fire	**LEXAN™ Cliniwall™ Sheet**
C	Limited contribution to fire	Plasterboard
D	Medium contribution to fire	Untreated wood
E	High contribution to fire	Acrylic
F	Very easily flammable	Gasoline

Table 3: Cleaning test overview of LEXAN CLINIWALL sheet by using various cleaning agents, presenting the retention of the original state of the product after testing.

ELONGATION @23°C	• ≥80% RETENTION / ! 60 - 80% RETENTION / X ≤60% RETENTION		
STRAIN	0%	0.5%	1%
No chemical	STD	•	•
Sodium hydroxide 10%	•	!	X
Neutral Soap	•	•	•
Acetone	X	X	X
Sodium sulphate 10%	•	•	•
Bleach	•	•	•
Phosphoric acid 30%	•	•	•
Nitric acid 10%	•	•	•
Hydrochloric acid 20%	•	•	•
Citric acid 10%	•	•	•
Acetic acid 10%	•	•	•
Hydrogen Peroxide 30%	•	•	•
Ammonium Chloride 10% **	•	•	!
Formaldehyde 1%	•	•	•
Ethanol 99.8%	•	•	•

* *Please contact POLYVANTIS to receive a copy of this test result of LEXAN CLINIWALL sheet.*

** *Concentration was 10 times higher as requested*

LEXAN™ CLINIWALL™ sheet is offered in various thicknesses and colors. You can find information about our product offerings below.

TEXTURES

Polished/Suede

product code - LEXAN CLINIWALL (A)C6206 sheet

COLORS

COLOR	COLOR CODE
White	WH6G057
Beige	BR8G038
Light grey/beige	GY8G179
Mint green	GN6G033
Light blue	BL8G009
Dark blue	BL1G038
Dark grey	GY1G140
Light grey	GY7G160
Off white	86183

All other colors are available on request.

STANDARD DIMENSIONS

Grade	Gauge	Width	Length
(A)C6206	1.7 mm	1300 mm	3050 mm
(A)C6206FR	0.067”	51.18”	120”

LEXAN™ CLINIWALL™ sheet is easy to form and install, even in pre-existing buildings. Whether it is a sheet directly glued on the prefabricated wall or it is fixed on profiles anchored to the brick wall with mechanical fixing, installation is easy and economical. Can be thermoformed for corner elements, bumper rails and door frames.

PREPARATION

- Store sheets in a room away from direct sunlight, and place them on a flat surface.
- Bring the sheet to room temperature for 24-36 hours prior to installation.
- Make sure the wall has a smooth / even surface.
- Clean and dry the surface as it is recommended on page 33.
- Cut the panels and profiles to dimensions needed for the intended surface.

Figure 1a

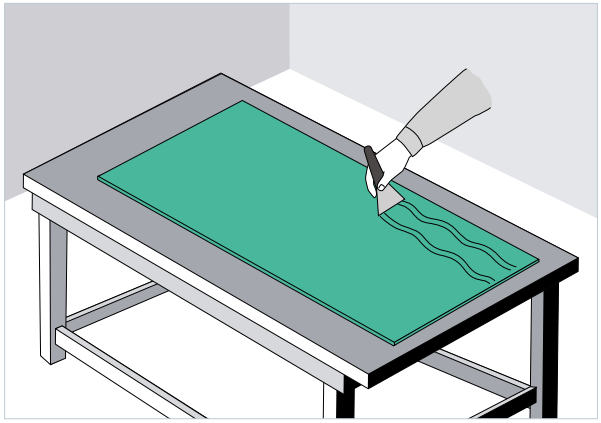


Figure 1b

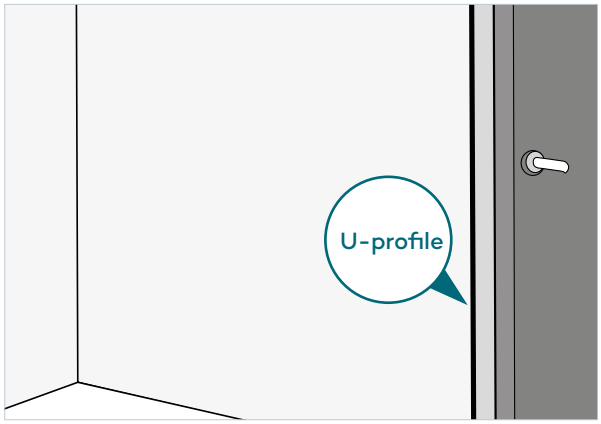


Figure 1c

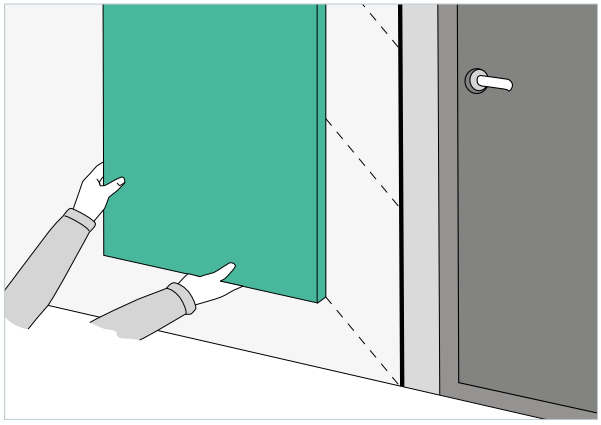
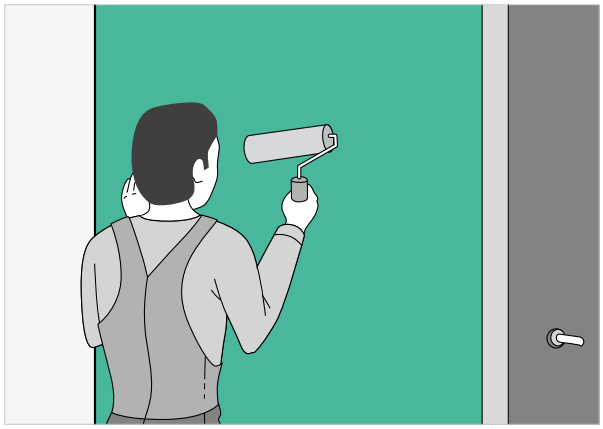


Figure 1d



INSTALLATION GUIDELINES

The following guidelines relate to the corresponding figures 1a-f :

1a Select the proper adhesive type based on the wall construction according to the instructions of the glue manufacturer. Apply the adhesive on the back of the LEXAN™ CLINIWALL™ sheet around the perimeter of the panel and in the center of the sheet with beads each approx. 250 mm or apply the adhesive directly with a notched trowel on the wall.
1b Position and attach a trimmed U base or a profile to the wall.
1c Attach the first LEXAN CLINIWALL sheet to the wall and profile.
1d Remove trapped air and check good adhesion by applying pressure to the entire sheet.
1e Place the H section base and give at least a 2 mm gap for expansion. Repeat steps a-d.
1f See 'Grooving and Bending for corner installation' on the next page.

Check out our installation video of LEXAN CLINIWALL sheet

Figure 1e

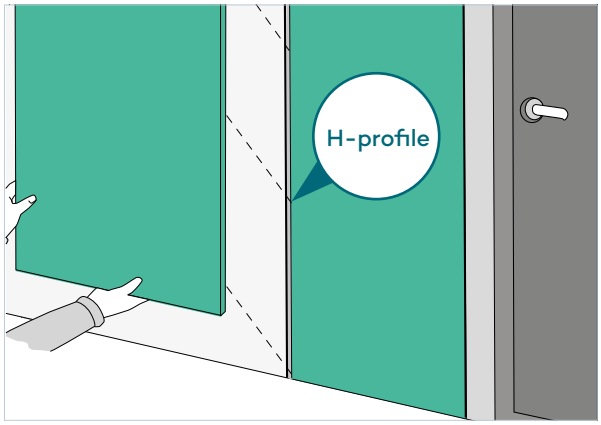
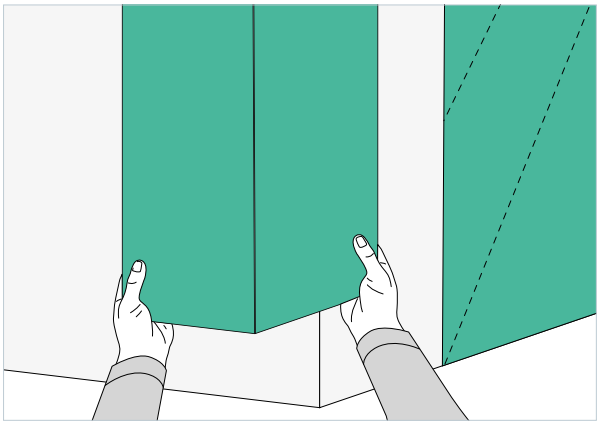


Figure 1f



HOT LINE BENDING

WALL PREPARATION
Make sure your wall is smooth, dry and clean.
Remove bumps and nails - fill any dents/holes.

PREPARE YOUR HEATING DEVICE
Figure 2a
- Temperature maximum 90°C.
- Place the sheet on the heating device for 30-60 seconds.

BENDING THE SHEET
Figure 2b
Slowly heat and bend the sheet to the desired angle.

WALL FITTING AND ADHESIVES
Figure 2c
- Fit the sheet on the corner wall.
- Apply glue to the sheet and let it dry for 10-30 minutes (the amount of glue and the dry time depends on the backwall structure).
- Place the sheet on the wall and press well to remove any possible air bubbles.

Check out our video of LEXAN CLINIWALL sheet

HOT LINE BENDING

Figure 2a

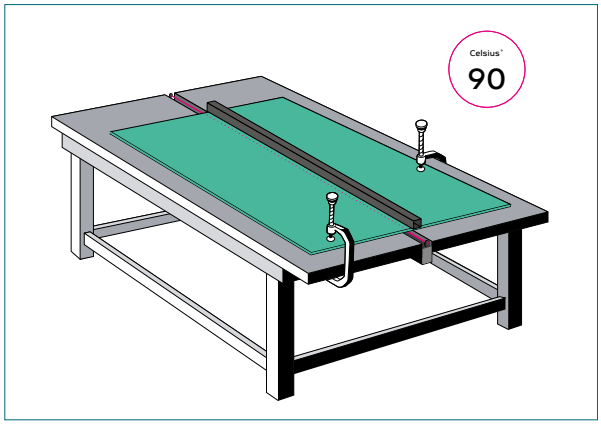


Figure 2b

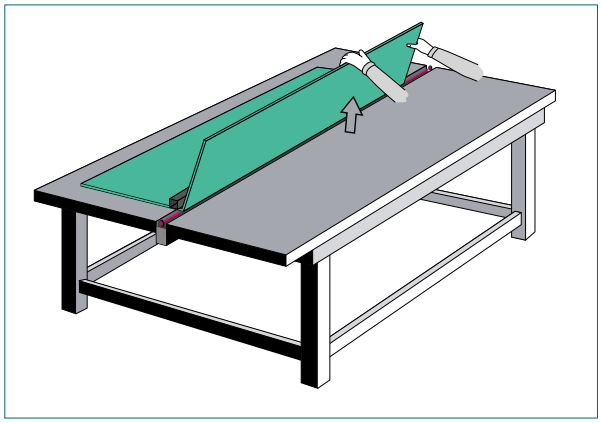
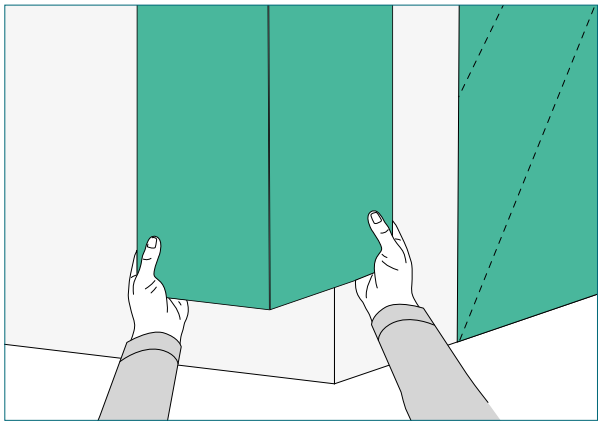


Figure 2c



COLD LINE BENDING

WALL PREPARATION
Make sure your wall is smooth, dry and clean. Remove bumps and nails - fill any dents/holes.

SHEET CLAMPING
Figure 3a
Place the sheet on a working surface and make sure it's securely clamped. Then cut the sheet into the final size.

MILLING THE SHEET
Figure 3b
Mill a V-groove at the back of the sheet at maximum half of the thickness.

BENDING THE SHEET
Figure 3c
Bend the sheet to the desired angle.

WALL FITTING AND ADHESIVES
Figure 2c
- Fit the sheet on the corner wall.
- Apply glue to the sheet and let it dry for 10-30 minutes (the amount of glue and the dry time depends on the backwall structure).
- Place the sheet on the wall and press well to remove any possible air bubbles.

Check out our video of LEXAN CLINIWALL sheet

COLD LINE BENDING

Figure 3a

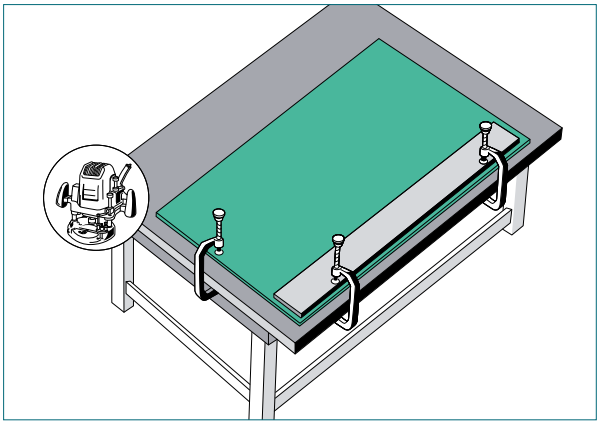


Figure 3b

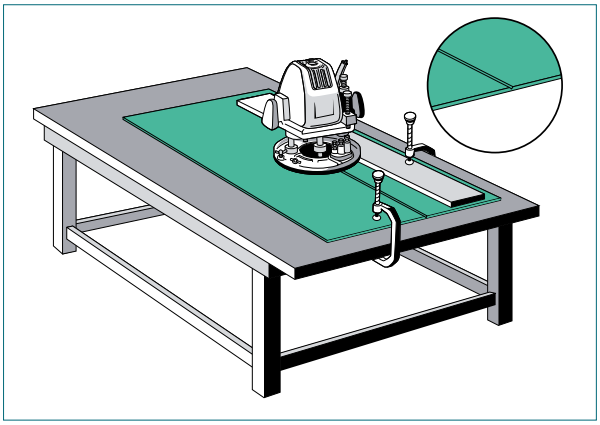
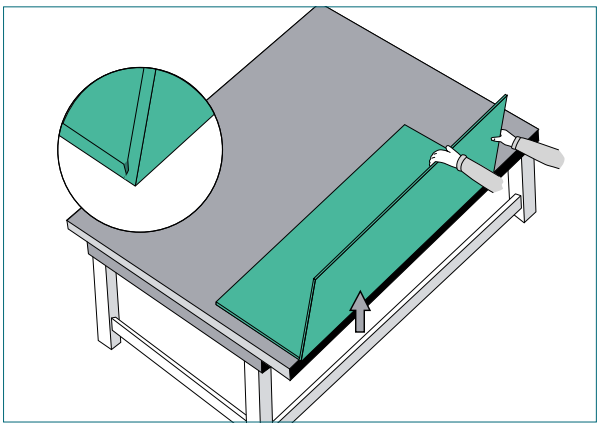


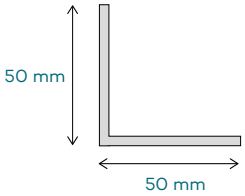
Figure 3c



PROFILE OPTIONS

CORNER PROFILE

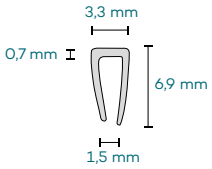
Grade name = CWP30C
Standard colors = White (WH6G057),
Grey (GY7G160), Blue (BL8G009),
Profile length = 3mtrs
profiles per bag = 33
Minimum Order quantity = 1 Bag



Wall thickness 1 mm

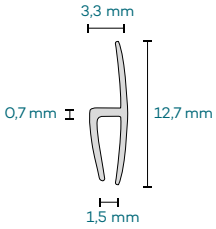
TOP U-PROFILE

Grade name = CWP69T
Standard colors = White (WH6G057),
Grey (GY7G160), Blue (BL8G009),
Profile length = 3mtrs
profiles per bag = 33
Minimum Order quantity = 1 Bag



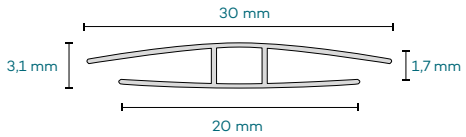
CONNECTION PROFILE

Grade name = CWP127C
Standard colors = White (WH6G057),
Grey (GY7G160), Blue (BL8G009),
Profile length = 3mtrs
profiles per bag = 33
Minimum Order quantity = 1 Bag



H-PROFILE

Grade name = CWP30U
Standard colors = White (WH6G057),
Grey (GY7G160), Blue (BL8G009),
Profile length = 3mtrs
profiles per bag = 33
Minimum Order quantity = 1 Bag



wall thickness 0,7 mm

Any other profile color will be on request.
Please contact POLYVANTIS regarding lead-times and prices.

The following section discusses the techniques and processes used to fabricate finished products from polycarbonate LEXAN™ sheet, including LEXAN™ CLINIWALL™ sheet, and provides recommendations and advice on how to achieve the best results.

CUTTING AND SAWING

LEXAN sheet products can be cut and sawn accurately using standard workshop equipment. Circular saws, band saws, jig saws and common hacksaws can all be used successfully. However, certain important guidelines should be followed. General guidelines are listed below with specific recommendations outlined in each cutting section.

Caution should be taken and required safety equipment should be worn when cutting and sawing. When working with thermoplastics sheet, always consider safe and careful handling. Please keep in mind that plastics will lose heat more slowly than metals. Avoid localized overheating.

The method and the purpose that you choose to utilize our products are beyond our control. Therefore, it is imperative that you test our products to determine to your own satisfaction whether our products, technical assistance and information are suitable for your intended use and application. This application-specific test must at least include analysis to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by POLYVANTIS. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale, which are available upon request.

For further technical assistance and recommendations, please contact POLYVANTIS using the contact details on the back page of this brochure.

- The sheet must always be securely clamped to avoid undesirable vibration and rough cut edges.
- All tools should be set for cutting plastics, with fine toothed panel blades.
- The protective masking should be left on the sheet to prevent scratching and other surface damage.
- When finishing the edges of all LEXAN sheet products should be clean and free of notches.
- If possible swarf and dust build-up should be blown away with a compressed air supply.

Circular Saws

This type of cutting operation is the most common and, whilst cutting speeds and feeds are not so critical as with other thermoplastics, it is important to follow the recommended guidelines.

- Tungsten carbide tipped saw blades are preferred with alternative teeth bevelled at 45° on both sides to improve cutting and reduce side pressure.
- Always use a low feed to get a clean cut.
- Always start cutting with the blade at full speed.
- For single sheets less than 3 mm thick, bandsaws or jig saws are preferred to circular saws.

Bandsaws

These can be of the conventional vertical type or the specially developed horizontal type suitable for plastic sheet materials. In both cases it is vital that the sheet is adequately supported and clamped during the cutting operation. The saw guides should be as close to the sheet as possible to reduce blade twist and off-line cutting.

Jig Saws and Hacksaws

The most important consideration with this type of cutting is support and clamping, particularly with the use of a jig saw. Blades with a tooth spacing of 2-2.5 mm are ideal with the emphasis upon low cutting feeds.

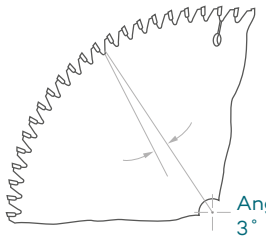
Guillotine Saw

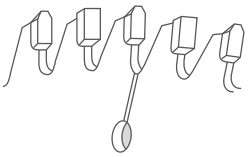
Can be applied commonly on non-FR type of sheets.

Table 4: Cutting and Sawing Recommendations

	CIRCULAR SAW	BANDSAW
Clearance Angle	20°-30°	20°-30°
Rake Angle	5-15°	0-5°
Rotation Speed	1800-2400 m/min	600-1000 m/min
Tooth Spacing	9-15 mm	1.5-4 mm

Figure 4: Circular Saw





Details of a typical saw:

Diameter	400 mm
Tooth spacing	12 mm
Gullet depth	11 mm
Shaft speed	4000 rev/min

A tungsten carbide tipped saw blade suitable for cutting Lexan sheet

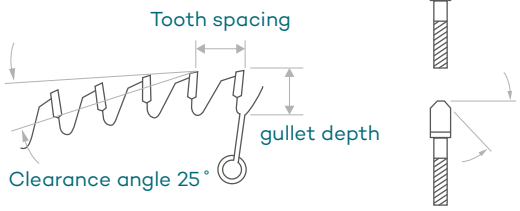
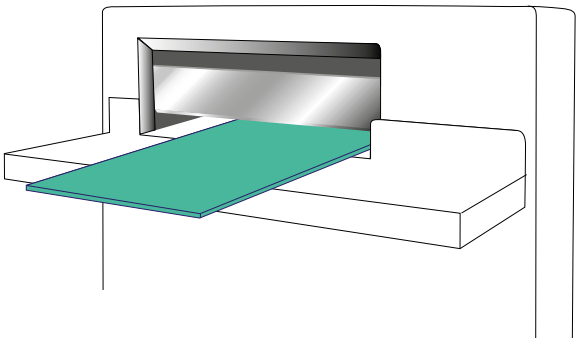


Figure 5: Guillotine Saw



DRILLING

Standard high speed steel twist drills or drills with an angular wedged bit can be used for drilling LEXAN™ sheet products. Carbide-tipped drills can also be used since they retain their sharp cutting edge. The most important factor to consider when drilling LEXAN sheet products is the heat generated during the actual process. In order to produce a clean, well-finished hole that is stress-free, the heat generated must be kept to an absolute minimum. By following a few basic guidelines, clean, stress-free holes can easily be produced.

- The drill hole must be cleared frequently to prevent swarf build-up and excessive frictional heat.
- The drill must be raised from the hole frequently and cooled with compressed air.
- The sheet or product must be adequately clamped and supported to reduce vibration and ensure a correctly sized hole.
- Holes should not be drilled closer to the edge of the sheet than 1-1.5 times the diameter of the hole.
- All holes must be larger than the bolt, screw or fixing to allow for thermal expansion and contraction.
- For long production runs the use of carbide-tipped twist drills is recommended.

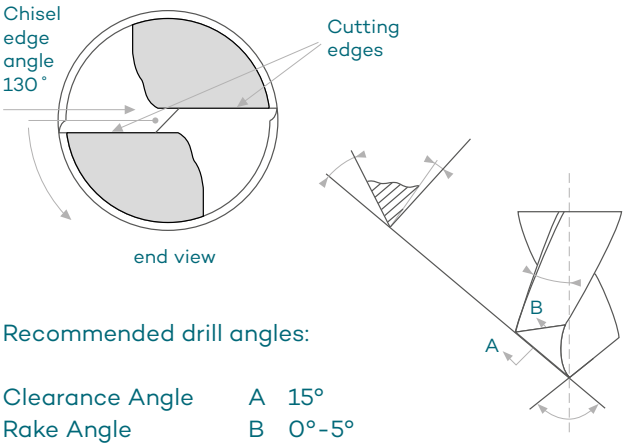
Drilling feeds and speeds are outlined in Table 5 with the various drill configurations in Figures 7 to 9.

REMARK:
Please consult suppliers for drilling, cutting, cooling fluids, which are recommended for polycarbonate.

Table 5: Front view drill bit

HOLE DIAMETER	SPEED (REV/MIN)	FEED (MM/MIN)
3	1750	125
6	1500	100
9	1000	75
12	650	50
18	350	25

Figure 6: Recommended Drill Angles



Recommended drill angles:

Clearance Angle	A	15°
Rake Angle	B	0°-5°
Included Tip Angle	C	120°-160°
Helix Angle	D	30°

Figure 7: Typical Drill Configuration

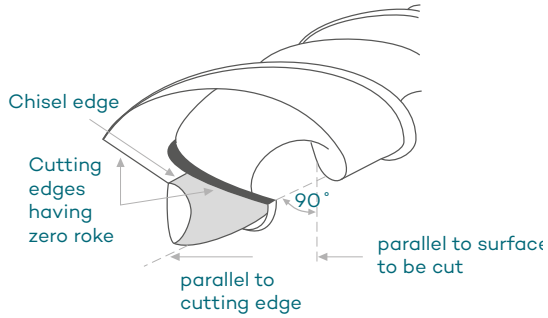


Figure 8: Drill suitable for large holes

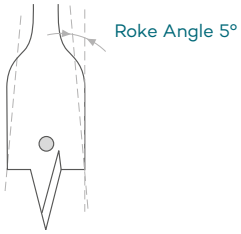
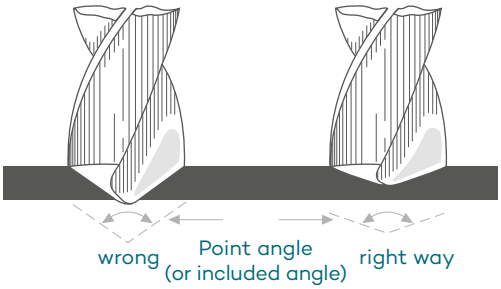


Figure 9: Drill suitable for thin sheet



MILLING

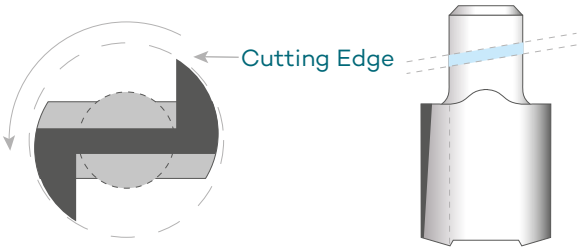
LEXAN™ sheet (polycarbonate) products can be machined using conventional milling machines fitted with standard high speed knife cutting tools. Once again the importance of suitable clamping cannot be over-emphasized. Mechanical jigs and fixtures, or vacuum chucks provide a suitable clamping medium. Table 6 outlines appropriate cutting speeds and feeds with a typical cutting tool illustrated in Fig. 10. Forced-air cooling enables higher cutting rates. However, care should be taken not to over-heat the material. The use of cutting fluids to lubricate or cool the sheet is not recommended.

Computerised trimming is a fully automatic milling process. It is extremely accurate and operates horizontally as well as vertically. The use of a vacuum-operated jig avoids vibration of the part ensuring a smooth cut. Standard high speed, two-sided cutting routers with tungsten carbide tips are recommended, with a cutting speed of approximately 250 m/min at 25.000/30.000 RPM at a sheet thickness of 4 mm.

Table 6: Milling Recommendations

CLEARANCE ANGLE	5°-10°
Rake Angle	0°-10°
Cutting Speed	100-500 m/min
Cutting Feed	0.1-0.5 mm/rev.

Figure 10: Typical milling Cutter



MECHANICAL FASTENING DEVICES

With a few exceptions, all mechanical assembly techniques involve some form of additional fastening device. The choice of device is often dependent upon the nature of the fastening required. Whilst rivets tend to be permanent, screws and nuts can be made detachable and some of the spring clips types can be either permanent or separable. There are many different types of mechanical fastening systems which can be used to successfully assemble plastic sheet components. Within the limitations of this publication only a small number can be discussed.

For simplicity they are divided into three groups:
- Screws, nuts and bolts
- Rivets
- Spring clips and other fastening devices

Two important factors need to be considered with all these fastening systems. Firstly, allowance needs to be made for thermal expansion and contraction. All holes, slots and cut-outs must be machined over-size to allow for the dimensional changes as a result of temperature changes. Secondly, the distribution of tightening torque should be equal. With the aid of compatible rubber washers and large screw and rivet heads, the tightening torque should be spread over as wide an area as possible and should not be excessive.

Table 7: Coefficient of Thermal Expansion

MATERIAL	M/M °C X 10-5
LEXAN sheet	6.7
Glass	0.7 - 0.9
Aluminium	2.1 - 2.3
Steel	1.2 - 1.5

MACHINE SCREWS

The majority of these screws are made from steel, but other metals and alloys are used for specialised applications. Several examples of this type of fastening system are shown on this page. Figures 11 and 12 illustrate sheet fastening devices known as 'blind screw' and 'blind nut' anchors.

SELF-TAPPING SCREWS

Self-tapping screws are widely used within the plastics industry. Basically they produce their own thread as they are driven into a hole and may be considered whenever an assembly is likely to be dismantled and re-assembled.

Whilst the majority of these screws are designed for plastic mouldings, with the aid of spring clips and washers they can be adapted for sheet applications. Fig. 13 shows a typical fastening system.

CAUTION!

If the application calls for a screwed assembly, it is vitally important that the following recommendations are considered.

- Do not use countersunk head screws, as the 'wedging' action of the countersunk head causes excessive hoop stress on the sheet. This can lead to part failure.
- Be sure that all oil, grease and other coatings are removed from the screws before assembly. Certain oils and greases can cause stress cracking.

Figure 11: Blind Nut and Blind Screw Anchor

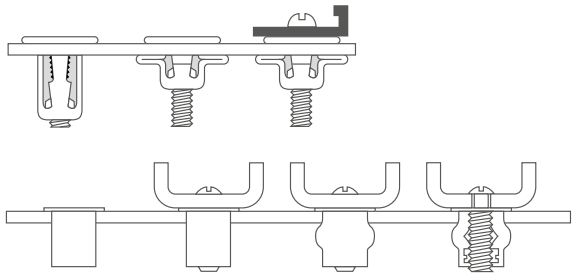


Figure 12: Other Typical Fastening Systems

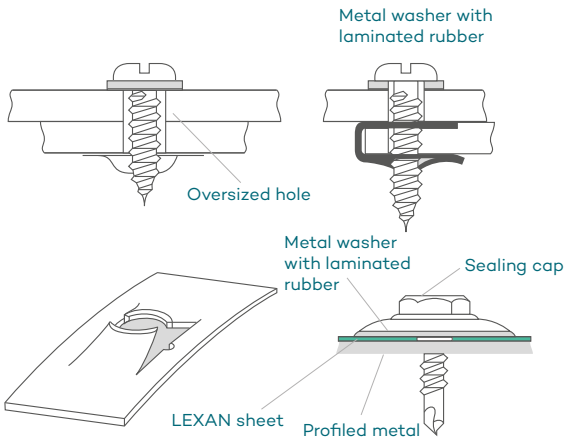
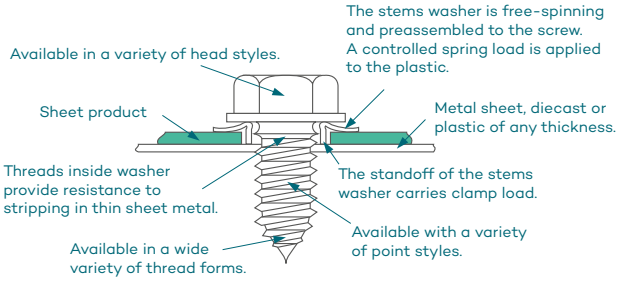


Figure 13: Hex Cap Screw Connection



RIVETING SYSTEMS

Certain guidelines should always be followed when considering this type of assembly method. Riveting can induce both radial and compressive stresses in the plastic sheet and precautions should be taken to distribute these forces over as wide an area as possible. In a plastic-to-plastic assembly a metal back-up washer with laminated rubber is recommended to reduce the compressive stresses. If the diameter of the rivet with a rubber washer is slightly bigger than the hole diameter, then the hoop stresses will be transmitted to the washer rather than the plastic sheet.

For plastic-to-metal joints, the head of the rivet with a rubber washer should be against the plastic, and the hole in the sheet should be large enough to allow for thermal movement. Holesize is 1.5 x expanded rivet diameter. Rivet diameters should be as large as possible and spacing should be between 5-10 times their diameter. POLYVANTIS recommends the use of aluminium, brass and copper rivets. There are several different types of riveting systems, the most popular for which is the 'pop-rivet'. This type of rivet provides the means to assemble two components together with access restricted to one side only. Figures 14 and 15 illustrate typical rivet assemblies.

Figure 14: Rivet Assembly

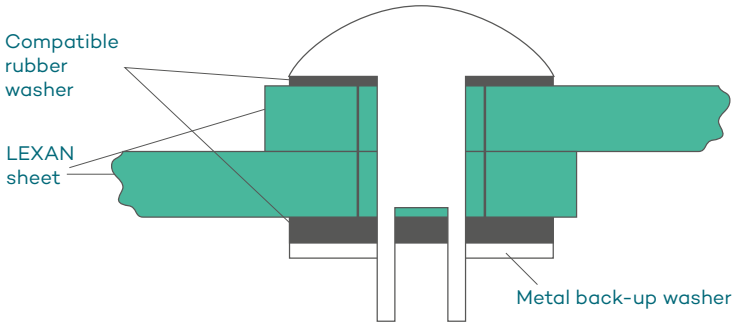
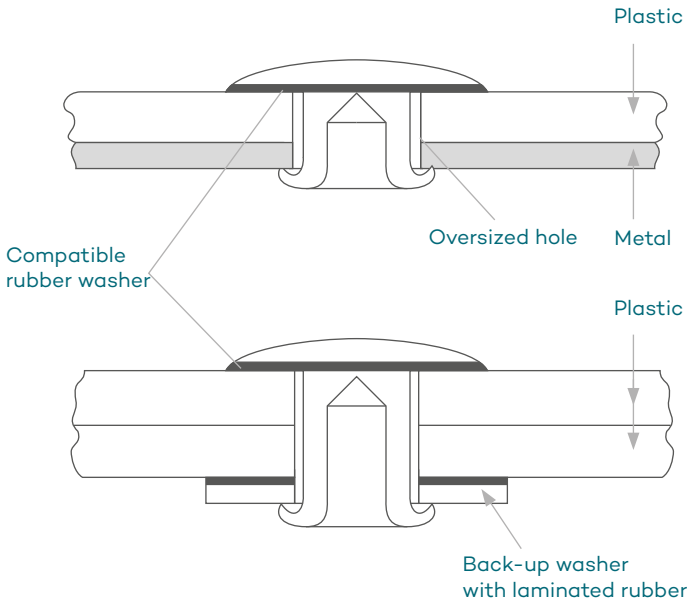


Figure 15: Typical Pop-Rivet Assembly



MISCELLANEOUS FABRICATING TECHNIQUES

Many different techniques are used to cut and fabricate LEXAN™ sheet products.

These techniques include:
- Shearing
- Punching
- Tapping
- Laser Cutting
- Water Jet Cutting

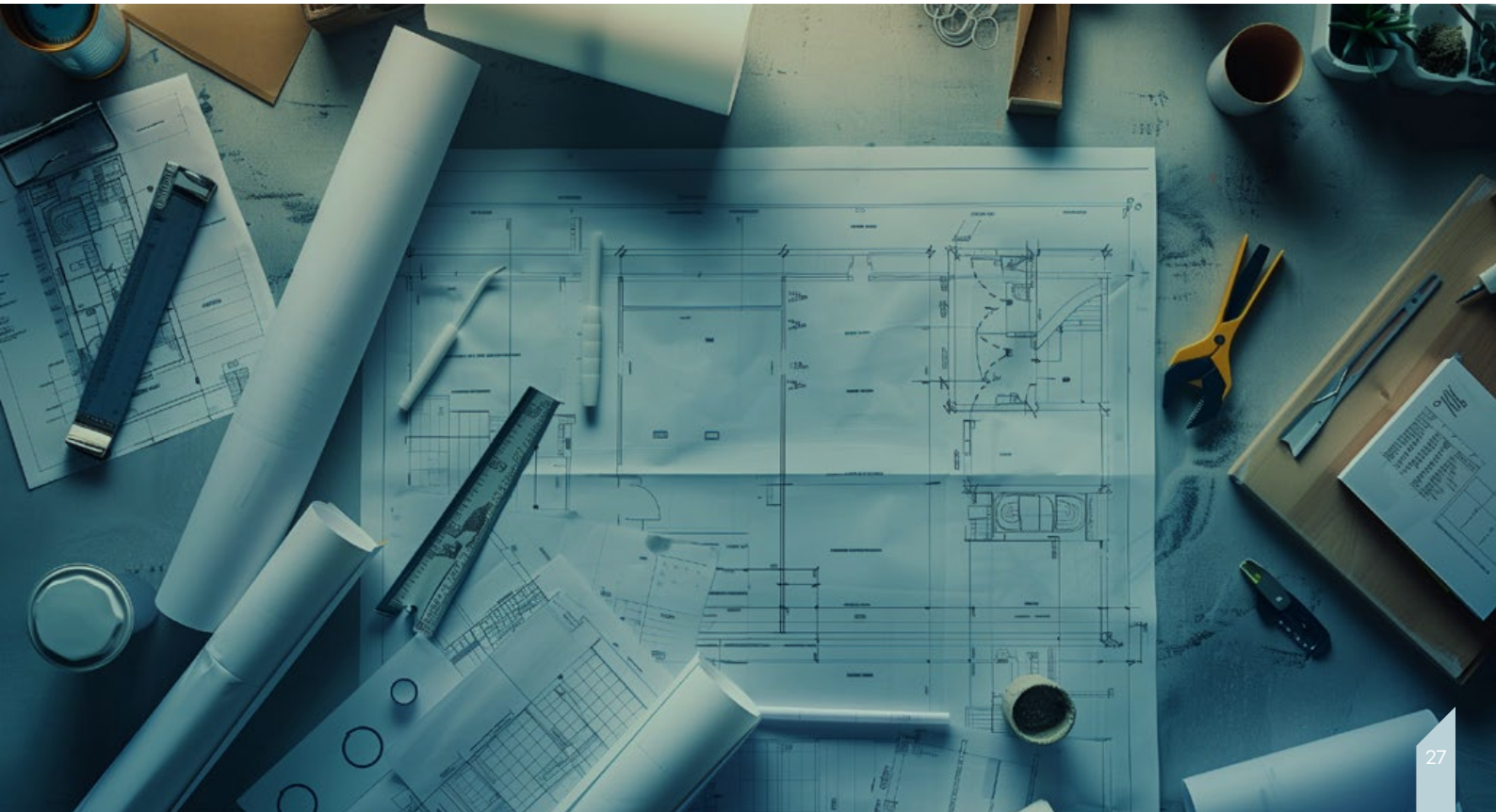
Whilst these techniques are used, they are not recommended since they either induce unnecessary stress on the finished part or result in a poor surface finish. With both shearing and punching the process involves a shearing action with a guillotine or a punch which tends to leave a roughly cut surface. This surface often contains micro-cracks which may lead to premature failure. Tapping is possible in LEXAN sheet. However, the process is usually restricted to moulded parts. Self-tapping screws or machine screws require a minimum depth to achieve the necessary holding power and sheet products do not have the necessary thickness.

Laser cutting of POLYVANTIS sheet products is not recommended due to the following disadvantages:
- Rough cutting edges
- Carbon deposition on cutting edges
- Stress level increase in thick sheets
- Discoloration

With water jet cutting, the following considerations should be taken into account:
- No stress at any sheet thickness
- Cutting edge requires further finishing
- Limited cutting speed
- Expensive equipment

For further technical assistance and recommendations, please contact POLYVANTIS, for which you can find the contact details on the back page of this brochure. When working with LEXAN sheet, always consider safe and careful handling.

The method and the purpose that you choose to utilize our products are beyond our control. Therefore, it is imperative that you test our products to determine to your own satisfaction whether our products, technical assistance and information are suitable for your intended use and application. This application-specific test must at least include analysis to determine suitability from a technical as well as health, safety, and environmental standpoint. Such testing has not necessarily been done by POLYVANTIS. Unless we otherwise agree in writing, all products are sold strictly pursuant to the terms of our standard conditions of sale, which are available upon request.



CHEMICAL RESISTANCE

The chemical resistance of a thermoplastic is dependent upon five major factors:

- Stress level in the application
- Temperature
- Exposure time
- Chemical concentration
- Type of chemical involved

LEXAN™ sheet has a good chemical resistance, at room temperature, to a variety of dilute organic and inorganic acids. Water, vegetable oils, solutions of neutral salts, aliphatic hydrocarbons and alcohols are also included in this category. When a thermoplastic is attacked by a chemical it usually takes one of three forms. In the first case the chemical is absorbed into the plastic, and plasticisation and/or crystallisation occurs.

The visible signs of this type of attack are swelling or surface whitening. LEXAN resin is affected in this way by partial solvents such as low molecular weight aldehydes and ethers, ketones, esters, aromatic hydrocarbons and perchlorinated hydrocarbons. In addition, chemical attack ranging from partial to complete destruction of LEXAN sheet occurs in contact with alkalines, alkali salts, amines and high ozone concentrations.

The third type of attack is often the most difficult to predict since environmental conditions dictate whether or not the plastic will be affected. Combinations of certain environments, coupled with stress and/or strain upon the material, cause stress cracking or crazing of the polycarbonate.

Crazing can be induced at moderate to high stress levels by low molecular weight hydrocarbons. Products such as acetone and xylene may cause stress cracking even at very low stress levels and should therefore be avoided.

Taking into account the complexity of chemical compatibility, all chemicals which come into contact with polycarbonate should be tested. For sheet products the most common contact is with sealants, gaskets and the various cleaning media. Chemical compatibility testing, table 8, is an on-going process at POLYVANTIS and many standard products have already been tested. A complete list of recommended cleaners, gaskets and sealants is available upon request. However, a shortened list of some of the more common compounds is outlined in the respective sections in Table 07.

Table 8: LEXAN sheet chemical compatibility summary

CHEMICAL CLASS	EFFECTS
Acids (Mineral)	No effect under most conditions of concentration and temperature.
Alcohols	Generally compatible.
Alkalis	Acceptable at low concentration and temperature. Higher concentrations and temperatures result in etching and attack as evidenced by decomposition.
Aliphatic Hydrocarbons	Generally compatible.
Amines	Surface crystallisation and chemical attack.
Aromatic Hydrocarbons	Solvents and severe stress-cracking agents.
Detergents and Cleaners	Mild soap solutions are compatible. Strongly alkaline ammonia materials should be avoided.
Esters	Cause severe crystallisation. Partial solvents.
Fruit Juices and Soft Drinks	Compatible at low stress levels. Some concentrates not recommended.
Gasoline	Not compatible at elevated temperatures and stress levels.
Greases and Oils	Pure petroleum types are generally compatible. Many additives used with them are not, thus materials containing additives should be tested.
Halogenated Hydrocarbons	Solvents and severe stress-cracking agents.
Ketones	Cause severe crystallisation and stress-cracking. Solvents.
Silicone Oils and Greases	Generally compatible up to 80°C.

STAIN RESISTANCE AND CLEANING

The following table show how to clean typical stains if that occurs on LEXAN™ sheet.

Table 9: Cleaning

STAIN SUBSTANCE	REMOVED WITH
Soda	Warm Water
Mustard	Dry Cloth
Lemon Juice	Warm Water
Fruit Preserve	Warm Water
Milk	Warm Water
Tea	Warm Water
Hot Chocolate	Warm Water
Coffee	Dry Cloth
Newspaper Print	Warm Water
Pencil	Warm Water
Ball Point Pen	Isopropyl Alcohol (IPA)
Neurtral Marker	Dry Cloth
Water Resistant Marker	Isopropyl Alcohol (IPA)

CLEANING RECOMMENDATIONS

Periodic cleaning of all polycarbonate LEXAN sheet products can be accomplished easily and without the need for specialised cleaning agents. However precautions need to be taken to avoid any aggressive cleaning agents. The basic cleaning agent for all LEXAN sheet products is a solution of lukewarm water with mild soap or household detergent, using a soft cloth or sponge to loosen any dirt and grime.

All surfaces are then rinsed with cold water and dried with a soft cloth to prevent water spotting caused by lime-scales. However, in some cases this may not be sufficient and certain solvent cleaners may be needed to remove stubborn stains, graffiti, etc. In these cases the following list of cleaning agents are approved for use at room temperature:

- Methyl alcohol
- Ethyl alcohol
- Butyl alcohol
- Isopropyl alcohol
- White spirit
- Heptane
- Hexane
- Petroleum ether (BP 65°)
- Hydroxide peroxide (1% H2O2)

CLEANING PRIOR TO FORMING

It is necessary to clean LEXAN sheet prior to forming. It is recommended that the dust is blown off with an ionising air gun or the sheet is wiped with a soft cloth dipped in water or a mixture of isopropanol and water.

POINTS TO REMEMBER!

- Don't use abrasive or highly alkaline cleaners such as acetone and avoid contact with such substances.
- Never scrape the sheet with squeegees, razor blades or other sharp instruments. This may cause aesthetic damage on the surface of the product.
- Don't clean LEXAN sheet products in direct sunlight or at elevated temperatures as this can lead to staining.

SMOKE TOXICITY COMPARISON

LEXAN™ POLYCARBONATE (PC) VS. PVC SHEET

The importance of testing smoke toxicity for fire wall cladding in hospitals and public facilities cannot be overstated.

We share comparative testing of LEXAN™ CLINIWALL™ Sheet and PVC (Polyvinyl Chloride) materials in accordance with EN 17084*.

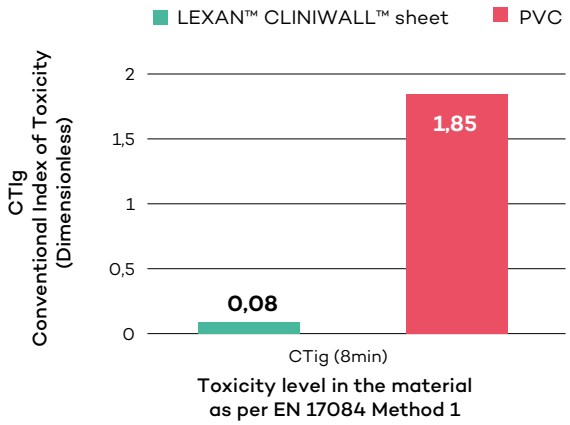
The smoke toxicity test results have shown that **typical PVC sheet has more than 20 times higher toxicity levels** in comparison to LEXAN™ CLINIWALL™ Sheet.

The high toxicity of burning PVC sheets is primarily the presence of Hydrochloric Acid (HCl) fumes in the smoke.

Table 9: Test Result

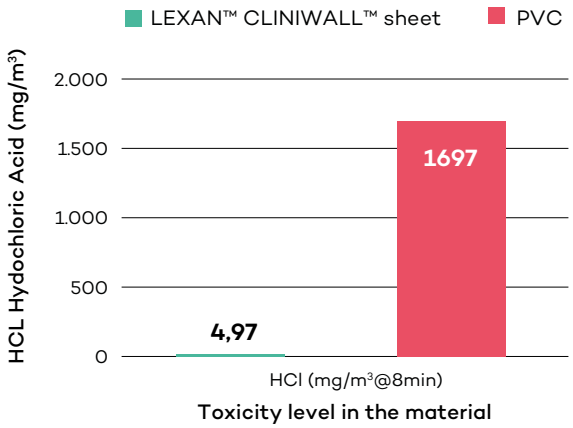
	MATERIAL	PC SHEET	PVC PANEL
TEST DATE: 26 APRIL 2024	Brand	LEXAN™ CLINIWALL™	PVC
	Grade	C6206x	-
TEST LAB: CREPIM FRANCE**	Color	White	White
	Thickness, mm	1,7	2
	Density	1150	1430

Graph 01: Comparision of Toxicity Level in the smoke of LEXAN and PVC



PVC is > 20 times toxic in comparison to LEXAN™ (PC) sheet

Graph 02: Comparision of HCl Hydochloric Acid fumes in the smoke of LEXAN and PVC



PVC has significantly higher amount of HCl fumes in the smoke in comparison to LEXAN™ (PC) sheet

* *EN 17084 - Toxicity test of materials and components in Railway applications, this standard describes CTIg (Conventional Index of Toxicity) values that shows toxicity level in a tested material and measures various toxic chemicals that are present in smoke.*

** *The smoke toxicity test is executed by a third-party laboratory CREPIM (France), an expert in Fire Retardant and Fire Tests.*

ABOUT POLYVANTIS

POLYVANTIS is committed to its customers around the world with a portfolio of Film & Sheet materials, application support and worldwide services.

We are a world-leading multi-material player for semi-finished plastic products. Our customers from a multitude of different industries can choose from an extensive range of high-quality products provided by a single source, including leading brands such as LEXAN™ film and sheet from polycarbonate resins and PLEXIGLAS® and ACRYLITE® for PMMA semi-finished products.

Our name stands for the variety of products we offer and our quest to secure progress in the area of polymers and related materials. POLYVANTIS offers innovative materials for different needs. The portfolio ranges from solid plastic sheets and films for a multitude of areas of application, through specialty products with custom properties, all the way up to the matching adhesives and auxiliaries. The POLYVANTIS umbrella unites strong plastics brands.

With 15 production sites across the United States, Europe, Asia and Africa, we offer innovative products and solutions for segments such as building and construction, transportation, aircraft & railway interiors, electrical engineering and electronics, automotive manufacturing and the home and garden sectors.

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