CHEMISTRY THAT MATTERS™

# AESTHETICS+ HYGIENIC

## LEXAN™ CLINIWALL™ SHEET FOR INTERIOR WALL CLADDING

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# ABOUT SABIC

At SABIC, we bring to life the visions of our customers to help them realize their ambition for their product – whether it is something stronger, brighter, greener, smarter, or altogether better. We not only create the chemistry that makes things possible, but also we believe that with ingenuity and the best materials technology, almost anything can be achieved.

SABIC offers a high-performance, engineering thermoplastics LEXAN™ sheet and film portfolio and full-service solutions for customers in various segments including mass transportation, consumer electronics, glazing, building and construction.

The company supports OEMs and converters by providing high-performance, proven sheet and foam and film materials, enabling customers to find new solutions to evolving requirements for design, sustainability and fire safety, as well as related challenges of cost reduction. SABIC's LEXAN sheet portfolio offers high quality polycarbonate monolithic and multiwall sheet products across a wide variety of industries, ranging from building and construction, lamination, signs, to transportation.

The company's virtually unbreakable, lightweight, fire resistant LEXAN sheet portfolio includes a wide variety of structures and it is backed by advanced technical support and application development services to meet our customers' specification needs with local supply.

SABIC ranks among the world's top petrochemical companies, and operates in more than 45 countries across the world with 40,000 employees worldwide. It has significant research resources with 19 dedicated technology and innovation facilities in Saudi Arabia, the USA, the Netherlands, Spain, Japan, India, China and South Korea.

# CHALLENGES THAT YOU CONFRONT

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

## PATIENT SAFETY & 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
- Need for materials that can be anti-bacterial and certified

## COMFORT & AESTHETICS

- Materials that can be thermoformed or shaped according to building design

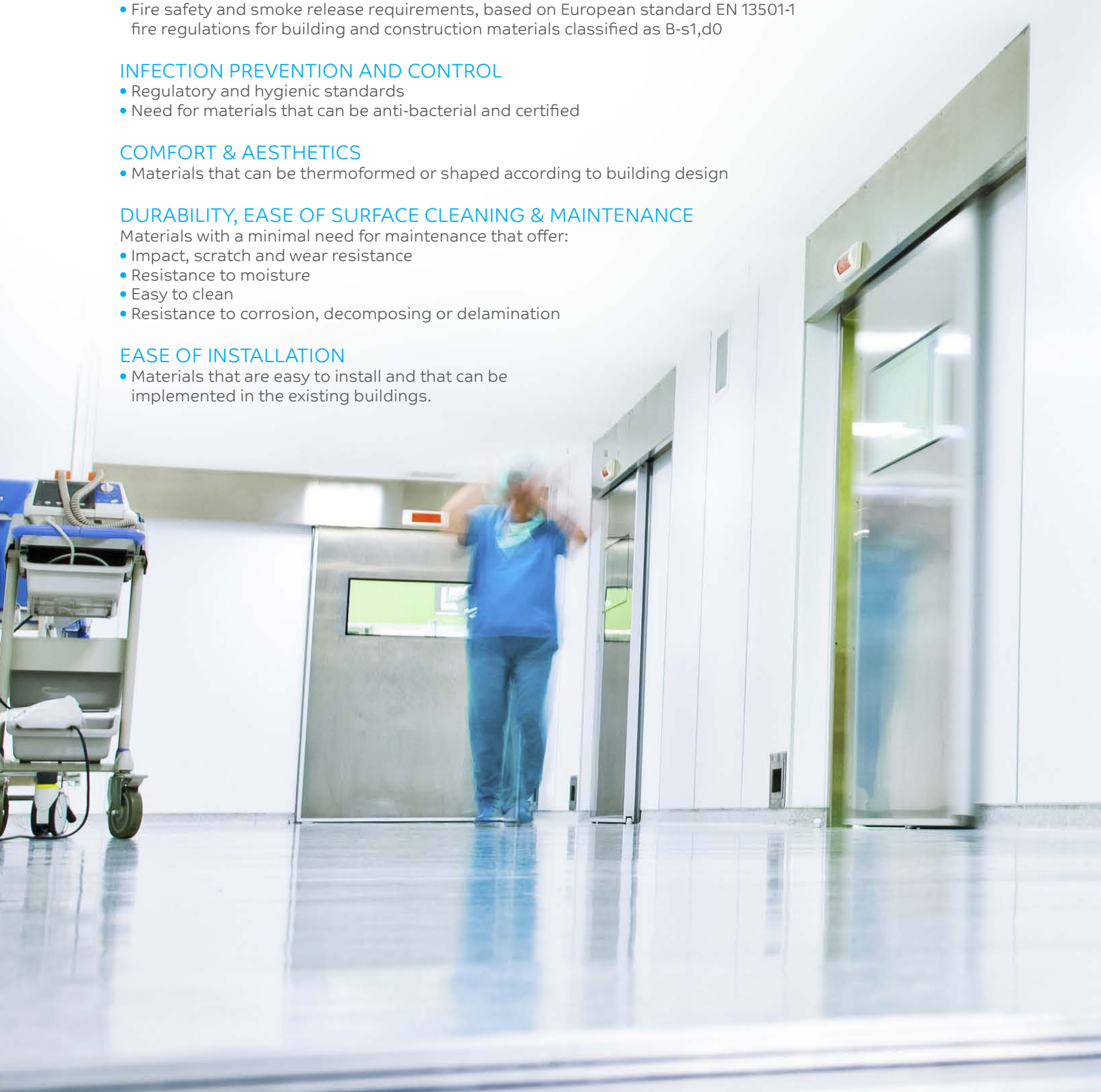
## DURABILITY, EASE OF SURFACE CLEANING & MAINTENANCE

Materials with a minimal need for maintenance that offer:

- Impact, scratch and wear resistance
- Resistance to moisture
- Easy to clean
- Resistance to corrosion, decomposing or delamination

## EASE OF INSTALLATION

- Materials that are easy to install and that can be implemented in the existing buildings.



# LEXAN™ CLINIWALL™ SHEET SOLUTIONS FOR WALL CLADDING

LEXAN CLINIWALL sheet is a new thermoplastics material solution for clean room surfaces and interior wall cladding applications in public facilities and hospitals. This opaque, low-gloss LEXAN based resin solid sheet 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 regulation 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 and it meets the current European EN 13501-1 regulation requirements of the most stringent fire and smoke standards, obtaining the best rating for a thermoplastic material.

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.

Pre-colored textured LEXAN CLINIWALL sheet can provide an excellent low-gloss surface finish for the wall cladding, 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

## POTENTIAL ADVANTAGES

### ENVIRONMENT

- non-chlorinated and non-brominated opaque sheet

### HIGH IMPACT STRENGTH AND SCRATCH RESISTANCE

- virtually unbreakable and resistant to abrasion

### ANTI-BACTERIAL PROPERTIES

- for specific grades

### EASY TO FORM AND INSTALL

- even for existing buildings

### EXCELLENT RESISTANCE

- to chemicals, including stain of blood and urine

### FIRE SAFETY AND EXCELLENT SMOKE PERFORMANCE

- B-s1-d0 rating according to European EN 13501-1 standard

### EASY TO CLEAN AND DISINFECT

- withstands repeated cleaning with common hospital cleaning agents

### DURABILITY

- 10 year written limited warranty

# TYPICAL CLADDING APPLICATIONS

LEXAN™ CLINIWALL™ sheet is an excellent material option for use in interior wall applications for:

## PUBLIC FACILITIES

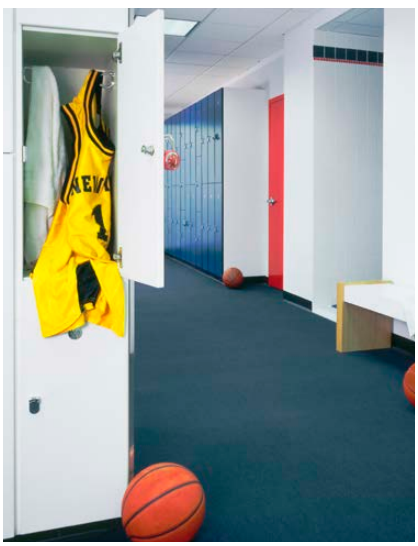
- Schools
- Kindergardens
- Restrooms
- Airports
- Bus stops and train stations
- Sports centers

## HEALTHCARE FACILITIES

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

## INDUSTRIAL FACILITIES

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

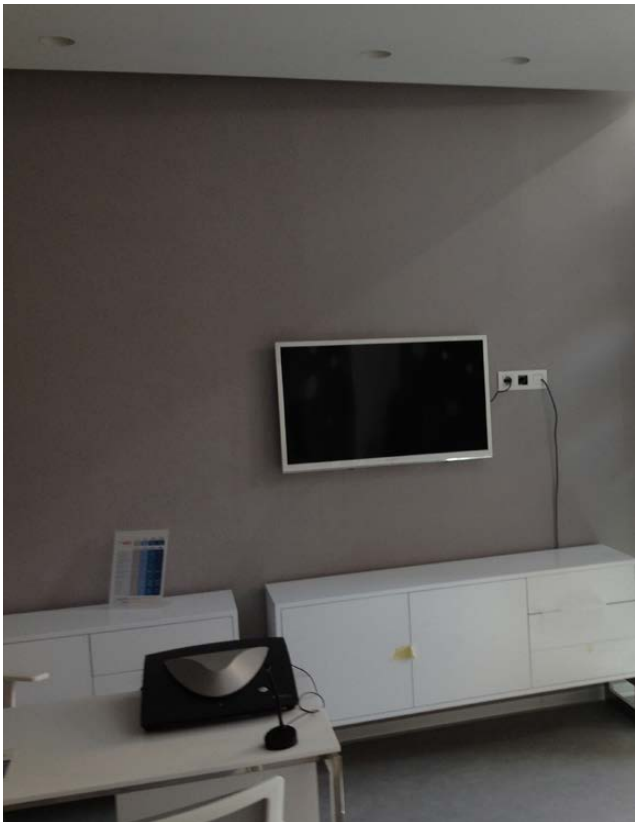


## PROJECT EXAMPLES

Hospital in Madrid, Spain

Medical clinic in Almeria, Spain

Medical clinic in Almeria, Spain



Auditory center in Valencia, Spain

Hospital in Murcia, Spain

# TECHNICAL DATA

# PRODUCT PROPERTIES

## 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 (1,7 mm & 1,5 mm) |

* 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 SABIC 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

SABIC's LEXAN™ CLINIWALL™ sheet offers a specific antibacterial grade (AC6206) featuring a pioneering thermoplastics material technology for clean room surfaces and interior wall cladding applications for public facilities and hospitals that requires a high level of sanitation.

LEXAN CLINIWALL AC6200 sheet has been independently tested* for log reduction values – the level of bacteria eliminated from a surface – according to the ISO 22196 / JIS Z 2801:2000 test protocol. The independent lab test results demonstrate that the antibacterial grade of LEXAN CLINIWALL sheet product shows greater than a 99.99% reduction in Methicillian-resistant Staphylococcus aureus (MRSA) and 99.999% E.Coli on the surface of the material over a 24 hour period at 35°C. This antibacterial material provides a layer of protection to interior wall cladding against the spread and multiplication of potentially harmful bacteria and therefore can be an excellent material choice for patient care and other hygiene-sensitive clinical operations.

## 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.

SABIC's 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 SABIC for additional information.

**Table 2: 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<br>! 60 - 80% Retention<br>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 SABIC to receive a copy of this test result of LEXAN CLINIWALL sheet.
** Concentration was 10 times higher as requested

## PRODUCT OPTIONS

LEXAN™ CLINIWALL™ sheet is offered in various thicknesses and colors. You can find information about our product offerings below. Please contact SABIC, if you require a color other than mentioned below.

### TEXTURES

**Polished/Suede**
product code - LEXAN CLINIWALL (A)C6206 sheet

**Polished/Silk Matte**
product code LEXAN CLINIWALL (A)C6205 sheet
on request with protective masking

### 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 (A)C6205: Gauges 1.2 / 1.5 / 1.7 mm, W – L =1300 – 3050mm
Grade (A)C6206: Gauges 1.2 / 1.5 / 1.7 mm, W – L =1300 – 3050mm

# INSTALLATION GUIDE

# INSTALLATION GUIDELINES

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.

To reach optimal results, the sheet materials needs to be heated with sandwich type heating systems to reach uniform heat uptake. Pre-drying of this material is necessary. Pre dry LEXAN CLINIWALL sheet at 100°C for 2 hours /mm thickness. Please note that the improper installation of the material may have effects on aesthetic performance of the product.

## 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 the wall smooth by removing peaking spots and filling dents.
- Clean and dry the surface as it is recommended on page 29.
- Cut the panels and profiles to dimensions needed for the intended surface.

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”

Figure 1a

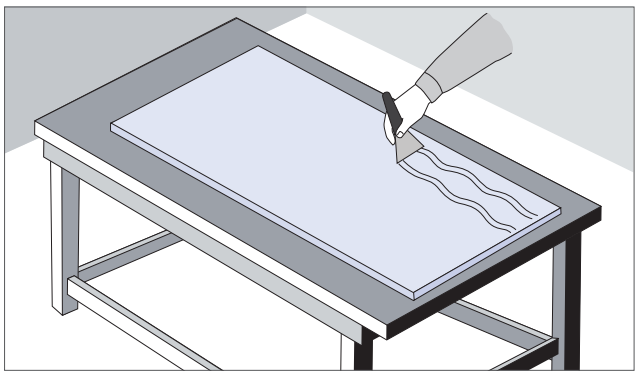


Figure 1b

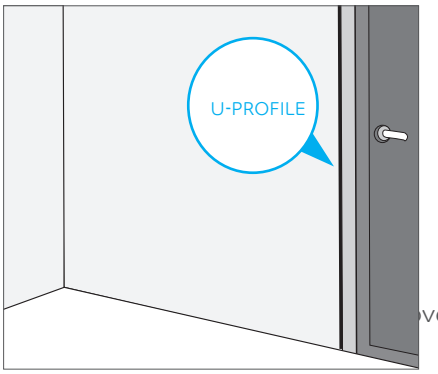



Figure 1c

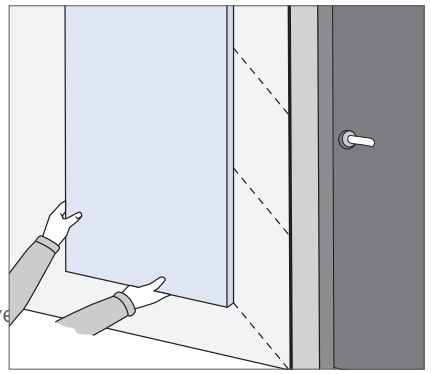


Figure 1d

Figure 1e

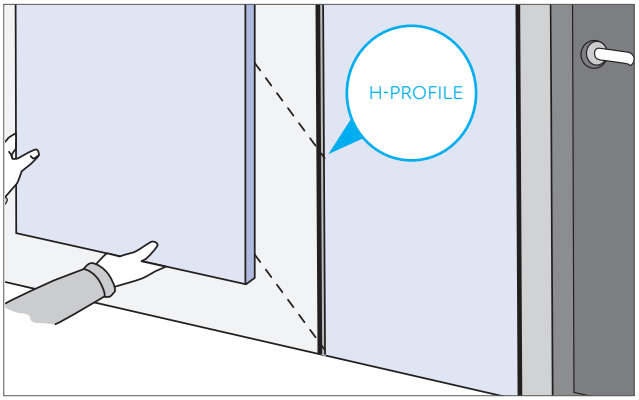



Figure 1f

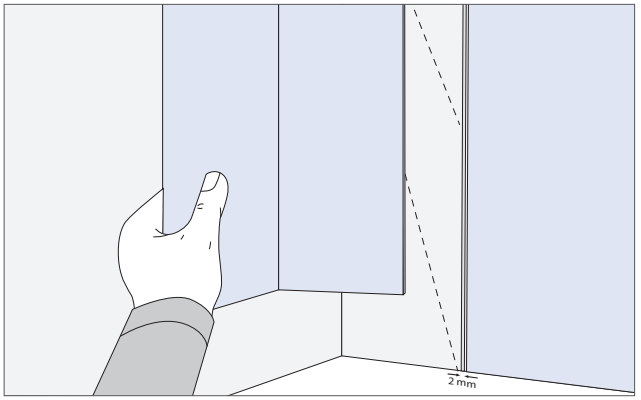


Figure 2a

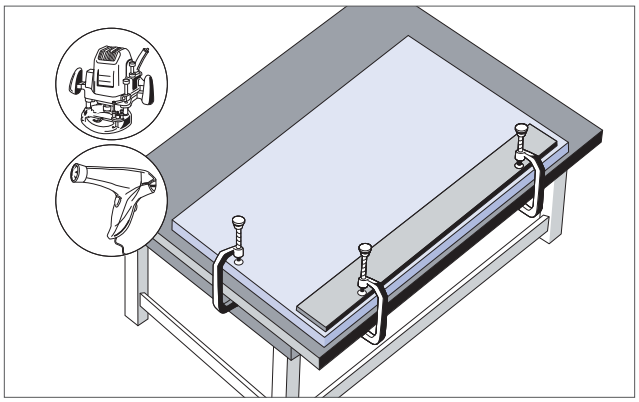


Figure 2b

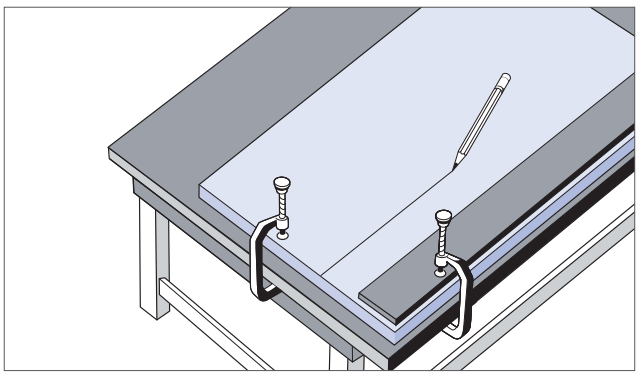
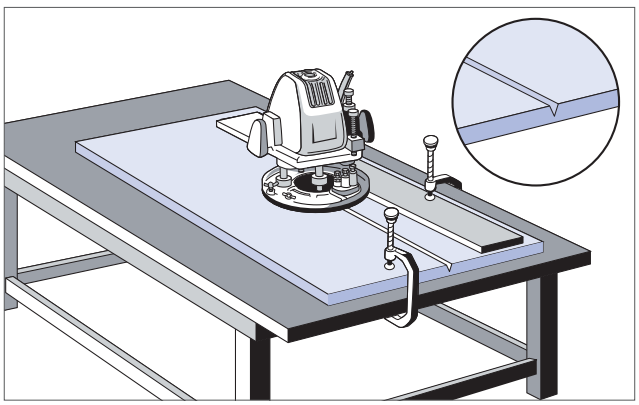


Figure 2c



## GROOVING AND BENDING FOR CORNER INSTALLATION

The following guidelines relate to the corresponding figures 2a-e:

2a Measure the distance between the sheet edge and the corner. Place the sheet on a working surface and secure it as it's shown in the figure 2a.

2b Mark the bending point on the back side of the LEXAN™ CLINIWALL™ sheet by drawing a line.

2c Prior to bending, it is recommended to prepare a groove on the backside along the marked line. The depth is maximum half the thickness of the sheet panel and does not exceed this thickness.

2d To create internal corners, place the groove over a straight table corner and use an industrial hot blower to soften the groove. Make sure that temperature of the panel doesn't not exceed 70°C. Once the groove softened, bend down to the desired angle.

2e To create external corner, place the groove over a straight table corner and use a hot industrial blower to soften the groove. Once the groove softened, bend up to the desired angle.

Figure 2d

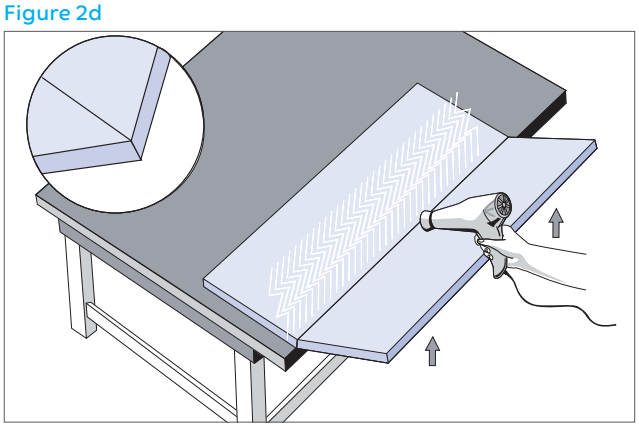
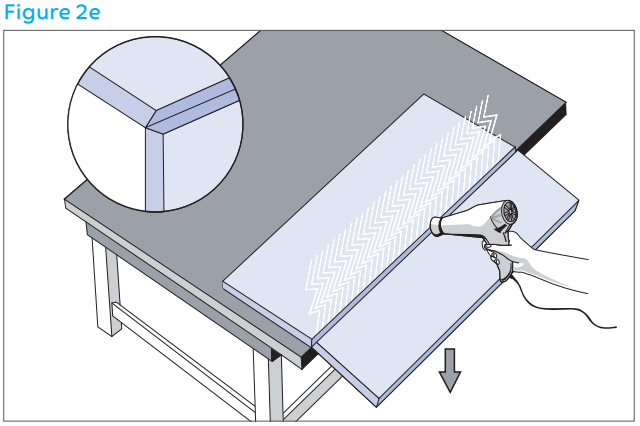


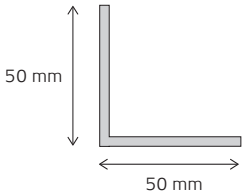
Figure 2e



# PROFILE OPTIONS

## CORNER PROFILE

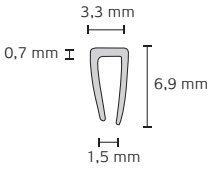
Grade name = CWP30C
Standard colors = White (WH6G057),
Grey (GY7G160), Blue (BL8G009),
Profile length = 3mtrs
# profiles per bag = 33
Minimum Order quantity = 1 Bag




Wall thickness 1 mm

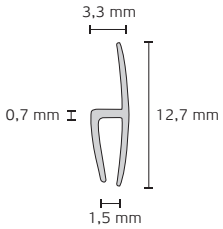
## TOP U-PROFILE

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



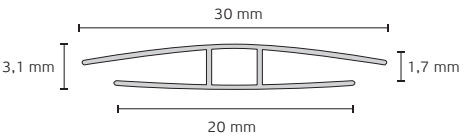

## CONNECTION PROFILE

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 SABIC regarding lead-times and prices.

# FABRICATION

# FABRICATING TECHNIQUES

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 SABIC. 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 SABIC 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.

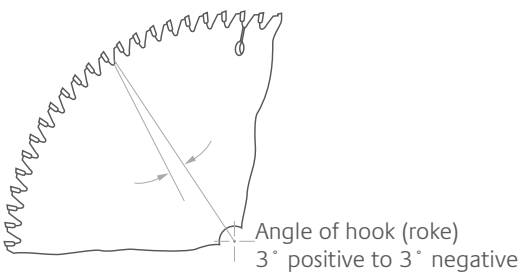
## GUILLOTINE SAW

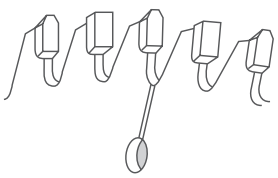
Can be applied commonly on non-FR type of sheets.

**Table 03: 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 04: 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

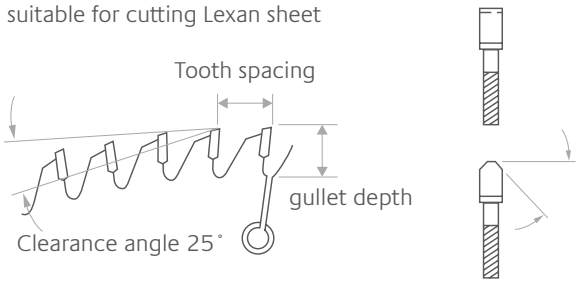
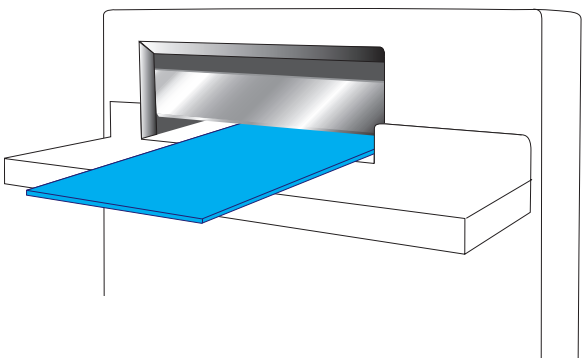



**Figure 05: Guillotine Saw**



## 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.

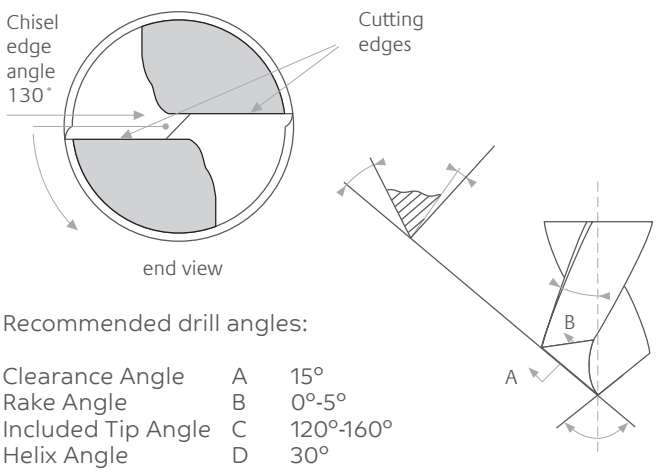
Drilling feeds and speeds are outlined in Table 05 with the various drill configurations in Figures 07 to 09.

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

**Table 04: 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 06: 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 07: Typical Drill Configuration

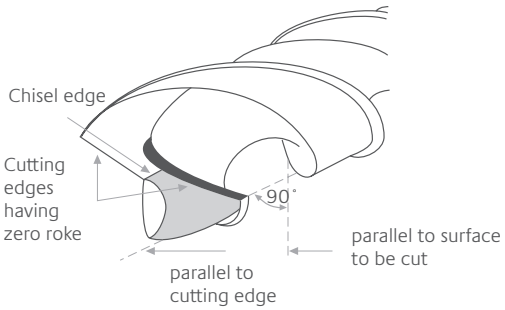



Figure 08: Drill suitable for large holes

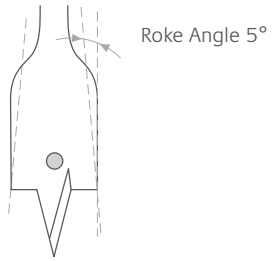
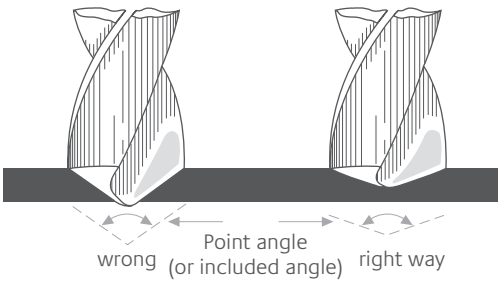



Figure 09: Drill suitable for thin sheet




## MILLING

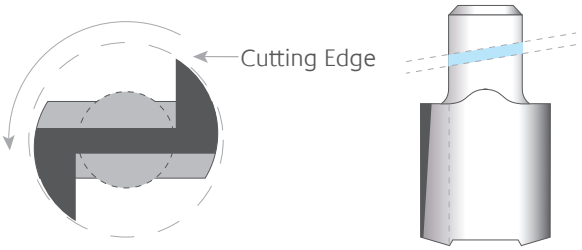
LEXAN™ sheet (polycarbonate) products can be machined using conventional milling machines fitted with standard high speed knife cutting tools. Once again the importance of suitable clamping cannot be over-emphasized. Mechanical jigs and fixtures, or vacuum chucks provide a suitable clamping medium. Table 05 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 05: 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 06: 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 environmental stress cracking.

**Figure 11: Blind Nut and Blind Screw Anchor**

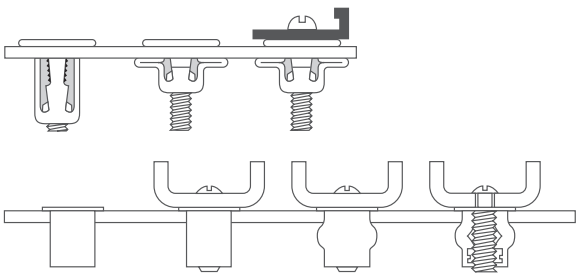


**Figure 12: Other Typical Fastening Systems**

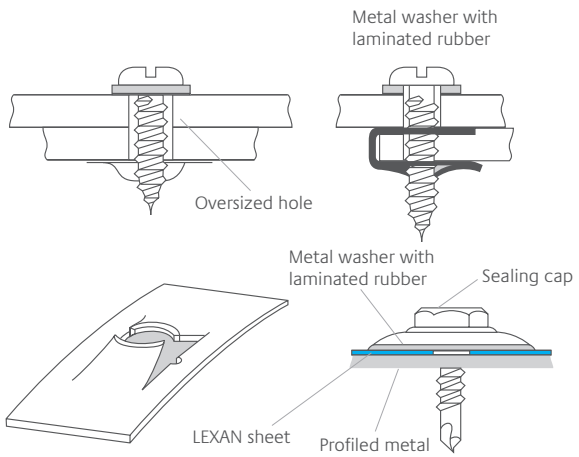
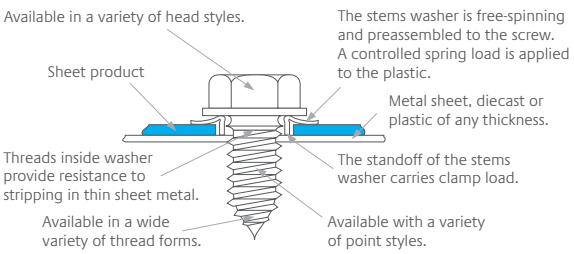



**Figure 13: Hex Cap Screw Connection**



## 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. SABIC 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**

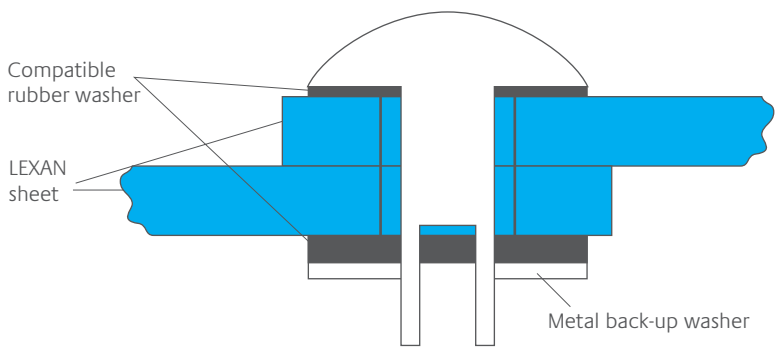
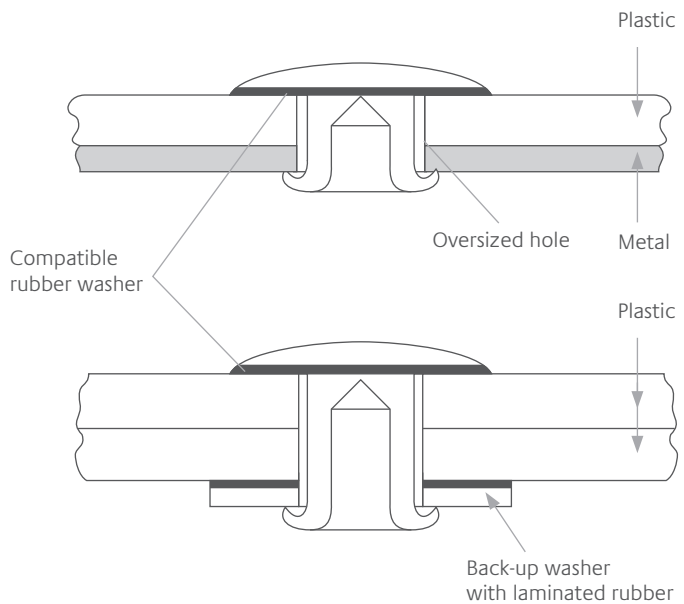



**Figure 15: Typical Pop-Rivet Assembly**



## 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 SABIC 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 SABIC, 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 SABIC. 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:

1. Stress level in the application
2. Temperature
3. Exposure time
4. Chemical concentration
5. 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 07, is an on-going process at SABIC 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 07: 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.<br>Strongly alkaline ammonia materials should be avoided. |
| Esters | Cause severe crystallisation. Partial solvents. |
| Fruit Juices and Soft Drinks | Compatible at low stress levels.<br>Some concentrates not recommended. |
| Gasoline | Not compatible at elevated temperatures and stress levels. |
| Greases and Oils | Pure petroleum types are generally compatible.<br>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 08: 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% $H_2O_2$)

## 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 the hot sun or at elevated temperatures as this can lead to staining.

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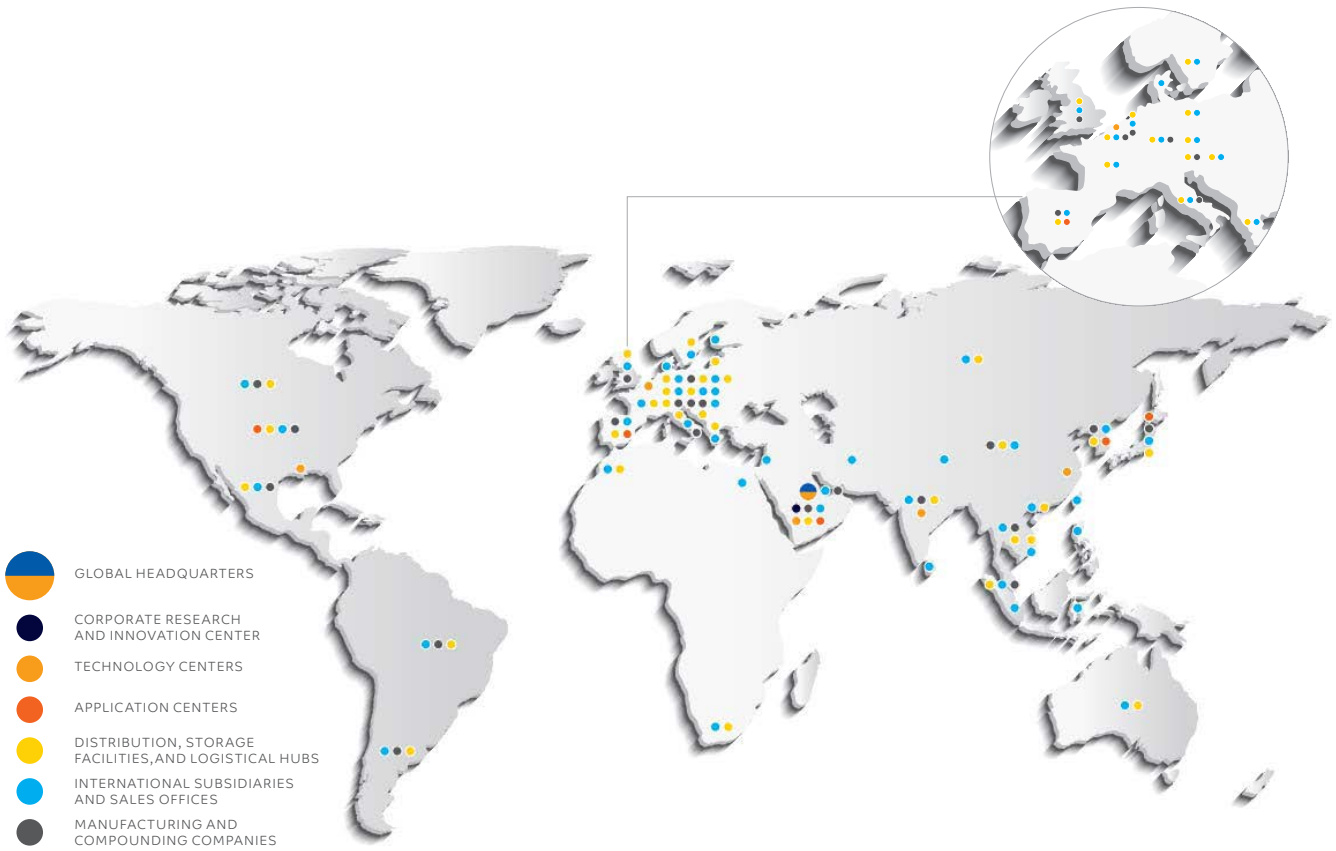


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