



International Committee of the Decorative Laminates Industry

## **Processing HPL compact laminates**

HPL according to EN 438

June, 2017



## Preface

High-pressure laminate (HPL) in accordance with EN 438 has been used in the construction and furniture sector for decades. The European standard EN 438 defines the material, requirements and properties of HPL.

HPL is a resin and paper-based thermosetting composite material and features a unique, extremely robust, resistant, modern and very decorative surface. HPL is omnipresent in our day-to-day lives and is self-supporting or used in conjunction with substrates. The application and usage areas of HPL are extremely diverse and are constantly evolving. This requires knowledge management which provides regularly updated information and assistance with regard to different applications and processing, in the form of technical bulletins.

The technical leaflet "Processing compact laminates" gives information on the interior and exterior use of compact boards. Further information is provided related to Transport and Storage, Machining, Processing, Cleaning and Maintenance.

This document makes no claim of completeness regarding listing the full details of any standards referred to in the text.

All information is based on the current state of technical knowledge, but it does not constitute any form of liability. It is the personal responsibility of the user of the products described in this information leaflet to comply with the appropriate laws and regulations.

For more than 50 years the ICDLI has been the international representative of the interests of European laminate manufacturers. Further information about the ICDLI and the data sheets published up to now can be found at [www.icdli.com](http://www.icdli.com).

This application was compiled by the International Committee of the Decorative Laminates Industry. It considers the conditions of application technology in the European countries. If you have further questions, please contact us:

June, 2017

### **ICDLI aisbl - International Committee of the Decorative Laminates Industry**

Rue de la presse 4, 1000 Bruxelles, Belgium

Head office:

Städelstraße 10, 60596 Frankfurt / Main, Germany, phone +49 69 2 71 05-31, fax +49 69 23 98 37,

E-Mail: [info@pro-kunststoff.de](mailto:info@pro-kunststoff.de)



## Table of Contents

1. Material description
2. Areas of application
  - 2.1 Indoor application
  - 2.2 Outdoor application
3. Transport and storage
  - 3.1 Transport
  - 3.2 Storage
4. Machining
  - 4.1 General information
  - 4.2 Sawing
  - 4.3 Routing and edge profiling
  - 4.4 Drilling
5. Processing
  - 5.1 Connecting HPL compact sheets together
    - 5.1.1 Tongue and groove
    - 5.1.2 Corner connections
    - 5.1.3 Adhesive bonding
  - 5.2 Installation on substructure
    - 5.2.1 Simple installation
    - 5.2.2 Fixing with continuous profiles
    - 5.2.3 Fixing with concealed screw connection
    - 5.2.4 Fixing with visible screw connection
  - 5.3 Doors
  - 5.4 Attaching to compact sheets
    - 5.4.1 Self-tapping screws
    - 5.4.2 Cavity wall plug
    - 5.4.3 Pass-through fixing
6. Cleaning and maintenance

Appendix: Application and design examples

## 1. Material description

HPL compact sheets are decorative high pressure laminate sheets as per EN 438-4 and EN 438-6 with a thickness of over 2 mm. They are large format sheets with a decorative, durable surface and homogeneous, closed cut edges. One or both sheet surfaces have decorative colours or designs. The surfaces can be smooth or textured.

HPL compact sheets feature the following advantages:

- Good dimensional stability
- Self-supporting > 5 mm thickness
- High impact and shock resistance/impact strength
- Especially high resistance to water and steam
- Resistance to frost and heat
- Permanent and non-corroding
- High colour fastness
- Easy to clean
- Food contact approved
- Meeting the highest hygienic requirements; surface and edges can be disinfected
- Resistant to organic solvents
- Low electrostatic charge (no accumulation of dirt)
- Easy installation, replacement, space-saving
- Easy machining
- Good fire behaviour (D-s2, d0 as per EN 13501-1, without further testing; B-s1, d0 as per EN 13501-1 with certificate for CGF\*); low smoke development; non-dripping; non-melting.

The further properties are listed in EN 438-4\* and EN 438-6\*\*.

In thicknesses under 3 mm, compact sheets are typically bonded to rigid supports. For self-supporting applications, rigid supports are required at shorter spacings for thickness up to 5 mm. For greater thicknesses, however, HPL compact sheets are usually self-supporting. Sheets with a thickness over 8 mm are suitable for large area (horizontal) use with more widely spaced supports.

It is up to the user to select the thickness of the product to the maximum requirements according to the specific purpose.

---

\* As per EN 438-4, CGS = interior grade compact laminate; CGF= interior grade compact laminate with improved fire retardant anti-flame characteristics.

\*\* As per EN 438-6, EGS = exterior grade compact laminate; EGF= exterior grade compact laminate with improved fire retardant anti-flame characteristics



## 2. Areas of application

### 2.1 Indoor application

Due to the excellent material properties described above, HPL compact sheets of type CGF/CGS can be used indoors virtually without limitations, in both horizontal and vertical applications. This applies in particular to areas with very high performance requirements for the material such as **moisture resistance, impact resistance and chemical resistance.**

#### Areas of application:

- Wet rooms
- Pharmacies
- Surgical rooms
- Vehicle manufacturing
- Equipment manufacturing
- Hotels and restaurants
- Interior work
- Hospitals
- Cold storage
- Laboratories
- Shop fittings
- Sanitary areas
- Slaughterhouses
- Schools
- Sports facilities and pools
- Underground stations

#### Application examples:

- Cover panels
- Elevators
- Bathroom furniture
- Ceiling panels
- Shower cubicles
- Residential letter boxes
- Kitchen worktops
- Kitchen cabinet fronts
- Laboratory
- Shelves
- Sanitary rooms
- Control cabinets
- Skirting boards
- Dividing walls
- Tunnel panelling
- Doors
- Roller shutter panels
- Wall panels



## 2.2 Outdoor application

HPL compact sheets of type EGS/EGF are ideal for use in areas exposed to moderate outdoor conditions and have no requirements for official approval or are subject to building codes.

Examples for such applications:

- campsite fittings
- bus stops and tram stops
- facilities in outdoor swimming pools
- children's playparks
- outdoor cafés
- landmark signs and information signs

Years of weather influence can visually impair the surfaces of the compact sheets, although without affecting the suitability for use.

For higher durability requirements, HPL compact sheets of types EDS/EDF should be used to provide enhanced weather protection.

**Note:**

***Compact sheets for facade cladding requiring approval are not covered by this leaflet.***

## 3. Transport and storage

HPL compact sheets have a high weight and a high material value, resulting in special requirements for transport and storage.

### 3.1 Transport

Large, flat and sturdy pallets are necessary for transporting sheet stacks in various transport vehicles. The sheets in the stack must be secured against sliding.

Foreign bodies and abrasive contaminations in the sheet stack can result in impressions, scratches and damage to the sheet surface.

During loading and unloading, the sheets must not be moved or pulled against one another. They must be lifted individually by hand or with suction units.

### 3.2 Storage

HPL compact sheets must be stored in a closed storage room under normal room climate conditions (18-23 °C and 50-60 % relative humidity).

Compact sheets should be stored horizontally on a protective board covered with plastic film with the edges straight. The top sheet of each stack should also be covered with plastic film and a protective board.

These storage conditions should be maintained after removing sheets from the stack.

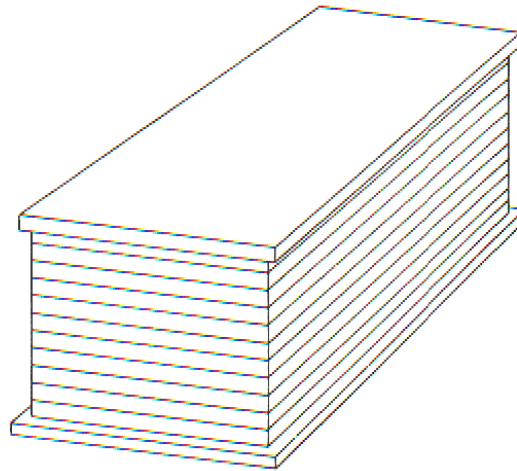


Fig. 1: Storage in a sheet stack

If HPL compact sheets are not stored horizontal and level for a prolonged period of time, deformations may occur. The thicker the sheets, the more difficult it is to reverse these deformations.

For compact sheets with protective film, this has to be removed from both sides at the same time.

#### **4. Machining**

As a general practise, the information described in the “General recommendations for working with HPL” apply. In addition to this, the following special requirements for machining compact sheets have to be observed:

##### **4.1 General information**

The machining of compact sheets leads to increased tool wear due to the greater sheet thickness. The selection of the required carbide tipped tools, particularly for saws and routers, should be based on manufacturers recommendations. This applies especially if larger batches are to be manufactured or if higher requirements exist for the cutting quality. Appropriate pre-testing is also recommended in these cases.

As a rule, local overheating from improper tool guiding has to be avoided for all machining processes. Furthermore, a good exhaust system has to be provided in the workplace to prevent dust pollution.

## 4.2 Sawing

Compact sheets have to be cut at a slower speed compared to HPL composite sheets. On Compact sheets with decorative surfaces on both sides, chipping of the lower decorative layer can be effectively prevented by changing the exit angle. This can be achieved by varying the height adjustment of the saw blade.

Note:

*With increasing projection of the cutting tool above the sheet, the upper cut edge is improved and the lower cut edge is poorer, and vice versa.*

Good results can also be achieved by placing plywood, chipboard or HPL underneath.

The best possible cutting quality of the lower edge is achieved by pre-scoring the underside of the sheet with a small circular saw blade (Fig.2). This prevents chipping on the underside of the sheet because the pre-scoring has already produced a clean cut on the underside of the sheet.

The pre-scoring saw usually runs in a forward direction, regardless of whether the following saw blade runs in forward or reverse direction.

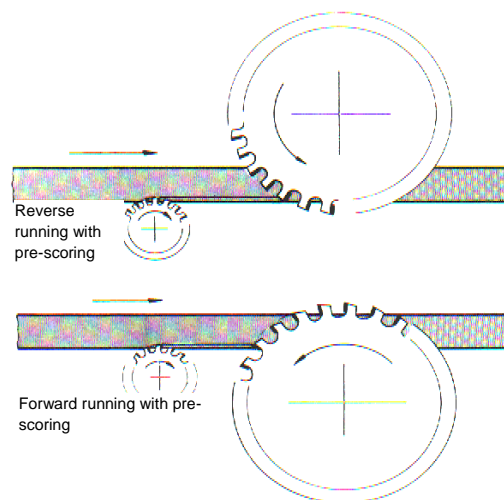


Fig. 2: Pre-scoring of the underside of the sheet

The feed rate has a crucial influence on the cutting quality for compact sheets. A feed distance per tooth between 0.03 and 0.05 mm has proven successful.

The feed rate is calculated using the formulas below.

$$\text{Feed rate per tooth: } S_z = \frac{S}{n \cdot Z} \text{ (mm/tooth)}$$

$$\text{transposed to } S = S_z \cdot n \cdot Z \text{ (mm/min)}$$



transposed to number of teeth  $Z = \frac{S}{n \cdot S_z}$

Whereas:  $S_z$  = feed distance in mm per tooth

$S$  = feed rate in mm/min

$n$  = rpm

$Z$  = number of teeth

Example:

number of teeth  $Z = 52$

rpm  $n = 3500$  rpm

feed rate per tooth  $S_z = 0.04$  mm

Substituted into the formula  $S = S_z \cdot n \cdot Z$ , this yields a feed of  $0.04 \cdot 52 \cdot 3500 = 7.28$  m/min

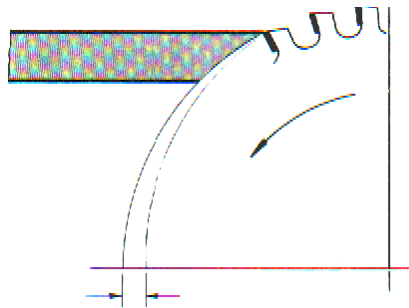


Fig. 3: Feed distance per tooth ( $S_z$ )

### 4.3 Routing and edge profiling

The edges of compact sheets can be machined. Better quality edges can be achieved by removing at least 2 mm and no more than 5 mm during the machining operation.

For large batches, the use of special router heads which were developed for compact sheets has proven successful. For profile routing, we recommend the use of diamond tipped tools. Due to the high cutting pressure, secure guiding of the workpiece and tool is imperative.

A special edge protection such as coating or painting is generally not required for compact sheets. A variety of design options are available for edges which are to remain visible:

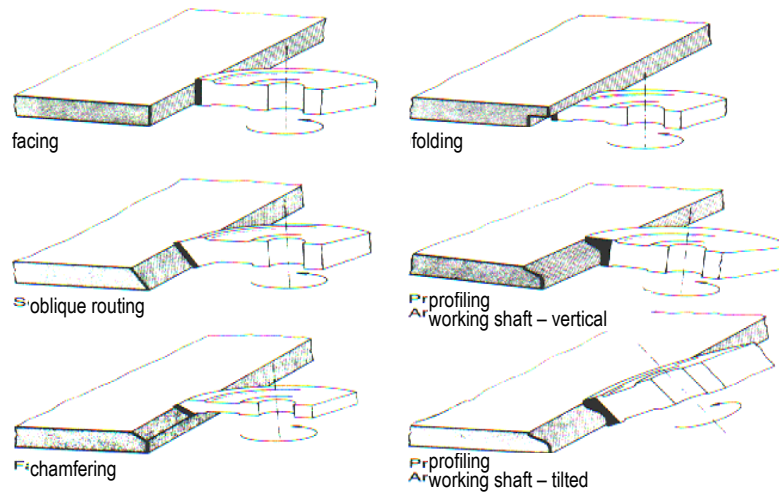


Fig. 4: Types of edge machining

Chatter marks from the profile routers on the routed surface are inevitable. They can be reduced through incremental cuts (only with mechanical guiding!). Any remaining markings can be removed during the subsequent profile finish through sanding and then polishing.

To further improve the appearance of the routed edge, we recommend treating the edge with silicone-free furniture oils after machining.

Free-standing edges and corners of compact sheets must always be slightly rounded to avoid injuries.

#### 4.4 Drilling

Drills for plastic materials are the best option for drilling compact sheets: these are special drills with a tip angle of about 60 – 80° rather than 120° on normal metal drills. They also have a steep angle with a large chip removal space.

To prevent splintering at the exit point on the compact sheet, the feed rate of the drill has to be continuously decreased. It is also recommended to work with a firm base which can be drilled into (e.g. chipboard, plywood). For drilling through holes, drills with a tip angle of 50 – 60° is preferred.

For drilling blind holes (see fig. 5), the hole depth should be chosen so that at least 1.5 mm sheet thickness (a) remains.

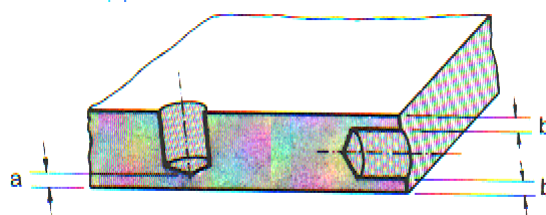


Fig. 5: Drilled holes in the sheet

For holes drilled parallel to the sheet plane, the remaining thickness (b) has to be at least 3 mm. Arbour-mounted counterbores can be used for simultaneous drilling and countersinking. In addition to carbide tools with fixed tips, carbide inserts are often used for drilling and routing recesses.

Furthermore, it is easy to cut threads into HPL compact sheets; self-tapping screws can also be used.

## 5. Fabrication

In the final end use it should be considered that compact sheets slightly change in dimension when the climate changes. The change in length of the sheets is typically half of the change in width; this difference can result in sheet warpage. Known fastening and connection methods (e.g. continuous or concealed profiles, tongue and groove, screws, nails) can be used for compact sheets\*. In areas with moisture influence, corrosion-resistant fastening materials must to be used.

\* If bonding to carrier materials becomes necessary for structural reasons, the principles of the "General recommendations for working with HPL" must to be observed.

### 5.1 Connecting compact sheets

#### 5.1.1 Tongue and groove

If two compact sheets are connected with tongue and groove, groove width (a) and groove side thickness (b) must be at least 3 mm. Where the design allows, the groove side thickness (b) should be larger than the groove width (a). The groove depth should be kept as low as possible (max. 10 mm). As for the rest, the following guide values apply:

groove width a	= 3 mm
groove side width b	≥ 3 mm (=a)
tongue width c	< 10 mm
sheet thickness d	= 10 mm

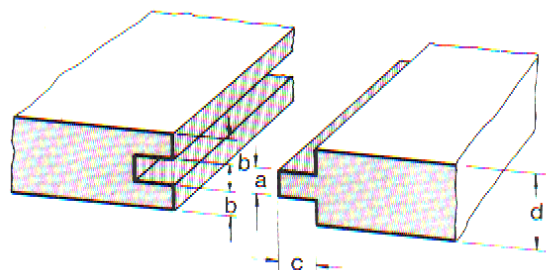


Fig. 6 Connection with tongue and groove

Due to the possible dimensional changes, the compact sheets have to be mounted with sufficient clearance between tongue and groove. Compact sheets with less than 10 mm thickness should not be connected with tongue and groove. A connection with a “false tongue” is also beneficial because it allows the full plate format to be used and simplifies processing.

### 5.1.2 Corner joints

Corner joints should only be executed with square blocks or corner rails depending on the expected load.

### 5.1.3 Adhesive bonding

Adhesive bonding must be carried out in such a way that the dimensional changes of the compact sheets are not constrained. It is also important that the sheets are bonded only in the same running direction because the dimensional changes differ in length and width which may cause failed bonding.

## 5.2 Installation on substructure

Metal substructures change their dimensions when temperature differences occur. The dimensions of the compact sheet also change under the influence of changing relative humidity (see item 5). These differences in dimensional changes between metal and Compact HPL can act in opposite directions. Sufficient flexibility therefore must be ensured during installation so that both materials can move accordingly.

The dimensional changes strongly depend on temperatures and humidity conditions as well as on thickness and format of the sheets.

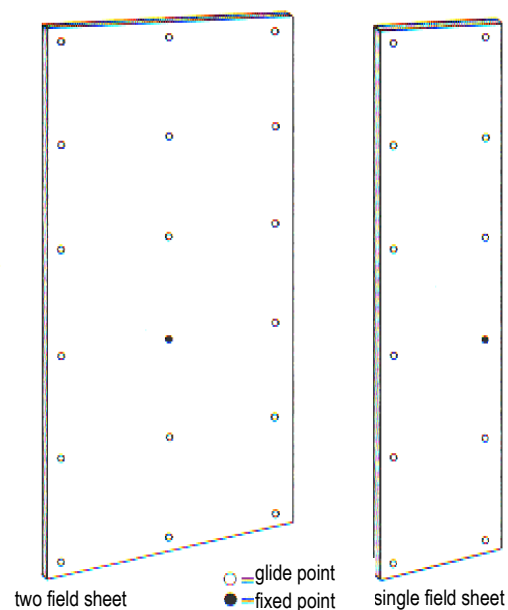


Fig. 7: Distribution example for fixed point and glide point for installation on substructure

There are many practices proven to create a successful installation, such as substructures which are:

- sturdy,
- well aligned,
- tension-free,
- level,
- firmly fixed to the wall.

The following must also be considered for panelling:

- The stability of the panelling is determined by the substructure and the thickness of the panelling material.
- The substructure must be protected against corrosion and rotting.
- Sufficient rear ventilation must be provided .
- Sufficient room must be provided for the compact sheets to move (expansion and contraction).

A special advantage of the compact sheets is that joints and partitions in the sheets can be placed so that electrical and plumbing systems are still accessible.

### 5.2.1 Simple installation

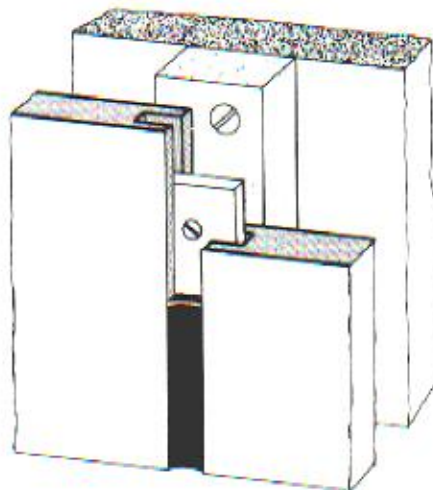


Fig. 8: Simple wall installation

Ideally, select a groove depth that allows the elements to be replaced later on by sliding sideways.

The solution shown in figure 8 allows the joint to be filled, producing a particularly hygienic joint structure (e.g. hospitals).

### 5.2.2 Attachment with continuous profiles

This type of attachment allows sufficient clearance for the compact sheets.

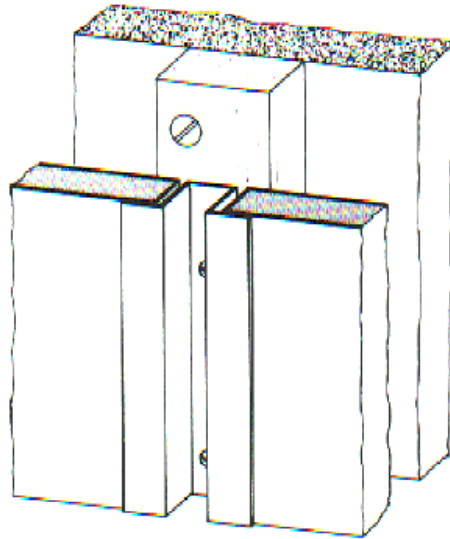


Fig. 9: Fixing with an omega profile

### 5.2.3 Attachment with concealed screw connection

When attaching compact sheets on rigid substructures (e.g. metal frames, bricks), ensure sufficient flexibility for the parts to be connected through properly cleared holes for the fastening elements and by using

- a) shims (A)
- b) slip film between the support surfaces or on connecting points (B)

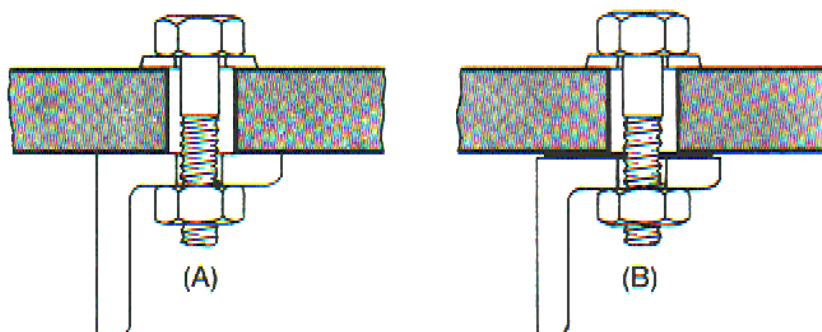


Fig. 11: Options for visible screw fixing

### 5.3. Doors

Small doors made of compact sheets (e.g. furniture) can be installed with two piano hinges.

Large doors for sanitary cells and changing rooms should be attached to more than two hinges to ensure the required dimensional stability. When selecting the hinges, observe the required expansion flexibility for the compact sheet. To keep this small, the door leaf should be cut from the compact sheet in longitudinal direction. The frame construction has to be sturdy, level and tension-free; door catches and locks or any required rubber seals must not introduce any permanent tensions into the door leaf. The influence of increased humidity and/or high temperature on one side of the door can cause the compact sheet to warp. Therefore, sufficient air circulation must be ensured.

### 5.4. Attaching to compact sheets

For fixing rigid objects (e.g. profiles, strips, fittings) with screws which pass fully through the sheet, the holes in the compact sheet have to be drilled accordingly larger as per 5.4.3. For screw fixings which do not pass fully through the sheet (e.g. with expanding anchors), the holes for the objects to be fixed also have to be drilled larger. Here as well, the use of a slip film between object and compact sheet is recommended.

#### 5.4.1 Self-tapping screws

Screws with a low pitch provide better pull-out strength values. Pre-drilling is always necessary. The hole diameter has to be one thread depth smaller than the outer screw diameter.

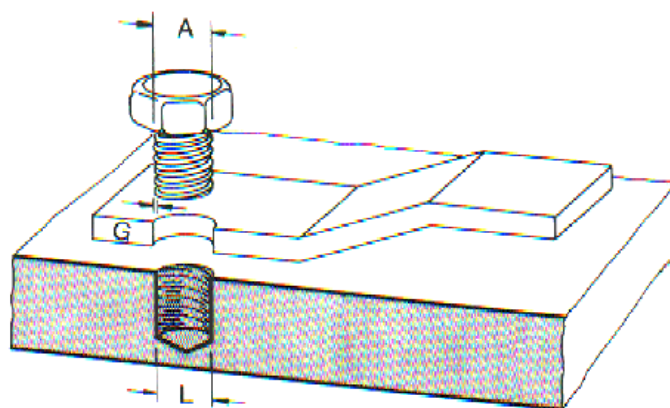


Fig. 12: Attached with threaded screw

When inserting screws, the drilled hole has to be at least 1 mm deeper than the insertion depth of the screw.

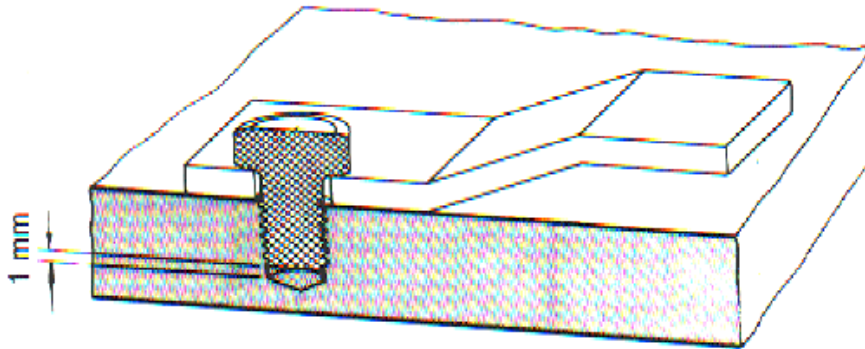


Fig. 13: Fixing with self-tapping screw

Screws should be lubricated before insertion.

#### 5.4.2 Expansion anchor

The highest pull-out strength for screws can be achieved with expansion anchor wall plugs.

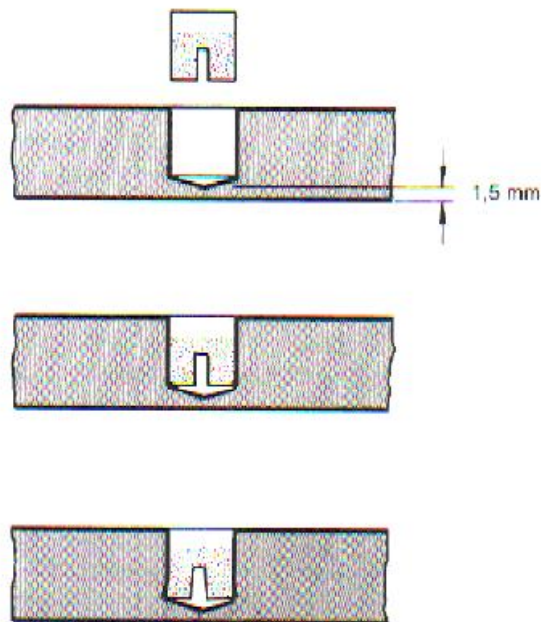


Fig. 14: Inserting a expansion anchor

Expansion anchor must not have any cutting burrs.

**Residual thickness of the compact sheet: 1.5 mm**

The use of expansion anchor parallel to the sheet plane is not recommended.

#### 5.4.3 Pass-through connections



The holes have to be drilled 2-3 mm larger than the diameter of the fixing elements (e.g. screws or nails). The required freedom of movement can also be achieved by using elastic sleeves (e.g. made of polyamide).

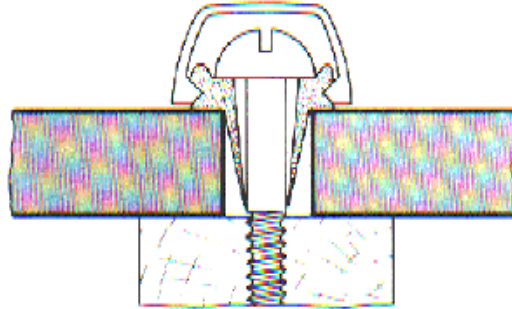


Fig. 15: Elastic sleeve with cover cap

## 6. Cleaning and maintenance

Compact sheets require no special care. The leaflet "Cleaning of HPL surfaces" provides details about cleaning and care.

### Application and design examples

